



HDPE Pipe

Specifications for HDPE Pipe

The physical properties of high-density polyethylene pipe are described using ASTM D 3350-05, "Standard Specification for Polyethylene Plastic Pipe and Fittings Materials". Recently this standard was changed. The two key areas changed are, density and slow crack growth. In the 05 version, the cell classifications for density were increased from four cells to seven cells defining the density ranges for various resins.

New high performance bimodal resins, PE 4710 resins, have higher PENT test values. Slow crack growth properties can now be defined using eight cells.

As of December 2006, most HDPE pipe is made from resin with a cell classification of PE 345464C. The pipe is labeled as PE3408/3608. The physical properties for PE 345464C are:

PROPERTY VALUE	SPECIFICATION	UNIT	NOMINAL VALUE
Material Designation	PPI / ASTM		PE 3408/3608
Cell Classification	ASTM D 3350		345464C
Density	(3) ASTM D 1505	g/cm ³	0.941-943
Melt Index	(4) ASTM D 1238	gm/ 10 min	0.05 -.11
Flexural Modulus	(5) ASTM D 790	psi	110,000 to 140,000
Tensile Strength	(4) ASTM D 638	psi	3,200
Slow Crack Growth			
ESCR	ASTM D 1693	hours in 100% igepal	>5,000
PENT	(6) ASTM F 1473	hours	>100
HDB @ 73 deg F	(4) ASTM D 2837	psi	1,600
UV Stabilizer	(C) ASTM D 1603	%C	2 to 2.5%

The density provided is without carbon black. Typical HDPE pipe has a density of .955 to .957 with carbon black.

Types of Polyethylene Pipe

All polyethylene (PE) is not the same. In ASTM D 3350-05, low density PE is defined as having a density range of 0.919 to 0.925 g/cc; medium density has a range of 0.926 to 0.940 g/cc and high density is defined with a range from 0.941 to 0.955. All densities are without carbon black.

Density influences key properties in polyethylene materials. As the density increases, the tensile strength increases; also chemical resistance increases.

Medium density PE resins have been used for gas distribution. This original selection was made based on superior slow crack growth properties of medium density resins. Medium density pipe is designated as PE 2406 and PE 2708.

Today new bimodal resins are being used in gas distribution because of higher pressure ratings plus superior slow crack growth. These resins are designated PE 3408, PE 3608, PE 3708, PE 3710 and PE 4710.

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Slow Crack Growth

The Pent test is used to determine stress crack resistance for PE resins. The PENT test is conducted in accordance with ASTM F 1473, "Standard Test Method for Notch Tensile Test to Measure the Resistance to Slow Crack Growth of Polyethylene Pipes and Resins". This test uses a solid sample of material which is notched and tested.

The PENT test is a good test of slow crack growth. Scratches and gouges can cause crack propagation. Materials with high PENT numbers are less likely to fail because of slow crack growth.

Traditional PE 3408/3608 resins have PENT test values of about 100 hours. New bimodal resins used to make PE 3710 and PE 4710 pipes have values ranging from 600 hours to several thousand hours.

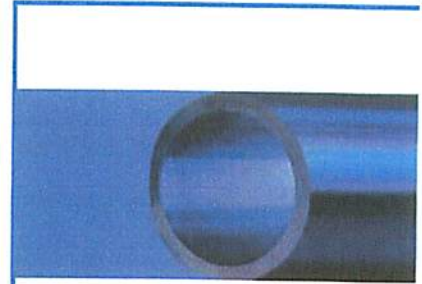
Physical Properties of PE 4710

HDPE pipe with a designation of PE 4710 is made from resin with a cell classification of PE 445474C or PE 445574C. We suggest using a specification calling for a minimum cell classification of PE 445474 C or higher. Both cell classifications can be used if specified in this way. The pipe is labeled as PE 4710. The physical properties for PE 445474C are provided below:

PROPERTY VALUE	SPECIFICATION	UNIT	NOMINAL VALUE
Material Designation	PPI / ASTM		PE 4710
Cell Classification	ASTM D 3350		445474 C
Density	(4) ASTM D 1505	g/cm ³	0.947-955
Melt Index	(4) ASTM D 1238	gm/ 10 min	<.15
Flexural Modulus	(5) ASTM D 790	psi	110,000 to 160,000
Tensile Strength	(5) ASTM D 638	psi	3500-4000
Slow Crack Growth			
ESCR	ASTM D 1693	hours in 100% igepal	>5,000
PENT	(7) ASTM F 1473	hours	>500
HDB @ 73 deg F	(4) ASTM D 2837	psi	1,600
UV Stabilizer	(C) ASTM D 1603	%C	2 to 2.5 %

The density provided is without carbon black. Typical PE 4710 HDPE pipe has a density of 0.956 to 0.964 with carbon black.

To be called a PE 4710, the pipe and resin has substantiation at 50 years.



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HDPE Pipe

PE 3608/3408 IPS HDPE Pipe Sizes

Pressure Rating	Nominal Size	3/4"	1"	1 1/4"	1 1/2"	2"	3"	4"	5"	5"	6"	7"	8"	10"	12"	14"	16"
	Actual O.D.	1.05"	1.315"	1.66"	1.90"	2.375"	3.50"	4.50"	5.375"	5.563"	6.625"	7.125"	8.625"	10.75"	12.75"	14.00"	16.00"
DR 7 (267psi)	Min. wall	0.150"	0.188"	0.237"	0.271"	0.339"	0.500"	0.643"	0.768"	0.795"	0.946"	1.018"	1.232"	1.536"	1.821"	2.000"	2.286"
	Average I.D.	0.732"	0.917"	1.157"	1.325"	1.656"	2.440"	3.137"	3.747"	3.878"	4.619"	4.967"	6.013"	7.494"	8.889"	9.760"	11.154"
	Weight lb/ft	0.190	0.290	0.460	0.603	0.950	2.060	3.400	4.850	5.200	7.360	8.490	12.480	19.400	27.280	32.900	42.970
DR 7.3 (254psi)	Min. wall	0.144"	0.180"	0.227"	0.260"	0.325"	0.479"	0.616"	0.736"	0.762"	0.908"	0.976"	1.182"	1.473"	1.747"	1.918"	2.192"
	Average I.D.	0.745"	0.933"	1.178"	1.348"	1.685"	2.484"	3.193"	3.814"	3.947"	4.701"	5.056"	6.120"	7.628"	9.047"	9.934"	11.353"
	Weight lb/ft	0.180	0.280	0.445	0.583	0.911	1.980	3.280	4.680	5.020	7.120	8.230	12.060	18.740	26.360	31.780	41.510
DR 9 (200psi)	Min. wall	0.117"	0.146"	0.184"	0.211"	0.264"	0.389"	0.500"	0.597"	0.618"	0.736"	0.792"	0.958"	1.194"	1.417"	1.556"	1.778"
	Average I.D.	0.803"	1.005"	1.269"	1.452"	1.816"	2.676"	3.440"	4.109"	4.253"	5.064"	5.447"	6.593"	8.218"	9.747"	10.702"	12.231"
	Weight lb/ft	0.150	0.234	0.372	0.490	0.770	1.660	2.750	3.920	4.200	5.932	6.890	10.054	15.680	22.070	26.610	34.750
DR 11 (160psi)	Min. wall	0.095"	0.120"	0.151"	0.173"	0.216"	0.318"	0.409"	0.489"	0.506"	0.602"	0.648"	0.784"	0.977"	1.159"	1.273"	1.455"
	Average I.D.	0.848"	1.062"	1.340"	1.534"	1.917"	2.825"	3.633"	4.339"	4.491"	5.348"	5.752"	6.963"	8.678"	10.293"	11.302"	12.916"
	Weight lb/ft	0.130	0.200	0.312	0.410	0.640	1.387	2.300	3.290	3.520	4.990	5.780	8.460	13.140	18.480	22.300	29.120
DR 13.5 (128psi)	Min. wall	--	--	--	--	0.176"	0.259"	0.333"	0.398"	0.412"	0.491"	0.528"	0.639"	0.796"	0.944"	1.037"	1.185"
	Average I.D.	--	--	--	--	2.002"	2.950"	3.793"	4.531"	4.689"	5.585"	6.006"	7.271"	9.062"	10.748"	11.801"	13.487"
	Weight lb/ft	--	--	--	--	0.531	1.160	1.910	2.730	2.920	4.150	4.800	7.030	10.920	15.360	18.520	24.190
DR 15.5 (110psi)	Min. wall	--	--	--	--	0.153"	0.226"	0.290"	0.347"	0.359"	0.427"	0.460"	0.556"	0.694"	0.823"	0.903"	1.032"
	Average I.D.	--	--	--	--	2.050"	3.021"	3.885"	4.640"	4.802"	5.719"	6.150"	7.445"	9.280"	11.006"	12.085"	13.812"
	Weight lb/ft	--	--	--	--	0.470	1.020	1.680	2.400	2.570	3.637	4.210	6.164	9.580	13.480	16.242	21.214
DR 17 (100psi)	Min. wall	--	--	--	--	0.140"	0.206"	0.265"	0.316"	0.327"	0.390"	0.419"	0.507"	0.632"	0.750"	0.824"	0.941"
	Average I.D.	--	--	--	--	2.079"	3.064"	3.939"	4.705"	4.869"	5.799"	6.236"	7.549"	9.409"	11.160"	12.254"	14.005"
	Weight lb/ft	--	--	--	--	0.430	0.932	1.540	2.200	2.353	3.340	3.860	5.660	8.880	12.362	14.910	19.470
DR 19 (89psi)	Min. wall	--	--	--	--	--	--	0.237"	0.283"	0.293"	0.349"	0.375"	0.454"	0.566"	0.671"	0.737"	0.842"
	Average I.D.	--	--	--	--	--	--	3.998"	4.775"	4.942"	5.886"	6.330"	7.663"	9.551"	11.327"	12.438"	14.215"
	Weight lb/ft	--	--	--	--	--	--	1.390	1.980	2.120	3.010	3.480	5.100	7.920	11.140	13.430	17.540
DR 21 (80psi)	Min. wall	--	--	--	--	--	--	0.214"	0.256"	0.265"	0.315"	0.339"	0.411"	0.512"	0.607"	0.667"	0.762"
	Average I.D.	--	--	--	--	--	--	4.046"	4.832"	5.001"	5.956"	6.405"	7.754"	9.665"	11.463"	12.587"	14.385"
	Weight lb/ft	--	--	--	--	--	--	1.262	1.801	1.930	2.740	3.170	4.640	7.21	10.134	12.220	15.960
DR 26 (64 psi)	Min. wall	--	--	--	--	--	--	0.173"	0.207"	0.214"	0.255"	0.274"	0.332"	0.413"	0.490"	0.538"	0.615"
	Average I.D.	--	--	--	--	--	--	4.133"	4.937"	5.109"	6.085"	6.544"	7.922"	9.873"	11.710"	12.859"	14.695"
	Weight lb/ft	--	--	--	--	--	--	1.030	1.470	1.574	2.233	2.582	3.790	5.880	8.270	9.970	13.022
DR 32.5 (51 psi)	Min. wall	--	--	--	--	--	--	0.138"	0.165"	0.171"	0.204"	0.219"	0.265"	0.331"	0.392"	0.431"	0.492"
	Average I.D.	--	--	--	--	--	--	4.206"	5.024"	5.200"	6.193"	6.660"	8.062"	10.049"	11.918"	13.087"	14.956"
	Weight lb/ft	--	--	--	--	--	--	0.831	1.190	1.270	1.801	2.083	3.053	4.750	6.671	8.050	10.510

- Items highlighted in Blue indicates standard stocking items that are more readily available.
- Pressures are based on using water at 23°C (73°F).
- Average inside diameter calculated using nominal OD and minimum wall plus 6% for use in estimating fluid flows. Actual ID will vary.
- Other piping sizes or DR's may be available upon request.
- Standard Lengths:
40' for 2"-24"
50' for 26" and larger
Coils available for 3/4"-6"(8" by special order)

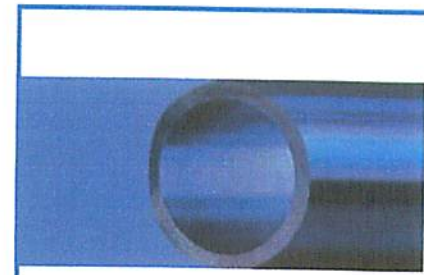
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PE 3608/3408 IPS HDPE Pipe Sizes

18"	20"	22"	24"	26"	28"	30"	32"	34"	36"	42"	48"	54"	63"	Nominal Size Actual O.D.	Pressure Rating
18.00"	20.00"	22.00"	24.00"	26.00"	28.00"	30.00"	32.00"	34.00"	36.00"	42.00"	48.00"	54.00"	62.99"		
2.571"	2.857"	3.143"	3.429"	—	—	—	—	—	—	—	—	—	—	Min. wall	DR 7 (267psi)
12.549"	13.943"	15.337"	16.731"	—	—	—	—	—	—	—	—	—	—	Average I.D.	
54.370	67.130	80.170	96.680	—	—	—	—	—	—	—	—	—	—	Weight lb/ft	
2.466"	2.740"	3.014"	3.288"	3.562"	—	—	—	—	—	—	—	—	—	Min. wall	DR 7.3 (254psi)
12.773"	14.182"	15.611"	17.030"	18.449"	—	—	—	—	—	—	—	—	—	Average I.D.	
52.530	64.850	78.140	93.390	110.769	—	—	—	—	—	—	—	—	—	Weight lb/ft	
2.000"	2.222"	2.444"	2.667"	2.889"	3.111"	3.333"	3.556"	—	—	—	—	—	—	Min. wall	DR 9 (200psi)
13.760"	15.289"	16.818"	18.347"	19.876"	21.404"	22.933"	24.462"	—	—	—	—	—	—	Average I.D.	
43.970	54.280	65.412	78.180	92.535	107.312	123.183	140.183	—	—	—	—	—	—	Weight lb/ft	
1.636"	1.818"	2.000"	2.182"	2.364"	2.545"	2.727"	2.909"	3.091"	3.273"	—	—	—	—	Min. wall	DR 11 (160psi)
14.531"	16.145"	17.760"	19.375"	20.989"	22.604"	24.218"	25.833"	27.447"	29.062"	—	—	—	—	Average I.D.	
36.840	45.490	54.820	65.520	77.440	89.785	103.076	117.285	132.411	148.454	—	—	—	—	Weight lb/ft	
1.333"	1.481"	1.630"	1.778"	1.926"	2.074"	2.222"	2.370"	2.519"	2.667"	3.111"	3.556"	—	—	Min. wall	DR 13.5 (128psi)
15.173"	16.859"	18.545"	20.231"	21.917"	23.603"	25.289"	26.975"	28.661"	30.347"	35.404"	40.462"	—	—	Average I.D.	
30.610	37.790	45.550	54.440	64.261	74.522	85.543	97.324	109.905	123.208	167.675	217.895	—	—	Weight lb/ft	
1.161"	1.290"	1.419"	1.548"	1.677"	1.806"	1.935"	2.065"	2.194"	2.323"	2.710"	3.097"	3.484"	—	Min. wall	DR 15.5 (110psi)
15.538"	17.265"	18.991"	20.717"	22.444"	24.170"	25.897"	27.623"	29.350"	31.076"	36.255"	41.435"	46.614"	—	Average I.D.	
26.849	33.146	40.107	47.731	56.532	65.563	75.264	85.672	96.714	108.424	147.568	192.774	243.921	—	Weight lb/ft	
1.059"	1.176"	1.294"	1.412"	1.529"	1.647"	1.765"	1.882"	2.000"	2.118"	2.471"	2.824"	3.176"	—	Min. wall	DR 17 (100psi)
15.755"	17.506"	19.256"	21.007"	22.758"	24.509"	26.259"	28.009"	29.760"	31.511"	36.762"	42.014"	47.266"	—	Average I.D.	
24.640	30.420	36.810	43.810	51.856	60.154	69.068	78.557	88.700	99.457	135.372	176.813	223.713	—	Weight lb/ft	
0.947"	1.053"	1.158"	1.263"	1.368"	1.474"	1.579"	1.684"	1.789"	1.895"	2.211"	2.526"	2.842"	—	Min. wall	DR 19 (89psi)
15.992"	17.768"	19.545"	21.322"	23.099"	24.876"	26.653"	28.429"	30.206"	31.983"	37.314"	42.644"	47.975"	—	Average I.D.	
22.200	27.410	33.162	39.470	46.701	54.189	62.196	70.755	79.865	89.571	121.925	159.198	201.502	—	Weight lb/ft	
0.857"	0.952"	1.048"	1.143"	1.238"	1.333"	1.429"	1.524"	1.619"	1.714"	2.000"	2.286"	2.571"	3.000"	Min. wall	DR 21 (80psi)
16.183"	17.981"	19.779"	21.577"	23.375"	25.173"	26.971"	28.770"	30.568"	32.366"	37.760"	43.154"	48.549"	56.631"	Average I.D.	
20.200	24.940	30.172	35.990	42.486	49.266	56.585	64.370	72.657	81.446	110.874	144.833	183.253	248.550	Weight lb/ft	
0.692"	0.769"	0.846"	0.923"	1.000"	1.077"	1.154"	1.231"	1.308"	1.385"	1.615"	1.846"	2.077"	2.423"	Min. wall	DR 26 (64 psi)
16.532"	18.369"	20.206"	22.043"	23.880"	25.717"	27.554"	29.391"	31.228"	33.065"	38.575"	44.086"	49.597"	57.854"	Average I.D.	
16.480	20.350	24.620	29.300	34.648	40.187	46.135	52.494	59.264	66.444	90.393	118.082	149.464	202.810	Weight lb/ft	
0.554"	0.615"	0.677"	0.738"	0.800"	0.862"	0.923"	0.985"	1.046"	1.108"	1.292"	1.477"	1.662"	1.938"	Min. wall	DR 32.5 (51 psi)
16.826"	18.695"	20.565"	22.434"	24.304"	26.174"	28.043"	29.913"	31.782"	33.652"	39.260"	44.869"	50.478"	58.881"	Average I.D.	
13.300	16.420	19.863	23.640	27.940	32.421	37.196	42.340	47.773	53.581	72.893	95.233	120.556	163.620	Weight lb/ft	



HDPE Pipe

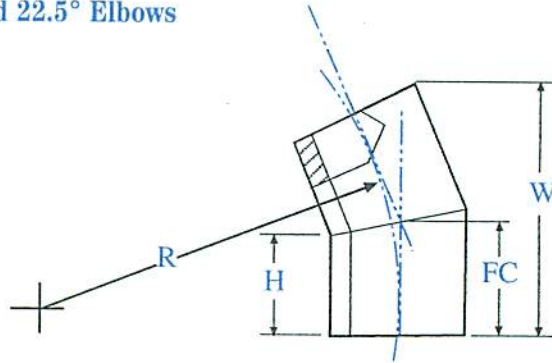
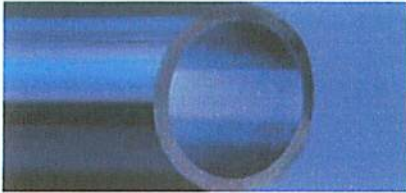
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IPS Fittings Fabricated 22.5° Elbows



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Pressure Rating is based on miter angle, pipe DR (Wall thickness), and resin properties.

Ratings based on 3608 resin/11.25 angle:	
DR	Pressure Rating
7	219 psi
9	160 psi
11	128 psi
13.5	100 psi
15.5	82 psi
17	73 psi
21	57 psi
26	44 psi
32.5	34 psi

Ratings based on 4710 resin/11.25 angle:	
DR	Pressure Rating
7	274 psi
9	202 psi
11	161 psi
13.5	126 psi
15.5	103 psi
17	92 psi
21	72 psi
26	55 psi
32.5	42 psi

Note: Size/DR listings shown are commonly requested. Many DR options not listed are available. Please consult an ISCO representative for availability.

Nominal Pipe Size(in)	DR	Part #	Dimensions				Weight (lbs)	Shipping Method	
			R (in)	H (in)	FC (in)	W (in)			
2	2.375	07	ISFF220207IPS	13.125	4	4.25	8.6	1	FedEx
		09	ISFF220209IPS	"	"	"	"	1	"
		11	ISFF220211IPS	"	"	"	"	1	"
3	3.5	07	ISFF220307IPS	13.625	4	4.375	9.03	2	FedEx
		09	ISFF220309IPS	"	"	"	"	1	"
		11	ISFF220311IPS	"	"	"	"	1	"
		17	ISFF220317IPS	"	"	"	"	1	"
4	4.5	07	ISFF220407IPS	14.25	5	5.5	11.34	3	FedEx
		09	ISFF220409IPS	"	"	"	"	3	"
		11	ISFF220411IPS	"	"	"	"	2	"
		17	ISFF220417IPS	"	"	"	"	1	"
6	6.625	07	ISFF220607IPS	15.25	6	6.625	14.08	8	FedEx
		09	ISFF220609IPS	"	"	"	"	7	"
		11	ISFF220611IPS	"	"	"	"	6	"
		17	ISFF220617IPS	"	"	"	"	4	"
		32.5	ISFF2206325IPS	"	"	"	"	2	"
8	8.625	07	ISFF220807IPS	16.25	6.5	7.375	15.81	15	FedEx
		09	ISFF220809IPS	"	"	"	"	12	"
		11	ISFF220811IPS	"	"	"	"	10	"
		17	ISFF220817IPS	"	"	"	"	6	"
		32.5	ISFF2208325IPS	"	"	"	"	3	"
10	10.75	07	ISFF221007IPS	17.25	6.5	7.625	16.62	24	FedEx
		09	ISFF221009IPS	"	"	"	"	20	"
		11	ISFF221011IPS	"	"	"	"	17	"
		17	ISFF221017IPS	"	"	"	"	11	"
		32.5	ISFF2210325IPS	"	"	"	"	6	"
12	12.75	07	ISFF221207IPS	19.5	8	9.25	20.27	42	FedEx
		09	ISFF221209IPS	"	"	"	"	34	"
		11	ISFF221211IPS	"	"	"	"	28	"
		17	ISFF221217IPS	"	"	"	"	19	"
		32.5	ISFF2212325IPS	"	"	"	"	10	"
14	14	07	ISFF221407IPS	21	8	9.375	20.75	51	FedEx
		09	ISFF221409IPS	"	"	"	"	41	"
		11	ISFF221411IPS	"	"	"	"	35	"
		17	ISFF221417IPS	"	"	"	"	23	"
		32.5	ISFF2214325IPS	"	"	"	"	12	"

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IPS Fittings Fabricated 22.5° Elbows(continued)

IPS Fittings Fabricated 22.5° Elbows									
Nominal Pipe Size(in)	Pipe OD(in)	DR	Part #	Dimensions				Weight (lbs)	Shipping Method
				R (in)	H (in)	FC (in)	W (in)		
16	16	07	ISFF221607IPS	24	8	9.625	21.51	66	FedEx
		09	ISFF221609IPS	"	"	"	"	55	"
		11	ISFF221611IPS	"	"	"	"	46	"
		17	ISFF221617IPS	"	"	"	"	31	"
		32.5	ISFF2216325IPS	"	"	"	"	17	"
18	18	09	ISFF221809IPS	27	8	9.75	22.28	71	FedEx
		11	ISFF221811IPS	"	"	"	"	60	"
		17	ISFF221817IPS	"	"	"	"	41	"
		32.5	ISFF2218325IPS	"	"	"	"	22	"
20	20	09	ISFF222009IPS	30	8	10	23.04	90	LTL
		11	ISFF222011IPS	"	"	"	"	75	"
		17	ISFF222017IPS	"	"	"	"	51	"
		32.5	ISFF2220325IPS	"	"	"	"	28	"
22	22	17	ISFF222217IPS	33	8	10.25	23.81	63	LTL
		32.5	ISFF2222325IPS	"	"	"	"	34	"
24	24	09	ISFF222409IPS	36	8	10.375	24.58	135	LTL
		11	ISFF222411IPS	"	"	"	"	113	"
		17	ISFF222417IPS	"	"	"	"	76	"
		32.5	ISFF2224325IPS	"	"	"	"	41	"
26	26	17	ISFF222617IPS	39	14	16.625	36.88	142	LTL
		32.5	ISFF2226325IPS	"	"	"	"	77	"
28	28	11	ISFF222811IPS	42	14	16.75	37.65	249	LTL
		17	ISFF222817IPS	"	"	"	"	167	"
		32.5	ISFF2228325IPS	"	"	"	"	90	"
30	30	11	ISFF223011IPS	45	14	17	38.41	289	LTL
		17	ISFF223017IPS	"	"	"	"	194	"
		32.5	ISFF2230325IPS	"	"	"	"	105	"
32	32	11	ISFF223211IPS	48	14	17.125	39.18	333	LTL
		17	ISFF223217IPS	"	"	"	"	223	"
		32.5	ISFF2232325IPS	"	"	"	"	120	"
36	36	11	ISFF223611IPS	54	14	17.625	40.71	426	LTL
		17	ISFF223617IPS	"	"	"	"	289	"
		26	ISFF223626IPS	"	"	"	"	191	"
		32.5	ISFF2236325IPS	"	"	"	"	153	"
42	42	17	ISFF224217IPS	63	21	25.125	56.47	563	LTL
		21	ISFF224221IPS	"	"	"	"	462	"
		26	ISFF224226IPS	"	"	"	"	377	"
		32.5	ISFF2242325IPS	"	"	"	"	301	"
48	48	21	ISFF224821IPS	72	21	25.75	58.77	753	LTL
		26	ISFF224826IPS	"	"	"	"	617	"
		32.5	ISFF2248325IPS	"	"	"	"	494	"
54	54	26	ISFF225426IPS	81	21	26.375	61.07	652	LTL
		32.5	ISFF2254325IPS	"	"	"	"	522	"
63	63	26	ISFF226326IPS	85.5	21	27.3	64.5	912	LTL
		32.5	ISFF2263325IPS	"	"	"	"	745	"



IPS
HDPE
Fittings

Pressure Rating is based on miter angle, pipe DR (Wall thickness), and resin properties.

Ratings based on 3608 resin/11.25 angle:

DR	Pressure Rating
7	219 psi
9	160 psi
11	128 psi
13.5	100 psi
15.5	82 psi
17	73 psi
21	57 psi
26	44 psi
32.5	34 psi

Ratings based on 4710 resin/11.25 angle:

DR	Pressure Rating
7	274 psi
9	202 psi
11	161 psi
13.5	126 psi
15.5	103 psi
17	92 psi
21	72 psi
26	55 psi
32.5	42 psi

Note: Size/DR listings shown are commonly requested. Many DR options not listed are available. Please consult an ISCO representative for availability.

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IPS Fittings Molded 90° Ell



IPS
HDPE
Fittings

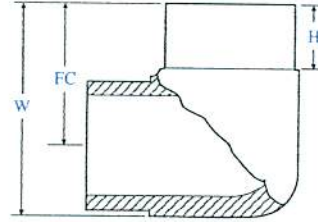
Pressure Rating of Molded Fittings are equal to pipe of same DR.

Molded Fittings from 3608 resin:	
DR	Pressure Rating
7	267 psi
9	200 psi
11	160 psi
13.5	128 psi
15.5	110 psi
17	100 psi
21	80 psi
26	64 psi
32.5	51 psi
Molded Fittings from 4710 resin:	
DR	Pressure Rating
7	336 psi
9	252 psi
11	202 psi
13.5	161 psi
15.5	139 psi
17	126 psi
21	101 psi
26	81 psi
32.5	64 psi

Note: Size/DR listings shown are commonly requested. Many DR options not listed are available. Please consult an ISCO representative for availability.

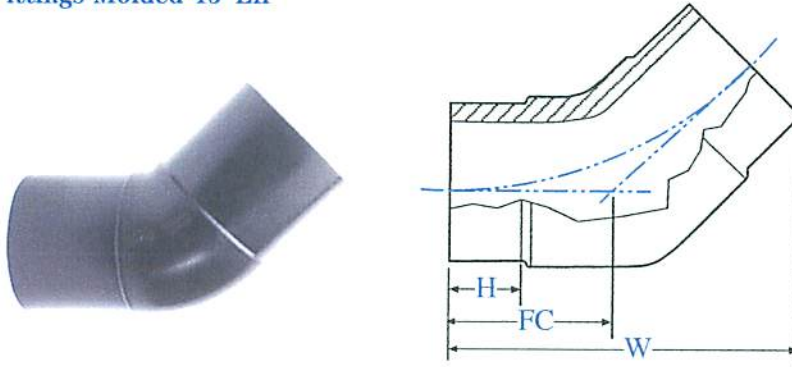
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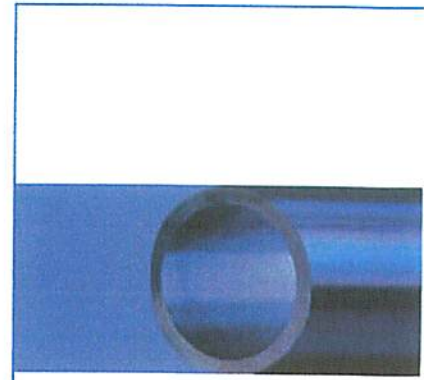


Nominal Pipe Size(in)	Pipe OD(in)	DR	Part #	Dimensions			Weight (lbs)	Shipping Method
				H (in)	FC (in)	W (in)		
3/4	1.05	11	ISMF9007511IPS	2.05	2.68	3.2	0.05	FedEx
1	1.315	11	ISMF900111IPS	2.17	2.91	3.57	0.1	FedEx
1-1/4	1.66	11	ISMF9012511IPS	2.44	3.35	4.18	0.15	FedEx
1-1/2	1.9	11	ISMF901511IPS	2.64	3.7	4.65	0.22	FedEx
2	2.375	09	ISMF900209IPS	2.5	4.25	5.815	0.5	FedEx
		11	ISMF900211IPS	"	"	"	0.43	"
3	3.5	09	ISMF900309IPS	3	5.25	7.4	1.5	FedEx
		11	ISMF900311IPS	"	"	"	1.2	"
		17	ISMF900317IPS	"	"	"	0.8	"
4	4.5	09	ISMF900409IPS	3	5.875	8.25	3	FedEx
		11	ISMF900411IPS	"	"	"	2.4	"
		17	ISMF900417IPS	"	"	"	1.6	"
6	6.625	09	ISMF900609IPS	4.125	8	12.5	7	FedEx
		11	ISMF900611IPS	"	"	"	6.7	"
		17	ISMF900617IPS	"	"	"	4.8	"
8	8.625	11	ISMF900811IPS	6	12	16.5	15	FedEx
		17	ISMF900817IPS	"	"	"	10	"
10	10.75	11	ISMF901011IPS	6	13.25	18.875	27	FedEx
		17	ISMF901017IPS	"	"	"	18	"
12	12.75	11	ISMF901211IPS	7.5	15.88	22.555	41	FedEx
		17	ISMF901217IPS	"	"	"	27	"

IPS Fittings Molded 45° Ell



IPS Fittings Molded 45° Ell								
Nominal Pipe Size(in)	Pipe OD(in)	DR	Part #	Dimensions			Weight (lbs)	Shipping Method
				H (in)	FC (in)	W (in)		
3/4	1.05	11	ISMF4507511IPS	2.05	2.28	4.29	0.05	FedEx
1	1.315	11	ISMF450111IPS	2.17	2.48	4.69	0.08	FedEx
1-1/4	1.66	11	ISMF45012511IPS	2.44	2.83	5.31	0.14	FedEx
1-1/2	1.9	11	ISMF4501511IPS	2.64	3.07	5.91	0.21	FedEx
2	2.375	11	ISMF450211IPS	2.64	3.23	6.38	0.35	FedEx
3	3.5	09	ISMF450309IPS	3.125	5.25	10.20	2.5	FedEx
		11	ISMF450311IPS	"	"	"	1.5	"
		17	ISMF450317IPS	"	"	"	1	"
4	4.5	09	ISMF450409IPS	3.125	5	10.13	3	FedEx
		11	ISMF450411IPS	"	"	"	2	"
		17	ISMF450417IPS	"	"	"	2	"
6	6.625	09	ISMF450609IPS	4.125	9	17.70	6	FedEx
		11	ISMF450611IPS	"	"	"	5.5	"
		17	ISMF450617IPS	"	"	"	5	"
8	8.625	11	ISMF450811IPS	6	11	21.8	12	FedEx
		17	ISMF450817IPS	"	"	"	11	"
10	10.75	11	ISMF451011IPS	6	13.25	26.42	22	FedEx
		17	ISMF451017IPS	"	"	"	20	"
12	12.75	11	ISMF451211IPS	7.5	15.75	31.39	32	FedEx
		17	ISMF451217IPS	"	"	"	29	"



IPS
HDPE
Fittings

Pressure Rating of Molded Fittings are equal to pipe of same DR.

Molded Fittings from 3608 resin:	
DR	Pressure Rating
7	267 psi
9	200 psi
11	160 psi
13.5	128 psi
15.5	110 psi
17	100 psi
21	80 psi
26	64 psi
32.5	51 psi

Molded Fittings from 4710 resin:	
DR	Pressure Rating
7	336 psi
9	252 psi
11	202 psi
13.5	161 psi
15.5	139 psi
17	126 psi
21	101 psi
26	81 psi
32.5	64 psi

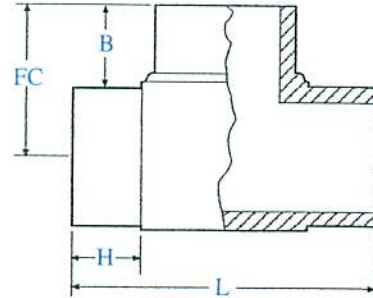
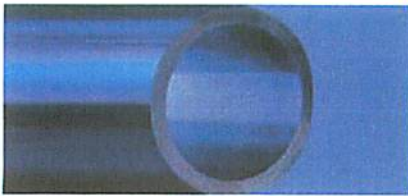
Note: Size/DR listings shown are commonly requested. Many DR options not listed are available. Please consult an ISCO representative for availability.

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IPS Fittings Molded Tees



IPS
HDPE
Fittings

Pressure Rating of Molded Fittings are equal to pipe of same DR.

Molded Fittings from 3608 resin:	
DR	Pressure Rating
7	267 psi
9	200 psi
11	160 psi
13.5	128 psi
15.5	110 psi
17	100 psi
21	80 psi
26	64 psi
32.5	51 psi

Molded Fittings from 4710 resin:	
DR	Pressure Rating
7	336 psi
9	252 psi
11	202 psi
13.5	161 psi
15.5	139 psi
17	126 psi
21	101 psi
26	81 psi
32.5	64 psi

Note: Size/DR listings shown are commonly requested. Many DR options not listed are available. Please consult an ISCO representative for availability.

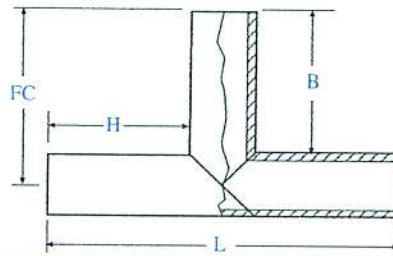
Nominal Pipe Size(in)	DR	Part #	Dimensions				Weight (lbs)	Shipping Method	
			L(in)	H(in)	FC(in)	B(in)			
3/4	1.05	11	ISMFTE07511IPS	5	1.77	2.5	1.98	0.1	FedEx
1	1.315	11	ISTETE0111IPS	5.67	1.77	2.83	2.17	0.17	FedEx
1-1/4	1.66	11	ISMFTE012511IPS	6.61	2.01	3.31	2.48	0.3	FedEx
1-1/2	1.9	11	ISMFTE015111IPS	7.99	2.52	4	3.05	0.47	FedEx
2	2.375	09	ISMFTE0209IPS	8.5	2.5	4.26	3.07	1	FedEx
		11	ISMFTE0211IPS	"	"	"	"	0.82	"
3	3.5	09	ISMFTE0309IPS	11.375	3	5.75	4	2.3	FedEx
		11	ISMFTE0311IPS	"	"	"	"	2.15	"
		17	ISMFTE0317IPS	"	"	"	"	1.45	"
4	4.5	09	ISMFTE0409IPS	12.25	3	6.25	4	4	FedEx
		11	ISMFTE0411IPS	"	"	"	"	3.8	"
		17	ISMFTE0417IPS	"	"	"	"	2.58	"
6	6.625	09	ISMFTE0609IPS	16.25	4	8.25	4.94	11	FedEx
		11	ISMFTE0611IPS	18	4.5	9	5.69	10	"
		17	ISMFTE0617IPS	"	"	"	"	7	"
8	8.625	11	ISMFTE0811IPS	23.75	5.85	11.9	7.59	25	FedEx
		17	ISMFTE0817IPS	"	"	"	"	17	"
10	10.75	11	ISMFTE1011IPS	27	6.15	13.5	8.13	43	FedEx
		17	ISMFTE1017IPS	"	"	"	"	29	"
12	12.75	11	ISMFTE1211IPS	31.6	7.5	15.9	9.53	67	FedEx
		17	ISMFTE1217IPS	"	"	"	"	46	"

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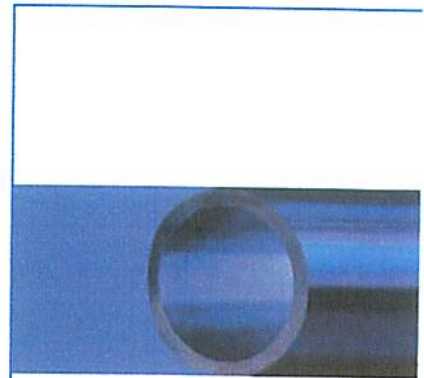


IPS Fittings Fabricated Tee - Three Segment



IPS Fittings Fabricated Tee - Three Segment

Nominal Pipe Size(in)	Pipe OD(in)	DR	Part #	Dimensions				Weight (lbs)	Shipping Method
				L(in)	H(in)	FC(in)	B(in)		
8	8.625	07	ISFFTE0807IPS	48	19.69	24	19.69	68	FedEx
		09	ISFFTE0809IPS	"	"	"	"	57	"
		11	ISFFTE0811IPS	"	"	"	"	47	"
		17	ISFFTE0817IPS	"	"	"	"	43	"
10	10.75	07	ISFFTE1007IPS	48	18.63	24	18.63	104	FedEx
		09	ISFFTE1009IPS	"	"	"	"	87	"
		11	ISFFTE1011IPS	"	"	"	"	73	"
		17	ISFFTE1017IPS	"	"	"	"	49	"
12	12.75	07	ISFFTE1207IPS	48	17.63	24	17.63	144	FedEx
		09	ISFFTE1209IPS	"	"	"	"	120	"
		11	ISFFTE1211IPS	"	"	"	"	101	"
		17	ISFFTE1217IPS	"	"	"	"	68	"
14	14	07	ISFFTE1407IPS	48	17	24	17	171	LTL
		09	ISFFTE1409IPS	"	"	"	"	144	"
		11	ISFFTE1411IPS	"	"	"	"	120	"
		17	ISFFTE1417IPS	"	"	"	"	81	"
16	16	07	ISFFTE1607IPS	48	16	24	16	220	LTL
		09	ISFFTE1609IPS	"	"	"	"	185	"
		11	ISFFTE1611IPS	"	"	"	"	155	"
		17	ISFFTE1617IPS	"	"	"	"	104	"
18	18	09	ISFFTE1809IPS	48	15	24	15	230	LTL
		11	ISFFTE1811IPS	"	"	"	"	193	"
		17	ISFFTE1817IPS	"	"	"	"	129	"
20	20	09	ISFFTE2009IPS	48	14	24	14	279	LTL
		11	ISFFTE2011IPS	"	"	"	"	234	"
		17	ISFFTE2017IPS	"	"	"	"	157	"
22	22	09	ISFFTE2209IPS	48	13	24	13	332	LTL
		11	ISFFTE2211IPS	"	"	"	"	279	"
		17	ISFFTE2217IPS	"	"	"	"	187	"
24	24	09	ISFFTE2409IPS	48	12	24	12	389	LTL
		11	ISFFTE2411IPS	"	"	"	"	326	"
		17	ISFFTE2417IPS	"	"	"	"	219	"
26	26	11	ISFFTE2611IPS	54	14	27	14	577	LTL
		17	ISFFTE2617IPS	"	"	"	"	390	"
28	28	11	ISFFTE2811IPS	56	14	28	14	689	LTL
		17	ISFFTE2817IPS	"	"	"	"	457	"
30	30	11	ISFFTE3011IPS	58	14	29	14	816	LTL
		17	ISFFTE3017IPS	"	"	"	"	552	"
36	36	17	ISFFTE3617IPS	76	20	51	33	1128	LTL
42	42	17	ISFFTE4217IPS	82	20	54	33	1331	LTL
48	48	26	ISFFTE4826IPS	88	20	57	33	1413	LTL
54	54	26	ISFFTE5426IPS	94	20	60	33	2026	LTL



IPS HDPE Fittings

Pressure Rating of Fab Tee is based pipe DR (Wall thickness) and resin properties.

Tees from 3608 resin:	
DR	Pressure Rating
7	200 psi
9	150 psi
11	120 psi
13.5	83 psi
15.5	72 psi
17	65 psi
21	52 psi
26	42 psi
32.5	33 psi

Tees from 4710 resin:	
DR	Pressure Rating
7	252 psi
9	189 psi
11	152 psi
13.5	105 psi
15.5	90 psi
17	82 psi
21	66 psi
26	53 psi
32.5	42 psi

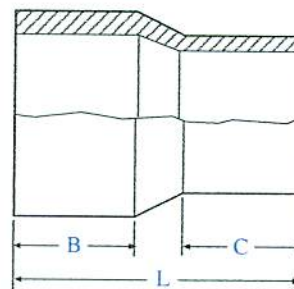
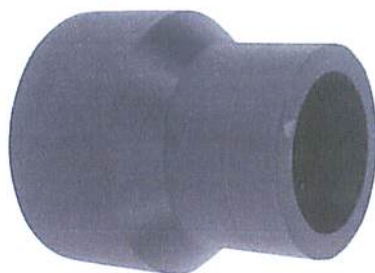
Note: Size/DR listings shown are commonly requested. Many DR options not listed are available. Please consult an ISCO representative for availability.

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IPS Fittings Concentric Reducer



IPS
HDPE
Fittings

Pressure Rating of Con. Reducers are equal to pipe of same DR.

Reducers from 3608 resin:

DR	Pressure Rating
7	267 psi
9	200 psi
11	160 psi
13.5	128 psi
15.5	110 psi
17	100 psi
21	80 psi
26	64 psi
32.5	51 psi

Reducers from 4710 resin:

DR	Pressure Rating
7	336 psi
9	252 psi
11	202 psi
13.5	161 psi
15.5	139 psi
17	126 psi
21	101 psi
26	81 psi
32.5	64 psi

Note: Size/DR listings shown are commonly requested. Many DR options not listed are available. Please consult an ISCO representative for availability.

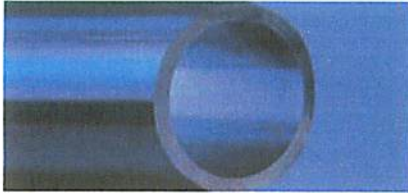
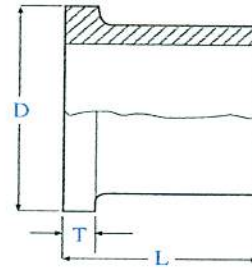
Nominal Size(in)	Pipe OD(in)	DR	Part #	Dimensions			Weight (lbs)	Shipping Method
				L (in)	B (in)	C (in)		
1 x 3/4	1.315 x 1.05	09	ISMFCR01X3/49.3	4.5	1.5	2.5	0.1	FedEx
		11	ISMFCR01X3/411	"	"	"	"	"
1-1/4 x 1	1.66 x 1.315	11	ISMFCR0125X111	4.3	1.8	1.25	0.1	FedEx
1-1/2 x 3/4	1.9 x 1.05	09	ISMFCR015X3/491	5.688	2.5	2.5	0.2	FedEx
		11	ISMFCR015X3/411	"	"	"	"	"
1-1/2 x 1	1.9 x 1.315	09	ISMFCR015X0193I	6	3.25	1.25	0.2	FedEx
		11	ISMFCR015X0111	"	"	"	"	"
1-1/2 x 1-1/4	1.9 x 1.66	11	ISFFCR01.5X1.25	4	1.88	2	0.2	FedEx
2 x 3/4	2.375 x 1.05	11	ISMFCR02X075111	6.25	3.25	1.25	0.3	FedEx
2 x 1	2.375 x 1.315	11	ISMFCR02X0111IP	6.25	3.25	1.25	0.3	FedEx
2 x 1-1/4	2.375 x 1.66	11	ISMFCR02X012511	6.25	3.25	2.25	0.3	FedEx
2 x 1-1/2	2.375 x 1.9	09	ISMFCR02X01509I	7	3	2.5	0.3	FedEx
		11	ISMFCR02X015111	"	"	"	"	"
3 x 2	3.5 x 2.375	09	ISMFCR03X0209IP	6.75	3	2.5	0.7	FedEx
		11	ISMFCR03X0211IP	"	"	"	"	"
4 x 2	4.5 x 2.375	11	ISMFCR04X0211IP	7.5	3	2.5	1.2	FedEx
		17	ISMFCR04X0217IP	"	"	"	0.8	"
4 x 3	4.5 x 3.5	09	ISMFCR04X0309IP	7.25	2.75	2.75	4	FedEx
		11	ISMFCR04X0311IP	"	"	"	3	"
		17	ISMFCR04X0317IP	"	"	"	2	"
5 x 4	5.563 x 4.5	11	ISMFCR05X0411IP	3.75	1.75	1.25	2.5	FedEx
6 x 3	6.625 x 3.5	11	ISMFCR06X0311IP	11.42	5.12	3.94	3	FedEx
		17	ISMFCR06X0317IP	"	"	"	2	"
6 x 4	6.625 x 4.5	09	ISMFCR06X0409IP	11	4.5	3.5	4	FedEx
		11	ISMFCR06X0411IP	"	"	"	3.5	"
		17	ISMFCR06X0417IP	"	"	"	2.4	"
6 x 5	6.625 x 5.563	11	ISMFCR06X0511IP	3.75	1.75	1.25	2.5	FedEx
8 x 6	8.625 x 6.625	09	ISFFCR08X0609IP	12	4.5	4	9	FedEx
		11	ISMFCR08X0611IP	"	"	"	7.3	"
		17	ISMFCR08X0617IP	"	"	"	5	"
10 x 8	10.75 x 8.625	09	ISFFCR10X0809IP	16	6	6	16	FedEx
		11	ISFFCR10X0811IP	"	"	"	13	"
		17	ISFFCR10X0817IP	"	"	"	9	"
12 x 8	12.75 x 8.625	11	ISFFCR12X0811IP	16	6	6	19	FedEx
		17	ISFFCR12X0817IP	"	"	"	13	"
12 x 10	12.75 x 10.75	09	ISFFCR12X1009IP	16	6	6	25	FedEx
		11	ISFFCR12X1011IP	"	"	"	21	"
		17	ISFFCR12X1017IP	"	"	"	14	"
14 x 12	14.0 x 12.75	09	ISFFCR14X1209IP	18	7	7	34	FedEx
		11	ISFFCR14X1211IP	"	"	"	28	"
		17	ISFFCR14X1217IP	"	"	"	19	"

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IPS Fittings Flange Adapter



IPS HDPE Fittings

Pressure Rating of Flanges are equal to pipe of same DR.

Flanges from 3608 resin:	
DR	Pressure Rating
7	267 psi
9	200 psi
11	160 psi
13.5	128 psi
15.5	110 psi
17	100 psi
21	80 psi
26	64 psi
32.5	51 psi

Flanges from 4710 resin:	
DR	Pressure Rating
7	336 psi
9	252 psi
11	202 psi
13.5	161 psi
15.5	139 psi
17	126 psi
21	101 psi
26	81 psi
32.5	64 psi

Note: Size/DR listings shown are commonly requested. Many DR options not listed are available. Please consult an ISCO representative for availability.

IPS Fittings Flange Adapter							
Nominal Size	Pipe OD (in)	DR	D (in)	Dimensions T(in)	L (in)	Weight (lbs)	Shipping Method
3/4	1.05	11	2	0.2	4	0.1	FedEx
1	1.315	11	2.375	0.21 - 0.24	4	0.1	FedEx
1-1/4	1.66	11	2.75	0.25	4 - 6	0.2	FedEx
1-1/2	1.9	11	3.125	0.29 - 0.3	4 - 6	0.2	FedEx
2	2.375	7	3.75 - 4.0	0.39 - 0.44	5.5 - 6	1	FedEx
		9	"	0.39 - 0.44	5.5 - 6	1	"
		11,17	"	0.3 - 0.55	5.5 - 6.125	1	"
3	3.5	7,9	4.625 - 5	0.6 - 0.63	6	2	FedEx
		11,17	"	0.4 - 0.67	6 - 6.125	2	"
4	4.5	7	6.0 - 6.625	0.54 - 0.8	6	3	FedEx
		9	"	0.54 - 0.8	6	3	"
		11,17,21	"	0.5 - 0.8	6 - 7.125	3	"
6	6.625	7	8.125 - 8.625	1.1 - 1.14	8 - 8.125	8	FedEx
		9	"	1.1 - 1.14	8 - 8.125	8	"
		11,17,21	"	0.7 - 1.02	8 - 8.07	4.07 - 7	"
		26, 32.5	"	1	8	7	"
8	8.625	7	10.6 - 10.75	1.4 - 1.5	8.625 - 9	11	FedEx
		9	"	1.13 - 1.47	8.625 - 9	10.0 - 11	"
		11	"	0.8 - 1.26	9.02 - 11	7.0 - 10	"
		17	"	0.9 - 1.02	9.02 - 11	5.0 - 10	"
10	10.75	7	12.75 - 13	0.9 - 1	11	5.0 - 10	"
		9	"	1.28 - 2	8.75 - 12	19	FedEx
		11	"	1.1 - 1.38	9.02 - 12	18	"
		17	"	0.9 - 1.28	9.02 - 12	18	"
12	12.75	7	15 - 15.75	1.1 - 1.28	11.0 - 12	18	"
		9	"	1.54 - 2.3	9.125 - 12	25	FedEx
		11	"	1.54 - 2.3	9.125 - 12	25	"
		17	"	1.3 - 1.54	10.79 - 12	24	"
14	14.00	7	17.0 - 17.5	1 - 1.54	10.79 - 12	24	"
		9	"	1.3 - 1.5	11.0 - 12	24	"
		11	"	1.5 - 2.35	12	41.8	FedEx
		17	"	1.5 - 2.35	12	35.9	"
16	16.00	7	19.5 - 20	1.5 - 1.7	11.0 - 12	40	"
		9	"	1.1 - 1.6	11.0 - 12	40	"
		11	"	1.1 - 1.6	11.0 - 12	40	"
		17	"	1.5 - 1.6	11 - 11.5	40	"
		21,26, 32.5	"	1.75 - 2.69	12	56.2	FedEx
18	18.00	7	21.0 - 21.5	1.75 - 2.69	12	48.5	"
		9	"	1.7 - 1.9	11.5 - 12	60	"
		11	"	1.2 - 1.8	11.5 - 12	60	"
		17	"	1.7 - 1.8	11.5 - 12	60	"

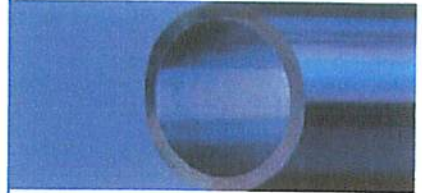
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IPS Fittings Flange Adapter (continued)

IPS Fittings Flange Adapter (continued)							
Nominal Size (in)	Pipe OD (in)	DR	Dimensions			Weight (lbs)	Shipping Method
			D (in)	T (in)	L (in)		
18	18.00	7	20.13 - 21.38	1.88, 3.02	12	64.2	FedEx
		9	"	1.88, 3.02	12	59	"
		11	"	1.88 - 2.1	11.5 - 12	64	"
		17	"	1.4 - 2	11.5 - 12	64	"
		21, 26, 32.5	"	1.9 - 2	11.5 - 12	64	"
20	20.00	7	23.25 - 23.5	3.35	12	70	FedEx
		9	"	2.27, 3.35	"	67	"
		11	"	2.15 - 2.5	"	66	"
		17	"	1.5 - 2.5	"	66	"
		32.5	"	2.5	"	66	"
22	22.00	7	25.25 - 25.6	3.68	12	85	FedEx
		9	"	3.68	"	85	"
		11	"	2.3 - 2.5	"	68	"
		17	"	1.6 - 2.5	"	68	"
		32.5	"	2.5	"	68	"
24	24.00	7	27.69 - 28	4.07	12.0 - 14	83	FedEx
		9	"	2.82 - 4.07	12.0 - 14	79	"
		11	"	2.5 - 2.9	12.0 - 14	79	"
		17	"	1.8 - 2.7	12.0 - 14	79	"
		32.5	"	2.7	14	79	"
26	26.00	7	29.75 - 30	3.4 - 4.10	14	125	LTL
		9	"	3.4 - 4.10	"	125	"
		11	"	2.7 - 2.95	"	120	"
		17	"	1.91 - 2.79	"	87	"
		32.5	"	1.91 - 2.79	"	87	"
28	28.00	9	32 - 32.3	3.65 - 4.5	14	95	LTL
		11	"	3.18 - 4.5	"	129	"
		17 - 32.5	"	2.06 - 3	"	95	"
30	30.00	9	34 - 34.3	3.91 - 4.8	14	108	LTL
		11	"	3.21 - 4.8	"	134	"
		17 - 32.5	"	2.21 - 3.21	"	108	"
32	32.00	11	36.125 - 36.7	3.3 - 3.42	14	124	LTL
		17 - 32.5	"	2.95 - 3.42	"	124	"
34	34.00	11	38.125 - 38.6	3.5 - 3.63	14	150	LTL
		17 - 32.5	"	2.5 - 3.63	"	150	"
36	36.00	11	40.5 - 40.8	3.7 - 3.84	14	159	LTL
		17 - 32.5	"	2.65 - 3.84	"	159	"
42	42.00	17	47.125 - 47.5	3.1 - 3.73	21	306	LTL
		21 - 32.5	"	2.6 - 3.73	"	238	"
48	48.00	17	53.5 - 54	3.32 - 4.27	21, 22	405	LTL
		26 - 32.5	"	2.6 - 3.5	"	316	"
54	54.00	21	59.5 - 60	3.3 - 3.8	21	370	LTL
		26 - 32.5	"	2.6 - 3.8	"	370	"
63	63.208	21 - 32.5	66.79	3.54 - 4.3	14, 134 - 21	425	LTL



IPS
HDPE
Fittings

Pressure Rating of Flanges are equal to pipe of same DR.

Flanges from 3608 resin:	
DR	Pressure Rating
7	267 psi
9	200 psi
11	160 psi
13.5	128 psi
15.5	110 psi
17	100 psi
21	80 psi
26	64 psi
32.5	51 psi

Flanges from 4710 resin:	
DR	Pressure Rating
7	336 psi
9	252 psi
11	202 psi
13.5	161 psi
15.5	139 psi
17	126 psi
21	101 psi
26	81 psi
32.5	64 psi

Note: Size/DR listings shown are commonly requested. Many DR options not listed are available. Please consult an ISCO representative for availability.

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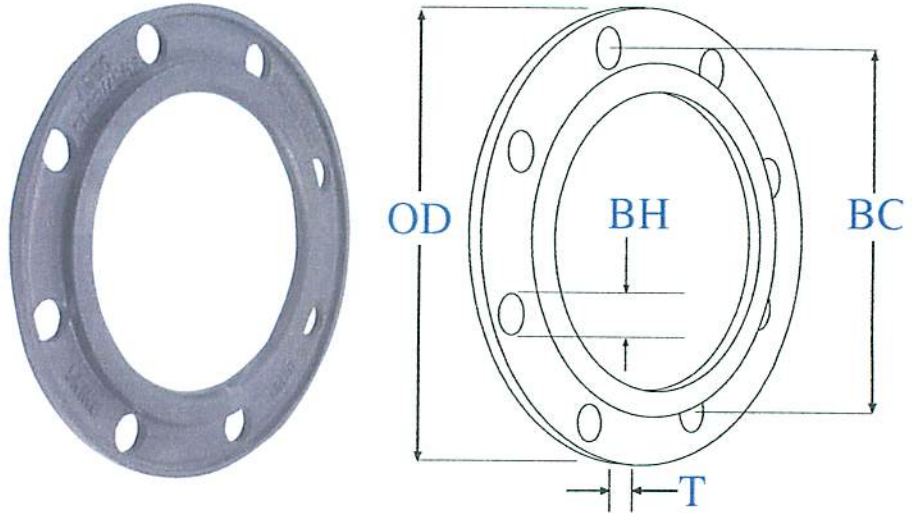
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IPS Fittings Back Up Rings (For use with the Flange Adapter)



IPS
HDPE
Fittings



IPS Fittings Back Up Rings (For use with the Flange Adapter)

Nominal Pipe Size (in)	Pipe OD (in)	Material	Dimensions				Pressure Rating	Weight (lbs)	Shipping Method	
			OD (in)	T (in)	Bolts (#)	BH (in)				BC (in)
3/4	1.05	Ductile Iron	3.875	0.5 - 0.53	4	0.625	2.75	267	1	FedEx
1	1.315	Ductile Iron	4.25	0.53 - 0.56	4	0.625	3.125	267	1	FedEx
		Stainless Steel	"	0.56	"	"	"	267	2	"
1 1/4	1.66	Ductile Iron	4.625	0.63	4	0.625	3.5	267	2	FedEx
1 1/2	1.9	Ductile Iron	5	0.69	4	0.625	3.875	267	2	FedEx
		Stainless Steel	"	0.69	"	"	"	267	2	"
2	2.375	Ductile Iron	6	0.5, 0.75	4	0.75	4.75	160, 267	1.5, 3	FedEx
		PP Coated DI	6.5	0.71	"	"	"	128, 275	1.8	"
		Stainless Steel	6	0.4, 0.75	"	"	"	160, 267	2, 2.6	"
3	3.5	Ductile Iron	7.5	0.53, 0.94	4	0.75	6	160, 267	2.5, 4.5	FedEx
		PP Coated DI	7.8	0.71, 0.73	"	"	"	128, 275	2.4	"
		Stainless Steel	7.5	0.4, 0.94	"	"	"	128, 267	3, 5"	"
4	4.5	Ductile Iron	9	0.55, 0.94	8	0.75	7.5	160, 267	3.5, 5.5	FedEx
		PP Coated DI	9.21	0.71, 0.98	"	"	"	128, 275	2.5, 4.2	"
		Stainless Steel	9	0.5 - 0.94	"	"	"	128, 267	5, 6"	"
6	6.625	Ductile Iron	11	0.63, 1	8	0.875	9.5	160, 267	4.5, 7.5	FedEx
		PP Coated DI	11.57	0.79, 1.18	"	"	"	128, 275	4.0, 7.1	"
		Stainless Steel	11	0.6, 1	"	"	"	128, 267	6, 9"	"
8	8.625	Ductile Iron	13.5	0.85, 1.125	8	0.875	11.75	160, 267	8, 12	FedEx
		PP Coated DI	13.86	1.1, 1.34	"	"	"	128, 275	7.5, 11.6	"
		Stainless Steel	13.5	0.7 - 1.13	"	"	"	128, 267	9, 13	"
10	10.75	Ductile Iron	16	0.98, 1.19	12	1	14.25	160, 267	12, 16	FedEx
		PP Coated DI	16.61	1.22, 1.52	"	"	"	128, 275	10.5, 16	"
		Stainless Steel	16	0.9, 1.19	"	"	"	128, 267	12, 18	"
12	12.75	Ductile Iron	19	1.25 - 1.5	12	1	17	160 - 267	20, 25	FedEx
		PP Coated DI	19.37	1.61, 2.01	"	"	"	128, 275	17.5, 28.2	"
		Stainless Steel	19	1.05 - 1.77	"	"	"	128 - 267	21 - 37	"

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IPS Fittings Back Up Rings (For use with the Flange Adapter) (continued)

IPS Fittings Back Up Rings (For use with the Flange Adapter) (continued)

Nominal Pipe Size(in)	Pipe OD(in)	Material	Dimensions					Pressure Rating	Weight (lbs)	Shipping Method
			OD(in)	T(in)	Bolts(#)	BH(in)	BC(in)			
14	14.00	Ductile Iron	21	1.38, 1.63	12	1.125	18.75	160, 267	29, 37	FedEx
		PP Coated DI	21.26	1.61, 2.05	"	"	"	128, 275	23, 35.7	"
		Stainless Steel	21	1.13 - 1.78	"	"	"	100 - 267	25 - 50	"
16	16.00	Ductile Iron	23.5	1.63 - 1.88	16	1.125	21.25	160, 267	39 - 49	FedEx
		PP Coated DI	23.82	1.75, 2.44	"	"	"	128, 275	30, 66.4	"
		Stainless Steel	23.5	1.25 - 2.17	"	"	"	80 - 267	31 - 67	"
18 → 18.00	18.00	Ductile Iron	25	1.67 - 2	16	1.25	22.75	160 - 267	42 - 53	LTL
		PP Coated DI	25.51	1.91, 2.44	"	"	"	128, 275	34, 60.6	"
		Stainless Steel	25	1.34 - 2.06	"	"	"	80 - 267	33 - 67	"
20	20.00	Ductile Iron	27.5	1.81 - 2.23	20	1.25	25	160 - 200	55 - 70	LTL
		PP Coated DI	27.87	2.13, 2.68	"	"	"	128, 275	42, 93.5	"
		Stainless Steel	27.5	1.47 - 2.27	"	"	"	80 - 267	39 - 90	"
22	22.00	Ductile Iron	29.5	2 - 2.41	20	1.375	27.25	160 - 200	65 - 80	LTL
		PP Coated DI	"	3.19	"	"	"	275	104.9	"
		Stainless Steel	"	1.54 - 2.43	"	"	"	80 - 267	50 - 106	"
24	24.00	Ductile Iron	32	2.13 - 2.56	20	1.375	29.5	160 - 200	80 - 103	LTL
		PP Coated DI	32.52	2.24, 3.19	"	"	"	128, 275	58.5, 142.2	"
		Stainless Steel	32	1.6 - 2.6	"	"	"	64 - 267	65 - 116	"
26	26.00	Ductile Iron	34.25	2 - 2.53	24	1.375	31.75	100 - 200	83 - 109	LTL
		Stainless Steel	"	2.2, 2.5	"	"	"	80, 160	96, 119	"
		Ductile Iron	36.5	2.06 - 2.6	28	1.375	34	100 - 200	92 - 130	LTL
28	28.00	PP Coated DI	36.95	2.99, 3.9	"	"	"	128, 275	105, 224.4	"
		Stainless Steel	36.5	2.3 - 2.68	"	"	"	80 - 160	109 - 134	"
		Ductile Iron	38.75	2.06 - 2.68	28	1.375	36	65 - 200	104 - 153	LTL
30	30.00	PP Coated DI	39.45	3.13, 3.9	"	"	"	128, 275	119, 247.1	"
		Stainless Steel	38.75	2.18 - 3.8	"	"	"	64 - 267	121 - 302	"
		Ductile Iron	41.75	2.06 - 2.84	28	1.625	38.5	65 - 200	111 - 175	LTL
32	32.00	Stainless Steel	"	2.36 - 2.85	"	"	"	64 - 128	145 - 199	"
		Ductile Iron	43.75	2.14 - 2.88	32	1.625	40.5	60 - 100	137 - 191	LTL
34	34.00	Stainless Steel	"	2.68 - 3.3	"	"	"	64 - 128	168 - 228	"
		Ductile Iron	46	2.06 - 3.14	32	1.625	42.75	50 - 160	129 - 225	LTL
		PP Coated DI	46.65	3.86	"	"	"	128	197	"
36	36.00	Stainless Steel	46	2.35 - 3	"	"	"	50 - 100	167 - 230	"
		Ductile Iron	50.75	3.5	36	1.625	47.25	128	307	LTL
		Stainless Steel	"	3.45	"	"	"	80	341	"
42	42.00	Ductile Iron	53	2.26 - 3.53	36	1.625	49.5	40 - 128	253 - 396	LTL
		Stainless Steel	"	2.48 - 3.25	"	"	"	40 - 80	223 - 330	"
48	48.00	Ductile Iron	59.5	3.5 - 3.82	44	1.625	56	64 - 100	332 - 400	LTL
		Stainless Steel	"	2.45 - 3.63	"	"	"	30 - 64	291 - 405	"
54	54.00	Ductile Iron	66.25	2.57 - 4.1	44	1.875	62.75	30 - 80	318 - 519	LTL
		Stainless Steel	"	2.8 - 4.03	"	"	"	30 - 64	365 - 513	"
63	62.99	Ductile Iron	73	2.8, 3.15	52	1.875	69.25	32, 64	277, 437	LTL
		Stainless Steel	"	3.23, 3.54	"	"	"	32, 51	455, 495	"



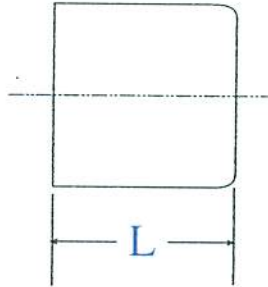
IPS
HDPE
Fittings

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IPS Fittings Cap



IPS Fittings Cap						
Nominal Size(in)	Pipe OD(in)	DR	Part #	Dimensions L (in)	Weight (lbs)	Shipping Method
3/4	1.05	11	ISMFCP07511IPS	2.375	0.05	FedEx
1	1.315	11	ISMFCP01111IPS	2.375	0.1	FedEx
1 1/4	1.66	11	ISMFCP012511IPS	2.25	0.1	FedEx
1 1/2	1.9	11	ISMFCP01511IPS	2.83	0.25	FedEx
2	2.375	09	ISMFCP0209IPS	3.25	0.3	FedEx
		11	ISMFCP0211IPS	"	"	"
3	3.5	09	ISMFCP0309IPS	3.25	0.8	FedEx
		11	ISMFCP0311IPS	"	"	"
4	4.5	09	ISMFCP0409IPS	5.5	2	FedEx
		11	ISMFCP0411IPS	"	"	"
6	6.625	09	ISMFCP0609IPS	4.5	3	FedEx
		11	SMFCP0611IPS	"	"	"
8	8.625	11	ISMFCP0811IPS	4.75	4.4	FedEx
10	10.75	11	ISMFCP1011IPS	4	13	FedEx
12	12.75	11	ISMFCP1211IPS	4	18	FedEx
14	14.00	7	ISFFCP1407IPS	4	21	FedEx
		11	ISFFCP1411IPS	"	21	"
		7	ISFFCP1407IPSLG	16	53	FedEx
		11	ISFFCP1411IPSLG	"	44	"
16	16.00	7	ISFFCP1607IPS	5	35	FedEx
		11	ISFFCP1611IPS	4	28	"
		7	ISFFCP1607IPSLG	16	76	FedEx
		11	ISFFCP1611IPSLG	"	57	"
18	18.00	7	ISFFCP1807IPS	5	44	FedEx
		11	ISFFCP1811IPS	5	44	"
		7	ISFFCP1807IPSLG	16	96	FedEx
		11	ISFFCP1811IPSLG	"	81	"
20	20.00	7	ISFFCP2007IPS	6	65	FedEx
		11	ISFFCP2011IPS	5	55	"
		7	ISFFCP2007IPSLG	16	130	LTL
		11	ISFFCP2011IPSLG	"	100	"
22	22.00	7	ISFFCP2207IPS	6	79	FedEx
		11	ISFFCP2211IPS	5	66	"
		7	ISFFCP2207IPSLG	16	157	LTL
		11	ISFFCP2211IPSLG	"	121	"
24	24.00	11	ISFFCP2411IPS	6	94	FedEx
		11	ISFFCP2411IPSLG	16	159	LTL

IPS
HDPE
Fittings

Pressure Rating of Caps are equal to pipe of same DR.

Caps from 3608 resin:	
DR	Pressure Rating
7	267 psi
9	200 psi
11	160 psi
13.5	128 psi
15.5	110 psi
17	100 psi
21	80 psi
26	64 psi
32.5	51 psi

Cap from 4710 resin:	
DR	Pressure Rating
7	336 psi
9	252 psi
11	202 psi
13.5	161 psi
15.5	139 psi
17	126 psi
21	101 psi
26	81 psi
32.5	64 psi

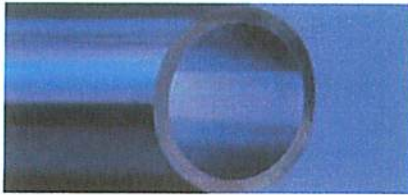
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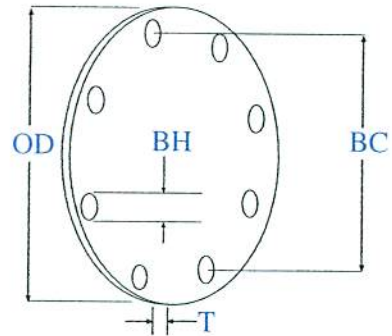
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Blind Flange



IPS-DIPS
HDPE
Fittings



Nominal Size(in)	Material	Part #	Dimensions				Weight (lbs)	Shipping Method	
			OD (in)	T(in)	Bolts(#)	BH(in)			BC(in)
3/4	HDPE	ISFFBF075HDPIPS	3.875	1	4	0.625	2.75	0.2	FedEx
	PVC	ISFFBF075PVCIPS	"	"	"	"	"	0.3	"
1	HDPE	ISFFBF01HDPIPS	4.25	1	4	0.625	3.125	0.3	FedEx
	PVC	ISFFBF01PVCIPS	"	"	"	"	"	0.5	"
1 1/4	HDPE	ISFFBF0125HDPIP	4.625	1	4	0.625	3.5	0.5	FedEx
	PVC	ISFFBF0125PVCIP	"	"	"	"	"	1	"
1 1/2	HDPE	ISFFBF015HDPIPS	5	1	4	0.625	3.875	0.5	FedEx
	PVC	ISFFBF015PVCIPS	"	"	"	"	"	1	"
	STEEL	BU015STBLNDFLG	"	0.625	"	"	"	3.6	"
2	HDPE	ISFFBF02HDPIPS	6	1	4	0.75	4.75	1	FedEx
	PVC	ISFFBF02PVCIPS	"	"	"	"	"	1.5	"
	STEEL	BU02STBLNDFLG	"	0.625	"	"	"	5.1	"
3	HDPE	ISFFBF03HDPIPS	7.5	1	4	0.75	6	1	FedEx
	PVC	ISFFBF03PVCIPS	"	"	"	"	"	2	"
	STEEL	BU03STBLNDFLG	"	0.625	"	"	"	8.2	"
4	HDPE	ISFFBF04HDPIPS	9	1	8	0.75	7.5	2	FedEx
	PVC	ISFFBF04PVCIPS	"	"	"	"	"	3	"
	STEEL	BU04STBLNDFLG	"	0.625	"	"	"	11.7	"
6	HDPE	ISFFBF06HDPIPS	11	1	8	0.875	9.5	3	FedEx
	PVC	ISFFBF06PVCIPS	"	"	"	"	"	4	"
	STEEL	BU06STBLNDFLG	"	0.688	"	"	"	17.8	"
8	HDPE	ISFFBF08HDPIPS	13.5	1	8	0.875	11.75	5	FedEx
	PVC	ISFFBF08PVCIPS	"	"	"	"	"	7	"
	STEEL	BU08STBLNDFLG	"	0.688	"	"	"	27.2	"
10	HDPE	ISFFBF10HDPIPS	16	1	12	1	14.25	6	FedEx
	PVC	ISFFBF10PVCIPS	"	"	"	"	"	9	"
	STEEL	BU10STBLNDFLG	"	0.688	"	"	"	38.1	"
12	HDPE	ISFFBF12HDPIPS	19	1	12	1	17	9	FedEx
	PVC	ISFFBF12PVCIPS	"	"	"	"	"	13	"
	STEEL	BU12STBLNDFLG	"	0.812	"	"	"	63.1	"
14	HDPE	ISFFBF14HDPIPS	21	1	12	1.125	18.75	11	FedEx
	PVC	ISFFBF14PVCIPS	"	"	"	"	"	16	"
	STEEL	BU14STBLNDFLG	"	0.938	"	"	"	88.8	"
16	HDPE	ISFFBF16HDPIPS	23.5	1	16	1.125	21.25	14	FedEx
	PVC	ISFFBF16PVCIPS	"	"	"	"	"	20	"
	STEEL	BU16STBLNDFLG	"	"	"	"	"	118.4	LTL
18	HDPE	ISFFBF18HDPIPS	25	1	16	1.25	22.75	16	FedEx
	PVC	ISFFBF18PVCIPS	"	"	"	"	"	23	"
	STEEL	BU18STBLNDFLG	"	1.062	"	"	"	140.6	LTL

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Blind Flange (continued)

Nominal Size(in)	Material	Part #	Dimensions					Weight (lbs)	Shipping Method
			OD(in)	T(in)	Bolts(#)	BH(in)	BC(in)		
20	HDPE	ISFFBF20HDPIPS	27.5	1	20	1.25	25	20	FedEx
	PVC	ISFFBF20PVCIPS	"	"	"	"	"	29	"
	STEEL	BU20STBLNDFLG	"	1.125	"	"	"	181.5	LTL
22	HDPE	ISFFBF22HDPIPS	29.5	1	20	1.375	27.25	23	FedEx
	PVC	ISFFBF22PVCIPS	"	"	"	"	"	33	"
	STEEL	BU22STBLNDFLG	"	1.188	"	"	"	212.7	LTL
24	HDPE	ISFFBF24HDPIPS	32	1	20	1.375	29.5	26	FedEx
	PVC	ISFFBF24PVCIPS	"	"	"	"	"	38	"
	STEEL	BU24STBLNDFLG	"	1.25	"	"	"	274.4	LTL
26	HDPE	ISFFBF26HDPIPS	34.25	1	24	1.375	31.75	30	LTL
28	HDPE	ISFFBF28HDPIPS	36.5	1	28	1.375	34	35	LTL
	STEEL	BU28STBLNDFLG	"	1.312	"	"	"	369.3	"
30	HDPE	ISFFBF30HDPIPS	38.75	1	28	1.375	36	40	LTL
	PVC	ISFFBF30PVCIPS	"	"	"	"	"	58	"
	STEEL	BU30STBLNDFLG	"	1.375	"	"	"	443.6	"
32	HDPE	ISFFBF32HDPIPS	41.75	1	28	1.625	38.5	45	LTL
	STEEL	BU32STBLNDFLG	"	1.5	"	"	"	587.3	"
36	HDPE	ISFFBF36HDPIPS	46	1	32	1.625	42.75	55	LTL
	PVC	ISFFBF36PVCIPS	"	"	"	"	"	80	"
	STEEL	BU36STBLNDFLG	"	1.625	"	"	"	734.6	"
40	HDPE	ISFFBF40HDPIPS	50.75	1	36	1.625	47.25	65	LTL
	STEEL	BU40STBLNDFLG	"	1.625	"	"	"	800	"
42	HDPE	ISFFBF42HDPIPS	53	1	36	1.625	49.5	75	LTL
	STEEL	BU42STBLNDFLG	"	1.75	"	"	"	1085	"
48	HDPE	ISFFBF48HDPIPS	59.5	1	44	1.625	56	100	LTL
	STEEL	BU48STBLNDFLG	"	1.75	"	"	"	1369	"
54	HDPE	ISFFBF54HDPIPS	66.25	1	44	1.875	62.75	120	LTL
	STEEL	BU54STBLNDFLG	"	2.125	"	"	"	2180	"

* HDPE and PVC Blinds are not rated for full pressure above 6".

*Steel Blinds may not be fully pressure rated above 10" depending on pipe (system) DR.

*Bolt circle for IPS Blind Flanges are the same for DIPS Blind Flanges 24" and smaller.

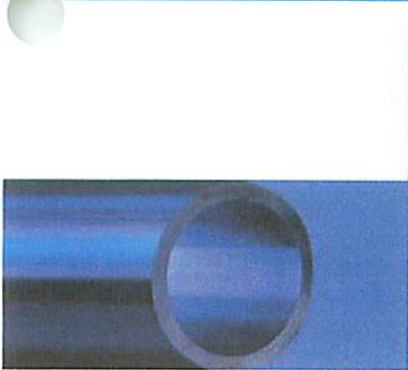


IPS-DIPS
HDPE
Fittings

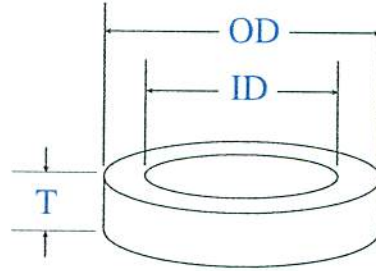
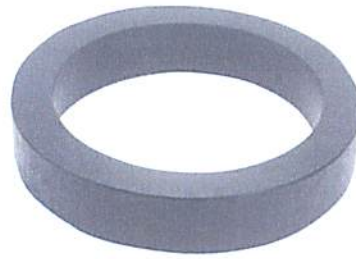
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IPS-DIPS
HDPE
Fittings

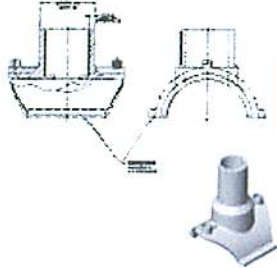


Nominal Size(in)	Pressure Rating	Part #	Dimensions			Weight (lbs)	Shipping Method
			OD (in)	ID (in)	T (in)		
2	160	ISFFVS0211IPS	3.5	2.8	2	0.25	FedEx
3	160	ISFFVS0311IPS	4.8	3.6	2	0.5	FedEx
4	160	ISFFVS0411IPS	6.625	5.15	2	1	FedEx
6	160	ISFFVS0611IPS	8.625	6.625	2	2	FedEx
8	160	ISFFVS0811IPS	10.75	8.625	2	2.5	FedEx
10	160	ISFFVS1011IPS	13.0	10.75	2	4	FedEx
12	160	ISFFVS1211IPS	15.25	12.45	2	5	FedEx
14	160	ISFFVS1411IPS	17.5	14.0	2	6	FedEx
16	160	ISFFVS1611IPS	20	16.0	2	7	FedEx
18	160	ISFFVS1811IPS	21.1	17.25	2	8	FedEx
20	160	ISFFVS2011IPS	23.5	19.25	2	9	FedEx
22	160	ISFFVS2211IPS	25.6	22.4	2	11	FedEx
24	160	ISFFVS2411IPS	28	22.75	2	13	FedEx

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Available Outlet Sizes:

4" DIPS - 8" DIPS*

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* Available in PE 3408 only

At Central Plastics we are proud to be recognized as the company that pioneered and introduced to industries within the United States to the concept of joining polyethylene piping systems together via the process of electrofusion. As an International leader in the world of manufactured Polyethylene (PE) Electrofusion fittings and with manufacturing facilities located around the world, Central Plastics has been actively involved since the early 1960's in the research and promotion of innovative joining methods for polyethylene piping systems for the natural gas, potable water, wastewater, oilfield, mining landfill, telecommunications and geothermal industries.

With unparalleled expertise focusing on the design and manufacturing of polyethylene electrofusion fittings, Central Plastics offers the largest, most complete line of electrofusion products, manufactured from a variety of common virgin resins, available in the market. Our substantial vertically integrated manufacturing capabilities allow Central Plastics to exercise complete control of our manufactured products. From design, to "state of the art" manufacturing, to shipping; Central Plastics maintains a high level of product consistency and quality throughout our manufacturing processes.

Central Plastics Electrofusion Branch Saddles are designed and manufactured in accordance with ASTM F-1055 for use with pipe conforming to ASTM D2513/3035, F-714 and with Butt fittings conforming to ASTM D3261 as applicable. These fittings can be supplied with an integral identification resistor which is recognized by all Central Plastic's processors to automatically set the proper fusion parameters. Electrofusion fittings are supplied with a 24 digit ISO compliant barcode label which facilitates the fusion of the Central Plastic electrofusion fitting with other manufacturer's processors.

PE2406 Electrofusion Branch Saddles are produced from a pre-blended virgin resin that has a PPI listing of PE2406 which complies with ASTM D3350.

PE3408 Electrofusion Branch Saddles are produced from a pre-blended virgin resin that has a PPI listing of PE3408 which complies with ASTM D3350. This resin carries a NSF Standard 61 listing for use with potable water.

AVAILABLE FEATURES:

- PE2406 fittings are engineered for use on MDPE Pipe
- PE3408 fittings are engineered for use on HDPE Pipe
- Compatible for fusion to either PE2406 or PE3408 pipe materials without special fusion procedures.
- Pressure rated for natural gas and potable water applications
- PE3408 fittings utilize NSF listed Resin
- PE3408 fittings are tested to the requirements of AWWA C906
- PE3408 fittings are FM Approved (4" x 2" - 8" x 2", 4" x 4" - 6" x 4")
- Live no-leak service tap made easy
- Manufactured in U.S.A.



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Polyethylene Joining Procedures



CHAPTER 6 POLYETHYLENE JOINING PROCEDURES

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FOREWORD

Polyethylene Joining Procedures is one of the chapters being prepared for inclusion in the Plastics Pipe Institute's *PPI Handbook of Polyethylene Piping*, which will be issued as a complete volume in the future. Other topics to be addressed in the handbook will include design of polyethylene piping systems, joining procedures, engineering properties, relevant codes and standards, and a variety of related information.

PPI is a division of The Society of the Plastics Industry, Inc. (SPI), and the major U.S. trade association representing all segments of the plastics industry.

The *Municipal and Industrial (M&I) Division of PPI* are producing the *PPI Handbook of Polyethylene Piping*. M&I membership consist of major North American manufacturers of polyethylene (PE) pipe and fittings, PE piping materials, machinery, and equipment used for joining and installing PE piping, related test laboratories, and professional organizations.

PPI maintains additional groups that address other applications such as gas distribution. PPI provides technical and promotional support for the effective use and continued application of thermoplastics pipe and related products, consistent with the best public interest. PPI membership also includes producers of polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC), polybutylene (PB), and crosslinked PE (PEX) piping products and materials.

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March, 1998

CHAPTER 6

POLYETHYLENE JOINING PROCEDURES

INTRODUCTION

This Chapter of the manual has been prepared for the benefit of producers, users, engineers, code officials, contractors, installers, and others interested in plastic piping. It is a discussion of the recommended procedures for the most common methods of joining polyethylene pipe and fittings. While reasonable efforts have been made by The Plastics Pipe Institute, the members of its technical groups, and its technical staff to provide reliable information in this report, it is recognized that the information may be incomplete. However, it is often possible to obtain more detailed information on joining plastic pipe or fitting materials from manufacturers. Safety considerations are very important when joining polyethylene materials, but they are not a part of this document; the user of this joining information must consult and follow appropriate safety instructions, which are available from manufacturers.

An integral part of any pipe system is the method used to join the system components. Proper engineering design of a system will take into consideration the type and effectiveness of the techniques used to join the piping components and appurtenances as well as the durability of the resulting joints. The integrity and versatility of the joining techniques used for polyethylene pipe allow the designer to take advantage of the performance benefits of polyethylene in a wide variety of applications.

GENERAL PROVISIONS

Polyethylene pipe or fittings are joined to each other by heat fusion or with mechanical fittings. Plastics may be joined to other materials by means of compression fittings, flanges, or other qualified types of manufactured transition fittings. There are many types and styles of fittings available from which the user may choose. Each offers its particular advantages and limitations for each joining situation the user may encounter. Contact with the various manufacturers is advisable for guidance in proper applications and styles available for joining as described in this document. There will be joining methods discussed in this document covering both large and small diameter pipe. Those persons who are involved in joining gas piping systems must note certain qualification requirements of the U.S. Department of Transportation Pipeline Safety Regulations ⁽¹⁾.

HEAT FUSION

Introduction

There are three types of heat fusion joints currently used in the industry; Butt, Saddle, and Socket Fusion. Additionally, there are two methods for producing the socket and saddle heat fusion joints.

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The principle of heat fusion is to heat two surfaces to a designated temperature, then fuse them together by application of a sufficient force. This force causes the melted materials to flow and mix, thereby resulting in fusion. When fused according to the pipe and/or fitting manufacturers' procedures, the joint area becomes as strong as or stronger than the pipe itself in both tensile and pressure properties. As soon as the joint cools to near ambient temperature, it is ready for handling. The following sections of this chapter provide a general procedural guideline for each of these heat fusion methods.

NOTE: This is a general discussion. Pipe and fitting manufacturers have established qualified fusion procedures⁽⁹⁾ which should be followed precisely when using their specific products.

One method, used for all three types of joints, uses special heating tools for heating the parts to be joined. The other method, 'electrofusion', is used only for socket and saddle-type joints. Heat is generated by inducing electric current into a wire coil that is a part of the fitting.



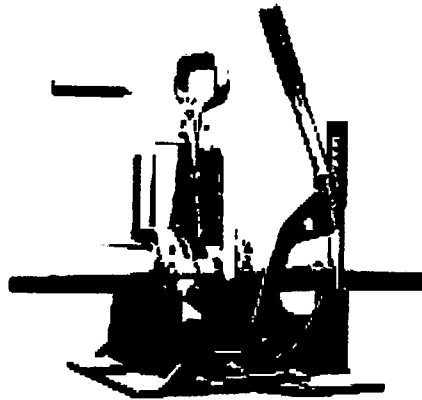
Figure 1 Standard Butt Fusion Joint

Butt Fusion

The most widely used method for joining individual lengths of large diameter polyethylene pipe is by heat fusion of the pipe butt ends as illustrated in Figure 6.1. This technique, which precludes the need for specially modified pipe ends or couplings, produces a permanent, economical and flow-efficient connection. Field-site butt fusions may be made readily by trained operators using specially developed butt fusion machines (see Figure 6.2) that secure and precisely align the pipe ends for the fusion process.

The six steps involved in making a butt fusion joint are:

1. Securely fasten the components to be joined
2. Face the pipe ends
3. Align the pipe profile
4. Melt the pipe interfaces
5. Join the two profiles together
6. Hold under pressure



**Figure 2 Typical Butt Fusion machine
for Smaller Diameter Pipe**

*(Butt Fusion machines are available to
fuse pipe up to 72 inches in diameter)*

Secure

Each component that is to be fused must be held in position so that it will not move unless it is moved by the clamping device.

Face

The pipe ends must be faced to establish clean, parallel mating surfaces. Most, if not all, equipment manufacturers have incorporated the rotating planer block design in their facers to accomplish this goal. Facing is continued until a minimal distance exists between the fixed and movable jaws of the machine and the facer is locked firmly and squarely between the jaws. This operation provides for a perfectly square face, perpendicular to the pipe centerline on each pipe end and with no detectable gap.

Align

The pipe profiles must be rounded and aligned with each other to minimize mismatch (high-low) of the pipe walls. This can be accomplished by adjusting the clamping jaws until the outside diameters of the pipe ends match. The jaws must not be loosened or the pipe may slip during fusion.

The minimal distance requirement between fixed- and moveable-jaws mentioned above allows the pipe to be rounded as close as possible to the joint area. The closer to the joint area that the pipe can be clamped, the better control the operator has in properly aligning the pipe.

Melt

Heat the ends of the pipe to the pipe manufacturer's recommended temperature, interface pressure, and time duration. By doing so, the heat will penetrate into the pipe ends and a molten "bead" of material will form at the pipe ends. Heating tools which simultaneously heat both pipe ends are used to accomplish this operation. These heating tools are normally furnished with thermometers to measure internal heater temperature so the operator can monitor the temperature before each joint is made. However, they can be used only as a general indicator because there is some heat loss from internal to external surfaces, depending on factors such as ambient temperatures and wind conditions. A pyrometer or other surface temperature measuring device should be used periodically to insure proper temperature of the heating tool. If temperature indicating crayons are used, do not use them on a surface which will come in contact with the pipe or fitting. Additionally, heating tools are usually equipped with suspension and alignment guides which center them on the pipe ends. The heater faces which come into contact with the pipe should be coated by the manufacturer to prevent molten plastic from sticking to the heater faces. Remaining molten plastic can interfere with fusion quality and must be removed according to the tool manufacturer's instructions.

Join

After the pipe ends have been heated for the proper time and to the proper temperature, the heater tool is removed and the molten pipe ends are brought together with sufficient pressure to properly mix the pipe materials and form a homogeneous joint. The pipe manufacturer's instructions may specify either interface pressure or bead size of molten material as a guide for a proper joint. There are machines available for pipe sizes from 5/8-inch through 72-inch diameters that will assist the operator to apply sufficient force to obtain the proper fusion pressure. Machines for 4-inch diameter and smaller sizes are normally lever-operated. Many of these smaller machines can be fitted with torque wrenches to obtain a theoretical value which allows the operator to consistently apply the approximate force required to properly fuse a joint. Larger machines employ hydraulics with various types of control systems such as:

1. Manual with hydraulic hand pump.
2. Semi-automatic with motorized hydraulics including pressure reducing, selector, and directional control valves.
3. Fully automatic with computer- or microprocessor-control of the heat and fusion cycles and pressures.

Hold

The molten joint must be held immobile under pressure until cooled adequately to develop strength. The designs of the machines vary from a lever-arm-assist to manual or automatic locking devices that assist the operator to accomplish this step. The proper cooling times for the joint are material-, pipe-diameter-, and wall-thickness-dependent and are established by the pipe manufacturer. Allowing proper times un-

der pressure for cooling prior to removal from the clamps of the machine is important in achieving joint integrity.

OPTIONAL BEAD REMOVAL

In some pipe system usage, the bead from the butt fusion process may be undesirable. Inside beads may create minor flow turbulence of liquids or may become an obstacle on which solids in the fluids may become lodged. Furthermore, outside beads may be a hinderance to sliplining operations. Equipment is available to remove the bead if that is desirable.

SADDLE/SIDEWALL FUSION

The technique to join a saddle to the sidewall, illustrated in Figure 6.3, consists of simultaneously heating both the external surface of the pipe and the matching surface of the "saddle" type fitting with concave and convex shaped heating tools until both surfaces reach proper fusion temperature. This may be accomplished by using a saddle fusion machine that has been designed for this purpose.

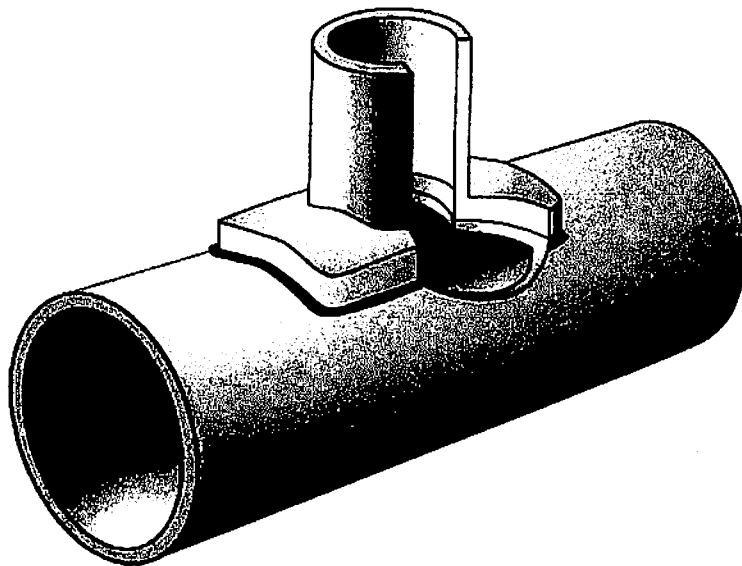


Figure 3 Standard Sidewall Fusion Joint

Saddle fusion, using a properly designed machine, provides the operator better alignment and force control, which is very important to fusion joint quality. The *Plastics Pipe Institute* recommends that sidewall-type fusion joints be made only with a mechanical assist tool unless hand fusion is expressly allowed by the pipe and/or fitting manufacturer⁽⁶⁾. If hand saddle fusion must be performed, it should be done only by

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following specific instructions provided by the pipe and fitting manufacturer.

There are eight sequential steps that are normally used to create a saddle fusion joint:

1. Clean the pipe
2. Install heater saddle adapters
3. Install the saddle fusion machine on the pipe
4. Prepare the surfaces of the pipe and fitting
5. Align the parts
6. Heat both the pipe and the saddle fitting
7. Press and hold the parts together
8. Cool the joint and remove the fusion machine

Clean the Pipe

Remove any dirt or coating that might interfere with the proper installation of the fusion machine.

Install the Heater Saddle Adapters

Install the proper size heater saddle adapters on the heater plate. Do not overtighten, but insure that mating surfaces of the heater and adapters are clean and flush. Any gap indicates a dirty or rough surface which will retard and limit heat transfer and thereby affect joint integrity. Allow the heater to come to the temperature specified by the pipe and fitting manufacturer.

Install the Saddle Fusion Machine

Install the saddle fusion machine to the pipe using appropriate tooling and the manufacturer's instructions to straighten and round the pipe. Use caution when tightening the clamping fixture so the pipe is not flattened.

Prepare Surfaces

Remove any mud or other contaminants. Then, using 50 or 60 grit utility cloth, clean and roughen the pipe surface and fitting saddle contour to expose fresh material. Brush away residue with a clean, dry cloth after roughening the surfaces. Avoid using sandpaper or other abrasive materials which are likely to leave grit or deposits of other foreign materials on the pipe surface.

Fitting Alignment

Assure that the proper saddle-fitting holding inserts are in the fusion machine. Position the fitting on the pipe and place the fitting into the insert. Apply a slight downward force on the fitting and inspect to insure a precise fit to the pipe. Move the fitting away from the pipe, then back to the pipe and inspect again for precise alignment.

Heating

Check the heater temperature. Periodically verify the proper surface temperature using a pyrometer or other surface temperature measuring device. If temperature indicating crayons are used, do not use them on a surface which will come in contact with the pipe or fitting. Place the heater tool in position to heat the pipe and fitting surfaces in accordance with the pipe and fitting manufacturers' instructions. Procedures will vary with different materials. Follow the instructions carefully.

Fusion

After the prescribed heating requirements have been met, remove the heater from the heated pipe and fitting surfaces with a "snap" action and quickly inspect the melt pattern on both the fitting and the pipe. Join the fitting to the pipe with the prescribed fusion force.

Cooling

Continue to hold the force during the cooling cycle as prescribed by the fitting and pipe manufacturer. Allow the joint to cool to the touch or to reach ambient temperature. Do not subject the joint to any external stresses until the fusion joint has cooled.

SOCKET FUSION



Figure 4 Standard Socket Fusion Joint

This technique consists of simultaneously heating both the external surface of the pipe and the internal surface of the socket fitting until the material reaches fusion temperature; inspecting the melt pattern; inserting the pipe end into the socket; and holding it in place until the joint cools. Figure 6.4 illustrates a typical socket fusion joint. Mechanical equipment is available and should be used for sizes larger than 2-inch diameter to attain the increased force required and to assist in alignment. Follow

Polyethylene Joining Procedures - 8

these general steps when performing socket fusion:

1. Select the equipment
2. Square and prepare the pipe ends
3. Heat the parts
4. Join the parts
5. Allow to cool

Equipment Selection

Select the proper size tool faces and heat the tools to the fusion temperature recommended for the material to be joined. For many years, socket fusion tools were manufactured without benefit of any industry standardization. As a result, variances of heater and socket depths and diameters, as well as depth gauges, do exist. More recently, ASTM F1056⁽⁶⁾ was written, establishing standard dimensions for these tools. Therefore, mixing various manufacturers' heating tools or depth gauges is not recommended unless the tools are marked "F1056," indicating compliance with the ASTM specification.

Square and Prepare Pipe

Cut the end of the pipe square. Chamfer the pipe end for sizes 1/4-inch diameter and larger (chamfering of smaller pipe sizes is acceptable and sometimes specified in the instructions). Remove any scraps, burrs shavings, oil, or dirt from the surfaces to be joined. Clamp the cold ring on the pipe at the proper position, using the integral depth gauge pins or a separate (thimble type) depth gauge. The cold ring will assist in re-rounding the pipe and provide a stopping point for proper insertion of the pipe into the heating tool and coupling during the fusion process.

Heating

Check the heater temperature. Periodically verify the proper surface temperature using a pyrometer or other surface temperature measuring device. If temperature indicating crayons are used, do not use them on a surface that will come in contact with the pipe or fitting. Bring the hot clean tool faces into contact with the outside surface of the end of the pipe and with the inside surface of the socket fitting, in accordance with pipe and fitting manufacturers' instructions. Procedures will vary with different materials. Follow the instructions carefully.

Joining

Simultaneously remove the pipe and fitting from the tool using a quick "snap" action. Inspect the melt pattern for uniformity and immediately insert the pipe squarely and fully into the socket of the fitting until the fitting contacts the cold ring. Do not twist the pipe or fitting during or after the insertion, as is a practice with some joining methods for other pipe materials.

Cooling

Hold or block the pipe in place so that the pipe cannot come out of the joint while the mating surfaces are cooling. These cooling times are listed in the pipe or fitting manufacturer's instructions.

ELECTROFUSION

This technique of heat fusion joining is somewhat different from the conventional fusion joining thus far described. The main difference between conventional heat fusion and electrofusion is the method by which the heat is applied. In conventional heat fusion joining, a heating tool is used to heat the pipe and fitting surfaces. The electrofusion joint is heated internally, either by a wire coil at the interface of the joint or, as in one design, by a conductive polymer. Heat is created as an electric current is applied to the conductive material in the fitting. Figure 6.5 illustrates a typical electrofusion joint and Figure 6.6 illustrates an electrofusion control box and fitting.

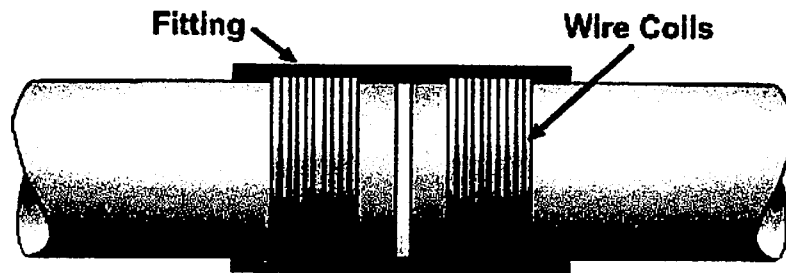


Figure 5 Typical Electrofusion Joint

General steps to be followed when performing electrofusion joining are:

1. Prepare the pipe
2. Clamp the fitting and pipe(s)
3. Apply the electric current
4. Cool and remove the clamps

Prepare the Pipe

First clean the pipe surface in the joint area. Cut the end of the pipe square (omit this operation for saddle-type electrofusion joints). Mark on the pipe surface the proper positioning of the fitting to be installed. Scrape the surface of pipe area to be joined, removing all surface degradation and contamination. Exercise caution to avoid contamination of the scraped pipe surfaces. There are tools available to assist the operator in this procedure.

Clamp the Fitting and Pipe(s)

Place the pipe(s) and fitting in the clamping fixture to prevent movement of the pipe(s) or fitting. Give special attention to proper positioning of the fitting on the prepared pipe surfaces.

Apply Electric Current

Connect the electrofusion control box to the fitting and to the power source. Apply electric current to the fitting as specified in the manufacturer's instructions. If the control does not do so automatically, turn off the current when the proper time has elapsed to heat the joint properly.

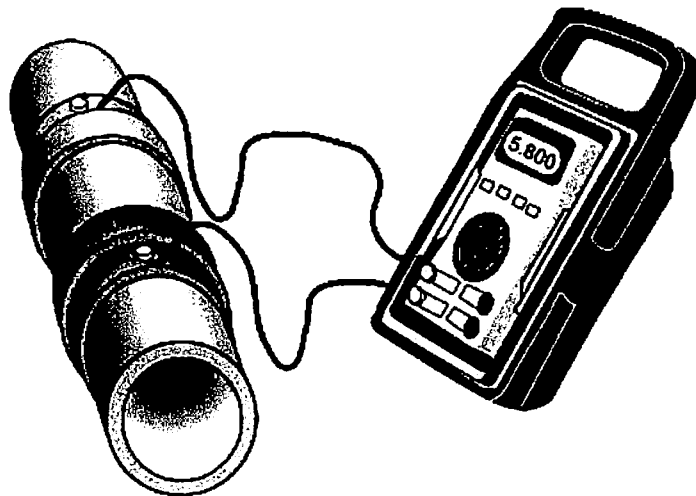


Figure 6 Typical Electrofusion Control Box and Leads with Clamps and Fittings

Cool Joint and Remove Clamps

Allow the joint to cool for the recommended time and remove the clamping fixtures. Premature removal from the clamps and any strain on a joint that has not fully cooled can be detrimental to joint performance.

HEAT FUSION JOINING OF UNLIKE POLYETHYLENE PIPE AND FITTINGS

Research has indicated that polyethylene pipe and fittings made from unlike resins can be heat-fused together to make satisfactory joints. Some gas companies have been heat-fusion joining unlike polyethylenes for many years with success. Extra

caution in training operators in conventional heat fusion methods (butt-socket-saddle) of unlike materials is recommended. Guidelines for heat fusion of unlike materials are outlined in TN 13⁽¹⁰⁾, issued by the Plastics Pipe Institute. Manufacturers of pipe and fittings can also be consulted. Electrofusion joining of dissimilar materials requires no special procedures.

Mechanical Connections

INTRODUCTION

As in the heat fusion methods, many types of mechanical connection styles and methods are available. Each of the mechanical connections has particular advantages or limitations of performance in some applications. This section does not address these advantages or limitations; it is, rather, a general description of these types of fittings and how they might be utilized.

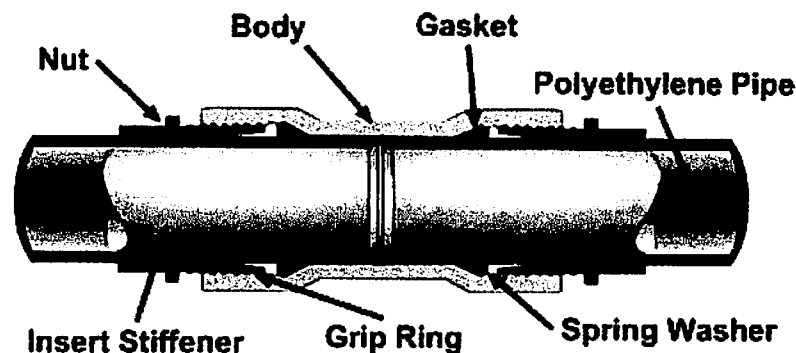


Figure 7 Typical Compression Nut Type Mechanical Plastic Coupling for Joining Polyethylene to Polyethylene

The Plastics Pipe Institute recommends that the user be well informed about the performance limitations of the particular mechanical connector being utilized. A mechanical tapping saddle for connecting the main to the service line is another connection used when fusion is not used.

MECHANICAL COMPRESSION FITTINGS

This style of fitting comes in many forms and materials. The components are generally a body; a threaded compression nut or a follower and bolt arrangement; an elastomer seal ring; a stiffener; and, with some, a gripping ring. Normally the design concept of this type of fitting typically includes an elastomer seal in the assembly.

The seal, when compressed by tightening of a threaded compression nut, as illustrated in Figure 6.7 or by bolts as illustrated in Figure 6.8, grips the outside of the pipe, effecting a pressure-tight seal and, in some designs, providing pull-out resistance. It is important that the inside of the pipe wall be supported by the stiffener under the seal ring and under the gripping ring (if incorporated in the design), to prevent collapse of the pipe. A lack of this support could result in a loss of the seal effected by the seal ring or the gripping of the pipe for pull-out resistance. This fitting style is normally used in service lines for gas or water pipe 2-inches in diameter and smaller. It is also important to consider that two categories of this type of joining device are available. One type is recommended to provide a seal only, and another is recommended to provide a seal plus pipe restraint against pull-out.

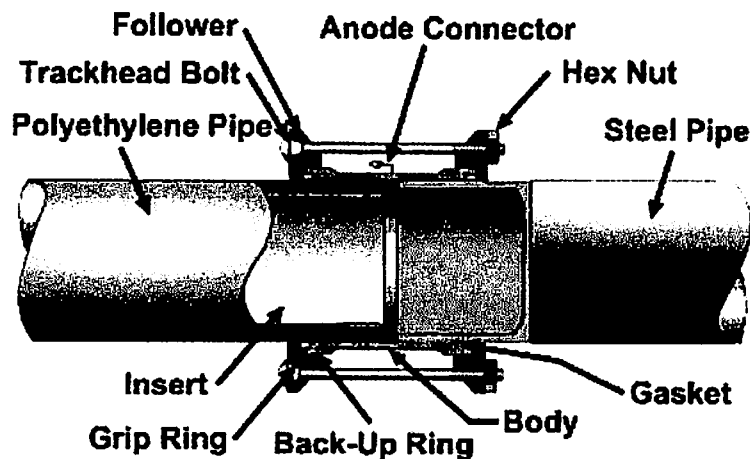


Figure 8 Bolt Type Mechanical Coupling for Joining Steel Pipe to Polyethylene or for Joining Two Polyethylene Pipes

STAB TYPE MECHANICAL FITTINGS

Here again many styles are available, but materials are limited to "Gas Grade" PE2406 and PE3408⁽²⁾ resins. The design concept is similar in most styles. Internally there are specially designed components including an elastomer seal, such as an "O" ring, and a gripping device to effect pressure sealing and pull-out resistance capabilities. Self-contained stiffeners are included in this design. With this style fitting the operator would have to prepare the pipe ends, mark the stab depth on the pipe, and "stab" the pipe in to the depth prescribed for the fitting being used. These fittings are available in sizes from 1/2 CTS through 2 IPS and are all of ASTM D2513⁽²⁾ Category I design, indicating seal and full restraint against pull-out.

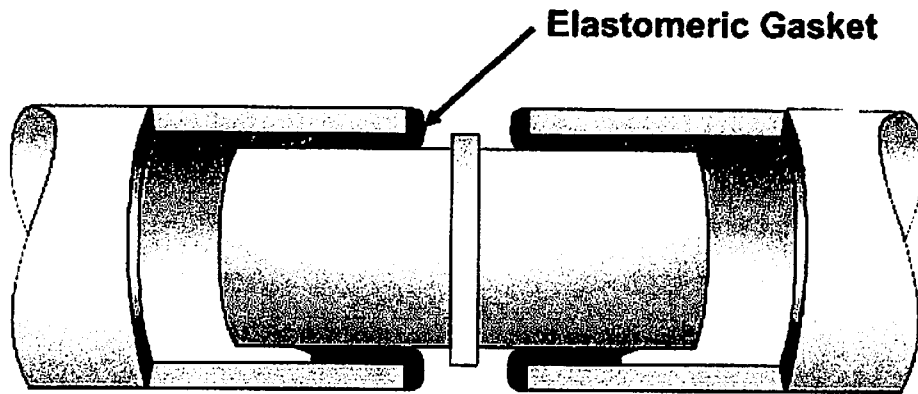


Figure 9 Double Bell Type Fitting

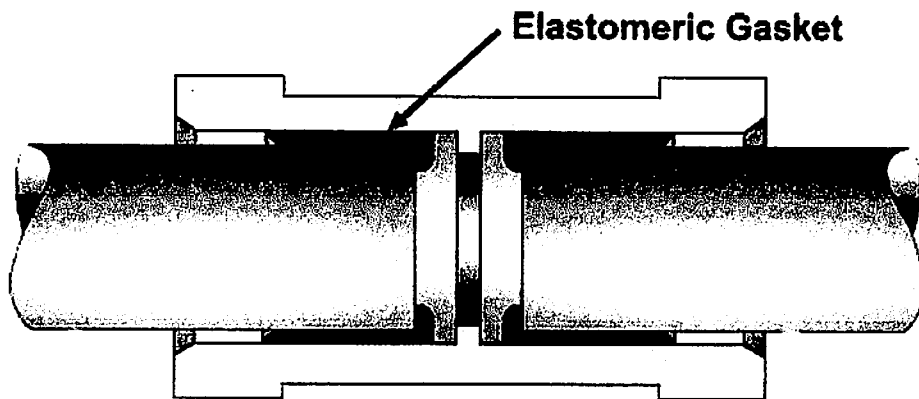


Figure 10 Double Spigot Type Fitting

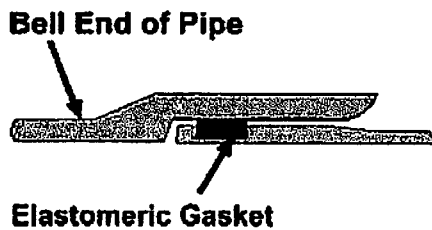


Figure 11 Bell & Spigot Pipe End Joint

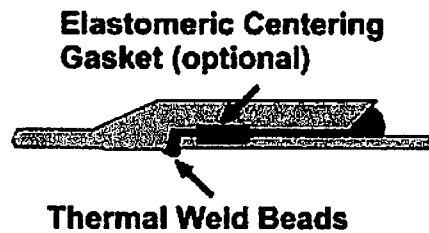


Figure 12 Bell & Spigot Pipe End Joint with Additional Weld Beads

JOINING OF PROFILE PIPE

The "profile" type pipes normally used in gravity flow and low pressure applications may be joined by some of the previously mentioned methods such as butt fusion or electrofusion, or with flange adapters. Profile pipe also utilizes "Bell" and "Spigot" types of joining methods. In this type of joining, the "Bell" or the "Spigot" may be separate components as illustrated in Figures 6.9 and 6.10, or actually formed on the profile pipe ends as illustrated in Figure 6.11. In either concept, the "Bell" always slips over the "Spigot" and an elastomeric gasket between the two surfaces effects a seal. If deemed necessary, the joint may also be anchored and a seal effected by use of a portable field extruder, forming a weld bead around the jointed surfaces. An example of this method is illustrated in Figure 6. 12. More detailed information on profile type pipe may be found in ASTM F894⁽⁴⁾.

FLANGED CONNECTIONS

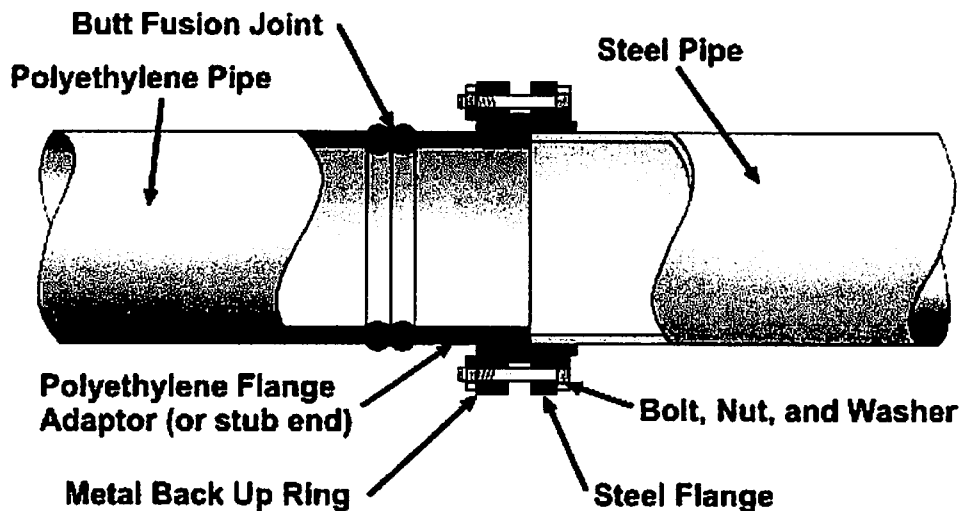


Figure 13 Typical Application of Polyethylene Flange Adapter or Stub End

When joining to metal or to certain other piping materials, or if a pipe section capable of disassembly is required, polyethylene flange adapters are available. The "Flange Adapter" and its shorter version, the "Stub End", are designed so that one end is sized the same as the plastic pipe for butt fusion to the plastic pipe. The other end has been especially made with a flange-type end that, with a metal back up ring, permits bolting to the non-plastic segment of a pipe line—normally a 1 50-pound ANSI flanged ⁽¹⁾.

The procedures would be:

1. Slip the metal ring onto the plastic pipe section, far enough away from the end to not interfere with operation of the butt fusion equipment.
2. If a stub end is used, first butt-fuse a short length of plastic pipe to the pipe end of the stub end. If a "flange adapter" is used, the plastic pipe-sized end is usually long enough that this step is unnecessary.
3. Butt fuse the flange adapter to the plastic pipe segment.
4. Position the flanged face of the adapter at the position required so that the back up ring previously placed on the plastic pipe segment can be attached to the metal flange.
5. Install and tighten the flange bolts in an alternating pattern normally used with flange type connections, drawing the metal and plastic flange faces evenly and flat. Do not use the flanges to draw the two sections of pipe together.

TRANSITION FITTINGS

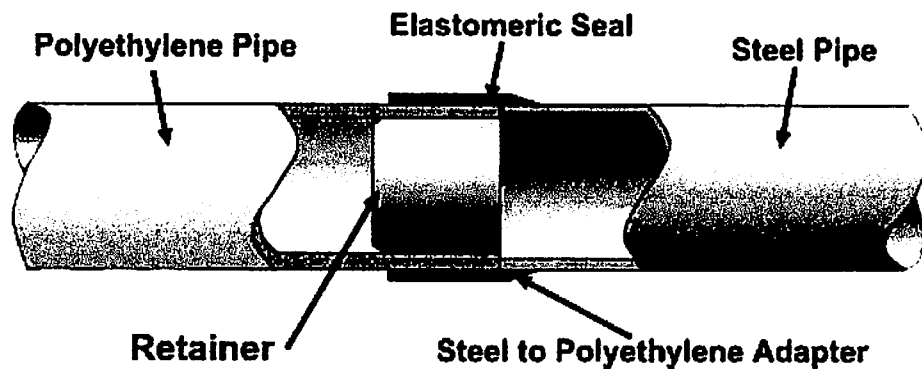


Figure 14 Standard Fitting for Plastic Pipe to Steel Pipe Transition

Other methods are available that allow joining of plastic to metal. Transition fittings are available which are pre-assembled at the manufacturer's facility. These transition fittings are normally pull-out resistant and seal tight with pressure and tensile values greater than that of the plastic pipe part of a system. However, the user should insist on information from the manufacturer to confirm design capabilities or limitations. Transition fittings are commonly available with a short segment of plastic pipe for joining to the plastic pipe section. The metal end is available with a bevel, for butt welding, with male pipe threads, or is grooved for a Victaulic⁽¹³⁾ style or flanged for connecting to an ANSI 150-pound flanged ⁽¹⁾.

THREADED CONNECTIONS OF PLASTIC

Polyethylene pipes can be threaded the same as metal pipes for a tapered NPT thread for joining to a matching female NPT thread. Caution must be used in this type of application. Polyethylene materials are subject to creep and cold flow under long-term stress. The life of a polyethylene threaded joint is very dependent on proper anchoring against pull-out forces and pressure regulations. These values will vary with pipe materials. Contact the pipe manufacturer before making this type of installation for possible limitations. Many federal, state, and local codes do not allow threaded plastic connections for containment of certain products.

FLARED CONNECTIONS

The practice of making polyethylene joints by "flaring" is one which has gradually been used less and less. The process is accomplished by "Cone Flaring" where heat is applied from an external source, or by "Spin Flaring" where the heat is produced by friction. These flared pipe ends are used with mechanical flare nuts and couplings to form a joint. Recent changes in AWWA C901⁽⁷⁾ and other written codes by PPFA⁽¹²⁾ and IAPMO⁽¹¹⁾ have discouraged or specifically prohibited flaring of PE pipe. The possibility of an unsatisfactory joint is much greater with this type of joint than with the other available joining techniques. The Plastics Pipe Institute recommends that the pipe manufacturer be contacted to determine if flared connections are recommended on the particular pipe material being considered for flare-type joining. Refer to ASTM D3140⁽³⁾ for guidance on how this type joint should be made.

ADHESIVE JOINING

At this time, there are no known adhesives or solvent cements that are suitable for pressure sealing or that have sufficient strength characteristics to join polyethylene pipes.

SQUEEZE-OFF

Regardless of the joining method applied in the installation of polyethylene pipe, it may become necessary to shut off the flow in the system. With PE pipe materials, squeeze-off of the pipe with specially-designed tools is a common practice. Consult the pipe manufacturer for guidance in tool selection and instructions for squeeze-off of their pipe material. General procedures for squeeze-off of polyethylene pipe can be found in ASTM F1041⁽⁵⁾.

SUMMARY

The applications for polyethylene piping products continue to expand at an accelerating rate. Gas distribution lines, potable water systems, submerged marine installations, gravity and force main sewer systems, and various types of above-ground exposed piping systems are but a few of the installations for which polyethylene pipe and fittings have been utilized.

A key element to this continued success is the diversity of methods available to join polyethylene pipe and fittings. The integrity of the butt and socket fusion joining technique has been proven by the test of time in a variety of applications. The manufacturers of polyethylene pipe and fittings have made every effort to make the systems as comprehensive as possible by producing a variety of fittings and components to insure compatibility with alternate piping materials and system appurtenances.

The purpose of this chapter has been to provide the reader with an overview of the various methods by which polyethylene piping materials may be joined. As a result, hopefully, the reader has developed a further appreciation for the flexibility, integrity, and overall utility afforded in the design, installation, and performance of polyethylene piping systems and components.

It should be noted that this document does not purport to address any safety problems associated with the use of these procedures. Information on safe operating procedures can be obtained from the manufacturers of the various types of joining equipment or polyethylene products.

REFERENCES:

1. ASME/ANSI B16.5-1988. American National Standard on Pipe Flanges and Flanged Fittings, American National Standards Institute, New York, NY, 1988.
2. ASTM D2513-90. Standard Specifications for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings, Annual Book of Standards, American Society for Testing and Materials (AS1M), Philadelphia, PA, 1991.
3. ASTM D3140-85. Standard Practice for Flaring Polyolefin Pipe and Tubing, Annual Book of Standards, American Society for Testing and Materials (ASTM), Philadelphia, PA, 1990.
4. ASTM F894-89a, Standard Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe, Annual Book of Standards, American Society for Testing and Materials (ASTM), Philadelphia, PA, 1991
5. AASTM F104 1-87. Standard Guide for Squeeze-Off of Polyolef n Gas Pressure Pipe and Tubing, Annual Book of Standards, American Society for Testing and Materials (ASTM), Philadelphia, PA, 1990.
6. ASTM F1056-87. Standard Specification for Socket Fusion Tools for Use in Socket Fusion Joining Polyeth'ylene Pipe or Tubing and Fittings, American Society for Testing and Materials (ASTM), Philadelphia, PA, 1991.
7. AWWA C901-88. Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. Through 3 in., for Water Service, American Water Works Association, Denver, CO, 1988.
8. Caution Statement on Sidewall Heat Fusion Witlmut Use of Mechanical Assist Tooling, Statement T. Plastics Pipe Institute, Wayne, NJ, 1991.
9. Code of Federal Regulations, Title 49, Part 192, Subpart F. "Pipeline Safety Regulations", Washington, DC, 1991.
10. General Guidelines for the Heat Fusion of Unlike Polyethylene Pipes and Fittings, Report TN-13, Plastics Pipe Institute, Wayne, NJ, 1989.
11. IAPMO, International Association of Plumbing and Mechanical Officials, Walnut, CA.
12. PPFA. Plastics Pipe and Fittings Association, Glen Ellyn, IL.
13. Victaulic General Catalog on Mechanical Piping Systems, Victaulic Company of America, Easton, PA, 1988.

ACKNOWLEDGEMENTS

This chapter has been produced by an industry task force of authors and reviewers, working under the direction of Steve Sandstrum, Solvay Polymers, Inc., chief editor of the PPI Handbook of Polyethylene Piping. Other members of the task force include:

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James Inhofe, Central Plastics Co.



Type 57 Butterfly Valve

Specifications

Sizes: Lever: 1-1/2" - 8"
Gear: 8" - 14"

Models: Wafer Style

Operators: Lever and Gear

Bodies: PVC, PP and PVDF

Discs: PVC, PP and PVDF

Seats: EPDM, FKM, and Nitrile

Seals: Same as seating material

Stems: 403 and 316 stainless steel, Titanium, Hastelloy C[†]

† Trademark of Cabot Corporation

Standard Features (Sizes 1-1/2" - 14")

- Standard model (1-1/2" - 14") has PVC Body and PP Disc for superior chemical resistance and elevated temperature capabilities
- 316/403 stainless steel shaft has full engagement over the entire length of the disc and is a non-wetted part.
- Only solid and abrasion-resistant plastic disc and elastomeric liner are wetted parts.
- ISO bolt circle on top flange-no body or stem modifications required for accessories.
- Stem retainer-PP retainer to prevent stem removal.
- Seat over tightening protection-Molded body stops and seat stress relief area.
- Spherical disc design offers increased Cv, ultimate sealing and high cycle life.

Options

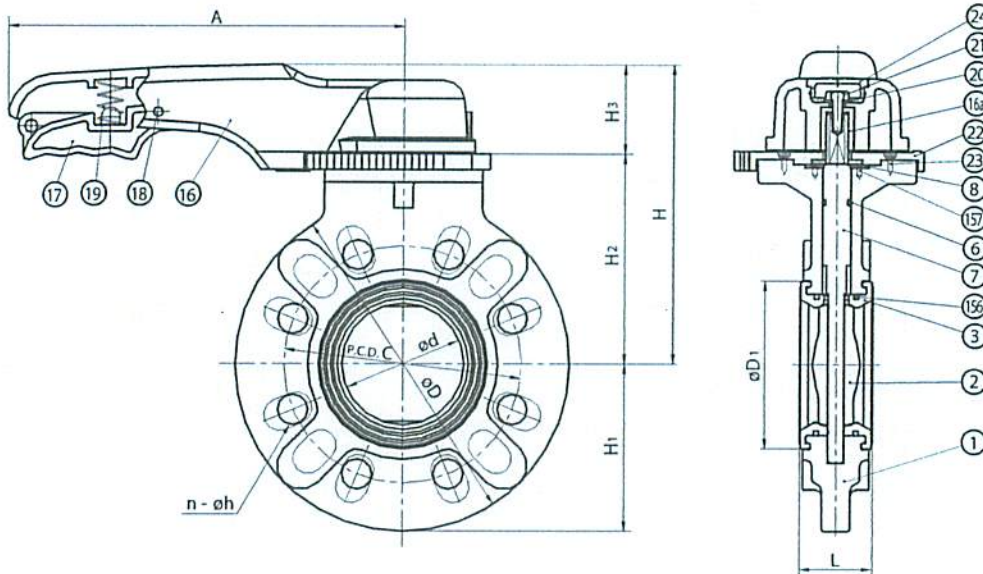
- Pneumatically and electrically actuated with accessories
- Alternate discs:
 - (I) PVC : 1-1/2" - 14"
 - (II) PVDF : 1-1/2" - 14"
- PlasgearTM gear operators for 1-1/2"- 6"
- Lug style (stainless steel 304 or 316) for blocking and end-of-line applications
- Stems in 316 stainless steel, titanium, Hastelloy C[®].
- 2" square nut on stem (1-1/2" - 8" only)
- 2" square nut on gear operator (All sizes)
- Stem extensions (Single stem and two-piece stem)
- Locking devices (Gear Type - Standard on Lever)
- Chain operators
- Manual limit switch - Asahi P-Series
- Tandem arrangements (Patented by A/A, Inc.)

Parts List (Lever: Sizes 1-1/2" - 8")

PARTS			
NO.	DESCRIPTION	PCS.	MATERIAL
1	Body	1	PVC, PP, PVDF
2	Disc	1	PVC, PP, PVDF
3	Seat	1	EPDM, FKM, NBR
6	O-Ring (C)	1	EPDM, FKM, NBR
7	Stem	1	Stainless Steel 316
8	Stem Retainer	1	PP
16	Handle	1	PP
16a	Metal Insert in Handle	1	Stainless Steel 316L
17	Handle Lever	1	PPG
18	Pin	1	PPG
19	Spring	1	Stainless Steel 304
20	Washer (A)	1	Stainless Steel 304
21	Bolt (B)	1	Stainless Steel 304
22	Locking Plate	1	PPG
23	Screw (B)	4	Stainless Steel 304
24	Cap (A)	1	PP
156	Liner Stabilization Ring	2	Stainless Steel (SCS13)
157	Screw (F)	4	Stainless Steel 304



Type 57 – Lever Operated Butterfly Valves



Dimensions (Lever: Sizes 1-1/2" – 8")

NOMINAL SIZE	ANSI CLASS 150													
	INCHES	mm	d	C	n	h	D	D1	L	H	H1	H2	H3	A
1 1/2	40	1.77	3.88	4	0.62	5.91	2.83	1.54	6.14	2.95	3.94	2.20	8.66	
2	50	2.20	4.75	4	0.75	6.50	3.23	1.65	6.54	3.25	4.33	2.20	8.66	
2 1/2	65	2.72	5.50	4	0.75	7.28	3.78	1.81	6.93	3.64	4.72	2.20	8.66	
3	80	3.03	6.00	4	0.75	8.31	4.17	1.81	7.52	4.15	5.31	2.20	9.84	
4	100	4.02	7.50	8	0.75	9.37	5.31	2.20	8.11	4.69	5.91	2.20	9.84	
5	125	5.08	8.50	8	0.88	10.39	6.69	2.60	9.33	5.20	6.61	2.72	12.60	
6	150	5.91	9.50	8	0.88	11.22	7.52	2.80	9.92	5.61	7.20	2.72	12.60	
8	200	7.68	11.75	8	0.88	13.39	9.53	3.43	11.14	6.69	8.43	2.72	15.75	

Cv Values

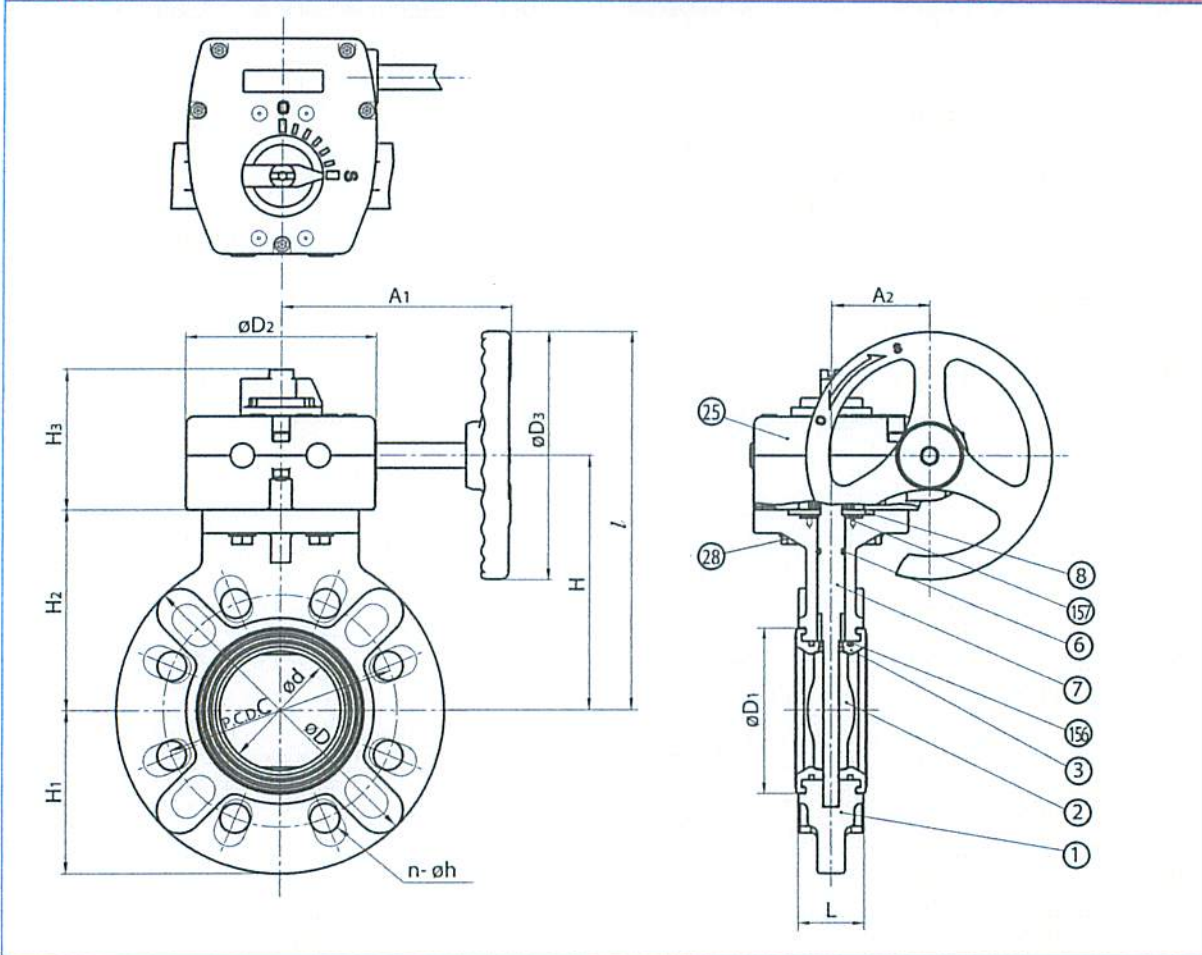
NOMINAL SIZE	Cv (at various opening degrees)		
	INCHES	mm	30° 60° 90°
1 1/2	40	4	43 71
2	50	7	73 120
2 1/2	65	15	153 250
3	80	18	183 300
4	100	28	287 470
5	125	49	506 830
6	150	66	671 1100
8	200	150	1525 2500

Pressure vs. Temperature (PSI, WATER, NON-SHOCK)* Wt. (LBS) / Vacuum Service

BODY DISC NOMINAL SIZE	PVC		PP		PVDF		NOMINAL SIZE	PVC	PP	PVDF	NOMINAL SIZE	VACUUM SERVICE (INCHES OF MERCURY)	
	PP		PP		PVDF								
	INCHES	mm	30° F 120° F	121° F 140° F	141° F 175° F	-5° F 140° F							141° F 175° F
1 1/2	40	150	70	30	150	100	150	100	85	75	1 1/2	40	-29.92
2	50	150	70	30	150	100	150	100	85	75	2	50	-29.92
2 1/2	65	150	70	30	150	100	150	100	85	75	2 1/2	65	-29.92
3	80	150	70	30	150	100	150	100	85	75	3	80	-29.92
4	100	150	45	30	150	100	150	100	85	75	4	100	-29.92
5	125	150	45	30	150	100	150	100	85	75	5	125	-29.92
6	150	150	45	30	150	100	150	100	85	75	6	150	-29.92
8	200	150	40	20	150	85	150	85	75	60	8	200	-29.92

* For lug style data consult factory

Type 57 – Gear Operated Butterfly Valves



Dimensions (Sizes 1-1/2" – 14") (NOTE: GEAR OPERATED VALVE IS STANDARD 8" – 14"; SIZES 1-1/2" – 6" ARE OPTIONS.)

NOMINAL SIZE		ANSI CLASS 150																Wheel Cycles	Gear Box Model No.
INCHES	mm	d	C	n	h	D	D1	D2	D3	L	H	H1	H2	H3	l	A1	A2		
1 1/2	40	1.77	3.88	4	0.62	5.91	2.83	4.80	6.30	1.54	5.12	2.95	3.74	3.54	8.27	6.57	2.52	9.5	
2	50	2.20	4.75	4	0.75	6.50	3.23	4.80	6.30	1.65	5.51	3.25	4.13	3.54	8.66	6.57	2.52	9.5	
2 1/2	65	2.72	5.50	4	0.75	7.28	3.78	4.80	6.30	1.81	5.91	3.64	4.53	3.54	9.06	6.57	2.52	9.5	
3	80	3.03	6.00	4	0.75	8.31	4.17	4.80	6.30	1.81	6.50	4.15	5.12	3.54	9.65	6.57	2.52	9.5	
4	100	4.02	7.50	8	0.75	9.37	5.31	4.80	6.30	2.20	7.09	4.69	5.71	3.54	10.24	6.57	2.52	9.5	241
5	125	5.08	8.50	8	0.88	10.39	6.69	4.80	6.30	2.60	7.68	5.20	6.30	3.54	10.83	6.57	2.52	9.5	
6	150	5.91	9.50	8	0.88	11.22	7.52	4.80	6.30	2.80	8.27	5.61	6.89	3.54	11.42	6.57	2.52	9.5	
8	200	7.68	11.75	8	0.88	13.39	9.53	4.80	6.30	3.43	9.49	6.69	8.11	3.54	12.64	6.57	2.52	9.5	
10	250	9.84	14.25	12	1.00	16.57	11.89	4.80	6.30	4.33	10.87	8.31	9.49	3.62	14.02	6.57	2.52	9.5	
12	300	11.93	17.00	12	1.00	19.21	14.17	7.40	11.81	5.08	13.39	9.61	11.73	4.25	19.29	9.53	3.90	9.5	243
14	350	13.82	18.75	12	1.12	21.22	15.47	7.40	11.81	5.08	14.45	10.63	12.80	4.25	20.35	9.53	3.90	9.5	

Type 57 – Gear Operated Butterfly Valves

Parts List (Gear: Sizes 1-1/2" – 14")

PARTS			
NO.	DESCRIPTION	PCS.	MATERIAL
1	Body	1	PVC, PP, PVDF
2	Disc	1	PVC, PP, PVDF
3	Seat	1	EPDM, FKM, NBR
6	O-Ring (C)	1	EPDM, FKM, NBR
7	Stem	1	Stainless Steel 316, 403
8	Stem Retainer	1	PP
25	Gear Box	1	Plasgear™
28	Bolt (C)	4	Stainless Steel 304
156	Liner Stabilization Ring	2	Stainless Steel (SCS13)
157	Screw (F)	4	Stainless Steel 304

Sample Specification

All solid thermoplastic butterfly valves sizes 1-1/2" thru 14" shall be of the TYPE 57 lined body design and bubble-tight seal (meeting or exceeding Class VI as defined by American National Standard Institute) with only the liner and disc as wetted parts. The lever handle (sizes 1-1/2" thru 8") shall have a molded provision for a padlock. Gear operators shall be worm gear design, self locking Plasgear.™ The spherical disc design for higher Cv values shall be of solid, abrasion-resistant plastic. Liner shall be molded and formed around the body, functioning as gasket seals with convex ring design on each side of the valve for lower bolt tightening torque and valve body shall have molded body stops and seat relief area to prevent over tightening of mating flanges. Stem shall be of 316/403 stainless steel, non wetted, have engagement over the full length of the disc and be locked into valve body by PP stem retainer. Valves shall have a molded ISO bolt pattern on top flange for actuator mount. PVC shall conform to ASTM D1784 Cell Classification 12454-A, PP conforming to ASTM D4101 Cell Classification PP0210B67272, and PVDF conforming to ASTM D 3222 Cell Classification Type II. All PVC PP and PVDF body valves shall be rated to 150 psi at 70 degrees F, sizes 1-1/2" thru 10" and 100 psi for sizes 12" and 14". Butterfly valves shall be wafer style, as manufactured by Asahi/America Inc.

Troubleshooting

What if fluid still flows when the valve is closed?

1. Make sure lever or gear is in a fully closed position (gear type may require travel stop adjustment).
2. Liner is damaged or worn. Replace liner.
3. Disc is damaged or abraded. Change disc.
4. Foreign material is caught between seat and disc. Remove the substance.
5. Mating flange bolts either over-tightened or unevenly tightened. Retighten properly.

What if fluid leaks outside between seat and mating flange?

1. Seat damage. Change seat.
2. Mating flange bolts not tightened with proper torque or unevenly tightened. Retighten to the appropriate torque.

What if valve does not operate smoothly?

1. Foreign material is caught between disc and seat. Remove the material and clean.
2. Lever or gearbox is damaged. Replace.
3. Mating flange bolts over-tightened. Retighten.

Caution

- Never remove valve from pipeline under pressure.
- Always wear protective gloves and goggles.

Cv Values

NOMINAL SIZE		Cv		
		(at various opening degrees)		
INCHES	mm	30°	60°	90°
8	200	150	1525	2500
10	250	232	2355	3860
12	300	342	3477	5700
14	350	386	3928	6440

Pressure vs. Temperature (PSI, WATER, NON-SHOCK)* Wt. (LBS) / Vacuum Service

BODY		PVC		PP		PVDF				NOMINAL SIZE	PVC	PP	PVDF	NOMINAL SIZE	VACUUM SERVICE (INCHES OF MERCURY)			
DISC		PP		PP		PVDF												
NOMINAL SIZE		30° F	121° F	141° F	-5° F	141° F	-5° F	141° F	176° F							211° F	INCHES	mm
		120° F	140° F	175° F	140° F	175° F	140° F	175° F	210° F	250° F								
8	200	150	40	20	150	85	150	85	75	60	8	200	24	20	28	8	200	-29.92
10	250	150	40	20	150	85	150	85	75	60	10	250	33	27	41	10	250	-29.92
12	300	100	30	15	100	60	100	60	45	30	12	300	62	53	76	12	300	-23.62
14	350	100	30	7	100	45	100	45	30	15	14	350	67	58	81	14	350	-23.62

* For lug style data consult factory

**City of Walla Walla Sudbury Landfill
Area 6 Closure 2010 Information**

Section

2. Electrical and Control Equipment

(TO BE PROVIDED BY OTHERS)

City of Walla Walla Sudbury Landfill

Area 6 Closure 2010 Information

Section

3. Security Camera System

(TO BE PROVIDED BY OTHERS)

City of Walla Walla Sudbury Landfill

Area 6 Closure 2010 Information

Section

4. Gas Extraction Wells



Mark Henett General Contractor, Inc
 1225 Port Way, P.O. Box 488, Clarkston, WA 99403
 ph (509) 243-7855 fax (509) 243-7844
 CCB: WA:MARKHGC990R1, ID:15257C123, OR:120465, MT:52727
 www.mhgcinc.com

Well Installation Log

Sudbury Road Landfill Area 6

Submittal 15100 H. 2.

Date	Well #	Total Depth	Perf 4" HDPE	Solid 4" HDPE	Solid 4" PVC 80	Slip Joint Depth	Solid 3" PVC 80
9/20/10	EW-11	71.0	25-70	20-25	7-20	7.0	0-7.0
9/20/10	EW-3	86.0	25-85	20-25	7-20	7.0	0-7.0
9/21/10	EW-2	71.0	25-70	20-25	7-20	7.0	0-7.0
9/21/10	EW-1	41.0	25-40	20-25	7-20	7.0	0-7.0
9/21/10	EW-4	61.0	25-60	20-25	7-20	7.0	0-7.0
9/22/10	EW-5	79.0	25-78	20-25	7-20	7.0	0-7.0
9/22/10	EW-6	60.0	25-59	20-25	7-20	7.0	0-7.0
9/22/10	EW-10	72.0	25-72	20-25	7-20	7.0	0-7.0
9/22/10	EW-8	71.0	25-70	20-25	7-20	7.0	0-7.0
9/23/10	EW-9	26.0	15-25	10-15	7-10	7.0	0-7.0
9/23/10	EW-7	26.0	15-25	10-15	7-10	7.0	0-7.0

All Depths are from Finish Grade Down

Installer Signature: _____

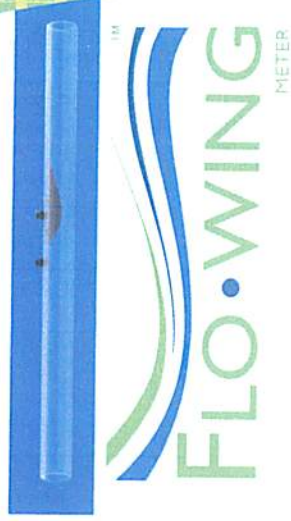


Developed by **Energyneering Solutions** to overcome the challenges of current wellhead technology the **Flo-wing™** provides landfill operators the widest measurement range, unobstructed liquid passage and varied placement options. These attributes result in reduced maintenance costs, reduced facility down-time and increased confidence in flow measurement. Accuracy has been proven through field tests at several landfill sites and by the mechanical engineering department of George Fox University. The **Flo-wing™** is compatible with any of today's commonly used monitoring instruments.

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Energyneering Solutions Inc.
All Rights Reserved

CONTACT US FOR DETAILS ON THE NEW
FLO-WING METER™ TO SEE IF IT MEETS
YOUR REQUIREMENTS.

ENERGYNEERING™
SOLUTIONS INC

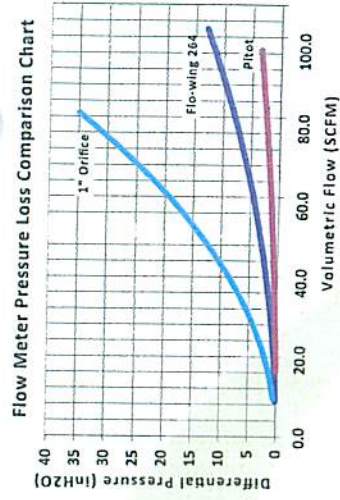
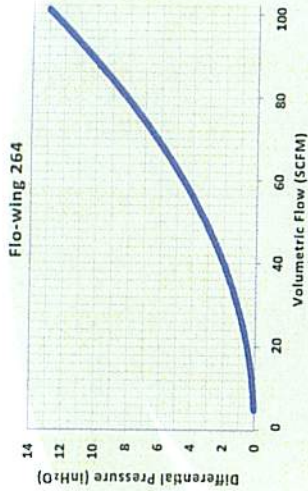


FLO-WING™
METER



Energyneering Solutions Inc.
15820 Barclay Drive
Sisters, OR 97759 USA
www.energyneeringsolutions.com





DESIGN ADVANTAGES:

- € WIDE FLOW MEASUREMENT RANGE
- € HORIZONTAL OR VERTICAL PLACEMENT
- € UNOBSTRUCTED LIQUID PASSAGE
- € REDUCED MAINTENANCE AND DOWN-TIME

Flo - wing 264
Flow Rate Reference Table

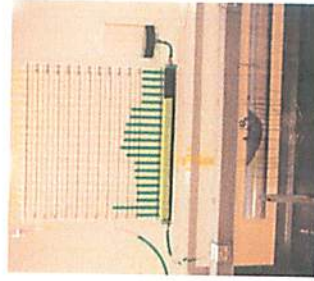
Diff. Pressure (InH2O)	Flow Rate (SCFM)	Diff. Pressure (InH2O)	Flow Rate (SCFM)
0.01	2.8	6.20	70.5
0.02	4.0	6.40	71.6
0.03	4.9	6.60	72.7
0.04	5.7	6.80	73.8
0.05	6.3	7.00	74.9
0.10	8.9	7.20	75.9
0.20	12.7	7.40	77.0
0.40	17.9	7.60	78.0
0.60	21.9	7.80	79.0
0.80	25.3	8.00	80.0
1.00	28.3	8.20	81.0
1.20	31.0	8.40	82.0
1.40	33.5	8.60	83.0
1.60	35.8	8.80	84.0
1.80	38.0	9.00	84.9
2.00	40.0	9.20	85.8
2.20	42.0	9.40	86.8
2.40	43.8	9.60	87.7
2.60	45.6	9.80	88.6
2.80	47.4	10.00	89.5
3.00	49.0	10.20	90.4
3.20	50.6	10.40	91.3
3.40	52.2	10.60	92.1
3.60	53.7	10.80	93.0
3.80	55.2	11.00	93.9
4.00	56.6	11.20	94.7
4.20	58.0	11.40	95.6
4.40	59.4	11.60	96.4
4.60	60.7	11.80	97.2
4.80	62.0	12.00	98.0
5.00	63.3	12.20	98.9
5.20	64.5	12.40	99.7
5.40	65.8	12.60	100.5
5.60	67.0	12.80	101.3
5.80	68.2	13.00	102.0
6.00	69.3	13.20	102.8

The state-of-the-art Flo-wing Meter holds many advantages over existing orifice-plate and pitot tube meters. The primary advantages are seen in the low maintenance features of the Flo-wing Meter™. Design provides accurate flow measurement across a wide flow range. The proprietary form factor minimizes differential pressure loss across the metering run and provides a directional flow path to avoid potential sample port clogging.

€ The Flo-wing Meter™ utilizes an eccentric design which allows for unobstructed flow of liquids to pass through the metering device area without hindering gas flow monitoring.

€ The Flo-wing Meter™ is versatile. It is compatible with any of the commonly used monitoring instruments and has been proven to measure gas flow accurately across a wide range.

The Flo-wing Meter™ has been bench and field tested by Energy Engineering Solutions and Elcom, Earthworks, Flow measurement accuracy was further verified by the George Fox University Mechanical Engineering Department using a Pitotek 1440 Wind Tunnel.



“It is nice to have accurate readings for once...and believe them.”

-STEVE KING, MANAGER, PNGC POWER, COFFIN BUTTE LANDFILL

“This is the first wellhead I’ve seen that solves the problem of condensate buildup in the wellhead.”

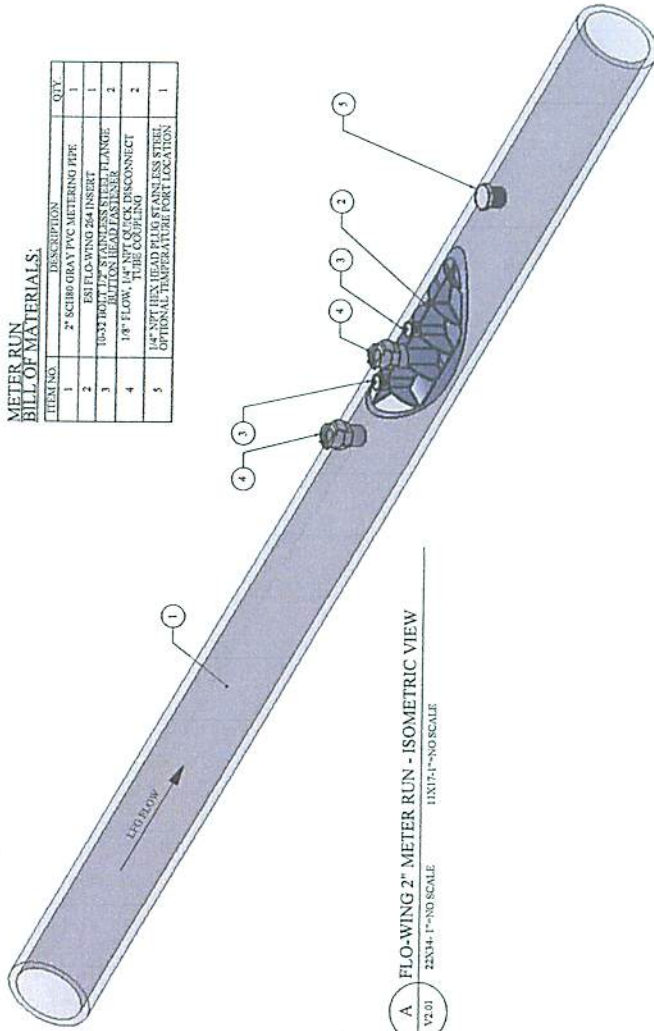
-JIM THOMPSON, LANDFILL GAS OPERATIONS MANAGER DESCHUTES COUNTY DEPARTMENT OF SOLID WASTE

“The Flo-wing Meter™ is the only meter I have been able to use successfully in a horizontal application.”

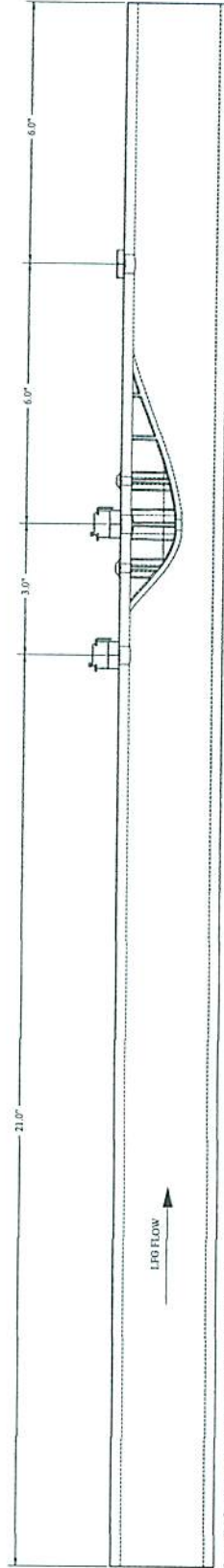
-ED GOEBEL, MANAGER, FINLEY BIOENERGY FEED FACILITY AND FINLEY BUTTES LANDFILL

**METER RUN
BILL OF MATERIALS:**

ITEM NO.	DESCRIPTION	QTY.
1	2" SCH80 GRAY PVC METERING PIPE	1
2	ESI FLO-WING 2" METER RUN	1
3	1032 1/2" 1/2" STAINLESS STEEL FLANGE BOLLON HEAD FASTENER	2
4	1/8" FLOW, 1/2" BORE COPPER DISCONNECT	2
5	1/4" NPT HEX HEAD PLUG STAINLESS STEEL OPTIONAL TEMPERATURE PORT LOCATION	1



A FLO-WING 2" METER RUN - ISOMETRIC VIEW
 22X3/4" 1"=NO SCALE 1:1X1/4"=NO SCALE



B FLO-WING 2" METER RUN - PROFILE VIEW
 22X3/4" 1"=NO SCALE 1:1X1/4"=NO SCALE



ENERGYENGINEERING SOLUTIONS INC
 15820 Barclay Drive Sisters, OR 97759
 Phone: (541) 549-8766
 Fax: (541) 549-1901

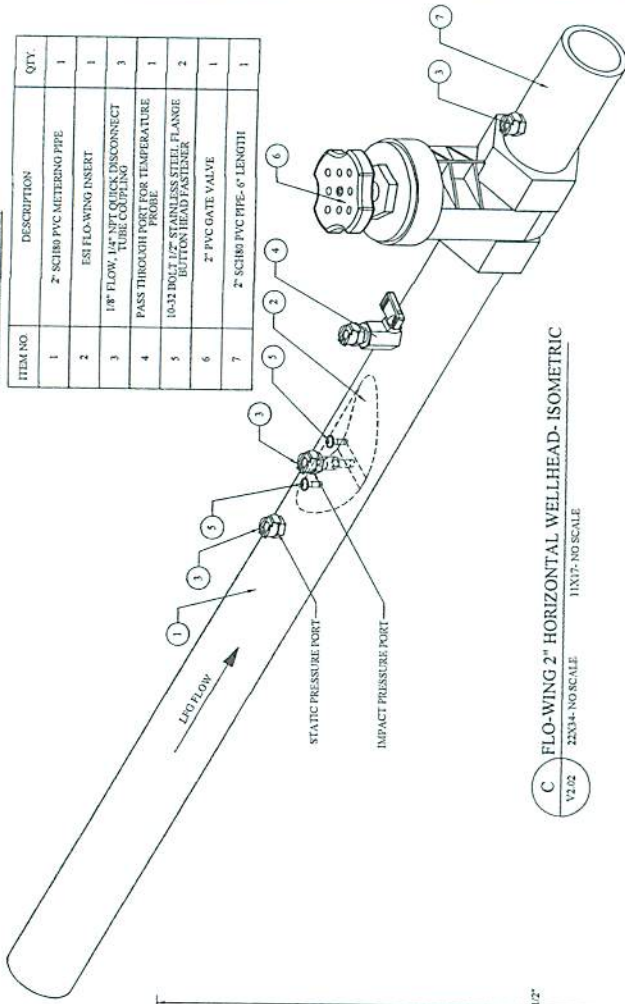
Drawing No. **V2.01**
 Project No.

FLO-WING 2" METER RUN
FLO-WING METER

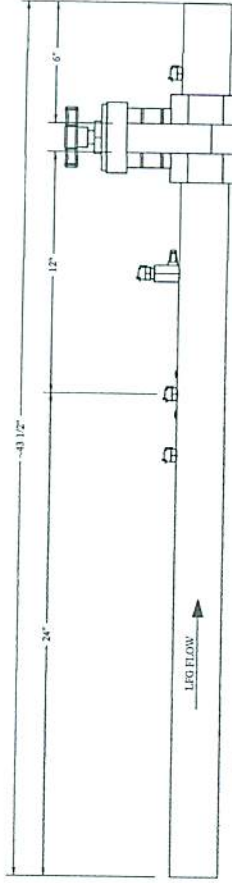
REV	DATE	DESCRIPTION	DRN BY	CHK BY
Rev# 1625108		Design Drawing	JRM	JRM
			DSS BY	CHK BY

**HORIZONTAL WELLHEAD
BILL OF MATERIALS:**

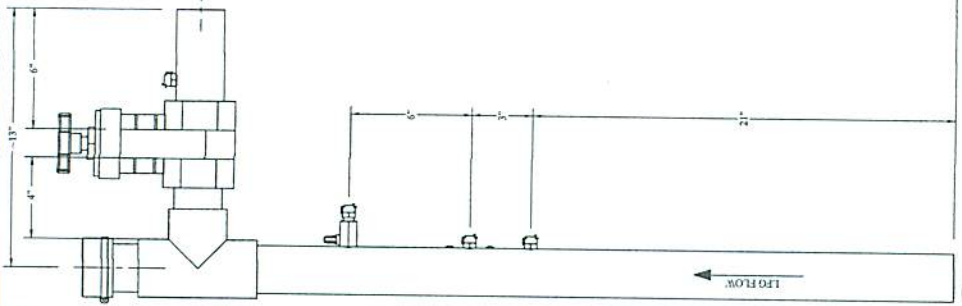
ITEM NO	DESCRIPTION	QTY.
1	2" SCH80 PVC METERING PIPE	1
2	ESI FLOW-WING INSERT	1
3	1/8" FLOW, 1/4" NPT QUICK DISCONNECT TUBE COUPLING	3
4	PASS THROUGH PORT FOR TEMPERATURE PROBE	1
5	10-32 BOLT 1/2" STAINLESS STEEL FLANGE BUTTON HEAD FASTENER	2
6	2" PVC GATE VALVE	1
7	2" SCH80 PVC PIPE-6' LENGTH	1



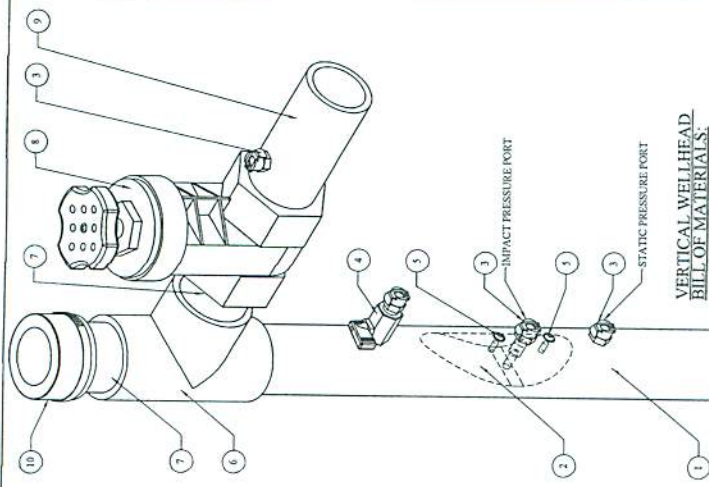
C FLO-WING 2" HORIZONTAL WELLHEAD- ISOMETRIC
V2.02 2X3/4" NO SCALE 1/16" NO SCALE



D FLO-WING 2" HORIZONTAL WELLHEAD- PROFILE
V2.02 2X3/4" NO SCALE 1/16" NO SCALE



B FLO-WING 2" VERTICAL WELLHEAD- PROFILE
V2.02 2X3/4" NO SCALE 1/16" NO SCALE



**VERTICAL WELLHEAD
BILL OF MATERIALS:**

ITEM NO	DESCRIPTION	QTY.
1	2" SCH80 PVC METERING PIPE	1
2	ESI FLOW-WING INSERT	1
3	1/8" FLOW, 1/4" NPT QUICK DISCONNECT TUBE COUPLING	3
4	PASS THROUGH PORT FOR TEMPERATURE PROBE	1
5	10-32 BOLT 1/2" STAINLESS STEEL FLANGE BUTTON HEAD FASTENER	2
6	2" SCH80 PVC SOC X SOCKET	1
7	2" SCH80 PVC CONNECTION- 4" LENGTH	2
8	2" PVC KIB GATE VALVE	1
9	2" SCH80 PVC PIPE- 6' LENGTH	1
10	2" FERRO-CAP	1

A FLO-WING 2" VERTICAL WELLHEAD- ISOMETRIC
V2.02 2X3/4" NO SCALE 1/16" NO SCALE

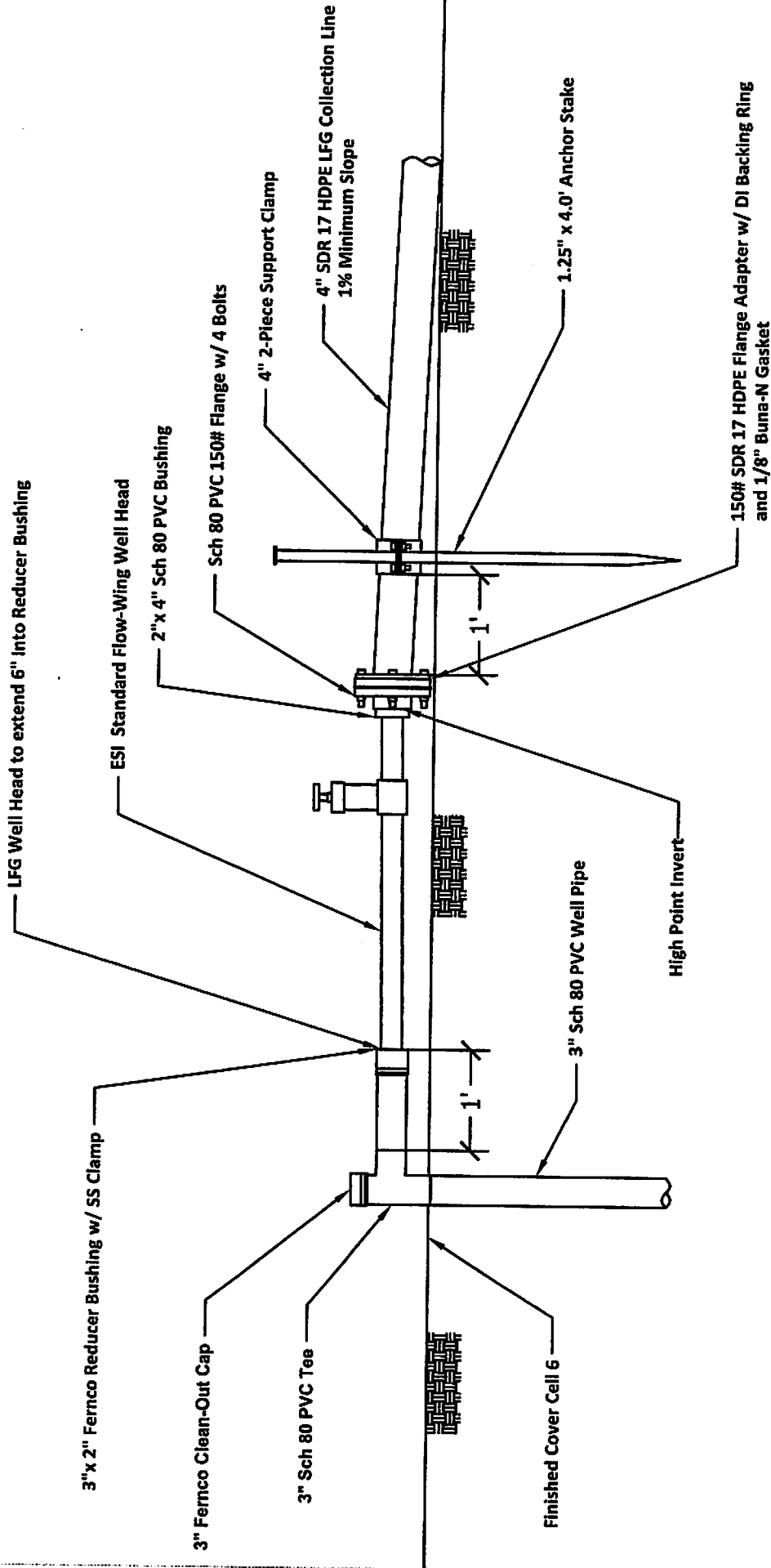



ENERGYENGINEERING™
SOLUTIONS INC
15820 Barclay Drive Sisters, OR 97759
Phone: (541) 549-8766
Fax: (541) 549-1901

Drawing No. **V2.02**
Project No.

FLO-WING 2" Wellheads
FLO-WING Meter

REV	DATE	DESCRIPTION	DRN BY	DSN BY	JRM	JRM	CHK BY
Rev0	6/23/08	Design Drawing			JRM	JRM	



 Mark Heuett General Contractor, Inc. P.O. Box 488 Clarkston, WA 99403 Ph: (509) 243-7855 F: (509) 243-7844 WA: WA0309004, ID: 1571213, OR: 0131004, MT: 57327 www.mhgc.com		City of Walla Walla Area 6 Closure Sudbury Road Landfill LFG Well Head Proposal		REV 1	DATE 9/1/10	DESCRIPTION Engineer Approval	DRN CC	COL CC	CHK CC	Scale: 1" = 1'-0"	Drawing Number <h1>G1.05</h1>
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MARK HEUETT GENERAL CONTRACTOR, INC
 P.O. Box 488, Clarkston, WA 99403
 ph (509) 243-7855 fax (509) 243-7844
 CCB: WA:MARKHGC990R1, ID:15257C123, OR:120465, MT:52727
 www.mhgcinc.com

Sudbury Road Landfill Initial Start-up Well Settings 1-6-2011

Device ID	Date/Time	CH4 %	CO2 %	O2 %	Balance %	Init. Static Press. inches H2O	Adj. Static Press. inches H2O	Int. Diff. Press. inches H2O	Int. Diff. Press. inches H2O	Adj. Diff. Press. inches H2O	Init. Gas Temp. DegF	Init. Flow Scfm	Adj. Flow Scfm	FLD-Tech	DL-Tech	Comments
EW-03	1/5/2011 13:29	56	43.8	0	0.2	-0.4	-0.4	-0.4	0.769	0.783	45	25	25	Chance Chacon	Chance Chacon	initial setting
EW-02	1/5/2011 13:34	56.5	43.2	0.2	0.1	-0.1	-0.1	-0.1	1.504	1.602	65	34	35	Chance Chacon	Chance Chacon	initial setting
EW-01	1/5/2011 13:39	56.2	43.5	0.1	0.2	-1.1	-1.1	-1.1	0.091	0.118	56	8	9	Chance Chacon	Chance Chacon	initial setting
EW-04	1/5/2011 13:43	57	42.7	0.1	0.2	-0.1	-0.1	-0.1	0.217	0.255	58	13	14	Chance Chacon	Chance Chacon	initial setting
EW-05	1/5/2011 13:49	57.4	42.2	0.3	0.1	-1	-1	-1	1.053	0.476	72	28	19	Chance Chacon	Chance Chacon	initial setting
EW-06	1/5/2011 13:53	56.4	43	0.4	0.2	-1	-1	-1	0.655	0.513	68	22	20	Chance Chacon	Chance Chacon	initial setting
EW-11	1/5/2011 13:58	56.1	43.4	0.3	0.2	-0.1	-0.1	-0.1	0.33	0.344	64	16	16	Chance Chacon	Chance Chacon	initial setting
EW-08	1/5/2011 14:02	56.7	43	0.1	0.2	-1.2	-1.2	-1.2	0.241	0.171	62	13	11	Chance Chacon	Chance Chacon	initial setting
EW-07	1/5/2011 14:06	57.2	42.5	0.2	0.1	-0.7	-0.7	-0.7	0.309	0.235	54	15	13	Chance Chacon	Chance Chacon	initial setting
EW-09	1/5/2011 14:10	57.2	42.5	0.1	0.2	-0.5	-0.5	-0.5	0.536	0.517	55	20	20	Chance Chacon	Chance Chacon	initial setting
EW-10	1/5/2011 14:17	56.1	43.5	0.3	0.1	-0.2	-0.2	-0.2	0.389	0.385	69	17	17	Chance Chacon	Chance Chacon	initial setting
FLARE	1/5/2011 14:29	57.2	42.2	0.5	0.1	-20.2	-20.2	-20.2	0	0	0	0	0	Chance Chacon	Chance Chacon	initial setting

City of Walla Walla Sudbury Landfill

Area 6 Closure 2010 Information

Section

5. Blower Facility

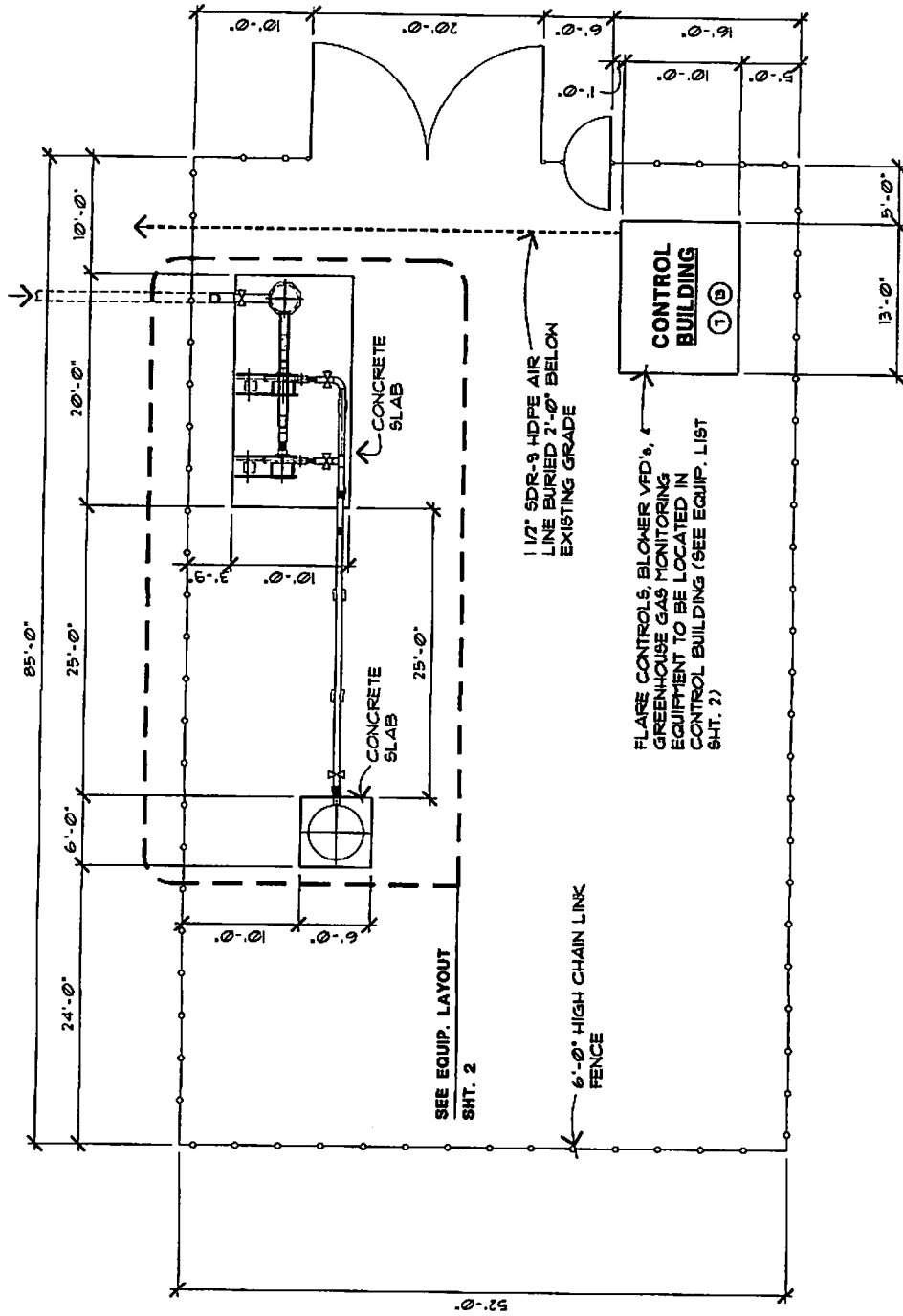
**BLOWER FLARE STATION
SUBBURY LANDFILL**
Walla Walla Washington
SITE PLAN

Mark Heuett General
Contractor Inc.
P.O. Box 488
Clarkston, WA 99403
P: (509) 243-7878 F: (509) 243-7844
CB: WA: MARK99081, ID: 15257C123
OR: 120465, MT: 52727

DRAWN BY: MR
CHECKED BY: MH
DATE: 8/25/10
JOB NO.: 100872
REVISION DATE:

SHEET:

1 3



SITE PLAN

1" = 10' — 0"

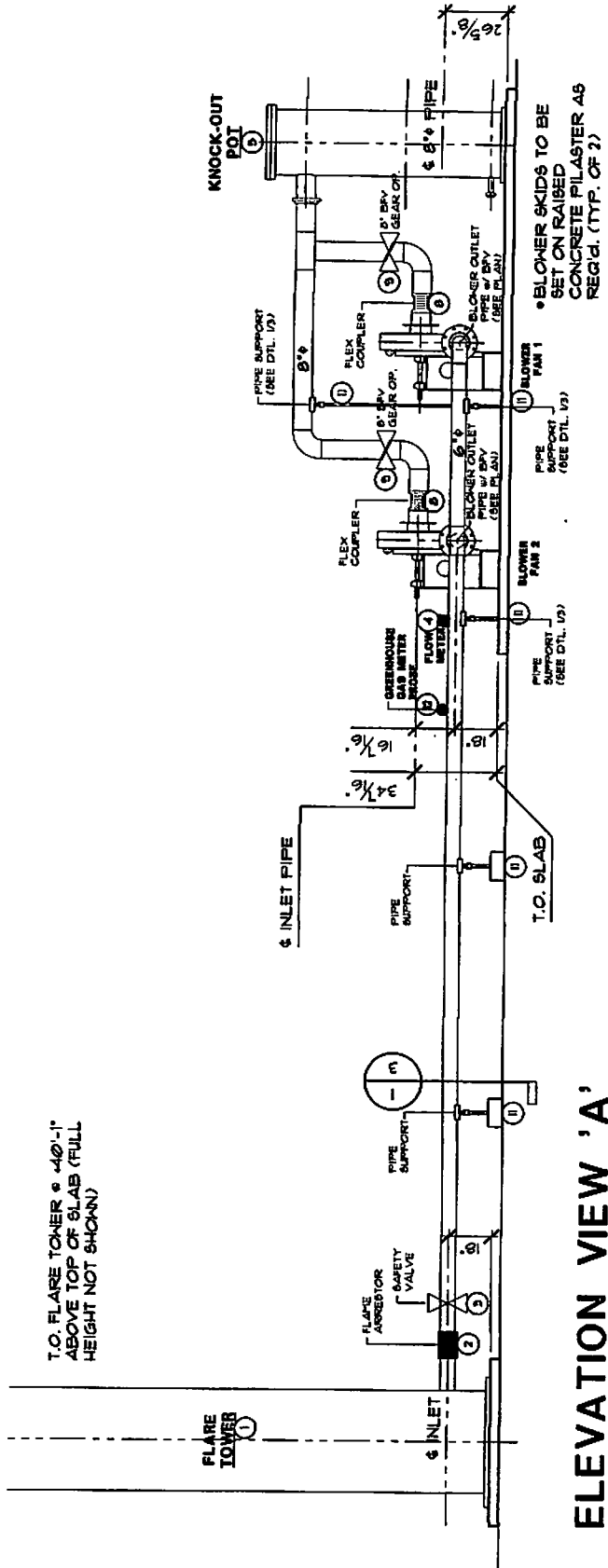
**BLOWER FLARE STATION
SUBBURY LANDFILL**
Walla Walla Washington
ELEVATION (SIDE) VIEWS

Mark Heuett General
Contractor Inc.
P.O. Box 488
Clarkston, WA 99403
P: (509) 243-7878 F: (509) 243-7844
COB: WA: MARK93R1, ID: 15257C123
OR: 120465, MT: 52727

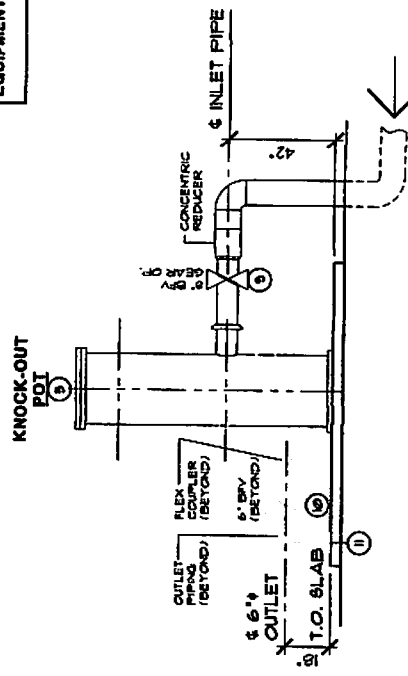
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CHECKED BY: PH
DATE: 9/25/10
JOB NO: 1000972
REVISION DATE:

SHEET: 3

3



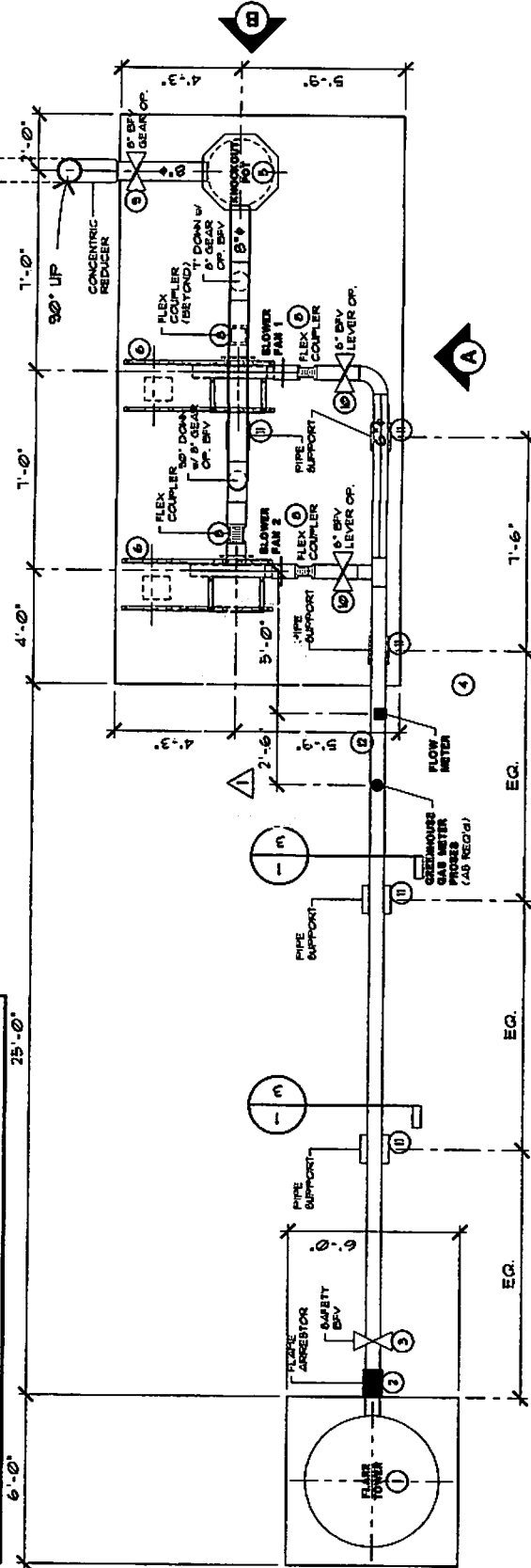
SEE SHT. 2 FOR
EQUIPMENT LEGEND



SEE SHT. 2 FOR
EQUIPMENT LEGEND

PIPE SUPPORT
1
3 1" = 1' - 0"

EQUIPMENT LEGEND	
1	'JOHN ZINK' ENCLOSED FLARE
2	6" ENARDO FLAME ARRESTOR
3	6" 'XOMOX' SAFETY BFV WITH 'BETTIS' AIR ACTUATOR
4	THERMAL INSTRUMENTS FLOW METER
5	'ZMS' CONDENSATE KNOCKOUT POT
6	'NEW YORK BLOWER' 8KID
7	'ALLEN BRADLEY' POWERFLEX 40 VFD
8	'UNAFLEX' SUPERLEX 1000 FLEXIBLE COUPLER
9	8" 'AASAH' MODEL 67 GEAR OPERATED BFV
10	8" 'AASAH' MODEL 67 LEVER OPERATED BFV
11	ADJUSTABLE PIPE SUPPORTS
12	'ELKINS' GREEN HOUSE GAS MONITOR PORTS
13	'ELKINS' GREEN HOUSE GAS MONITOR



EQUIPMENT LAYOUT

1/4" = 1' - 0"

- ALL PIPING TO BE 6DR 11 HFDE.
- BLOWERS 91T ON RAISED PAD. TOP OF RAISED PAD TO BE ±1 1/8" ABOVE TOP OF FINISH SLAB (FIELD VERIFY). CENTERLINE OF BLOWER OUTLET PIPING TO BE ±48" ABOVE TOP OF SLAB, TO TIE INTO FLAME TOWER INLET.

BLOWER FLARE STATION
SUBBURY LANDFILL
 Walla Walla Washington
EQUIPMENT LAYOUT

Mark Heuett General Contractor Inc.
 P.O. Box 488
 Clarkston, WA 99403
 P: (509) 243-7878 F: (509) 243-7844
 CCB: WA: MAFK990R1, ID: 16257C123
 OR: 120465, MT: 52727

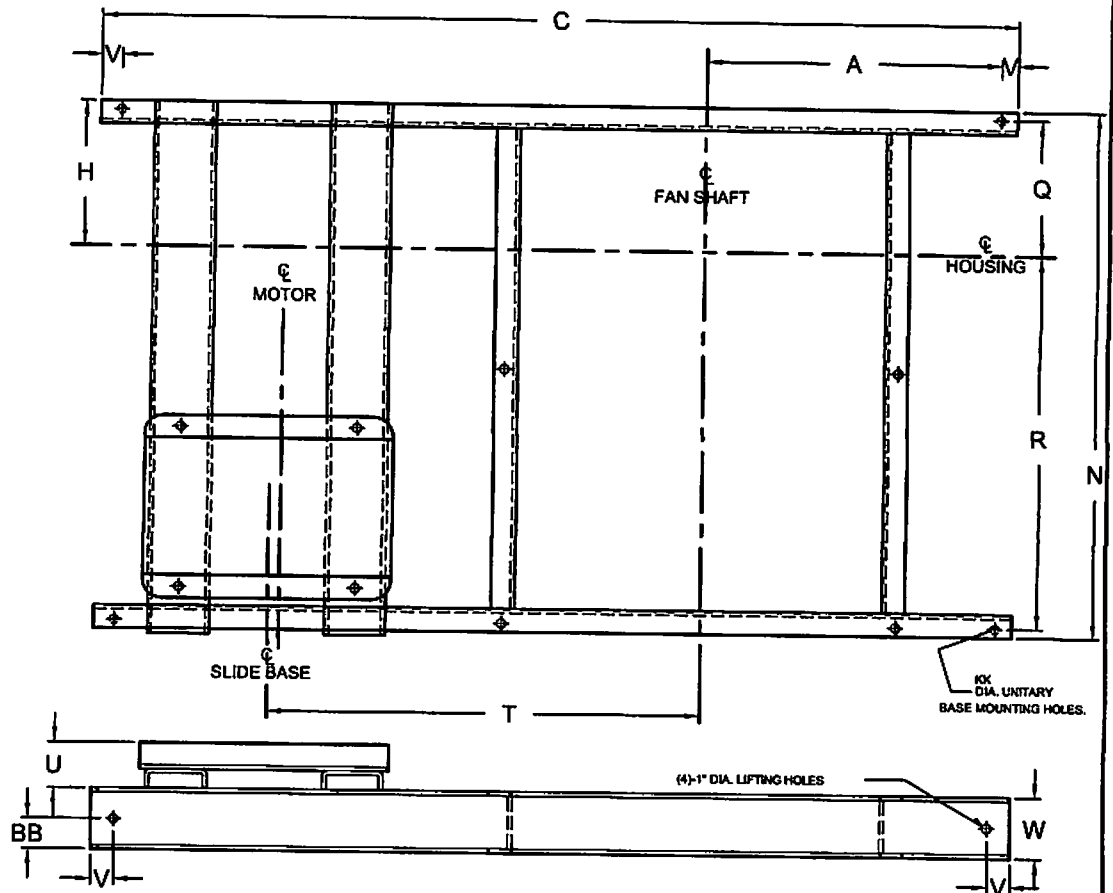
DRAWN BY: M/R
 CHECKED BY: P/H
 DATE: 8/25/10
 JOB NO.: 020912
 REVISION DATE:
 8/30/10

SHEET:

2 3

PAPE & SONS CONSTRUCTION 9401 - 54th Avenue NW, Suite 1

PURCHASE ORDER: 663-2



ITEM	DIMENSIONS	
	In	mm
A	13 3/4	349
C	63 3/8	1610
H	4 3/4	121
Q	3 7/8	98
N	21 3/4	552
R	16 1/8	410
T	35 3/4	908
U	3 7/8	98
V	1 1/2	38
W	4	102
BB	2	51
KK	(4) - 9/16	-

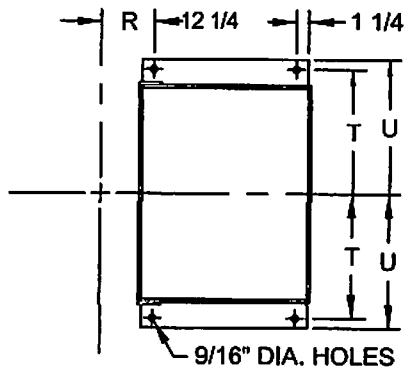
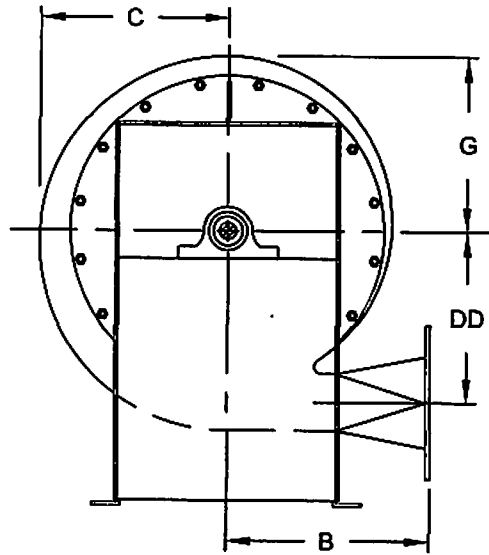
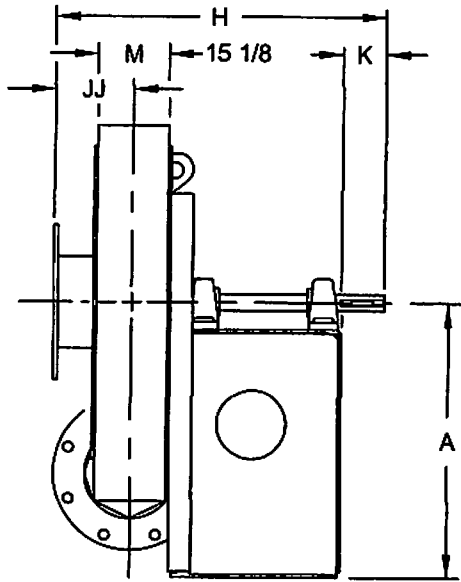
nyb The New York Blower Company
 7660 Quincy Street, Willowbrook, IL 60527

Unitary Base - Position Z
 SIZE: 2608A

Date 06-09-09 Certified JRW
 Drawing No. D08740-100-4 Rev.

Approx. Weight: 117 lbs (Includes slide base weight.)

A-Size UBASE.dwg



INLET AND OUTLET FLANGES ARE 3/8" THICK MATERIAL.

PRESSURE BLOWERS ARE ROTATABLE IN THE FIELD BY 22 1/2° INCREMENTS.

FURNISHED WITH FLANGED INLET AND OUTLET WHICH FITS ANSI 150 PIPE FLANGES.

MAXIMUM TEMPERATURE :
200°F (93°C) - ALUMINUM WHEEL
300°F (149°C) - STEEL WHEEL

ITEM	DIMENSIONS	
	In	mm
A	26 5/8	676
B	19	483
C	19 7/16	494
DD	17 5/8	448
G	18 1/4	464
H	29 5/8	752
JJ	7	178
K	5	127
M	5	127
R	3 7/8	98
T	10 7/8	276
U	11 3/4	298
SHAFT DIA.	1 11/16	-
KEYWAY	3/8	-

FLANGED OUTLET	DIMENSIONS	
	In	mm
I.D.	6	152
B.C.	9 1/2	241
O.D.	11	279
NO. HOLES	8	-
DIA. HOLES	7/8	22

FLANGED INLET	DIMENSIONS	
	In	mm
I.D.	8	203
B.C.	11 3/4	298
O.D.	13 1/2	343
NO. HOLES	8	-
DIA. HOLES	7/8	22

TOLERANCE: ±1/8" (±3mm)

nyb The
New York Blower
Company

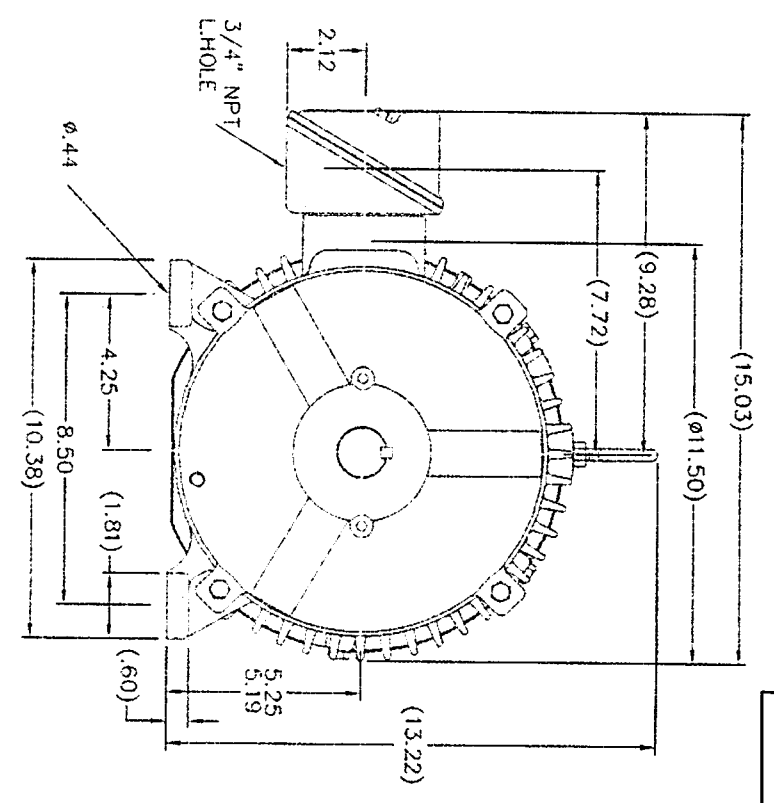
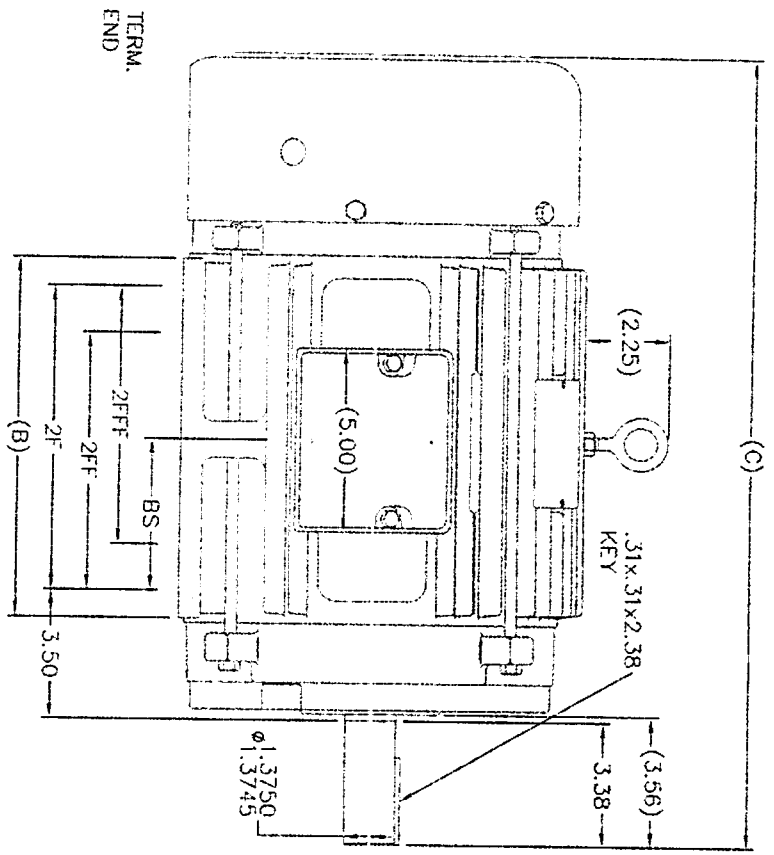
7660 Quincy Street, Willowbrook, IL 60521

Pressure Blower A1

SIZE: 23to2606 CCW BH

Date: 05-01-06 Drawn By: NYB

DWG: PB-23to2606-1-CCW-BH-999-F



- NOTES:
1. CONDUIT BOX CAN BE ROTATED IN 90° STEPS.
 2. CONDUIT BOX CAN BE MOUNTED ON OPPOSITE SIDE BY REMOVING BRACKETS AND TURNING FRAME 180°.
 3. NAMEPLATE TO BE READ FROM CONDUIT BOX SIDE OF MOTOR.

DASH FRAME	B	2F	2FF	2FFF	BS	FOOT HOLE QTY.	MOUNTING	CAST FAN GUARD	STEEL FAN GUARD
725	2131	7.00	5.50	-	2.75	4	F1 OR F2	18.22	18.74
875	2151	8.50	7.00	-	3.50	4	F1 OR F2	19.72	20.24
875	213/51	8.50	7.00	5.50	3.50	8	F1 OR F2	19.72	20.24
1000	2131	9.75	8.25	5.50	4.12	8	F1 OR F2	20.97	21.49
1000	2151	9.75	8.25	7.00	4.12	8	F1 OR F2	20.97	21.49

13	REMOVED NOTE "SEE TABLE FOR HOLE QTY."	RMH 11-16-2003	ML	DATE	REV	BY	CHK	APP	QTY	REV
12	-875'S FOOT HOLE QTY. WERE SWITCHED CH2323	ERM 10-21-2003	ML	DATE	REV	BY	CHK	APP	QTY	REV
11	REMOVED TABLE TO CLAMP Y MOUNTINGS	CH2323	ML	DATE	REV	BY	CHK	APP	QTY	REV
10	CORRECTED CONDUIT BOX VIEWS	CH28426	ML	DATE	REV	BY	CHK	APP	QTY	REV
9	REMOVED CONDUIT BOX	CH28426	ML	DATE	REV	BY	CHK	APP	QTY	REV
8	REMOVED DASH TABLE AND FOOT HOLE DIM.	MRB 3-26-1999	ML	DATE	REV	BY	CHK	APP	QTY	REV
7	REVISION	BY 6 DATE	ML	DATE	REV	BY	CHK	APP	QTY	REV
6	THIS DRAWING IN DESIGN AND DETAIL IS OUR PROPERTY AND MUST NOT BE USED EXCEPT IN CONNECTION WITH OUR WORK. ALL RIGHTS OF DESIGN AND INVENTION ARE RESERVED. THIS IS AN ELECTRONICALLY GENERATED DOCUMENT - DO NOT SCALE THIS PRINT	BY 6 DATE	ML	DATE	REV	BY	CHK	APP	QTY	REV
5			ML	DATE	REV	BY	CHK	APP	QTY	REV
4			ML	DATE	REV	BY	CHK	APP	QTY	REV
3			ML	DATE	REV	BY	CHK	APP	QTY	REV
2			ML	DATE	REV	BY	CHK	APP	QTY	REV
1			ML	DATE	REV	BY	CHK	APP	QTY	REV

The New York Blower Company
 Fan-to-Size
 Fan Selection Data

Project:	Sudbury Landfill
Location:	Walla Walla, WA.
Contact:	MHGC

Fan Design

Product:	Pressure Blower	Arrangement:	1
Size/Model:	2606A	Drive type:	Belt
Wheel Type:	Aluminum		
Wheel Material:	Aluminum		
Wheel Width:	100.0 %	Wheel Diameter:	100.0 %

Operating Conditions

Volume Flow Rate:	380 CFM	Fan Speed:	3649 rpm
Fan Static Pressure:	50.0 in wg	Fan Input Power:	7.78 bhp
Outlet Velocity:	1939 ft/min	VP/SP ratio:	0.0043
Altitude (above mean sea level):	600 ft	Operating Temperature:	100 Deg F
Operating Inlet Airstream Density:	0.0690 lb/ft3		
Static Efficiency:	38.38%	Mechanical Efficiency:	38.55%
Maximum Operating Temperature:	100 Deg F	Maximum Safe Operating Speed:	3800 rpm

Conditions at 70 Deg F and 600 ft

Volume Flow Rate:	380 CFM	Fan Speed:	3649 rpm
Fan Static Pressure:	52.8 in wg	Fan Input Power:	8.22 bhp
Density at Altitude (600 ft) :	0.0729 lb/ft3	Max. Safe Speed at 70 Deg F:	3800 rpm

Sound Power Level Ratings Levels expressed in dB (power levels reference 10⁻¹² watts)

Center Frequency (Hz):	63	125	250	500	1000	2000	4000	8000	
Octave Bands:	1	2	3	4	5	6	7	8	Overall
Total Fan Power Levels*:	87.3	95.	102.2	105.	103.1	97.1	93.	82.6	109.
Inlet Power Levels**:	84.3	92.	99.2	102.	100.1	94.1	90.	79.6	106.
Outlet Power Levels**:	84.3	92.	99.2	102.	100.1	94.1	90.	79.6	106.

*As corrected for point of operation (location on fan curve)

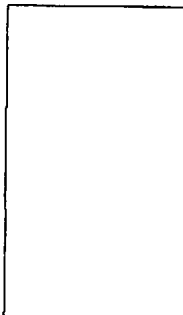
**Unsilenced Inlet and Outlet power ratings are 3 dB lower than total fan power levels under the assumption that "half" of the sound power can be attributed to each opening. Silenced power ratings include this 3 dB reduction as well as the silencer attenuation.

Estimated Sound Pressure Levels Expressed in dB (pressure levels reference 2x10⁻⁷ microbar)

Directivity/Reflection Factor (Q) is 2, hemispherical radiation; Distance is 5 ft.; A-weighting is in use.

The estimated sound pressure level outside the fan due to an open inlet OR outlet is 92.3 dBA at 5.0 feet. The estimated sound pressure level outside the fan when BOTH inlet and outlet are ducted is 80.4 dBA at 5.0 feet (Housing Radiated Noise).

Your Representative:
 Baxter Air Engineering
 12625 NE Woodinville Dr
 Woodinville, WA 98072-8206
 Phone: (425) 486-6666
 Fax: (425) 486-8260
 E-Mail: jay@baxair.com



The New York Blower Company certifies that the Pressure Blower fan is licensed to bear the AMCA Air Performance Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and comply with the requirements of the AMCA Certified Ratings program.

AMCA Licensed for Air Performance without Appurtenances (Accessories). Power (bhp) excludes drives.

Performance certified is for installation type: B - free inlet, ducted outlet.

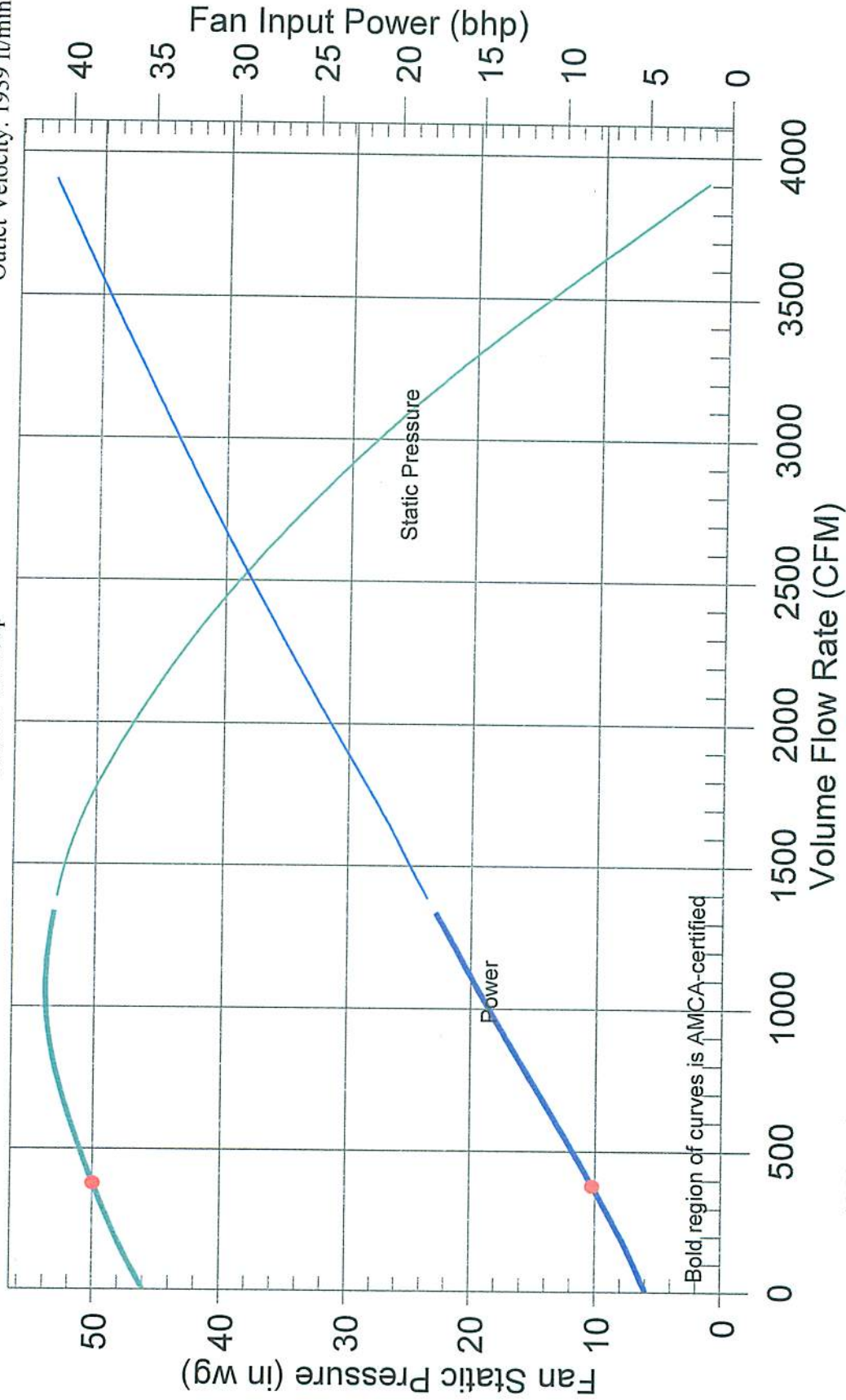
The New York Blower Company

Fan-to-Size

Pressure Blower
2606 Aluminum
Arr.: 1

Volume Flow Rate: 380 CFM
Fan Static Press.: 50.0 in wg
Speed: 3649 rpm
Power: 7.78 bhp

Temp.: 100 Deg F
Altitude: 600 ft
Density: 0.0690 lb/ft³
Outlet Velocity: 1939 ft/min



AMCA Licensed for Air Performance without Appurtenances (Accessories). Power (bhp) excludes drives.
Performance certified is for installation type: B - free inlet, ducted outlet.

[v1.78.00-R -- October 2007] Date Printed: 8/24/2010
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Your Sales Representative:
Baxter Air Engineering
Phone: (425) 486-6666



Call Toll Free: 1.800.327.1286

E-mail: sales@unaflex.com



Rubber Expansion Joints and Flexible Connectors

Home

Style 150

Style 189

Style 200 (XL)

Style 600

Style 800 & 802

Style 1000 & 1100

1000 & 1100 Data

Super-Flex 1200

Dura-Perm

Radi-Flex Elbow

Styles 3150 & 3250

Styles 2150 & 2250

Superflex Style 1000 and 1100

Superflex Style 1000 Expansion Joint

The Superflex 1000 provides double arch movements utilizing a single low profile wide arch. Manufactured utilizing tire industry technology the style 1000 has been designed to provide greater strength and pressure capabilities. The construction combines woven polyester fabric and reinforced with wire to create a product with superior performance characteristics.

The wide self-flushing arch provides more movement than a traditional spool type joint. When built with a filled arch for smooth bore service, (such as slurry applications) the movements are one half of the single open arch spool type joints. The double reinforced construction gives longer life expectancy and is also available in a full range of elastomers to enable multi-purpose applications.

The primary difference between the Style 1000 and Style 1100 is in the manufacturing process.

The 1000 is hand-wrapped to allow for design variations including offsets, non-standard face to face dimensions, multi-arch configurations and special flanges or drillings while still offering wide arch movement.



The Style 1000 is available in these Elastomers and Constructions:

- | | | |
|---|--|--|
| <ul style="list-style-type: none"> • Chlorobutyl • EPDM • Gum • Hypalon | <ul style="list-style-type: none"> • Neoprene • Nitrile • SBR • Silicone • Viton® • Flourel® | <ul style="list-style-type: none"> • Multi-Arch • Offset • Special ends • Alternative drilling |
|---|--|--|

Optional liners and covers are available

Superflex Style 1100 Expansion Joint

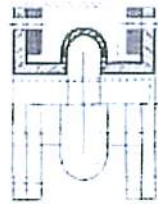
Unaflex's® 1100 series has been designed to compete with the imports in terms of cost, and out perform the imports with a product that's made in America. The movements and benefits match the Style 1000 (above), if you don't need the customization options of the Style 1000....the Style 1100 is a value packed expansion joint.

The cover has been formulated with an ozone and temperature resistant compound which prevents the Style 1100 from cracking unlike the imports. This new manufacturing technology has provided a product that has excellent performance at competitive price.



Due to the molded construction all face to face dimensions are standard. Engineered to withstand full vacuum and high pressure, (see next page). The Style 1100 is an excellent performer with a super price. Specify Superflex!

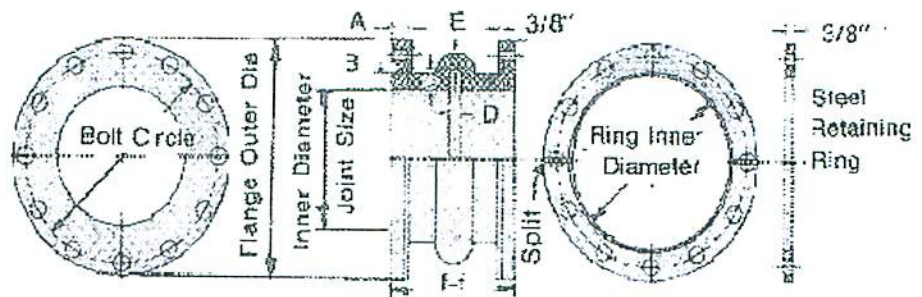
This drawing shows the 1100 Style construction. A wide self flushing arch allows greater movement and flexibility. Available in sizes from 2" to 36". See next page for dimensions and movement details. Optional liners and covers are available.



This drawing shows the 1100 Style construction. A wide self flushing arch allows greater movement and flexibility. Available in sizes from 2" to 36". See next page for dimensions and movement details. Optional liners and covers are available.

Dimensions for Superflex Style 1000 and 1100 Expansion Joints

We do not use marginal constructions which reduce safety factors and cause pressure reductions with slight operating pressure increases. All SUPERFLEX Expansion Joints have a minimum 4 to 1 safety factor at rated operating temperatures and pressures.





Call Toll Free: 1.800.327.1286

E-mail: sales@unaflex.com

Rubber Expansion Joints and Flexible Connectors

Superflex Style 1000 and 1100 Data

Home

Size in inches

Style 150

A-Flange Thickness

Style 189

B-Body Thickness

Style 200 (XL)

C-Internal Arch Height

D-Arch Width

Style 600

E-Arch Thickness

Note: Maximum diameter for Style 1100 is 36"

Style 800 & 802

Style 1000 & 1100

1000 & 1100 Data

Super-Flex 1200

Dura-Perm

Radi-Flex Elbow

Styles 3150 & 3250

Styles 2150 & 2250

Joint Size I.D. (in.)	Face-to-Face	Flange O.D.	Bolt Circle Dia.	No of Bolt Holes	Bolt Hole Dia.	Ring I.D.	A	B	C	D	E	Style 1000 Max. P.S.I.	Style 1100 Max. P.S.I.	Axial Comp.	Axial Ext.	Trav. Defl.	Joint Wt.	Ret. Rgs.	Ctrl.Units
1/2	6	3-1/2	2-3/8	4	9/16	1-1/4	1/2	7/8	1	1-3/4	3/8	225	225	1-3/4	3/4	3/4	1	1-1/2	6
3/4	6	3-7/8	2-3/4	4	9/16	1-5/8	1/2	7/8	1	1-3/4	3/8	225	225	1-3/4	3/4	3/4	1-1/2	2	6
1	6	4-1/4	3-1/8	4	5/8	1-7/8	9/16	7/8	1	1-3/4	3/8	225	225	1-3/4	3/4	3/4	2	2-1/4	6
1-1/4	6	4-5/8	3-1/2	4	5/8	2-1/8	9/16	7/8	1-1/8	1-3/4	7/16	225	225	1-3/4	3/4	3/4	2-1/2	2-1/2	6
1-1/2	6	5	3-7/8	4	5/8	2-3/8	9/16	7/8	1-1/8	1-3/4	7/16	225	225	1-3/4	3/4	3/4	3	3	6
2	6	6	4-3/4	4	3/4	3-1/8	9/16	29-32	1-1/4	1-3/4	1/2	225	225	1-3/4	3/4	3/4	4	4	7
2-1/2	6	7	5-1/2	4	3/4	4-1/8	9/16	29-32	1-1/4	1-3/4	1/2	225	225	1-3/4	3/4	3/4	4-1/2	5-1/2	7
3	6	7-1/2	6	4	3/4	4-5/8	5/8	29-32	1-1/4	1-3/4	1/2	225	225	1-3/4	3/4	3/4	5-1/2	6	7
4	6	9	7-1/2	8	3/4	5-7/8	3/4	7/8	1-1/4	1-3/4	1/2	225	225	1-3/4	3/4	3/4	8	7-1/2	8
5	6	10	8-1/2	8	7/8	6-7/8	3/4	7/8	1-1/4	1-3/4	1/2	225	225	1-3/4	3/4	3/4	9	8	8
6	6	11	9-1/2	8	7/8	7-7/8	3/4	1	1-1/4	1-3/4	1/2	225	225	1-3/4	3/4	1	11	9	9
8	6	13-1/2	11-3/4	8	7/8	9-7/8	7/8	1	1-1/2	1-3/4	5/8	225	225	1-3/4	3/4	1	15	12	12





Type 57 Butterfly Valve

Specifications

Sizes: Lever: 1-1/2" - 8"
Gear: 8" - 14"

Models: Wafer Style

Operators: Lever and Gear

Bodies: PVC, PP and PVDF

Discs: PVC, PP and PVDF

Seats: EPDM, FKM, and Nitrile

Seals: Same as seating material

Stems: 403 and 316 stainless steel, Titanium, Hastelloy C[†]

† Trademark of Cabot Corporation

Standard Features (Sizes 1-1/2" - 14")

- Standard model (1-1/2" - 14") has PVC Body and PP Disc for superior chemical resistance and elevated temperature capabilities
- 316/403 stainless steel shaft has full engagement over the entire length of the disc and is a non-wetted part.
- Only solid and abrasion-resistant plastic disc and elastomeric liner are wetted parts.
- ISO bolt circle on top flange—no body or stem modifications required for accessories.
- Stem retainer—PP retainer to prevent stem removal.
- Seat over tightening protection—Molded body stops and seat stress relief area.
- Spherical disc design offers increased Cv, ultimate sealing and high cycle life.

Options

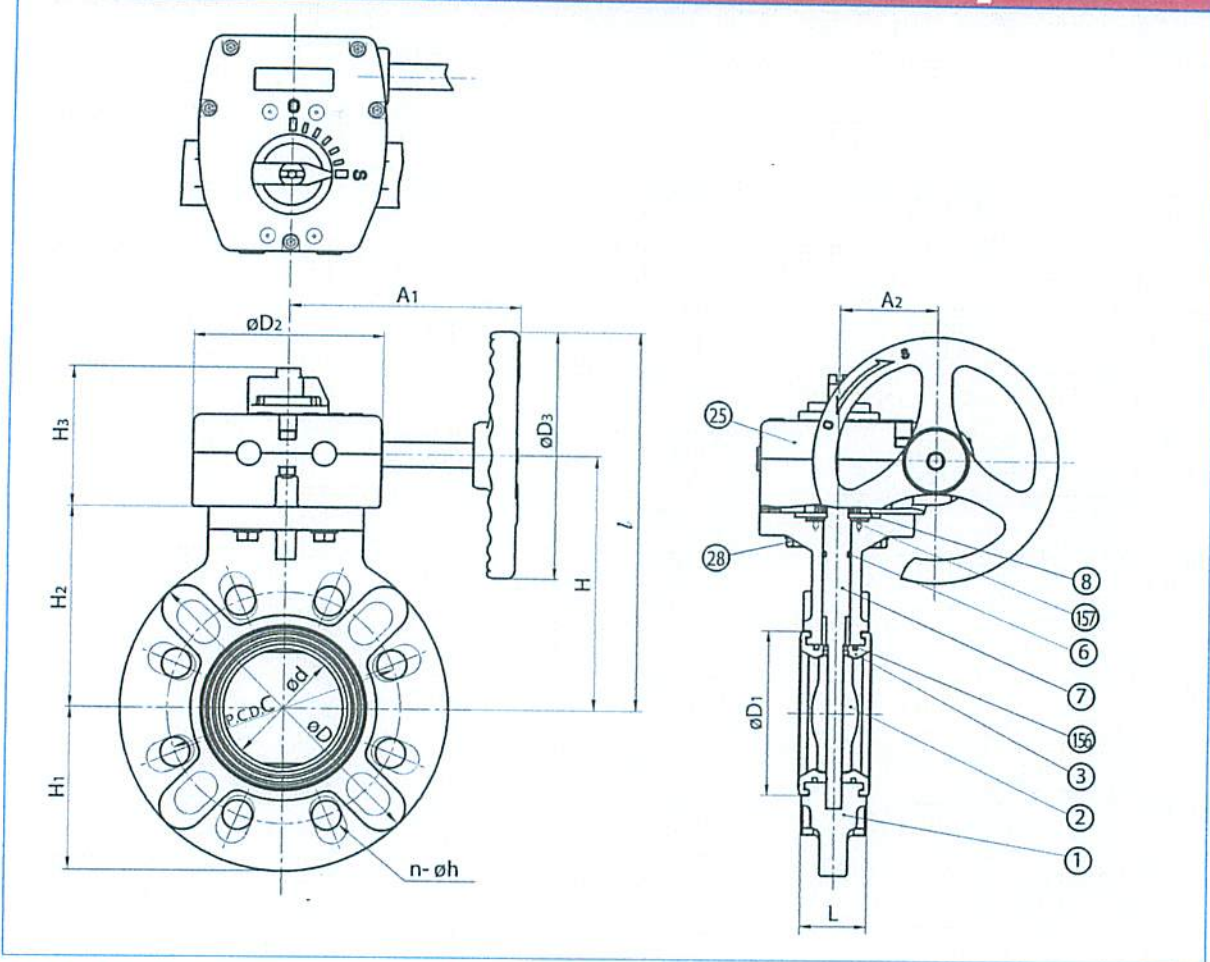
- Pneumatically and electrically actuated with accessories
- Alternate discs:
 - (I) PVC : 1-1/2" - 14"
 - (II) PVDF : 1-1/2" - 14"
- Plasgear™ gear operators for 1-1/2"- 6"
- Lug style (stainless steel 304 or 316) for blocking and end-of-line applications
- Stems in 316 stainless steel, titanium, Hastelloy C®.
- 2" square nut on stem (1-1/2" - 8" only)
- 2" square nut on gear operator (All sizes)
- Stem extensions (Single stem and two-piece stem)
- Locking devices (Gear Type - Standard on Lever)
- Chain operators
- Manual limit switch - Asahi P-Series
- Tandem arrangements (Patented by A/A, Inc.)

Parts List (Lever: Sizes 1-1/2" - 8")

PARTS			
NO.	DESCRIPTION	PCS.	MATERIAL
1	Body	1	PVC, PP, PVDF
2	Disc	1	PVC, PP, PVDF
3	Seat	1	EPDM, FKM, NBR
6	O-Ring (C)	1	EPDM, FKM, NBR
7	Stem	1	Stainless Steel 316
8	Stem Retainer	1	PP
16	Handle	1	PP
16a	Metal Insert in Handle	1	Stainless Steel 316L
17	Handle Lever	1	PPG
18	Pin	1	PPG
19	Spring	1	Stainless Steel 304
20	Washer (A)	1	Stainless Steel 304
21	Bolt (B)	1	Stainless Steel 304
22	Locking Plate	1	PPG
23	Screw (B)	4	Stainless Steel 304
24	Cap (A)	1	PP
156	Liner Stabilization Ring	2	Stainless Steel (SCS13)
157	Screw (F)	4	Stainless Steel 304



Type 57 – Gear Operated Butterfly Valves



Dimensions (Sizes 1-1/2" – 14") (NOTE: GEAR OPERATED VALVE IS STANDARD 8" – 14"; SIZES 1-1/2" – 6" ARE OPTIONS.)

NOMINAL SIZE		ANSI CLASS 150														Gear Box Model No.			
INCHES	mm	d	C	n	h	D	D1	D2	D3	L	H	H1	H2	H3	l	A1	A2	Wheel Cycles	Model No.
1 1/2	40	1.77	3.88	4	0.62	5.91	2.83	4.80	6.30	1.54	5.12	2.95	3.74	3.54	8.27	6.57	2.52	9.5	241
2	50	2.20	4.75	4	0.75	6.50	3.23	4.80	6.30	1.65	5.51	3.25	4.13	3.54	8.66	6.57	2.52	9.5	
2 1/2	65	2.72	5.50	4	0.75	7.28	3.78	4.80	6.30	1.81	5.91	3.64	4.53	3.54	9.06	6.57	2.52	9.5	
3	80	3.03	6.00	4	0.75	8.31	4.17	4.80	6.30	1.81	6.50	4.15	5.12	3.54	9.65	6.57	2.52	9.5	
4	100	4.02	7.50	8	0.75	9.37	5.31	4.80	6.30	2.20	7.09	4.69	5.71	3.54	10.24	6.57	2.52	9.5	
5	125	5.08	8.50	8	0.88	10.39	6.69	4.80	6.30	2.60	7.68	5.20	6.30	3.54	10.83	6.57	2.52	9.5	
6	150	5.91	9.50	8	0.88	11.22	7.52	4.80	6.30	2.80	8.27	5.61	6.89	3.54	11.42	6.57	2.52	9.5	
8	200	7.68	11.75	8	0.88	13.39	9.53	4.80	6.30	3.43	9.49	6.69	8.11	3.54	12.64	6.57	2.52	9.5	
10	250	9.84	14.25	12	1.00	16.57	11.89	4.80	6.30	4.33	10.87	8.31	9.49	3.62	14.02	6.57	2.52	9.5	243
12	300	11.93	17.00	12	1.00	19.21	14.17	7.40	11.81	5.08	13.39	9.61	11.73	4.25	19.29	9.53	3.90	9.5	
14	350	13.82	18.75	12	1.12	21.22	15.47	7.40	11.81	5.08	14.45	10.63	12.80	4.25	20.35	9.53	3.90	9.5	

Type 57 – Gear Operated Butterfly Valves

Parts List (Gear: Sizes 1-1/2" – 14")

PARTS			
NO.	DESCRIPTION	PCS.	MATERIAL
1	Body	1	PVC, PP, PVDF
2	Disc	1	PVC, PP, PVDF
3	Seat	1	EPDM, FKM, NBR
6	O-Ring (C)	1	EPDM, FKM, NBR
7	Stem	1	Stainless Steel 316, 403
8	Stem Retainer	1	PP
25	Gear Box	1	Plasgear™
28	Bolt (C)	4	Stainless Steel 304
156	Liner Stabilization Ring	2	Stainless Steel (SCS13)
157	Screw (F)	4	Stainless Steel 304

Sample Specification

All solid thermoplastic butterfly valves sizes 1-1/2" thru 14" shall be of the TYPE 57 lined body design and bubble-tight seal (meeting or exceeding Class VI as defined by American National Standard Institute) with only the liner and disc as wetted parts. The lever handle (sizes 1-1/2" thru 8") shall have a molded provision for a padlock. Gear operators shall be worm gear design, self locking Plasgear.™ The spherical disc design for higher Cv values shall be of solid, abrasion-resistant plastic. Liner shall be molded and formed around the body, functioning as gasket seals with convex ring design on each side of the valve for lower bolt tightening torque and valve body shall have molded body stops and seat relief area to prevent over tightening of mating flanges. Stem shall be of 316/403 stainless steel, non wetted, have engagement over the full length of the disc and be locked into valve body by PP stem retainer. Valves shall have a molded ISO bolt pattern on top flange for actuator mount. PVC shall conform to ASTM D1784 Cell Classification 12454-A, PP conforming to ASTM D4101 Cell Classification PPO210B67272, and PVDF conforming to ASTM D 3222 Cell Classification Type II. All PVC PP and PVDF body valves shall be rated to 150 psi at 70 degrees F, sizes 1-1/2" thru 10" and 100 psi for sizes 12" and 14". Butterfly valves shall be wafer style, as manufactured by Asahi/America Inc.

Troubleshooting

What if fluid still flows when the valve is closed?

1. Make sure lever or gear is in a fully closed position [gear type may require travel stop adjustment].
2. Liner is damaged or worn. Replace liner.
3. Disc is damaged or abraded. Change disc.
4. Foreign material is caught between seat and disc. Remove the substance.
5. Mating flange bolts either over-tightened or unevenly tightened. Retighten properly.

What if fluid leaks outside between seat and mating flange?

1. Seat damage. Change seat.
2. Mating flange bolts not tightened with proper torque or unevenly tightened. Retighten to the appropriate torque.

What if valve does not operate smoothly?

1. Foreign material is caught between disc and seat. Remove the material and clean.
2. Lever or gearbox is damaged. Replace.
3. Mating flange bolts over-tightened. Retighten.

Caution

- Never remove valve from pipeline under pressure.
- Always wear protective gloves and goggles.

Cv Values

NOMINAL SIZE		Cv (at various opening degrees)		
INCHES	mm	30°	60°	90°
8	200	150	1525	2500
10	250	232	2355	3860
12	300	342	3477	5700
14	350	386	3928	6440

Pressure vs. Temperature (PSI, WATER, NON-SHOCK)* Wt. (LBS) /Vacuum Service

NOMINAL SIZE	BODY		PVC		PP		PVDF				NOMINAL SIZE	PVC	PP	PVDF	NOMINAL SIZE	VACUUM SERVICE (INCHES OF MERCURY)				
	INCHES	mm	PP		PP		PVDF										INCHES	mm	INCHES	mm
			30° F	121° F	141° F	-5° F	141° F	-5° F	141° F	176° F										
8	200	150	40	20	150	85	150	85	75	60	8	200	24	20	28	8	200	-29.92		
10	250	150	40	20	150	85	150	85	75	60	10	250	33	27	41	10	250	-29.92		
12	300	100	30	15	100	60	100	60	45	30	12	300	62	53	76	12	300	-23.62		
14	350	100	30	7	100	45	100	45	30	15	14	350	67	58	81	14	350	-23.62		

* For lug style data consult factory



THE NEW YORK BLOWER COMPANY
7660 Quincy Street
Willowbrook, IL 60527-5530

Visit us on the Web: <http://www.nyb.com>
Phone: (800) 208-7918 Email: nyb@nyb.com

INSTALLATION
MAINTENANCE
OPERATING
INSTRUCTIONS

IM-140

PRESSURE BLOWERS TYPE HP PRESSURE BLOWERS

WARNING

THIS FAN HAS MOVING PARTS THAT CAN CAUSE SERIOUS BODILY INJURY. BEFORE OPERATING OR STARTING MAINTENANCE READ THE INSTALLATION AND MAINTENANCE INSTRUCTIONS AND THE AMCA SAFETY PRACTICES MANUAL PROVIDED WITH THIS FAN.

DURING OPERATION

1. KEEP BODY, HANDS, AND FOREIGN OBJECTS AWAY FROM THE INLET, THE OUTLET, AND THE OTHER MOVING PARTS OF THE FAN SUCH AS SHAFTS, BELTS, AND PULLEYS.

2. DO NOT OPERATE AT EXCESSIVE SPEEDS OR TEMPERATURES.

BEFORE STARTING MAINTENANCE WORK:

LOCK POWER SUPPLY IN OFF POSITION AND IMMOBILIZE FAN WHEEL.

98-0250

A WORD ABOUT SAFETY

The above **WARNING** decal appears on all **nyb** fans. Air moving equipment involves electrical wiring, moving parts, sound, and air velocity or pressure which can create safety hazards if the equipment is not properly installed, operated and maintained. To minimize this danger, follow these instructions as well as the additional instructions and warnings on the equipment itself.

All installers, operators and maintenance personnel should study AMCA Publication 410, "Recommended Safety Practices for Air Moving Devices", which is included as part of every shipment. Additional copies can be obtained by writing to New York Blower Company, 7660 Quincy St., Willowbrook, IL 60527.

ELECTRICAL DISCONNECTS

Every motor driven fan should have an independent disconnect switch to isolate the unit from the electrical supply. It should be near the fan and must be capable of being locked by maintenance personnel while servicing the unit, in accordance with OSHA procedures.

MOVING PARTS

All moving parts must have guards to protect personnel. Safety requirements vary, so the number and type of guards needed to meet company, local and OSHA standards must be determined and specified by the user. Never start a fan without having all safety guards installed. Check regularly for damaged or missing guards and do not operate any fan with guards removed. Fans can also become dangerous because of potential "windmilling", even though all electrical power is disconnected. Always block the rotating assembly before working on any moving parts.

SOUND

Some fans can generate sound that could be hazardous to exposed personnel. It is the responsibility of the system designer and user to determine sound levels of the system, the degree of personnel exposure, and to comply with applicable safety requirements to protect personnel from excessive noise. Consult **nyb** for fan sound power level ratings.

AIR PRESSURE AND SUCTION

In addition to the normal dangers of rotating machinery, fans present another hazard from the suction created at the fan inlet. This suction can draw materials into the fan where they become high velocity projectiles at the outlet. It can also be extremely dangerous to persons in close proximity to the inlet, as the forces involved can overcome the strength of most individuals. Inlets and outlets that are not ducted should be screened to prevent entry and discharge of solid objects.

ACCESS DOORS

DANGER

DO NOT OPEN UNTIL THE POWER SUPPLY HAS BEEN LOCKED OFF AND THE SHAFT HAS STOPPED ROTATING.

FAILURE TO DO THIS CAN RESULT IN SERIOUS BODILY INJURY.

98-0249

The above **DANGER** decal is placed on all **nyb** cleanout doors. These doors, as well as access doors to the duct system, should never be opened while the fan is in operation. Serious injury could result from the effects of air pressure or suction.

Bolted doors must have the door nuts or fasteners securely tightened to prevent accidental or unauthorized opening.

RECEIVING AND INSPECTION

The fan and accessories should be inspected on receipt for any shipping damage. Turn the wheel by hand to see that it rotates freely and does not bind. If dampers or shutters are provided, check these accessories for free operation of all moving parts.

F.O.B. factory shipping terms require that the receiver be responsible for inspecting the equipment upon arrival. Note damage or shortages on the Bill of Lading and file any claims for damage or loss in transit. **nyb** will assist the customer as much as possible; however, claims must be originated at the point of delivery.

- Belts tend to stretch somewhat after installation. Recheck tension after several days of operation. Check sheave alignment as well as setscrew and/or bushing bolt tightness.

COUPLING

Coupling alignment should be checked after installation and prior to start up. Alignment is set at the factory, but shipping, handling, and installation can cause misalignment. Also check for proper coupling lubrication. For details on lubrication and for alignment tolerances on the particular coupling supplied, see the manufacturer's installation and maintenance supplement in the shipping envelope.

Installation

Most nyb fans are shipped with the coupling installed. In cases where the drive is assembled after shipping, install the coupling as follows:

- Remove all foreign material from fan and motor shafts and coat with machine oil for easy mounting of coupling halves.
- Mount the coupling halves on each shaft, setting the gap between the faces specified by the manufacturer. Avoid using force. If mounting difficulty is encountered, lightly polish the shaft with emery cloth until the halves slide on freely.

Alignment

- Align the coupling to within the manufacturer's limits for parallel and angular misalignment (see Figure 2). A dial indicator or laser can also be used for alignment where greater precision is desired. Adjustments should be made by moving the motor to change shaft angle, and by the use of foot shims to change motor shaft height. Do not move the fan shaft or bearing.
- When correctly aligned, install the flexible element and tighten all fasteners in the coupling and motor base. Lubricate the coupling if necessary.
- Recheck alignment and gap after a short period of operation, and recheck the tightness of all fasteners in the coupling assembly.

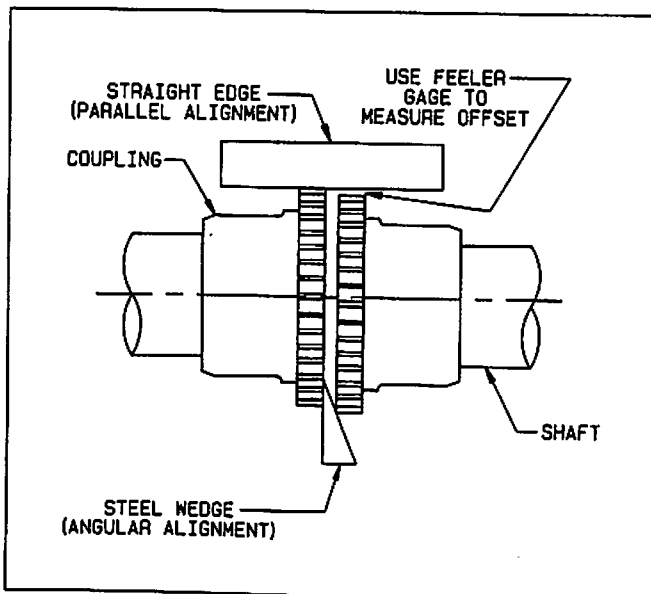


Figure 2

START-UP

Safe operation and maintenance includes the selection and use of appropriate safety accessories for the specific installation. This is the responsibility of the system designer and requires consideration of equipment location and accessibility as well as adjacent components. All safety accessories must be installed properly prior to start-up.

Safe operating speed is a function of system temperature and wheel design. Do not under any circumstances exceed the maximum safe fan speed published in the nyb engineering supplement, which is available from your nyb field sales representative.

CAUTION

BEFORE INITIAL OPERATION:

- TIGHTEN ALL SET SCREWS IN FAN WHEEL
- TIGHTEN ALL SET SCREWS IN BEARINGS.
- REPEAT AFTER 8 HOURS OF OPERATION.
- REPEAT AGAIN AFTER TWO WEEKS OPERATION.

88-0271

Procedure

- If the drive components are not supplied by nyb, verify with the manufacturer that the starting torque is adequate for the speed and inertia of the fan.
- Inspect the installation prior to starting the fan. Check for any loose items or debris that could be drawn into the fan or dislodged by the fan discharge. Check the interior of the fan as well. Turn the wheel by hand to check for binding.
- Check drive installation and belt tension.
- Check the tightness of all setscrews, nuts and bolts. When furnished, tighten hub setscrews with the wheel oriented so that the setscrew is positioned underneath the shaft.
- Install all remaining safety devices and guards. Verify that the supply voltage is correct and wire the motor. "Bump" the starter to check for proper wheel rotation.
- Use extreme caution when testing the fan with ducting disconnected. Apply power and check for unusual sounds or excessive vibration. If either exists, see the section on Common Fan Problems. To avoid motor overload, do not run the fan for more than a few seconds if ductwork is not fully installed. On larger fans, normal operating speed may not be obtained without motor overload unless ductwork is attached. Check for correct fan speed and complete installation. Ductwork and guards must be fully installed for safety.
- Setscrews should be rechecked after a few minutes, eight hours and two weeks of operation (see Tables 1 & 2 for correct tightening torques).

NOTE: Shut the fan down immediately if there is any sudden increase in fan vibration.

Lubrication

Use the table for relubrication scheduling according to operating speed and shaft diameter. Bearings should be lubricated with a premium quality lithium-based grease conforming to NLGI Grade 2. Examples are:

Mobil - Mobilgrease XHP Chevron - Amolith #2
 Texaco - Premium RB Shell - Alvania #2

These greases are for bearing surface temperatures of 40°F. to 180°F. For surface temperatures of 181°F. to 230°F. use Mobilith SHC220.

Do not use "high temperature" greases, as many are not formulated to be compatible with fan bearings.

Add grease to the bearing while running the fan or rotating the shaft by hand. Be sure all guards are in place if lubrication is performed while the fan is operating. Add just enough grease to cause a slight purging at the seals. Except on split pillowblocks. Completely filled bearings will run hotter until a sufficient amount of grease is purged out of the seals.

Split pillowblock bearings (Link-Belt P-LB6800 & P-LB6900, SKF SAF 22500, Dodge SAF-XT) should be cleaned and repacked at approximately every eighth lubrication interval. This requires removal of the bearing cap. Clean out old grease and repack the bearing with fresh grease. Pack the bearing fully and fill the housing reservoir to the bottom of the shaft on both sides of the bearing. Replace the bearing cap, being careful not to mix caps as they are not interchangeable from one bearing to another. Do not over lubricate.

Excessive Vibration

A common complaint regarding industrial fans is "excessive vibration". **nyb** is careful to ensure that each unit is precisely balanced prior to shipment; however, there are many other causes of vibration including:

1. Loose mounting bolts, setscrews, bearings or couplings.
2. Misalignment or excessive wear of couplings or bearings.
3. Misaligned or unbalanced motor.
4. Bent shaft due to mishandling or material impact.
5. Accumulation of foreign material on the wheel.
6. Excessive wear or erosion of the wheel.
7. Excessive system pressure or restriction of airflow due to closed dampers.
8. Inadequate structural support, mounting procedures or materials.
9. Externally transmitted vibration.

Inadequate Performance

1. Incorrect testing procedures or calculations.
2. Fan running too slowly.
3. Fan wheel rotating in wrong direction or installed back-wards on shaft.
4. Wheel not properly centered relative to inlet cone.
5. Damaged or incorrectly installed cut off sheet or diverter.
6. Poor system design, closed dampers, air leaks, clogged filters, or coils.
7. Obstructions or sharp elbows near inlets.
8. Sharp deflection of airstream at fan outlet.

Excessive Noise

1. Fan operating near "stall" due to incorrect system design or installation.
2. Vibration originating elsewhere in the system.
3. System resonance or pulsation.
4. Improper location orientation of fan intake and discharge
5. Inadequate or faulty design of supporting structures.
6. Nearby sound reflecting surfaces.
7. Loose accessories or components.
8. Loose drive belts.
9. Worn bearings.

BEARING LUBRICATION INTERVAL [months]

RPM Shaft	1 - 500	501 - 1000	1001 - 1500	1501 - 2000	2001 - 2500	2501 - 3000	3001 - 3500	3501 - 4000
1 7/16	6	6	5-6	4-6	4-6	3-5	2-4	2-4
1 11/16	6	6	4-6	4-6	2-4	2-4	2	1-2
2 3/16			6	4-6	4	2-4	2	--
2 7/16			6	4-6	4	2-4	2	--
2 15/16			4-6	4-6	2-4	2	1-2	--

Ball Bearings & Split
 Split Pillowblock
 Spherical Roller Bearings



Non-Split Pillowblock
 Spherical Roller Bearings

NOTE:

1. These are general recommendations only; specific manufacturer's recommendations may vary slightly.
2. Assumes clean environment, -20°F. to 120°F.
 - a. Consult The New York Blower Company for operation below -20°F. ambient.
 - b. Ambient temperatures greater than 120°F. will shorten bearing life.
 - c. Under extremely dirty conditions, lubricate more frequently.
3. Assumes horizontal mounting configuration. For vertically mounted applications, lubricate twice as frequently.

COMMON FAN PROBLEMS

Premature Component Failure

1. Prolonged or major vibration.
2. Inadequate or improper maintenance.
3. Abrasive or corrosive elements in the airstream or surrounding environment.
4. Misalignment or physical damage to rotating components or bearings.
5. Bearing failure from incorrect or contaminated lubricant or grounding through the bearings while arc welding.
6. Excessive fan speed.
7. Extreme ambient or airstream temperatures.
8. Improper belt tension.
9. Improper tightening of wheel setscrews.

REPLACEMENT PARTS

It is recommended that only factory-supplied replacement parts be used. **nyb** fan parts are built to be fully compatible with the original fan, using specific alloys and tolerances. These parts carry a standard **nyb** warranty.

When ordering replacement parts, specify the part name, **nyb** shop and control number, fan size, type, rotation (viewed from drive end), arrangement and bearing size or bore. Most of this information is on the metal nameplate attached to the fan base. For assistance in selecting replacement parts, contact your local **nyb** representative or visit: <http://www.nyb.com>.

Example: Part required: Wheel/shaft assembly
 Shop/control number: B-10106-100

Fan description: Size 2206A10 Pressure Blower Rotation: Clockwise

Arrangement: 4

Suggested replacement parts include:

Wheel	Component parts: Damper
Shaft	Motor
Bearings*	Coupling*
Shaft Seal*	Sheaves*
	V-Belts*

* For Arrangement 1/8 fan only.

AMCA Publication 410

RECOMMENDED SAFETY PRACTICES

for Users and Installers of Industrial and Commercial Fans

AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC.



30 West University Drive
Arlington Heights, IL 60004-1893 U.S.A.

Tel: (847) 394-0150 • <http://www.amca.org>
Fax: (847) 253-0088 • info@amca.org

FOREWORD

i. This publication has been prepared by the Air Movement Division of the Air Movement and Control Association International, Inc. (AMCA International). The information contained in this publication has been derived from many sources. The suggestions made necessarily should be general in their meaning and cannot be applied literally to all specific situations or conditions.

ii. **The safe installation and operation of fans is the responsibility of the system designer, installer, maintainer, and user.**

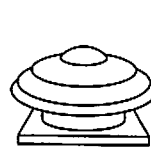
From the initial system design through the life of the equipment, safety should be a foremost consideration. Some areas which require some special attention include system design, layout and construction, fan performance specification, foundation and installation details, storage procedures, start-up and commissioning procedures, operation, maintenance, and repair. Specific safety requirements are mandated by federal, state, and local codes. *Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans* is published by AMCA International for assistance. System designers, installers, maintainers, and users should consult and properly comply with all applicable codes and guidelines.

iii. The safety recommendations contained herein are intended to assist designers, installers, maintainers, or other users of air moving devices in the safe operation and use of the devices mentioned. These recommendations do not represent the only methods, procedures, or devices appropriate for the situations discussed. Caution should be used at all times when working in or around moving parts.

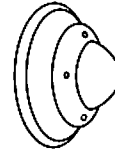
iv. AMCA International disclaims any and all warranties, expressed or implied, regarding the products sold by the manufacturer with which this booklet has been provided. Further, AMCA International recommends that competent personnel be consulted in deciding what is the preferred or recommended safety procedure in a particular instance where the guidelines contained in this booklet are unclear or in any way incomplete.

v. AMCA International has offered the information within this booklet to assist in the safe operation, maintenance, and use of the products sold by members of AMCA International. In so doing, AMCA International does not assume any legal duties of the designer or manufacturer to instruct or warn about their product. AMCA International expressly disclaims liability for any injury or damage arising out of the operation or use of the product or the guidelines contained herein.

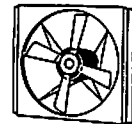
vi. These recommended safety practices were adopted by the AMCA International membership on April 28, 1996.



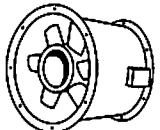
Power Roof Ventilator



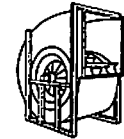
Wall Exhauster



Propeller Fan



Axial Fan



Centrifugal Fan



Upblast Roof Exhauster

1. Introduction

1.1 Fans and other air moving devices are made in a wide variety of types, sizes, and arrangements. This guide addresses the proper use and installation of industrial and commercial fans. It is not intended to address residential and consumer fans.

1.2 Various "size" factors are important when assessing potential for injury; some factors include: diameter of impeller (wheel, rotor, propeller), rotational inertia, voltage, and current.

1.3 This guide is intended to assist in the safe installation of air moving equipment and to warn operating and maintenance personnel of the commonly recognized hazards associated with this equipment.

1.4 **Handling and installation should always be performed only by experienced and trained personnel who are aware of the hazards associated with rotating equipment. Failure to comply with these practices may result in death or serious bodily injury.** In addition to following the manufacturer's installation instructions, care should be taken to ensure compliance with specific safety requirements mandated by federal, state, and local codes. Industry safety standards and practices published by AMCA International and by other recognized agencies and associations should be consulted and followed where applicable.

2. Personnel Safety Accessories

2.1 General

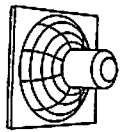
Protective devices are incorporated as standard construction on some types of fans but on many fans, these devices are offered as optional accessories. This is done because the need for the devices and the design required will frequently depend upon the type of system, fan location, and operating procedures being employed. Proper protective safety devices; company safety standards; specific safety requirements mandated by federal, state, and local codes; and industry safety standards and practices published by AMCA International and by other recognized agencies and associations should be determined by the user, who should specify and obtain the appropriate devices from the fan manufacturer or others, and should not allow operation of the equipment without them. Examples of available devices include the following:

2.2 Fan Guards

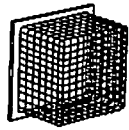
2.2.1 All fans have moving parts which require guarding in the same way as other moving machinery. Fans located less than seven (7) feet above the floor require special consideration. Specific safety requirements should comply with mandated federal, state, and local codes; and industry safety standards and practices published by AMCA International and

by other recognized agencies and associations should be followed.

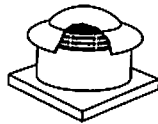
2.2.2 Roof-mounted fans and other fans which are not generally accessible may not require safety guards which might otherwise be appropriate. Where accessibility to these fans is occasional or infrequent, the expense of permanent guarding may be reduced through the use of lockout switches and suitable warnings. In such cases, maintenance personnel should engage the lockout switch before undertaking any maintenance or repairs. As is the case with other machinery involving moving parts, common sense and caution will preserve personal safety.



Industrial Type Guard for Propeller Fan



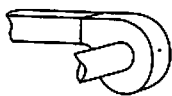
Maximum Safety Guard for Propeller Fan



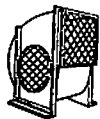
Screen on Roof Ventilator

2.3 Inlet and Outlet Guards

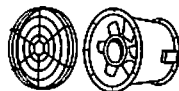
Axial and centrifugal fans are often connected directly to ductwork which will prevent contact with the internal moving parts; when an exposed inlet or outlet represents a hazard, a suitable guard should be installed.



Centrifugal Fan Protected by Ductwork



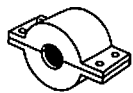
Inlet or Outlet Guard on Centrifugal Fan



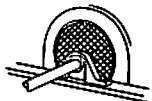
Guard for Axial Fan with Non-Ducted Inlet or Outlet

2.4 Drive Guards

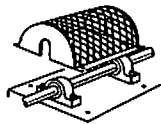
2.4.1 Fans may be driven directly from the motor shaft or through a belt drive. Where the bearing assembly, rotating shaft, sheaves, or belts are exposed, a suitable guard may need to be provided. Some example guards are shown below.



Drive Coupling Guard

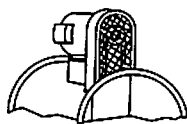


Heat Slinger Guard (shaft and bearing guard omitted for clarity)



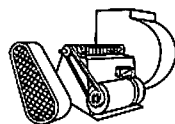
Shaft and Bearing Guard

2.4.2 Drive guards may be required for tubular centrifugal or axial fans to cover the exposed drive sheave and belts outside the fan housing.



Drive Guard - Axial Fan

2.4.3 A typical centrifugal fan drive guard may vary with the arrangement. Safety guards should be used when drive systems are accessible to personnel. In restricted areas, omission of the back cover may be acceptable.



Drive Guard - Centrifugal Fan

2.4.4 Dampers and their linkage may operate suddenly without warning at high speeds. Dampers and their linkage contain pinch points which should be identified and guarded.

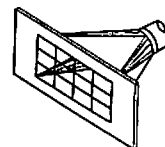
3. Hidden Dangers

3.1 General

In addition to the obvious hazards associated with the moving parts of rotating machinery, fans present additional potential hazards that are not so obvious and should be considered by the system designer and user for safe operation.

3.2 Suction and Pressure

3.2.1 Fans operate by creating suction and air pressure which can be hazardous. Solid objects can be drawn into a fan's inlet and then become dangerous projectiles when they are exhausted through the fan's outlet. Solid objects can also cause fan failure or impeller failure due to imbalance or damage to the impeller blades. Personnel in close proximity to a fan inlet can be overcome by the suction, and drawn into the fan.



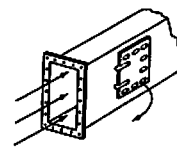
Special Purpose Intake Screen

3.2.2 Whenever there is a possibility that solid objects can be drawn into a remote intake, the intake should be guarded at all times. Before a guard is removed, the fan should be disconnected and the power supply locked out.

3.2.3 Where fans are installed over an occupied area, safety guards should be provided to prevent dropped objects from entering this area during installation and maintenance.

3.2.4 Access doors to a fan or duct system should never be opened while the fan is operating or coasting to a stop. On the downstream (or pressure) side of the system, releasing the door with the system in operation may result in an explosive opening. On the upstream (or suction) side, the inflow may be sufficient to draw in tools, clothing, and other materials. The power supply should always be locked out prior to accessing a fan or ductwork.

3.2.5 Fan design sometimes requires access doors to be supplied with internal components such as a plug to fill a hole in the fan casing. These doors can often be heavy and difficult to handle. Care should be exercised when opening, removing, and installing these components.



Bolted Access Door in Duct

3.3 Windmilling

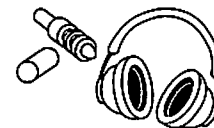
Even when the power supply is locked out, fans may cause injury or damage if the impeller is subject to "windmilling" which is the turning of the impeller and drive components due to a draft in the system. To guard against this hazard, the impeller should be secured to physically restrict rotational movement.

3.4 Temperature

Many fans, fan motors, and fan components run at temperatures that could burn someone who comes in contact with the hot areas, including discharged or leaking gases. If this potential hazard is present, steps should be taken so that personnel working near the fan are aware of the danger and can exercise caution.

3.5 Fan Noise and Environment

Some fans can generate sound that could be hazardous to exposed personnel. Sound pressure can be measured in the field, but obtaining accurate data is difficult. The environment in which the fan operates can impact the ability to obtain accurate fan sound readings. Consult the manufacturer for fan sound data. It is the responsibility of the system designer, installer, user, and maintainer to comply with specific safety requirements mandated by federal, state, and local codes; and to follow industry safety standards and practices published by AMCA International and by other recognized agencies and associations, regarding personnel safety from exposure to fan noise associated with use and exposure to equipment.



Hearing Protection

3.6 Stroboscopic Effect

The stroboscopic effect of certain lights in combination with certain fan speeds may cause a rotating assembly to appear stopped. In these cases, irregular markings can be placed on the moving parts to prevent this type of effect. Personnel should be warned that the fan may be in motion even if it appears not to be.

3.7 Special Purpose Fans and Systems

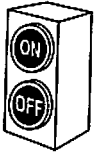
The hidden dangers associated with Special Purpose Fans used in special systems are covered in Section 6.

4. Power Isolation

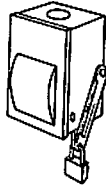
4.1 Every fan should be installed with a suitable device allowing it to be completely disconnected or isolated from the power supply.

4.2 Many fans are started by remote switches or push-buttons, by interlocks with other equipment, or by automatic controls. Before performing any maintenance, inspection, or other activity which will require removal of guards, ductwork, access doors, etc., or exposure of moving parts, the fan power supply should be locked out and the fan tagged out of service.

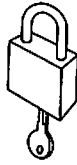
4.3 In some installations other equipment, such as gas burners, may be interlocked with the fan so that disconnecting the fan will automatically shut off the burner or other device. Maintenance on systems of this type should be performed only under the supervision of competent engineering personnel and in accordance with applicable codes and standards.



Remote Switch



Disconnect Switch



Lock Carried by Maintenance Personnel

4.4 In cases where the fan is power driven by a source other than an electric motor, appropriate provisions should be made for the isolation or disengagement of the power supply.

5. Start-Up Checklist

5.1 General

5.1.1 Before putting any fan into initial operation, the manufacturer's instructions should be followed. Transportation, handling, and installation can cause fasteners to loosen, and cause misalignment of fan components. Carefully follow this check list when commissioning equipment.

5.1.2 Lock out the primary and all secondary power sources.

5.1.3 A complete inspection should be made of all of the ductwork and the interior of the fan. Make certain there is no foreign material which can be drawn into or blown through the fan or ductwork. Appropriate protective measures and safety practices should be observed when entering or working within these areas. These measures might include the use of goggles, respirators, or other personal protective devices.

5.1.4 Make sure the foundation or mounting arrangement and the duct connections are adequately designed and installed per drawings and in accordance with recognized acceptable engineering practices and with the fan manufacturer's recommendations.

5.1.5 Check and tighten all bolts, fasteners, and set screws as necessary.

5.1.6 Check the fan assembly and bearings for proper grounding to prevent static electricity discharge.

5.1.7 Ensure power and drive components such as motor starter, variable frequency drive, or hydraulic power unit are properly sized, matched, and connected to the fan.

5.1.8 Check bearings for recommended lubricant and lubrication amount.

5.1.9 Spin the rotating assembly to determine whether it rotates freely, without hitting anything, and is not grossly out of balance.

5.1.10 Inspect impeller for proper rotation for the fan design.

5.1.11 Check alignment of drives and all other components.

5.1.12 Check the belt drive for proper sheave selection and installation

and make sure the sheaves are not reversed (excessive speeds could develop).

5.1.13 Check for recommended belt tension.

5.1.14 Properly secure all safety guards.

5.1.15 Assure that all appropriate warnings have been put in place.

5.1.16 Secure all access doors to the fan and ductwork.

5.1.17 Momentarily energize the fan to check the direction of rotation. Listen as the fan coasts to a stop for any unusual noise, identify the source, and take corrective action as necessary.

5.1.18 Switch on the electrical supply and allow the fan to reach full speed. Check carefully for:

(1) Excessive vibration

(2) Unusual noise

(3) Proper belt alignment

(4) Proper lubrication

(5) Proper amperage, voltage, or power values.

(6) If any problem is indicated, SWITCH OFF IMMEDIATELY.

(7) Lock out the power supply. Secure the fan impeller if there is a potential for windmilling. Check carefully for the cause of the trouble, correct as necessary, and repeat check list procedure.

5.2 Even if the fan appears to be operating satisfactorily, shut down after a brief period, lock out the power supply, and recheck items 5.1.5 through 5.1.17 as the initial start-up may have loosened the bolts, fasteners, and set screws.

5.3 The fan may now be put into operation, but during the first eight hours of running, it should be closely observed and checked for excessive vibration and noise. At this time checks should also be made of motor input current and motor and bearing temperatures to ensure that they do not exceed manufacturer's recommendations.

5.4 After eight (8) hours of operation, the fan should be shut down and the power locked out. Check list items 5.1.5 through 5.1.17 should be inspected and adjusted, if necessary.

5.5 After twenty-four (24) hours of satisfactory operation, the fan should be shut down (locked out) and the drive belt tension should be readjusted to recommended tension.

5.6 After commissioning and start-up, the fan should be operated and maintained in accordance with the manufacturer's and component manufacturer's recommendations. Some basic guidelines for Warning Signs and Routine Maintenance are included in Sections 7 and 8. These sections are meant as a supplement to the manufacturer's instructions and are not intended to replace the manufacturer's instructions.

6. Special Purpose Fans

6.1 Most fans are designed to handle clean air at standard temperatures between 32 °F and 120 °F. These fans should not be placed in systems or used for other than their design intended use. Special Purpose Fans are designed for use in systems that may include extreme temperatures, explosive, toxic, or special gases, material handling, corrosive environments, or other special hazards which should be carefully considered. Specific safety requirements should comply with mandated federal, state, and local codes; and industry safety standards and practices published by AMCA International and by other recognized agencies and associations should be followed.

6.2 Where the system will handle explosive or flammable material (dust, fumes, gases), fans of spark-resistant construction should be used.

6.3 Fans connected by ductwork or other piping may contain gases other than air which are hazardous. In these cases, procedures should be established to prevent exposure of personnel working on or near the fan, and by maintenance personnel who may need to enter the fan. Appropriate personal protective equipment as determined by the material safety data sheet, and system operators should be utilized. Appropriate environmental protective measures should also be taken.

6.4 Fan inlet boxes, housings, ductwork, and other system components which are large enough to permit entry should be considered confined spaces. System areas may also serve as low points where heavy gases, liquids, or other substances may accumulate and present explosive, fire, health, or suffocation hazards. Appropriate protective measures and safety practices should be observed when entering or working within these areas.

6.5 Material-handling fans are specially designed to allow the fan to handle a specific type of material without excessive accumulation of material on the fan impeller. Fans handling corrosive gases or erosive material should be checked periodically. If loss of material is evident, the fan should be shut down, power supply locked out, and tagged out of service. The manufacturer or other qualified personnel should be consulted to determine if the fan is within safety limits for operation. To ensure satisfactory operation it is essential to observe the manufacturer's limitations concerning the type of material to be handled by the fan.

6.6 Fan ratings and maximum speed limits are typically based on the use of air at 70 °F. At temperatures above the normal range (specified by the manufacturer), a reduction should be made in the maximum speed limit. Information on this reduction and on other precautions to be taken for high temperature applications should be obtained from the fan manufacturer. Personnel working near high temperature fans should be aware that coming in contact with the fan's housing, ductwork, or handled gases could result in serious burns. Where the danger of burns is not apparent, appropriate warnings should be posted. Appropriate protective apparel should be worn whenever working in close contact with heated housings or ductwork.

6.7 Corrosive contaminants can be formed when moisture combines with an active airborne chemical. Fans subjected to corrosive contaminants will corrode; however, suitable protective coatings or material, if used in the fan construction, can delay corrosion. Protected fans should be regularly inspected to ensure that the protection remains effective. Personnel working in environments with airborne chemicals may require personal protective apparel equipment.

6.8 Where liquid can accumulate within the fan, provide for the installation of adequately sized drains.

6.9 In those applications where there is a potential for chemical build-up (such as grease, creosote, etc.), periodic cleaning and proper drainage are necessary to avoid a fire hazard.

7. Warning Signs

7.1 General

7.1.1 A change in the operating characteristics of a fan may indicate the need for maintenance. Sudden changes may indicate severe problems or dangerous conditions developing. Investigate any changes in the operational characteristics or unusual symptoms of the fan. Refer to AMCA Publication 202, Troubleshooting, for a more detailed explanation of investigating procedures. Consult your manufacturer or other qualified consultant with questions concerning changes observed.

7.2 Excessive Vibration

7.2.1 Operational vibration levels are one of the best indicators of the condition of the blower. Careful observation and monitoring of vibration levels can detect a minor problem in the early stages of development when correction is less costly and easier. Recommended maximum vibration levels should be obtained from the equipment manufacturer.

7.2.2 If excessive vibration is observed, stop the fan and lock it out until the cause is corrected. Check for material build-up on the impeller. Generally this will show up as material flaking off the fan impeller and causing an imbalance which may lead to catastrophic failure of the fan or its components. Excessive vibration can also be caused by looseness in the drive train, loose fasteners, misalignment or impeller damage. Contact the fan manufacturer or other qualified consultant to determine the maximum vibration level if it is not included in maintenance instructions.

7.3 Noise

Changes to the sound level may indicate maintenance is needed. Some

unusual noises often heard include: bearing noise indicating the bearings need lubricant or replacement; scraping or ticking noise indicating the rotating parts are hitting the stationary parts; squealing indicating the belt drive needs tensioning; repeated changing pitch of the blower indicating operation of the blower at too low a flow. If any of these noises or any other unusual noises are detected, their cause should be determined and corrective action taken as necessary.

7.4 High Motor Temperatures

Check that cooling air to the motor has not been diverted or blocked by dirty guards or similar obstacles. Check the input amperage. An increase in amperage may indicate that some major change has occurred in the system.

7.5 High Bearing Temperatures

This condition is usually caused by improper lubrication; this can be either "over," "under," or "unsuitable" lubrication. In every case, if the cause of the trouble is not easily seen, experienced personnel should examine the equipment before it is put back in operation.

7.6 Poor Performance

Too much flow or pressure or too little flow or pressure is often a symptom of a change in the operating system. A fan will typically operate at the same performance in a static system some typical causes include: operating of the fan backwards after maintenance procedures; filters dirty or not in place; change or blockage in the ductwork; change in speed of the fan (switching the sheaves); loss or failure of the impeller. All of these causes and many others will affect the flow and pressure produced by the fan.

8. Routine Maintenance

8.1 A preventive maintenance program is an important aspect of an effective safety program. Consult your manufacturer or other qualified consultant with questions concerning changes observed during periodic inspections and routine maintenance.

8.2 The fan manufacturer's operating and maintenance recommendations, as well as the components manufacturer's instructions (such as motor, bearing, drives, etc.) should be strictly followed.

8.3 Maintenance should always be performed by experienced and trained personnel who are aware of the hazards associated with rotating equipment. Do not attempt any maintenance on a fan unless the fan power supply has been locked out and tagged out and the impeller has been secured.

8.4 When performing maintenance functions which include disassembly of the fan, careful consideration should be given to the size, weight, center of gravity, and lifting means of the fan components. It should also be noted that the outboard bearing on some fans such as arrangements 1, 8, 9, and 10 is often cap-loaded. Removal of the securing means may result in a sudden change in impeller position.

8.5 Historical data is often the best indicator for determining the operational condition of the fan. Maintenance logs which include relubrication, vibration levels, temperature levels, power requirements, inspection, and other pertinent records should be maintained and consulted as necessary when assessing the condition of the fan.

8.6 Under normal circumstances, handling clean air, the system should require cleaning only once a year. However, the fan and system should be checked at regular intervals to detect any unusual accumulation.

8.7 The fan impeller should be specially checked for build-up of material or dirt which may cause an imbalance with resulting undue wear on bearings and belt drives. A regular maintenance program should be established as needed to prevent material build-up.

8.8 Periodic inspection of the rotating assembly should be made to detect any indication of weakening of the rotor because of corrosion, erosion, or metal fatigue. Where signs of deterioration are found, lock out and tag out the impeller until the unit has been inspected and approved by a qualified consultant.

City of Walla Walla Sudbury Landfill

Area 6 Closure 2010 Information

Section

6. Flare Facility

Operation and Maintenance

Manual for a

4' Diameter, 40' High

ENCLOSED ZTOF[®]

BIOGAS FLARE SYSTEM



John Zink Company
11920 East Apache Street
Tulsa, Oklahoma 74116-1300

OPERATION AND MAINTENANCE MANUAL

FOR A

4' DIAMETER, 40' HIGH

ENCLOSED ZTOF[®]

BIOGAS FLARE SYSTEM

FACILITY: Sudbury Landfill
Walla Walla, WA

WARNING

Do not attempt flare operation without first becoming familiar with these instructions. Improper equipment operation may result in personal injury, death, or equipment damage.

Prepared for

Purchasing Company: Mark Heuett Contractors
End User: Sudbury Landfill
Purchase Order: 08232010LTR

Prepared by

John Zink Company
11920 East Apache Street
Tulsa, Oklahoma 74116-1300
Sales Order: 9109403
Date: December 2010

For assistance, please contact John Zink Company as follows:

Service (918) 234-2751

Emergency (918) 234-1800

Spare Parts (918) 234-2751

Facsimile (918) 234-2700

Request field service and spare part assistance during regular office hours, from 8:00 a.m. to 4:30 p.m. (CST).

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II. INTRODUCTION

This manual provides an overview of a John Zink Biogas Flare System. The system consists of an Enclosed ZTOF[®] Biogas Flare and a Flare Control Panel. Pertinent information required to operate and maintain safely the John Zink supplied equipment is located within these instructions.

A John Zink Enclosed ZTOF Biogas Flare offers automated operation and is designed to destroy safely, with automatic temperature control, typical organic compounds generated by solid waste and other biogas processes. The system is controlled with a processor, or programmable logic controller (PLC), which receives and transmits signals with respect to operating conditions. If an unacceptable operating condition occurs, the control system discontinues flow of biogas or adjusts the operating parameters to correct the problem. Control of the Enclosed ZTOF Biogas Flare includes an initial purge cycle, automatic ignition sequence, and fail-safe controls. A self-checking flame scanner monitors pilot flame or main flame and integrated safety shutdown features prevent equipment damage.

Please become familiar with this manual. Contact John Zink Company with any questions or to request additional assistance.

III. SAFETY SUMMARY

The following general safety precautions apply to operating and maintaining a John Zink Biogas Flare System. Instructions contained in this manual are in addition to, and do not replace, the existing operating procedures and policies of the operating company and owner with regard to standard safety precautions for flare operation and maintenance.

WARNING

High voltages capable of causing death are associated with this equipment. Use extreme caution when servicing electrical enclosures or any other electrical components. Disconnect the electrical source of any circuit on which service is being performed and lock open the corresponding disconnect switch. Ensure electrical enclosures and components are grounded properly before applying power.

WARNING

Flare systems may contain or produce toxic gases. Always consider appropriate safety precautions whenever personnel may be exposed to flare gases. In particular, exposure may occur during close inspection of a flare tip or pilot and during removal or maintenance of equipment attached to gas supply pipe.

WARNING

Failure to use proper respiratory protection may result in exposure to hazardous materials. Ceramic fiber blanket insulation contains fibers which may cause cancer. After firing, cristabolite, a ceramic fiber material known to cause cancer, may be present. In addition to proper respiratory protection, refer to Section XVII, "Material Safety Data Sheets" to avoid exposure.

WARNING

Elevated surface temperatures may exist during certain operating conditions. Exercise caution while near equipment to prevent burns.

IV. RECEIPT AND INSTALLATION

Receipt

Upon delivery to the site and prior to installation, carefully examine the equipment for damage. Any damage sustained during shipment will be reimbursed through the freight company and their insurance agent. To assure prompt and accurate processing of any claims, the following is recommended:

1. Inspect each item as it is unloaded or uncrated. Note any damage or shortages on the shipping documentation before signing for delivery acceptance.
2. If the shipment cannot be inspected upon arrival, sign the delivery acceptance documents with the following qualification:

“accepted subject to future inspection”
3. Inspect the delivery as soon as possible, and no later than 10 days after delivery.
4. If damage or shortages are apparent, notify the freight company immediately and supply an itemized damage or shortage list. In addition, notify John Zink Company to initiate prompt replacement or repair procedures.

Installation

Reference Drawings

The following list of drawings are necessary for equipment installation and are located in Section XII, "Reference Drawings". To identify specific components or for additional information, also refer to component specification sheets located in Section XIII, "Specification Sheets".

D-F-9109403-150	Process and Instrument Diagram
D-F-9109403-301	Enclosed ZTOF Biogas Flare
ST-11916	KE-1/ST Pilot
D-F-9109403-303	ZMS Moisture Separator
D-F-9109403-400	Panel Detail
D-F-9109403-401	Wiring Diagram
D-F-9109403-402	Wiring Diagram
D-F-9109403-403	Wiring Diagram
D-F-9109403-404	Wiring Diagram

General

1. Installation, connection, and assembly of the stack, any remaining piping, electrical conduit, wiring, supports, and field or finish painting are not the responsibility of John Zink Company.
2. The foundation is to be level and designed for site soil conditions considering loads the equipment will produce. Required anchor bolt and support locations appear on the reference drawings.
3. Ensure equipment is grounded adequately for site soil conditions and as directed by local electric codes.

4. Review the reference drawings for electrical and process piping connections to the system.
5. Power wires, thermocouple wires, signal wires, and flame scanner wires each are to be installed in separate conduit. Wire separation is necessary to avoid electrical interference problems which may affect equipment performance.
6. The ignition rod insulators in the pilot are fragile. Verify the insulators are not damaged and the rod, insulator bracket, and insulators are secure.
7. Verify the thermocouple assemblies are not damaged.
8. Clean inside all system piping and remove sand, rocks, weld slag, or any other debris immediately prior to assembly or installation. Use high pressure air to clear piping after assembly and installation.
9. If high winds are probable, positioning a windscreen approximately 6 feet in front of each damper is recommended.

CAUTION

EPDM gasket material is not recommended for biogas applications.

Mechanical - Stack

1. Position the flare stack on a concrete foundation by connecting one main crane with spreader bar to the lifting lugs at the top of the stack, and connecting a separate tailing crane near the bottom of the stack.
2. Bolt the stack to the foundation.
3. Install a 6 inch depth of gravel inside the bottom of the stack before initial operation to protect the foundation from radiant heat.
4. Remove all lifting lugs from the stack *prior* to initial operation to avoid unsafe conditions during future usage. Material degradation from high temperature exposure during flare operation may significantly reduce lug integrity.
5. Install all flare tips on the flare manifold with the bolts, nuts, and gaskets provided.
6. Verify the drain plug at the flare inlet, connection C1, is secure.
7. Inspect the internal ceramic blanket insulation for any damage.
8. Install the automatic damper, TCV-202A, to the *hinged* connection N4. Gaskets are not required. Locate the actuator and bracket assembly on the right when facing the damper.
9. Thread the sight glass assembly, CA-ST-0600, to connection C6.
10. Mount the pilot assembly to connection N2 with the bolts and nuts provided. A gasket is not required.
11. Mount the Ignition Panel, PNL-103, to the brackets on the stack exterior with the bolts and nuts provided.
12. Mount the scanner swivel assembly, ST-11065, and flame scanner, BE-203, to connection C5.
13. Mount the purge air blower, BL-204, to connection N3 with the bolts and nuts provided. A gasket is not required.
14. Mount the purge air pressure switch, PDSL-204, to the brackets on the stack exterior with the screws provided.
15. Connect the purge air pressure switch, PDSL-204, to connection C4 with tubing and

- fittings provided.
16. Install the thermocouples, TE-201, TE-202A, TE-202B, and TE-202C, in connections C11, C8, C9, and C10, respectively. Refer to the following table for thermocouple placement information:

Automatic Temperature Control Thermocouple

Flow Rate (SCFM) *	Elevation (ft)
150 – 216	17.00
217 – 283	22.50
284 – 350	28.00

* based on 50% methane concentration

High Temperature Thermocouple

all flow rates	17.00
----------------	-------

17. Verify the sample port plugs contain insulation and are secure in connections C12 and C13.
18. Mount the flame arrester, FA-107, directly to the flare inlet flange, connection N1, with bolts, nuts, and gasket.

Mechanical - Interconnecting Pipe

1. Connect gas supply pipe with supports to the ZMS Moisture Separator, V-101, inlet, connection N20, with bolts, nuts, and gasket.
2. Install gas pipe with supports and an expansion joints, if necessary, between the ZMS Moisture Separator, connection N21, and the flame arrester, FA-107, at the flare inlet.
3. Install automatic block valve SOV-102.
4. Mount the flow meter, FE-107, in the gas pipe. For proper performance, the manufacturer requires a minimum distance of ten pipe diameters of straight, undisturbed flow upstream of the flow meter, and five diameters of straight, undisturbed flow downstream of the flow meter.
5. Connect a compressed air or nitrogen source to the automatic block valve solenoid, SV-102.
6. Connect a natural gas or propane source to the pilot gas pipe spool, containing the pressure regulator, PCV-302, solenoid valve, SV-303, hand valve, HV-304, and pressure gauge, PI-305. Install pilot gas pipe with supports between the pilot gas pipe spool and the pilot, connection C2, mounted in the stack (allow sufficient flexible hose at the pilot for adjustment).

Electrical - Stack

1. Install conduit and connect ignition wire between the Ignition Panel, PNL-103, and the pilot, connection C3.
2. Install conduit and connect power wire between the following components and the panel rack, PR-101:

Ignition Panel, PNL-103
purge air blower, BL-204
purge air pressure switch, PDSL-204
damper actuator, TCV-202A

3. Install conduit and connect signal wire between the following components and the panel rack, PR-101:

flame scanner, BE-203
damper actuator, TCV-202A

4. Install conduit and connect thermocouple wire between the thermocouples, TE-201, TE-202A, TE-202B, and TE-202C, and the panel, PNL-101.

Electrical - Panel

1. Install conduit and connect supply power wire to the panel, PNL-101.

Electrical - Interconnecting Pipe

1. Install conduit and connect power wire between the flow meter, FE-107, and the panel rack, PR-101 (allow sufficient flexible conduit for removal).
2. Install conduit and connect signal wire between the flow meter, FE-107, and the panel rack, PR-101 (allow sufficient flexible conduit for removal).

Miscellaneous

1. Confirm all filter elements, mesh screens, and mist elimination elements are installed properly, if required.
2. Verify all pipe fittings and flanges (with gaskets, if required) are secure and all threaded nuts, bolts, and fittings are tightened properly.
3. If applicable, do not seal electrical conduit connections until the system installation is verified and initial operation is complete.
4. Verify all electrical conduit fittings (with seals, if required) are secure.
5. Verify all external electrical control and power wire is sized correctly and the system contains adequate overload protection.
6. Verify all electrical wiring connections are secure and all threaded terminals are tightened properly.

NOTE

An enclosure heater is installed in the Flare Control Panel, PNL-101, to prevent internal corrosion. Individual electric motors may contain integral heaters also to prevent internal corrosion. Ensure all heaters are connected to a reliable power supply and operated continuously, especially during outside storage or when operation is discontinued for an extended duration. Consult wiring diagrams in Section XII, "Reference Drawings" for additional details.

V. DESIGN BASIS

Gas Stream

Type:	landfill
Composition:	50% CH ₄ (maximum) 50% CO ₂ , air, inert gases
Lower Heating Value:	454 BTU/SCF
Temperature:	100 °F
Flow Rate:	350 SCFM (maximum) 150 SCFM (minimum)
Heat Release *:	9,530,000 BTU/hr (maximum)
* lower heating value basis	

CAUTION

Flame flashback may occur if the gas stream contains an amount of oxygen within the explosive limit.

NOTE

Methane concentrations less than 30% may require the addition of enrichment fuel for stable combustion.

Process Design

Smokeless Capacity:	100%
Destruction Efficiency:	98% (minimum)
Operating Temperature:	1400 °F to 1800 °F (2000 °F shutdown)
Retention Time:	0.7 second at 1800 °F (minimum)
Flare Inlet Pressure:	5" H ₂ O (maximum)
Ambient Pressure:	14.7 psia

Mechanical Design

Wind Speed Classification:	100 mph
Seismic Classification:	zone 4
Ambient Temperature:	32 to 120 °F
Electrical Area Classification:	non-hazardous for control panel PNL-101 Class I Div I on all stack mounted controls Class I Div II for the gas blowers
Site Elevation:	1000 feet AMSL

Utility Requirements

Pilot Gas:	22 SCFH of propane at 10 psig
Compressed Air or Nitrogen:	100 psig (minimum) dry
Electrical:	120 V, single phase, 60 Hz for control components

VI. OPERATIONAL PHILOSOPHY

The following information briefly describes the operating logic and sequence for an Enclosed ZTOF® Flare System.

WARNING

Do not circumvent the purge cycle, any flame management sequence, or any other safety sequence.

Logic

A burner management system, which includes a flame safeguard package, monitors specific parameters and discontinues operation if an unsafe condition occurs. An ultraviolet, self-checking flame scanner detects both pilot flame and main flame. The flame scanner is unable to distinguish between flame sources. Typical shutdown scenarios include:

Flare High Temperature Shutdown

Flare High Temperature Shutdown occurs the moment a temperature above the high temperature switch setpoint value is detected within the flare enclosure by a dedicated high temperature thermocouple. The "Flare Shutdown" light illuminates immediately and system operation discontinues.

Flare Low Temperature Shutdown

Flare Low Temperature Shutdown occurs when a temperature below the low temperature switch setpoint value is detected within the flare enclosure by the selected temperature control thermocouple and exists for ten minutes consecutively. The "Flare Shutdown" light illuminates and system operation discontinues.

Pilot Flame Failure and Shutdown

Pilot Flame Failure occurs, during the ignition sequence, when the flame scanner is unable to detect the presence of flame inside the flare enclosure. When Pilot Flame Failure occurs, system operation is interrupted momentarily. Then the entire purge cycle and ignition sequence are repeated automatically. A Shutdown occurs only after three consecutive Failures, or unsuccessful attempts. Once Pilot Flame Shutdown occurs, the "Flare Shutdown" light illuminates and system operation discontinues.

Main Flame Failure and Shutdown

Main Flame Failure occurs, after the ignition sequence is complete, when the flame scanner is unable to detect the presence of flame inside the flare enclosure. When Main Flame Failure

occurs, system operation is interrupted momentarily. Then the entire purge cycle and ignition sequence are repeated automatically. A Shutdown occurs only after three consecutive Failures, or unsuccessful attempts. Once Main Flame Shutdown occurs, the "Flare Shutdown" light illuminates and system operation discontinues.

Other safety features include:

- Purge Failure
- Automatic Block Valve Failure
- Gas Blower Failure

Upon determining the source of an alarm condition and completing the necessary corrective action, a system reset is required to begin operation again.

Sequence

A typical operating sequence consists of:

System Control Selection

Select either local or remote system control to begin system operation. Local control requires interaction at the control panel to start and stop operation. Remote control allows starting and stopping operation without interaction at the control panel.

Operating Permissives

System operation is permitted only after confirming two safety conditions exist. The closed limit switch for the automatic block valve must be satisfied, proving a closed valve position. Additionally, the flame scanner must not detect the presence of flame inside the flare enclosure.

Purge Cycle

Prior to beginning the ignition sequence, the combustion chamber and flare enclosure must be purged with ambient air to ensure no potentially explosive gas mixture exists inside. To create a safe condition for pilot ignition, the purge air blower operates and the automatic air damper louvers are maintained fully open for five minutes prior to each ignition attempt. When purge air blower operation begins, the "Flare Operating" light flashes.

Ignition Sequence

The ignition sequence begins immediately after the purge cycle is complete. The pilot gas solenoid valve opens automatically, supplying gas to the pilot, and the ignition transformer energizes. The ignition transformer continues for ten seconds and then the flame scanner verifies flame is present.

Gas Supply

Once the flame scanner detects pilot flame, the automatic block valve opens, operation of the selected gas blower begins, supplying gas to the flare. After the open limit switch for the automatic block valve is achieved, the pilot gas solenoid valve closes, and the "Flare Operating" light illuminates. While the flame scanner verifies the presence of flame, system operation continues.

Automatic Air Damper Temperature Control

The operating temperature, or temperature maintained inside the flare enclosure, is controlled by varying the ambient air available through the air damper louvers. The elevation of the temperature control thermocouple is selected depending on the gas flow rate and methane concentration. The operating temperature is maintained by adjusting automatically the position of the louvers. Closing the louvers reduces the amount of air available and increases the operating temperature, while opening the louvers increases the amount of air available and decreases the operating temperature. The louvers are maintained open initially, before beginning automatic temperature control modulation, which introduces air inside the flare enclosure while the enclosure is cold and lacking draft, to minimize smoke during initial operation.

Operator Interface Panel

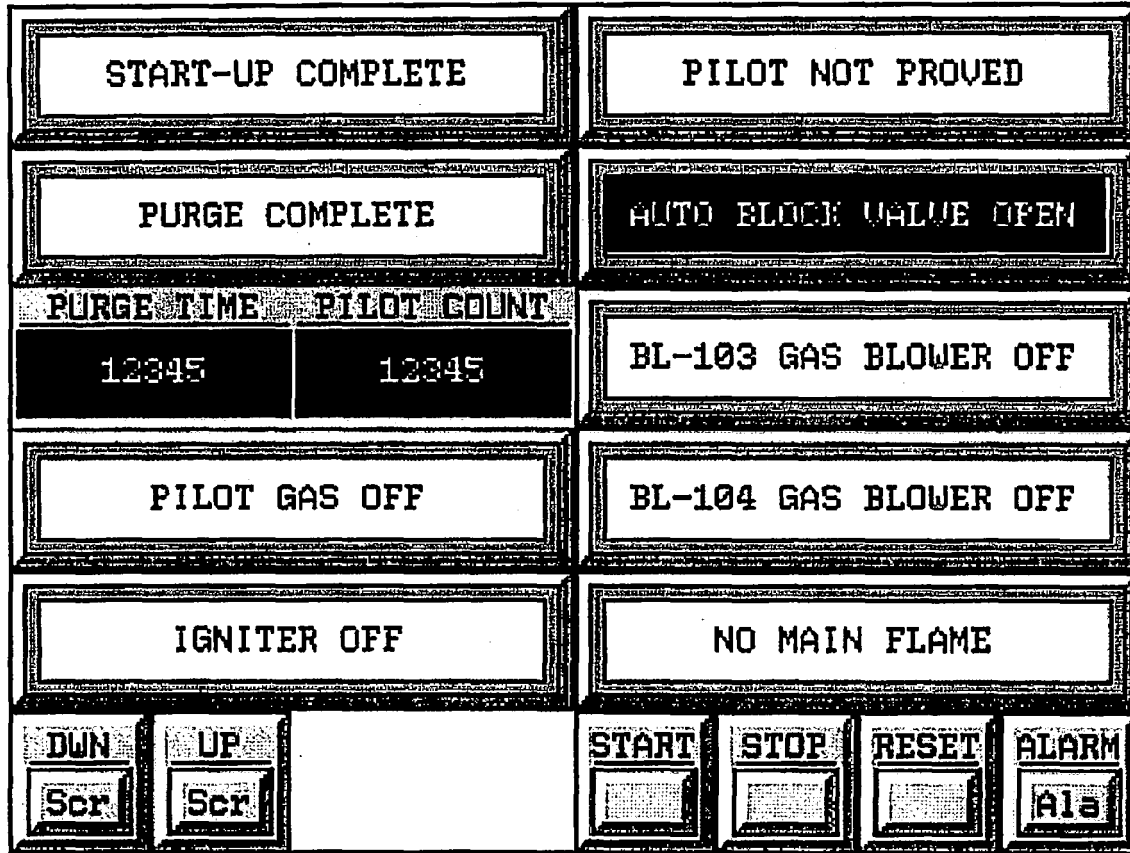
The Flare Control Panel contains an Operator Interface Panel (OIP), or touch screen, which replaces the usual selector switches, indicating lights, and pushbuttons provided to control, operate, and monitor the system equipment.

Contact Screen



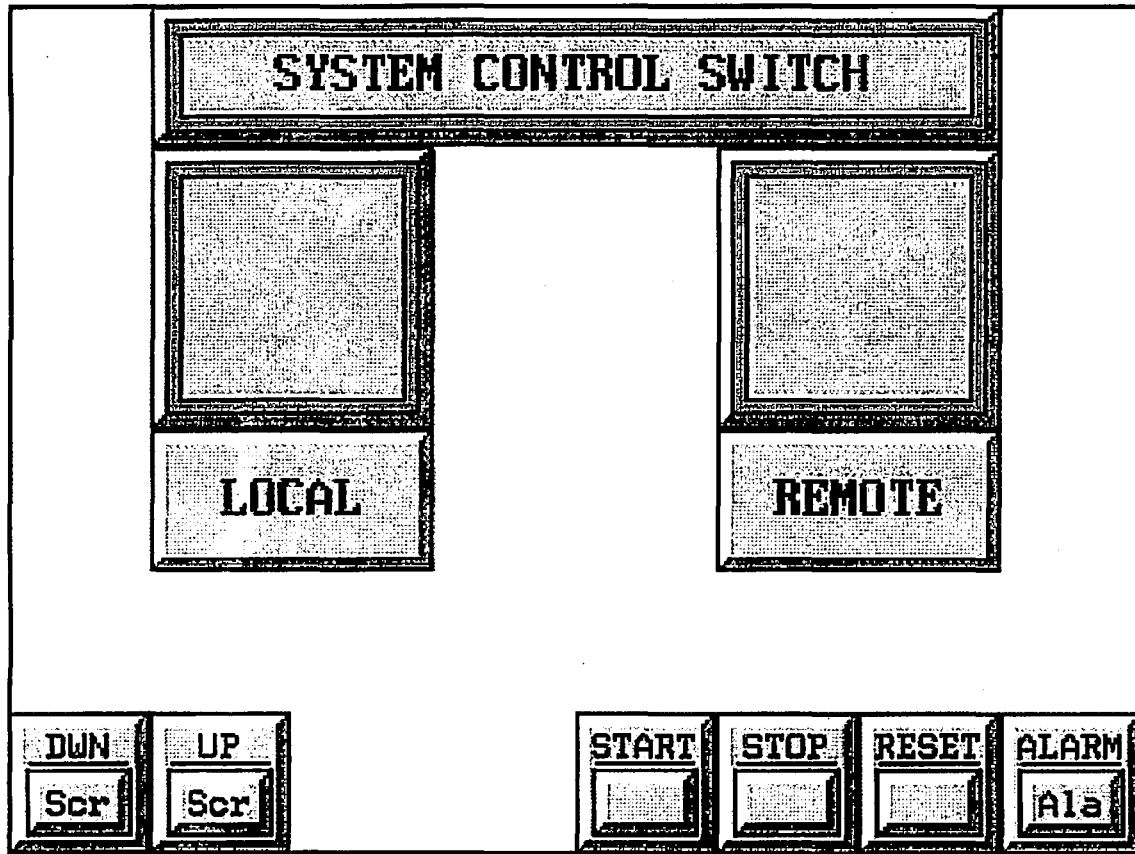
The "Contact" screen displays contact information for John Zink Company and each available screen contains separate buttons for transferring to the various screens or for controlling system operation. Press either button located at the bottom left corner of any screen to activate the next ("Up") or previous ("Down") screen. Press the corresponding buttons located at the bottom right corner of any screen to begin system operation automatically ("Start"), discontinue system operation ("Stop"), reset a fault condition ("Reset"), or access detailed alarm information ("Alarm"). Press the "Lamp" button to confirm all panel indicating lights are functional and press the "Conf" button to access parameters from a separate "Configuration" screen.

Flare Status Screen



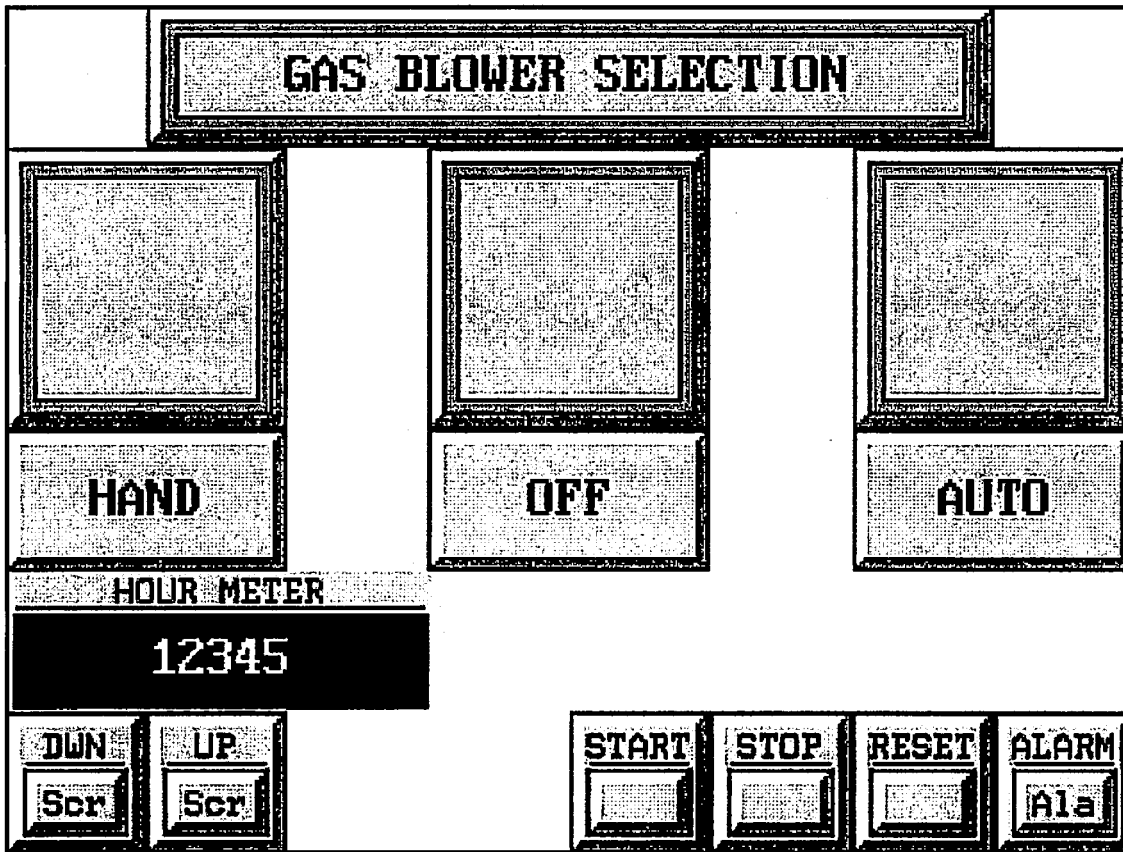
Access the "Flare Status" screen to continuously monitor progression through the flare operating sequence and the current flare operating status. Depress buttons located at the bottom left corner of the screen to activate the next ("Up") or previous ("Down") screen available in the series, or return to the contact ("Home") screen. For a particular series of screens, buttons at the bottom right corner of the screen apply only for that series. Depress these buttons to begin flare operation automatically ("Start"), discontinue flare operation ("Stop"), or reset a flare fault condition ("Reset").

System Control Screen



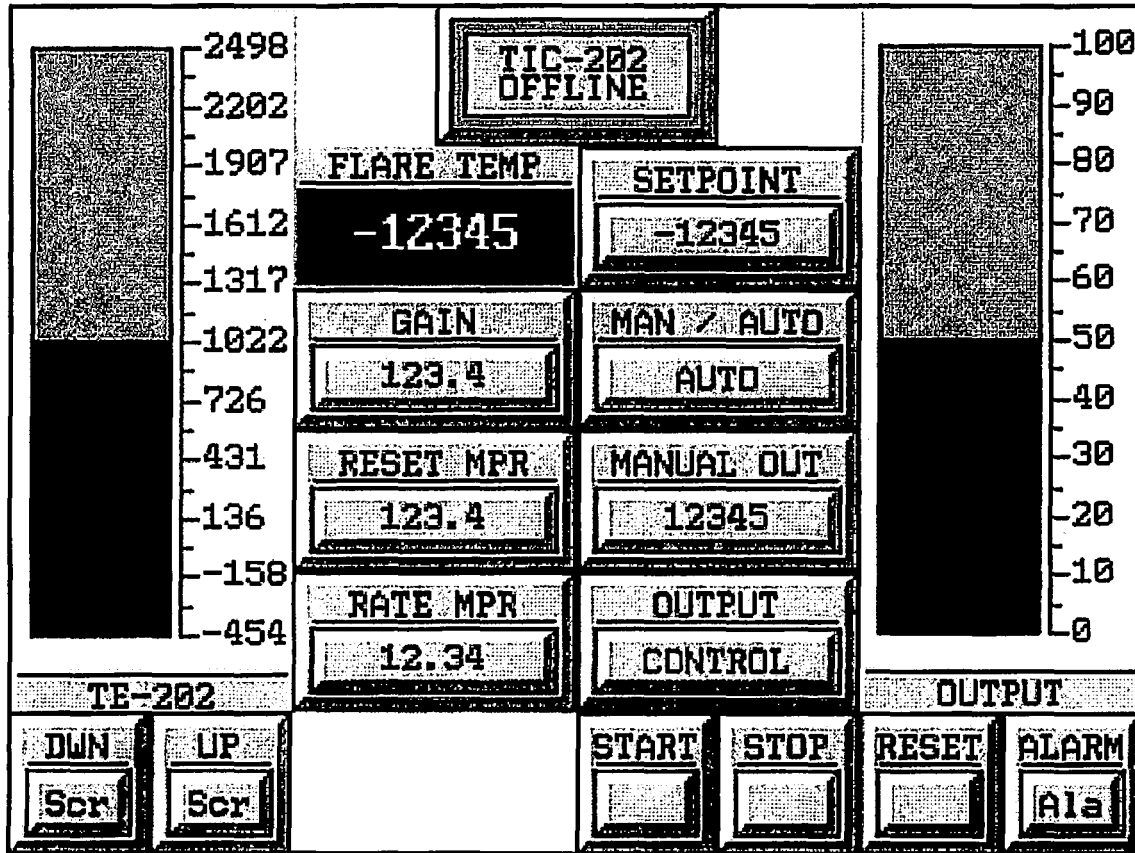
Access the "System Control" screen to select either "Local" or "Remote" system operation.

Blower Selection Screen



Separately access each "Gas Blower Selection" screen to start and stop gas blower operation. A cumulative hour meter for the blower is displayed. Select the blower to operate automatically by pressing the "Auto" button. Blower operation is discontinued by pressing the "Off" button. Verify motor rotation by pressing and holding the "Hand" button.

Air Damper Temperature Control Screen

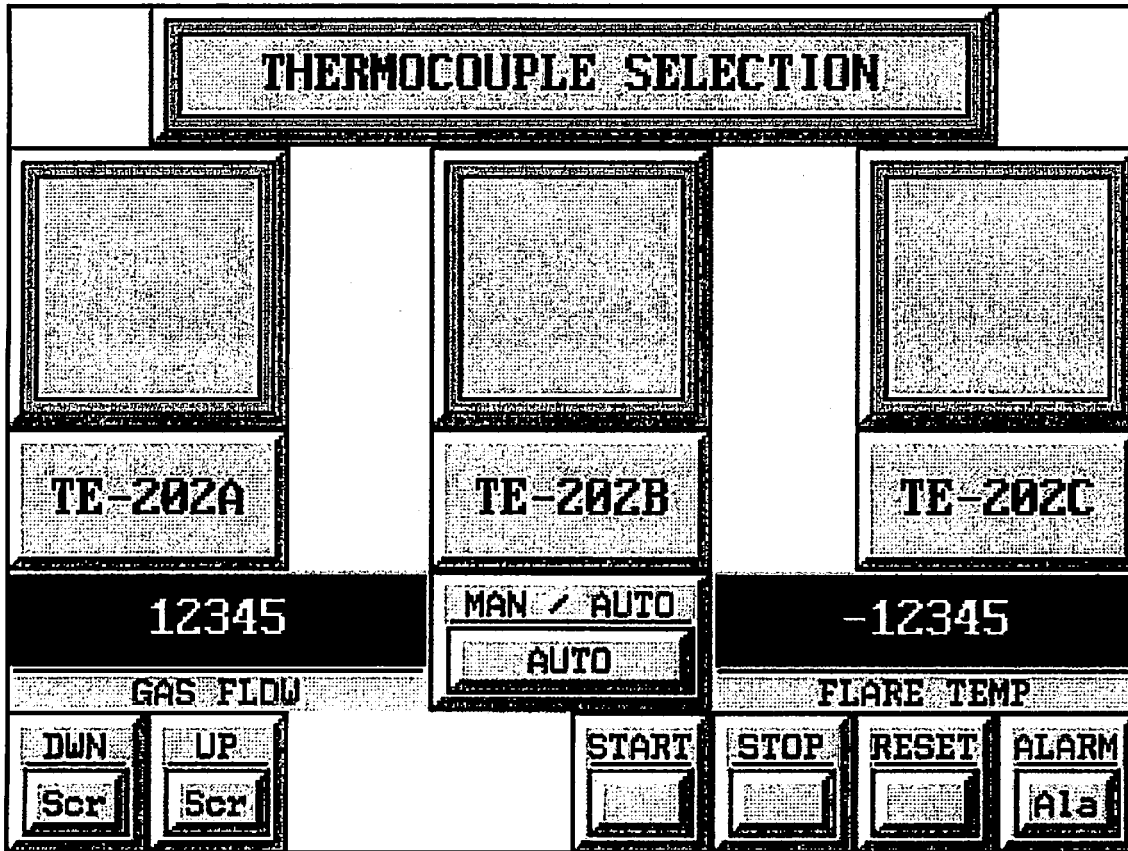


Access the "TIC-202" screen to adjust or monitor the temperature control module. The actual flare temperature detected by the selected control thermocouple (the operating temperature) is labeled "Flare Temp". The operating temperature setpoint is labeled "Setpoint". Press the "Setpoint" value to adjust the operating temperature setpoint. The tuning parameters corresponding to modulation of the air damper louvers are labeled "Gain", "Reset", and "Rate". Press each of the three "Gain", "Reset", or "Rate" values to adjust the corresponding parameter. The signal value controlling the louver position is labeled "Output". The louvers are fully open with a 0% value and fully closed with a 100% value. Press the "Man/Auto" button to adjust the louver position manually. After selecting manual operation, press the "Manual Out" value and the louver position adjusts to the value entered. For automatic operation only, press the "Output Control" button to access more parameters, which allow entering values to restrict the minimum and maximum louver position or maintaining a fixed louver position until exceeding a certain temperature limit.

TIC-202 OUTPUT CONTROL	
OUTPUT LOW LIMIT (°)	OUTPUT HIGH LIMIT (°)
-12345	12345
POSITION 1 (°)	POSITION 1 TEMPERATURE
-12345	-12345
POSITION 2 (°)	POSITION 2 TEMPERATURE
-12345	-12345

TIC 202	START	STOP	RESET
------------	-------	------	-------

Thermocouple Selection Screen



Access the "Thermocouple Selection" screen to monitor or select the flare temperature control thermocouples. Values appear for the actual temperature detected by the selected temperature control thermocouple (the operating temperature) and the total gas flow rate to the flare. Either automatic or manual thermocouple selection is available. Automatic thermocouple selection continuously determines the proper elevation of the temperature control thermocouple for maintaining the operating temperature considering the total gas flow rate and any subsequent variation in total gas flow rate. Press the "Man/Auto" button to select the temperature control thermocouple manually. After selecting manual operation, select the proper elevation of the temperature control thermocouple for maintaining the operating temperature by considering the total gas flow rate and pressing the button next to the corresponding thermocouple. Each significant variation in total gas flow rate again will require manual selection of the proper temperature control thermocouple.

CAUTION
Equipment damage may occur if the elevation of the
temperature control thermocouple is selected incorrectly.

Gas Blower Inlet Pressure Control Screen

Access the "PIC-100A" (inlet) screen to adjust or monitor the pressure control module. The actual vacuum detected by the inlet pressure transmitter is labeled "Gas Press". The operating pressure setpoint is labeled "Setpoint". Press the "Setpoint" value to adjust the operating pressure setpoint. The tuning parameters corresponding to modulation of the gas blower variable frequency drives are labeled "Gain", "Reset", and "Rate". Press each of the three "Gain", "Reset", or "Rate" values to adjust the corresponding parameter. The signal value controlling the variable frequency drives is labeled "Output". The variable frequency drives operate the gas blowers at minimum rotational speed with a 0% value and at maximum rotational speed with a 100% value. Press the "Man/Auto" button to adjust the variable frequency drives manually. After selecting manual operation, press the "Manual Out" value and the variable frequency drive adjusts to the value entered. Press the "Output Limit" value and the maximum rotational speed is restricted by the value entered.

Process Variables Screen

PROCESS VARIABLES			
TIC-202 SETPOINT	-12345	PILOT COUNT	12345
FLARE TEMP	-12345	MAIN COUNT	12345
TE-202A	-12345	PURGE TIME	12345
TE-202B	-12345		
TE-202C	-12345		
GAS FLOW	12345		

DWN	UP	START	STOP	RESET	ALARM
Scr	Scr				Ala

Access the "Process Variables" screen to monitor various system parameters. Values appear for the actual temperature detected by each control thermocouple and gas flow rate, along with summarizing other operating information.

Configuration Screen

TSL-202 SETPOINT 1234	BL-103 HOUR METER RESET
FT-107 MAX RANGE SCFM 12345	BL-104 HOUR METER RESET
SWITCH TE-202B TO A SCFM 12345	
SWITCH TE-202C TO B SCFM 12345	
RTN Scr	START STOP RESET

Access the "Configuration" screen by entering a password to adjust various operating parameters. The setpoint appears for the flare low temperature switch and the flow rate values required for automatic thermocouple selection, along with reset buttons for the gas blower cumulative hour meter. Press any of the values to adjust the corresponding setpoint.

VII. COMMISSIONING

The presence of a qualified John Zink Company representative is recommended for initial operation.

Process and Instrument Diagram Review

The equipment is fabricated according to the reference drawings. Operating personnel need to review the Process and Instrument Diagram and become familiar with the equipment.

Mechanical Review

Verify all equipment, including valves and control components, are functional prior to operation. Also, before beginning flare operation, complete the following:

1. Verify all equipment is installed according to the reference drawings.
2. Verify all electrical devices are connected to the proper power sources.
3. For the recommended chromel-alumel type K thermocouples, the red wire is negative (-) and the yellow wire is positive (+). Confirm the thermocouple extension wire is adequate for the radiation exposure and is proper for the particular thermocouple (KX wire with insulation for Type K thermocouples).

NOTE

Cross connecting the red and yellow wires anywhere in the circuit will nullify the thermocouple output.

4. All system pipe must be dry and free of dirt or foreign material, including the pilot gas pipe. Verify the pilot gas pipe is dry and unobstructed by removing the mixer orifice and strainer screen, if applicable, and blowing with clean, dry air. Replace the orifice and screen when clear flow exists.
5. Verify all drain and vent valves are closed and all drain and vent plugs are secure.
6. Close all manual and isolation valves initially.
7. Verify all disconnect handles are in the OFF position.
8. Verify all circuit breakers inside the control panels are in the OFF position.
9. Place all selector switches in the OFF or CLOSED position.
10. Verify the pilot gas pressure is adjusted properly (no pressure is displayed on the pressure gauge until the pilot gas solenoid valve opens).
11. Verify the hand valve supplying compressed air or nitrogen to the automatic block valve solenoid is closed.

12. Confirm operating setpoint values are as follows:

Description	Parameter Tag	Default Value
Flare High Temperature	TSHH-201	2000 °F
Flare Operating Temperature	TIC-202	1600 °F
	G (Gain)	5.0
	I (Reset)	7.0
	D (Rate)	1.1
	Minimum Limit	0%
	Maximum Limit	<100% when all louvers actuated
	Position 1	50% until 880 °F
Position 2	50% until 880 °F	
Flare Low Temperature	TSL-202	1400 °F
Flame Scanner	BS-203	
	Flame Proved (Relay On)	4
	Flame Failure (Relay Ratio)	50%
	Flame Failure Response (FFRT)	3 s
Purge Air Pressure	PDSL-204	0.5" H ₂ O
Compressed Air or Nitrogen Pressure	--	100 psig minimum
Pilot Gas Operating Pressure	PCV-302	10 psig for propane
		15 psig for natural gas
Enclosure Heater Thermostat	HTR-1	70 °F

NOTE

These setpoint values are recommended for initial operation and may require adjustment to satisfy specific operating conditions.

VIII. SYSTEM OPERATION

Preparation

1. Place all circuit breakers inside the control panels in the ON position.
2. Place all disconnect handles in the ON position.
3. Place the "Panel Power" switch in the ON position and the "Power On" light illuminates.
4. Open the hand valve supplying compressed air or nitrogen to the automatic block valve solenoid and set the pressure regulator to 100 psig minimum.
5. Open the pilot gas hand valve.
6. Press the "Auto" button only for the gas blower to be operated.
7. Open fully the manual butterfly valve at the corresponding gas blower inlet and outlet.

Start-up

1. Press the "Reset" button to clear any residual conditions from the program memory.
2. Begin system operation by pressing the "Local" and "Start" buttons, respectively.
3. The purge cycle begins and continues for five minutes. During this cycle, the "Flare Operating" light flashes. Once the purge cycle is complete, the ignition sequence begins.
4. The pilot gas solenoid valve opens and the ignition transformer energizes for ten seconds, igniting the pilot.
5. The flame scanner verifies pilot ignition and the automatic block valve opens.
6. Gas blower operation begins when the closed limit switch for the automatic block valve releases.

WARNING

All personnel stand clear from the flare air damper openings during start-up operations. Flame flashback through these openings is possible until the flare operating temperature is achieved.

8. Modulation of the air damper louvers begins one minute after the closed limit switch for the automatic block valve releases.
9. The pilot gas solenoid valve closes one minute after the open limit switch for the automatic block valve is achieved.

Operation

Flare

1. As the temperature inside the flare enclosure increases, the temperature control module sends a signal to the air damper actuator which adjusts accordingly to maintain the specified operating temperature.
2. Adjust the pilot gas pressure regulator until a stable, light blue flame with a defined cone shape exists.

Gas Blower

1. Manually adjust the output of the selected blower VFD to reach the required vacuum.
2. Simultaneous operation of multiple gas blowers is not allowed. However, operation may be transferred between the gas blowers. If the transfer exceeds ten seconds, the "Flare Shutdown" light illuminates and system operation discontinues.

NOTE

Suction generated from gas blower operation may prevent gravity draining liquid from the ZMS Moisture Separator.

Shutdown

Normal Shutdown

A normal shutdown is available whenever the operator needs to discontinue system operation. Press the "Stop" button, the "Flare Shutdown" light illuminates, and the following occurs:

- a. The pilot gas solenoid valve closes, if open.
- b. The ignition transformer discontinues, if energized.
- c. The automatic block valve closes, if open.
- d. The gas blower discontinues, if operating.
- e. The automatic damper louvers open fully.

When the system is not operating for an extended duration, also complete the following:

1. Place the "Panel Power" switch in the OFF position.
2. Close all manual and isolation valves.
3. Place all selector switches in the OFF or CLOSED position.

NOTE

To start the flare system again after addressing any reason for shutdown, the fault must be cleared by pressing the "Reset" button.

Power Failure

A power failure is caused by disrupting electrical service. The following occurs:

- a. The pilot gas solenoid valve closes, if open.
- b. The ignition transformer discontinues, if energized.
- c. The automatic block valve closes, if open.
- d. The gas blower discontinues, if operating.
- e. The automatic damper louvers are maintained in the last position.

Once power is restored, the system attempts operation automatically.

Fault Conditions

Flare High Temperature Shutdown occurs when the dedicated thermocouple detects temperature above the temperature switch setpoint value.

Flare Low Temperature Shutdown occurs when the selected temperature control thermocouple detects temperature below the temperature switch setpoint value for ten minutes consecutively.

Pilot Flame Failure and Shutdown occur during the ignition sequence, after three unsuccessful attempts, when flame is not detected by the flame scanner.

Main Flame Failure and Shutdown occur once the ignition sequence is complete, after three unsuccessful attempts, when flame is not detected by the flame scanner.

With any of these fault conditions, the "Flare Shutdown" light illuminates and the following occurs:

- a. The pilot gas solenoid valve closes, if open.
- b. The ignition transformer discontinues, if energized.
- c. The automatic block valve closes, if open.
- d. The gas blower discontinues, if operating.
- e. The automatic damper louvers open fully.

An operator reset is required to continue operation.

IX. SYSTEM TESTING

Lamp Test

- a. Press the "Lamp Test" button.
- b. All panel lights illuminate.

Purge Failure

- a. Press the "Stop" button.
- b. Disconnect tubing from the purge air pressure switch.
- c. Press the "Reset" button.
- d. Press the "Start" button.
- e. Purge air blower operation begins and the "Flare Operating" light flashes.
- f. After one minute, the "Flare Operating" light diminishes, the "Flare Shutdown" light illuminates, and system operation discontinues.
- g. Press the "Reset" button.
- h. The "Flare Shutdown" light diminishes.
- i. Connect tubing to the purge air pressure switch.

Pilot Flame Failure and Shutdown

- a. Press the "Stop" button.
- b. Close the pilot gas hand valve.
- c. Press the "Reset" button.
- d. Press the "Start" button and the "Flare Operating" light flashes.
- e. Purge air blower operation begins and the purge cycle continues for five minutes.
- f. Upon completing the purge cycle, the ignition sequence begins.
- g. The pilot gas solenoid opens and the ignition transformer remains energized for ten seconds.
- h. The flame scanner is unable to detect flame.
- i. The pilot gas solenoid closes and the purge cycle and ignition sequence are attempted again automatically.
- j. After the third unsuccessful attempt to detect pilot flame, the "Flare Operating" light diminishes, the "Flare Shutdown" light illuminates, and system operation discontinues.
- k. Press the "Reset" button.
- l. The "Flare Shutdown" light diminishes.
- m. Open the pilot gas hand valve.

Flare High Temperature Shutdown

- a. Press the "Stop" button.
- b. Place the "Panel Power" switch in the OFF position.
- c. Inside the Flare Control Panel adjust the dial on the flare high temperature switch to approximately 200 °F.
- d. Place the "Panel Power" switch in the ON position.
- e. Press the "Reset" button.
- f. Press the "Start" button and the "Flare Operating" light flashes.
- g. Allow the purge cycle to complete and the pilot to ignite.
- h. After the automatic block valve opens and gas blower operation begins, monitor the value appearing on the temperature control module.
- i. Upon exceeding the setpoint on the flare high temperature switch the "Flare Operating" light diminishes, the "Flare Shutdown" light illuminates, and system operation discontinues.

- j. Press the "Reset" button.
- k. The "Flare Shutdown" light diminishes.
- l. Place the "Panel Power" switch in the OFF position.
- m. Inside the Flare Control Panel return the dial on the flare high temperature switch to 2000 °F.

Automatic Block Valve Failure

- a. Press the "Stop" button.
- b. Disconnect the compressed air or nitrogen source from the automatic block valve solenoid.
- c. Press the "Reset" button.
- d. Press the "Start" button and the "Flare Operating" light flashes.
- e. Allow the purge cycle to complete and the pilot to ignite.
- f. The automatic block valve is unable to open.
- g. After 45 seconds, the open limit switch for the automatic block valve is not achieved.
- h. The "Flare Operating" light diminishes and the "Flare Shutdown" light illuminates.
- i. Press the "Reset" button.
- j. The "Flare Shutdown" light diminishes.
- k. Connect the compressed air or nitrogen source to the automatic block valve solenoid.

X. TROUBLESHOOTING

Problem: The "Panel On" light does not illuminate.

Possible Causes:

- a. The main circuit breaker is off.
- b. The "Panel Power" switch is off.
- c. The light bulb is defective.
- d. Power is not connected to the panel.
- e. The connecting wires are loose.

Problem: The purge cycle does not begin.

Possible Causes:

- a. The automatic block valve limit switches are not satisfied.
- b. The flame scanner detects flame.
- c. Power is not connected to the motor starter or motor.
- d. The motor starter circuit breaker is off.
- e. The motor starter contact is not closed.
- f. The motor starter holding coil is defective.
- g. The motor starter overload relay requires resetting.

Problem: The purge cycle fails.

Possible Causes:

- a. The pressure switch contact is not satisfied.
- b. The pressure switch tube is plugged or disconnected.
- c. Power is not connected to the pressure switch.
- d. The connecting wires are loose.

Problem: The pilot does not ignite.

Possible Causes:

- a. The pilot gas hand valve is closed.
- b. The pilot gas source is insufficient.
- c. The pilot orifice is plugged.
- d. The ignition wire is loose or broken.
- e. The ignition transformer is defective.
- f. The pilot electrode is defective.
- g. The pilot insulators are broken.
- h. The pilot gas pressure regulator requires adjustment.
- i. The pilot gas solenoid valve is not functioning properly.
- j. Power is not connected to the pilot gas solenoid.

Problem: The pilot flame is not detected after igniting the pilot.

Possible Causes:

- a. The flame scanner relay is not functioning properly.
- b. The flame scanner is not sensing flame.
- c. The scanner lens is dirty.
- d. The flame scanner amplifier is not functioning properly.
- e. The scanner is not installed properly.
- f. The scanner is not functioning properly.
- g. The connecting wires are loose.

Problem: The gas blower fails.

Possible Causes:

- a. Power is not connected to the variable frequency drive or motor.
- b. The variable frequency drive circuit breaker is off.
- c. The variable frequency drive circuit breaker is not adjusted properly.
- d. A variable frequency drive fault occurs.
- e. The connecting wires are loose.

Problem: The automatic block valve does not open.

Possible Causes:

- a. The compressed air or nitrogen source is insufficient.
- b. The automatic block valve solenoid is not wired correctly.
- c. Valve motion is obstructed inside the pipe.
- d. Power is not connected to the automatic block valve solenoid.
- e. The corresponding control relay is not functioning properly.
- f. The connecting wires are loose.

Problem: The automatic damper does not operate correctly.

Possible Causes:

- a. The signal wire is loose or broken.
- b. The temperature control module is not functioning properly.
- c. The actuator is defective.
- d. The thermocouple input to the control module is defective.
- e. The corresponding control relay is not functioning properly.

Problem: Flame Failure or Shutdown occurs.

Possible Causes:

- a. The gas flow rate or methane content is low.
- b. The flame scanner failed.
- c. The flame scanner amplifier failed.
- d. The automatic damper actuator failed.
- e. The gas blower failed.
- f. The flame arrester is plugged.
- g. The flare tips are plugged.

Problem: Flare High Temperature Shutdown occurs.

Possible Causes:

- a. A thermocouple is damaged.
- b. The gas flow rate or methane content is high.
- c. The thermocouple wires are reversed.
- d. The automatic damper actuator is not operating properly.
- e. The high temperature switch is not set or operating properly.
- f. The connecting wires are loose.

Problem: Flare Low Temperature Shutdown occurs.

Possible Causes:

- a. The gas flow rate or methane content is low.
- b. The incorrect temperature control thermocouple elevation is selected.
- c. The thermocouple wires are reversed.
- d. The low temperature setpoint is incorrect.
- e. The automatic damper actuator is not operating properly.
- f. The gas blower failed.
- g. The flame arrester is plugged.
- h. The flare tips are plugged.
- i. The connecting wires are loose.

XI. MAINTENANCE

The following maintenance summary is designed only as a guideline and does not identify all areas or components requiring maintenance attention. A maintenance program must be developed considering existing company policy, operational experience, and manufacturer requirements. This operating manual is to be used in conjunction with, and does not replace, any company policies.

General

1. Refer to the manufacturer literature in Section XVIII, "Manufacturer Information" for specific maintenance requirements of individual components.
2. Review operation and calibration procedures for individual instruments in Section XVIII, "Manufacturer Information" as recommended by the manufacturer.
3. Inspect all flanges and connections for indications of leaking. Repair or replace if necessary.

Flare

1. Visually inspect the flare tips and flare stack for damage or deterioration.
2. Inspect the exterior surface for indications of heat degradation. Paint discoloration may indicate insulation damage.
3. Assess the overall integrity of the internal insulation once a month. Torn or worn insulation may result in equipment damage. Repair if necessary.
4. Remove the flare tip for cleaning if an obstruction is suspected. Measure the pressure differential between the flare inlet flange and the flare tip exit. If the value exceeds 5" H₂O, then clean the tips.
5. Inspect all thermocouple assemblies and replace at least once each year.
6. Inspect the pilot assembly, ignition rod, electrode, and insulators for damage once every three months. Repair or replace if necessary.
7. Verify pilot gas supply pressure and pilot ignition.
8. Inspect the flame detection components. Clean the flame scanner lens and vent port.
9. Verify proper operation of the air damper louvers and lubricate if necessary.
10. Remove the flame arrester element for cleaning every six months. Measure the pressure differential across the flame arrester element. If the value exceeds 5" H₂O, then clean the element.

Panel

1. Confirm the control logic is functioning properly and all input and output signals are correct.
2. Verify all safety shutdown devices every three months per Section IX, "System Testing".
3. Inspect all electrical enclosures for any apparent corrosion or moisture.
4. Confirm all enclosure and actuator heaters are functioning.
5. Confirm the integrity of conduit seals, if applicable.
6. Verify the supply power voltage.
7. Verify power to motor starters.
8. During operation, measure gas blower line current and voltage.
9. Confirm chart recorder operation.

Miscellaneous

1. Remove and clean any filter elements or mesh strainers every three months.
2. Verify approximately 2" H₂O appears on the differential pressure gauge. If the value exceeds 5" H₂O, then clean the mist elimination element inside the ZMS Moisture Separator.
3. Press the "Hand" button for the gas blower to verify proper operation.
4. Verify sufficient pressure is available from the compressed air or nitrogen source.
5. Inspect any gauges and valves for deterioration.

NOTE

An enclosure heater is installed in the Flare Control Panel, PNL-101, to prevent internal corrosion. Individual electric motors may contain integral heaters also to prevent internal corrosion. Ensure all heaters are connected to a reliable power supply and operated continuously, especially during outside storage or when operation is discontinued for an extended duration. Consult wiring diagrams in Section XII, "Reference Drawings" for additional details.

XII. REFERENCE DRAWINGS

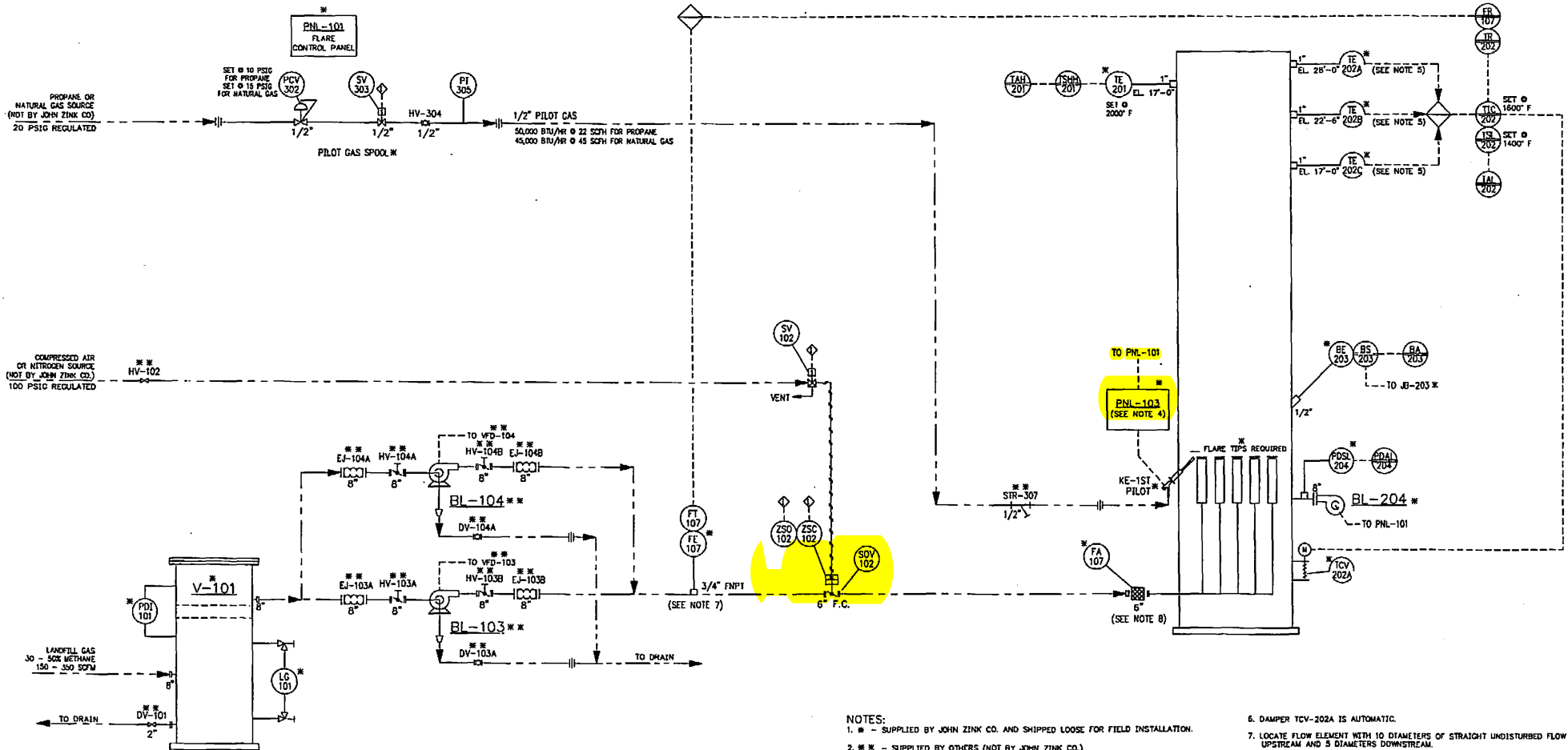
D-F-9109403-150	Process and Instrument Diagram
D-F-9109403-301	Enclosed ZTOF Biogas Flare
ST-11916	KE-1/ST Pilot
D-F-9109403-303	ZMS Moisture Separator
D-F-9109403-400	Panel Detail
D-F-9109403-401	Wiring Diagram
D-F-9109403-402	Wiring Diagram
D-F-9109403-403	Wiring Diagram
D-F-9109403-404	Wiring Diagram

V-101
ZMS MOISTURE SEPARATOR
2' x 8'

BL-103, BL-104
GAS BLOWERS

ENCLOSED
ZT OF FLARE
4' x 40'

BL-204
PURGE AIR BLOWER
3/4 HP



NOTES:

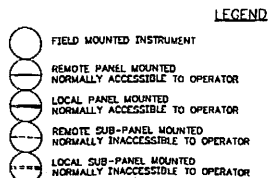
- * - SUPPLIED BY JOHN ZINK CO. AND SHIPPED LOOSE FOR FIELD INSTALLATION.
- ** - SUPPLIED BY OTHERS (NOT BY JOHN ZINK CO.)
- ELECTRICAL AREA CLASSIFICATION: NON-HAZARDOUS
- IGNITION TRANSFORMER IS INSIDE PNL-103 AND MOUNTED ON FLARE.
- TEMPERATURE CONTROL THERMOCOUPLE (TE-202) IS SELECTED DEPENDING ON GAS FLOW RATE TO FLARE. EQUIPMENT DAMAGE MAY OCCUR IF THE IMPROPER ELEVATION IS SELECTED.
- DAMPER TCV-202A IS AUTOMATIC.
- LOCATE FLOW ELEMENT WITH 10 DIAMETERS OF STRAIGHT UNDISTURBED FLOW UPSTREAM AND 5 DIAMETERS DOWNSTREAM.
- LOCATE FLAME ARRESTER WITH 5 DIAMETERS OF STRAIGHT UNDISTURBED FLOW UPSTREAM.
- THERMOCOUPLE WIRE AND IGNITION WIRE SUPPLIED BY JOHN ZINK CO. AND SHIPPED LOOSE FOR FIELD INSTALLATION.

HIGH TEMPERATURE SHUTDOWN THERMOCOUPLE LOCATION

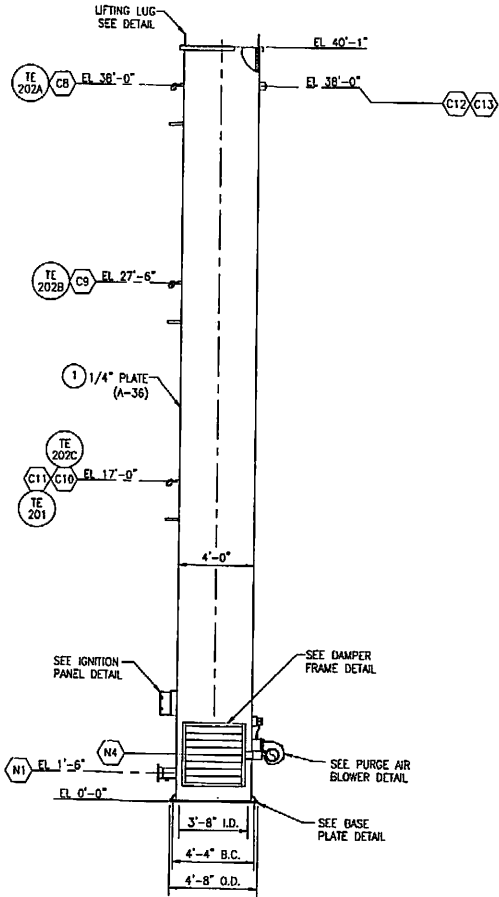
GAS FLOW (SCFM)	TE-201 ELEVATION (FT)
ALL FLOW RATES	17'-0"

TEMPERATURE CONTROL THERMOCOUPLE LOCATION AT MAXIMUM METHANE CONCENTRATION

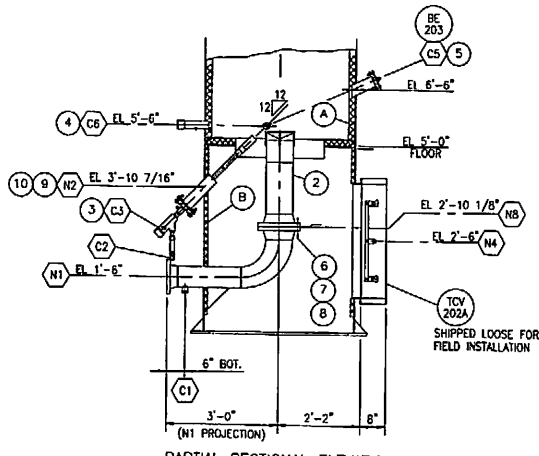
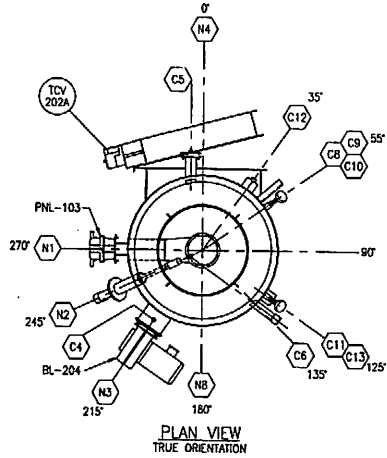
GAS FLOW (SCFM)	TE-202 ELEVATION (FT)
150 - 216	17'-0"
217 - 283	22'-6"
284 - 350	28'-0"



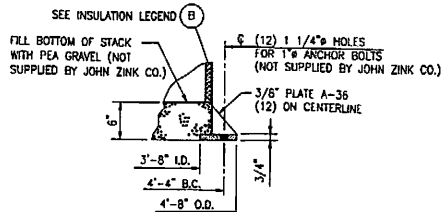
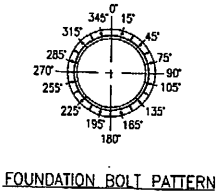
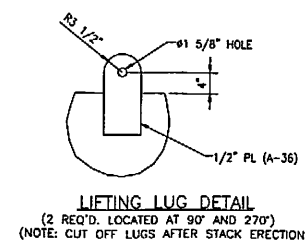
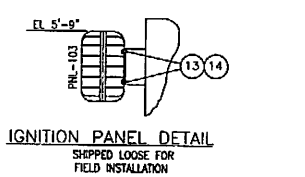
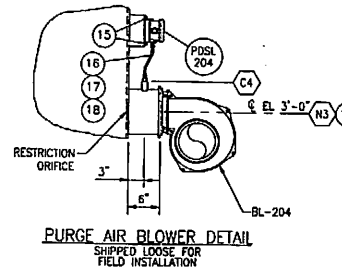
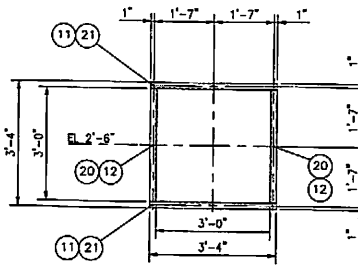
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FOR: MARK HELETT CONTRACTORS			
USER: SLOBBARY LANDFILL		JOHN ZINK COMPANY LLC	
JUSTICE WALLA WALLA, WA		PARTS AND SERVICE, CALL 1-800-755-4252 FAX (509) 234-1958	
S.O. NO. 07-010403		PROCESS & INSTRUMENT DIAGRAM	
P.O. NO. 02320101R		FOR AN ENCLOSED ZT OF FLARE SYSTEM	
DR: BPJ	DATE: 8-10-10	CERTIFIED	DRAWING NUMBER: D-1-0108403-150
CK: AJ	DATE: 9-24-10		REV: 0
APP: AJ	DATE: 9-24-10	SCALE: NONE	1 of 1



ELEVATION
NOT TRUE ORIENTATION



PARTIAL SECTIONAL ELEVATION
NOT TRUE ORIENTATION



PARTS LIST

ITEM	QTY	DESCRIPTION	MK: NO	MATERIAL
1	1	ENCLOSED ZTOP FLARE	D-701-1	
2	1	8" FLARE TIP ASSEMBLY	D-ST-1328-1	
3	1	PILOT ASSEMBLY	ST1916-1	
4	1	2" SIGHT PORT	CA-ST-0600-1	
5	1	SWIVEL SCANNER MOUNT ASSEMBLY	CB-150-R	NON-ASB
6	1	GASKE: 8" 150# RF x 1/16" THK	SB-6-4 1/2	A-193-B7
7	8	BOLT, STUD: 3/4" x 4 1/2" LG (PLATED)	HW-5-2 1/2	A-307
8	16	NUT, HYV HEX: 5/8-11NC (PLATED)	HW-5	A-307
9	4	BOLT, HEX HD: 5/8 x 2 1/2" LG (PLATED)	HW-3-1 1/4	A-307
10	4	NUT, REG HD: 5/8-11NC (PLATED)	HW-2	A-307
11	2	BOLT, HEX HD: 3/8 x 1 1/4" LG (PLATED)	HW-3	A-307
12	10	NUT, REG HD: 3/8-16NC (PLATED)	HW-2	A-307
13	4	BOLT, HEX HD: 1/4 x 1" LG (PLATED)	HW-2	A-307
14	4	NUT, REG HD: 1/4-20NC (PLATED)	HW-3	A-307
15	2	SCREW, HEX HD MACH #10-24NC x 3/4" LG (PLATED)	HCS-#10-3/4	A-307
16	1	3/8" COPPER TUBING x 1'-0" LG		COPPER
17	1	MALE CONNECTOR, 1/8" NPT x 3/8" TUBING		BRASS
18	1	MALE ELBOW CONNECTOR, 1/2" NPT x 3/8" TUBING		BRASS
19	1	GAL ZINC CLAD II PLUS #B69V212/B69V215/B69D11 (TOUGH-UP)		PAINT
20	6	SCREW, FLAT HD, SL: 3/8-NC x 1" LG (PLATED)	FN-3-1	A-307
21	2	WING NUT: 3/8-16NC (PLATED)	WN-3	A-307

NOZZLE LEGEND

MK	QTY	DESCRIPTION
N1	1	GAS CONNECTION: 8" 150# F.F.
N2	1	PILOT MTC CONN: 3/8" PLATE FLG W/ 3" 150# DRILLING
N3	1	BLOWER - 8" CONN 10" O.D. x 3/8" PL W/ (4) 3/8" STUDS ON 9 1/8" B.C.
N4	1	DAMPER CONN - SEE DETAIL. (HS KINGED)
N8	1	FLARE TIP CONN - 8" 150# RF
C1	1	DRAIN - 1" FNPT WITH PLUG
C2	1	PILOT GAS CONN - 1/2" FNPT
C3	1	PILOT CONDUIT CONN - 1/2" FNPT
C4	1	PURGE AIR PRESSURE CONN - 1/2" FNPT
C5	1	SCANNER CONN - 1" MNPT
C6	1	SIGHT PORT - 2" MNPT
C8-11	4	THERMOCOUPLE CONN - 1" FNPT
C12-13	2	SAMPLE PORT 4" FNPT WITH PLUG

DESIGN DATA

WINDLOAD (PER ASCE 7-95, EXP. C) _____ 110 M.P.H.
 SEISMIC (PER UBC-1994) _____ ZONE 4
 SHEAR @ BASE _____ 7.0 K
 MOMENT @ BASE _____ 130.0 K-FT
 DEADLOAD _____ 8.5 K
 SHELL DESIGN TEMPERATURE _____ 500 F
 CORROSION ALLOWANCE _____ 0.0

LIFTING NOTES

A: MAIN CRANE AT TOP REQUIRES SPREADER BAR. (NOT SUPPLIED BY JOHN ZINK CO.)
 B: CHOKO STACK AT APPROX. 5'-0" EL WITH TAILING CRANE
 C: LIFTING LUGS DESIGNED FOR 13 1/2 TON CROSBY ANCHOR SHACKLE AND VERTICAL SLINGS.

INSULATION LEGEND

A: (1) OVERLAPPING LAYER OF 1" THICK 8 LB DENSITY, 2300° F. BACKED WITH (1) LAYER, 1" THICK 6 LB DENSITY, 2300° F. ON INCONEL PINS AND KEEPERS.
 B: (1) OVERLAPPING LAYER OF 1" THICK 6 LB DENSITY, 2300° F. ON INCONEL PINS AND KEEPERS.

GENERAL NOTES

- TAG NUMBERS TO BE PRECEDED BY JOHN ZINK SALES ORDER NUMBER.
- FLARE ASSEMBLY IS NOT TO BE USED AS AN ANCHOR POINT FOR CUSTOMER PIPING.
- PRE-TENSION ANCHOR BOLTS BY THE "TURN OF THE NUT" METHOD/ASC.
- BOLT HOLES TO STRADDLE NORMAL CENTER LINES UNLESS NOTED.
- FINISH EXTERIOR CARBON STEEL, INSIDE OF SKIRT, BOTTOM OF FLOOR PLATE, AND MAINFOLD, SANDBLAST PER SSPC-SP-6 AND PRIME WITH SHERWIN WILLIAMS ZINC CLAD II PLUS #B69V212/B69V215/B69D11 (3-4 MILS D.F.T.)

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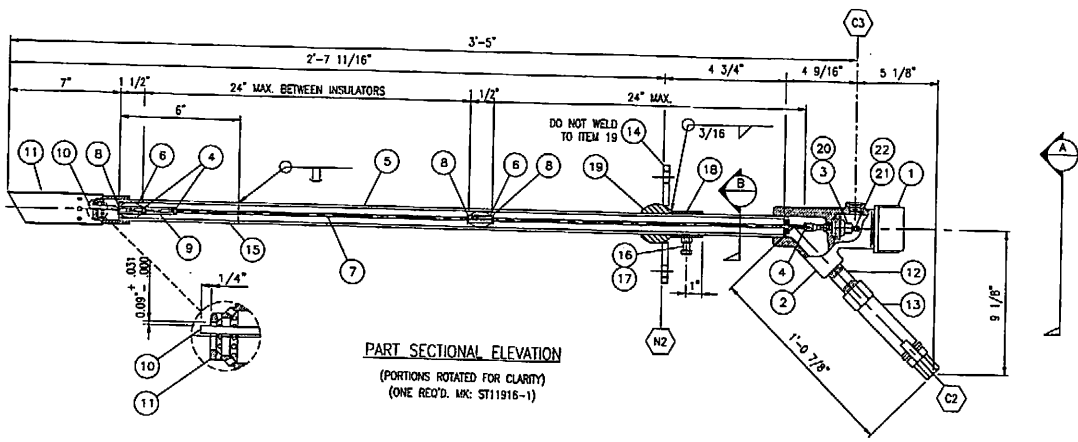
FOR: MANK HEJETT CONTRACTORS
 USER: SADBURY LANDSL
 JOBSITE: WAKALA WAKALA WA
 S.O. NO. 0F-9109403
 P.O. NO. 0823201010
 DR. MGR DATE: 09-10-10
 CL. SAN DATE: 09-16-10
 APP. AJ DATE: 09-24-10

DRAWING NUMBER
 D-F-9109403-301

REVISION DESCRIPTION

SCALE
 1" = 4'

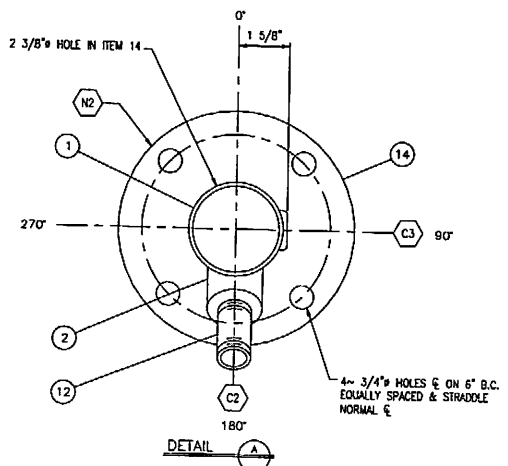
JOHN ZINK
 JOHN ZINK COMPANY LLC
 PARTS AND SERVICE, CALL 1-800-785-1282 FAX (918) 234-1968
 ENCLOSED ZTOP FLARE
 4'-0" O.D. x 40' H.



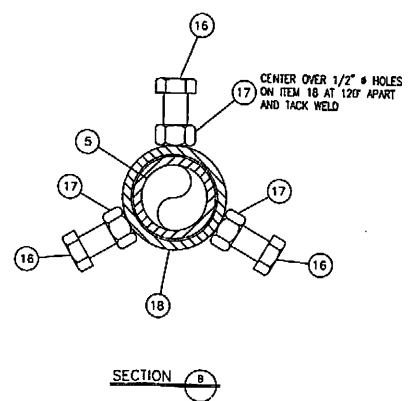
PART SECTIONAL ELEVATION
(PORTIONS ROTATED FOR CLARITY)
(ONE REQ'D. MK: ST11916-1)

PARTS LIST				
ITEM	QTY	DESCRIPTION	MK: NO	MATERIAL
1	1	PIPE CAP (2"-150#)		A-187
2	1	WEATHERHEAD (KE-1)	A-PAT-0697	DUCT.
3	1	SPARK PLUG (WCC-12-1)		
4	3	NUT, REG HEX (#10-24)		A-307
5	1	PIPE, 1" SCH 40		A-106-B
6	2	INSULATOR	CA-PAT-1714	A-106-B
7	1	IGNITION ROD EXTENSION		CERAMIC
8	3	3/16" PUSH ON RETAINER	S-10228-4	316 SS
9	1	CONNECTOR COUPLING	CA-PAT-1720	STL
10	1	IGNITION ROD	CA-ST-0907	416 SS
11	1	PILOT TIP ST-1S (PER CA-ST-1118)	CA-ST-0606	316 SS
12	1	PIPE, NIPPLE		SS
13	1	PILOT MIXER ASSEMBLY	CA-ST-0619-60	A-106-B
14	1	PLATE FLANGE		A-36
15	1	GAS NIPPLE		304 SS
16	3	BOLT, HEX 3/8-NC x 1" LG (PLATED)		A-307
17	3	NUT, REG HEX: 3/8-16NC (PLATED)		A-307
18	1	PIPE, 1 1/4" S40		A-106-B
19	1	PIVOT BALL	CA-PAT-1903	CR-1213
20	1	CONN. SPARK PLUG STRT BARE T199		
21	1	ANCHOR BASE STUD (TERMINAL NUT 548)		ALUM
22	1	LOCK WASHER #8		C.S.
23	1 PT	GRAY ALKYL PRIMER #850WZ3		PAINT

NOZZLE LEGEND		
MK	QTY	DESCRIPTION
C2	1	PILOT GAS CONN: 1/2" FNPT
C3	1	PILOT CONDUIT CONN: 1/2" FNPT
N2	1	PILOT MOUNT CONN: 3/8" PLATE P.L.C. W/ 3" 150 LB DRILLING

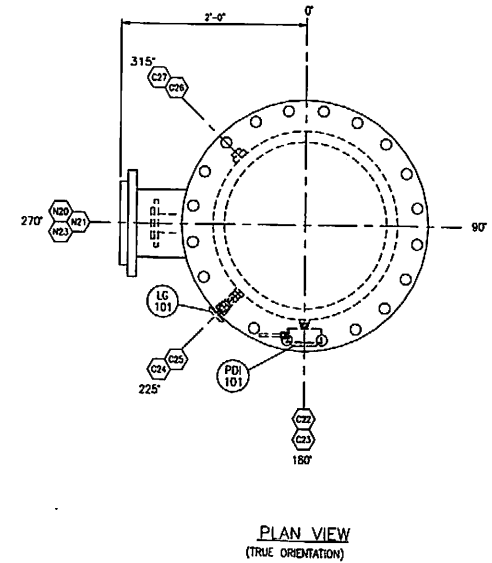
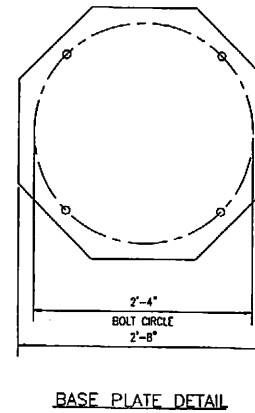
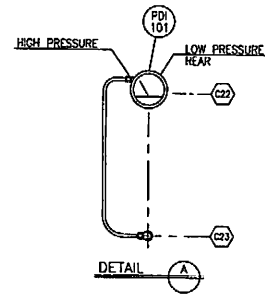
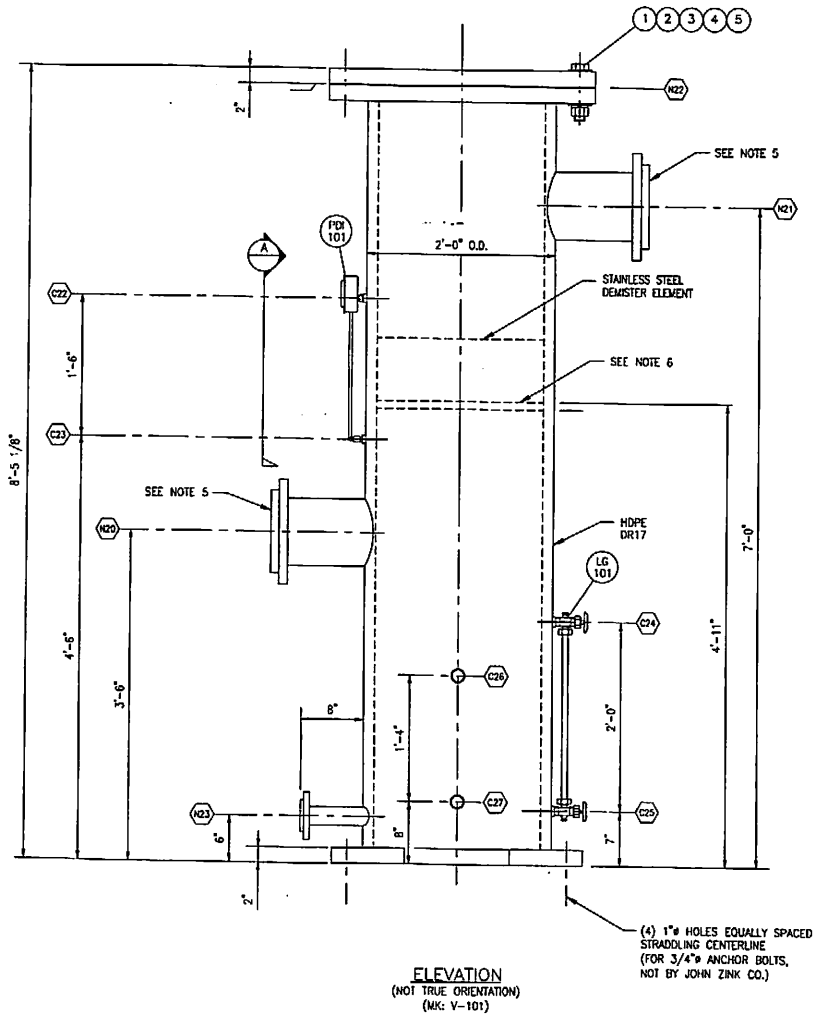


(TRUE ORIENTATION, MIXER NOT SHOWN)
ORIENT MIXER BELOW THE CONDUIT
CONNECTION FOR FREE LIQUID DRAINING



- NOTES:
- PILOT ORIFICE IS DRILLED MTD 60
 - FUEL GAS MUST BE FILTERED TO ELIMINATE FOREIGN MATTER ABOVE 0.01 INCH EFFECTIVE DIAMETER. A FILTER, ACCESSIBLE WITHOUT INTERRUPTING OPERATION, IS RECOMMENDED.
 - NATURAL GAS USAGE 45 SCFH @ 15 PSIG
PROPANE GAS USAGE 22 SCFH @ 10 PSIG
 - PREPARE CARBON STEEL SURFACES SSPC-SP-2 PRIME WITH GRAY ALKYL

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FOR: _____ USER: _____ JOB: _____ S.O. NO. _____ P.O. NO. _____		
DR. CFC DATE: 11-24-09 DC. JPR DATE: 11-24-09 APP. JPR DATE: 11-24-09		KE-1ST PILOT ASSEMBLY DRAWING NUMBER: ST11916 SCALE: _____ 1. of 1



PARTS LIST				
ITEM	QTY	DESCRIPTION	MK: DWG	MATERIAL
1	1	GASKET, 1/8" THICK		NEOPRENE
2	20	HEX BOLT, 1 1/4" x 8 1/2" LG (PLATED)		A-307
3	20	NUT, REG HEX, 1 1/4" (PLATED)		A-307
4	40	WASHER, 1 1/4" FLAT (PLATED)		A-569
5	20	WASHER, 1 1/4" LOCK (PLATED)		A-569

NOZZLE LEGEND	
MK	DESCRIPTION
N20	INLET: 8" FLANGE ADAPTER WITH 150# BACK-UP RING
N21	OUTLET: 8" FLANGE ADAPTER WITH 150# BACK-UP RING
N22	FLANGED TOP: 32" O.D. WITH (20) 1 3/8" HOLES ON 28 1/2" B.C.
N23	DRAIN: 2" FLANGE ADAPTER WITH 150# BACK-UP RING
C22	PRESSURE CONNECTION: 1/2" FNPT (SS)
C23	PRESSURE CONNECTION: 1/2" FNPT (SS)
C24	LIQUID LEVEL GAUGE CONNECTION: 3/4" FNPT (SS)
C25	LIQUID LEVEL GAUGE CONNECTION: 3/4" FNPT (SS)
C26	LIQUID LEVEL SWITCH CONNECTION: 1" FNPT WITH SS PLUG
C27	LIQUID LEVEL SWITCH CONNECTION: 1" FNPT WITH SS PLUG

- NOTES**
- BOLT HOLES TO STRADDLE NORMAL CENTERLINES UNLESS NOTED.
 - MOISTURE SEPARATOR IS NOT TO BE USED AS AN ANCHOR POINT FOR CUSTOMER PIPING.
 - PRE-TENSION ANCHOR BOLTS BY THE "TURN OF THE NUT" METHOD/AISC.
 - TAG NUMBERS TO BE PRECEDED BY JOHN ZINK SALES ORDER NUMBER.
 - FLANGE ADAPTERS TO BE SDR-17 AND BACK-UP RINGS TO BE PAINTED.
 - DEMISTER MOUNTING RING 1" THICK X 2" WIDE WITH (8) 1/4" BOLT HOLES.

DESIGN DATA

VACUUM _____ -5 PSI

EMPTY WEIGHT _____ 700 LB.

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FOR: MARK HEYDT CONTRACTORS
USER: SUDARY LAMPELL
ADDRESS: WALLA WALLA, WA

JOHN ZINK
JOHN ZINK COMPANY LLC
PARTS AND SERVICE: CALL 1-800-755-6292 FAX (509) 234-1968
ZMS MOISTURE SEPARATOR
2" O.D. x 8" HIGH

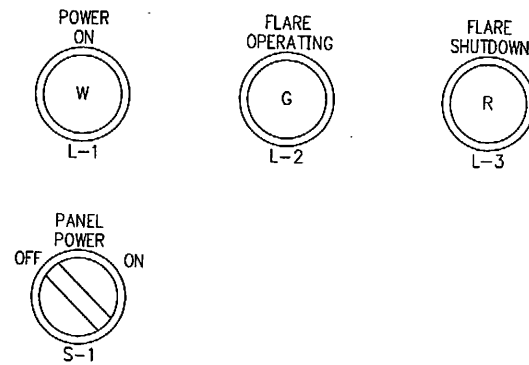
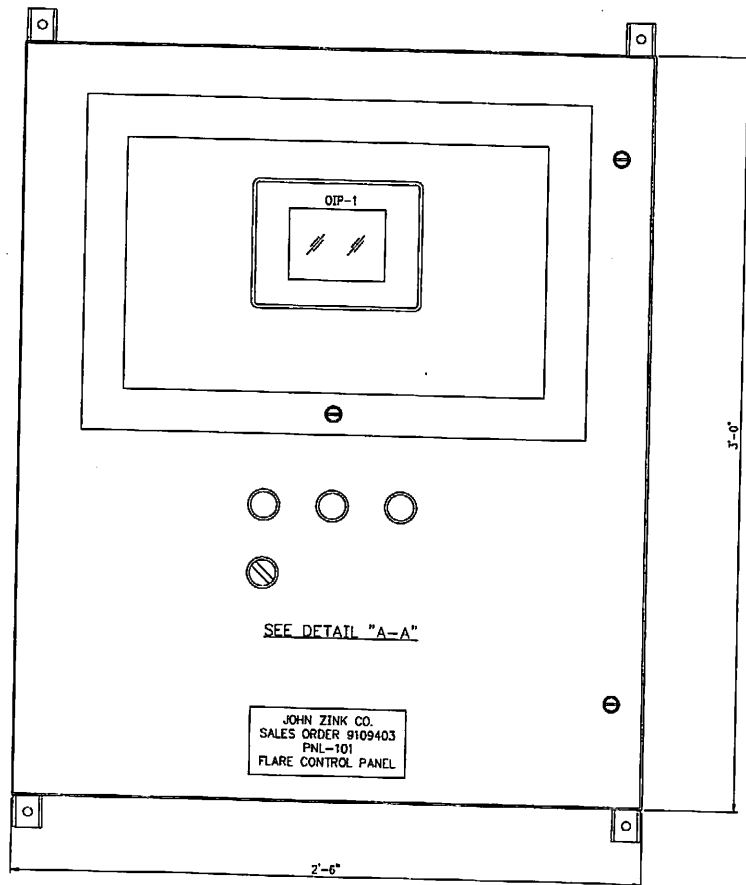
S.O. NO. 07-9109403
P.O. NO. 0623020202

DR. MED. DATE: 09-13-10
CK. SAH DATE: 09-16-10

APPROVED: [Signature] DATE: 09-24-10

REVISION DESCRIPTION BY DATE

DRAWING NUMBER: B-F-9109403-303
SCALE: 1 of 1



DETAIL "A-A"

NOTE:
1. ELECTRICAL AREA CLASSIFICATION: NON-HAZARDOUS.

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FOR: MARK HELETTI CONTRACTORS USER: SUDBURY LANDFILL JOB SITE: WALLA WALLA, WA S.O. NO. 07-9109403 P.O. NO. 082320101218			
JOHN ZINK COMPANY LLC PARTS AND SERVICE, CALL 1-800-795-4252 FAX (918) 234-1983 PANEL DETAIL (PNL-101) FOR AN ENCLOSED ZTGF FLARE SYSTEM			
DR. RPL	DATE: 8-10-10	CERTIFIED	DRAWING NUMBER
DC. AJ	DATE: 8-24-10		D-F-9109403-400
APP. AJ	DATE: 8-24-10	SCALE: NONE	REV. 0
NO.	REVISION DESCRIPTION	BY	DATE

NOTES:

1. ALL WIRING TO BE AS FOLLOWS UNLESS INDICATED OTHERWISE:

WIRE SIZING PER NEC
 MIN. 18 GA./7000 V/TBHN OR THIN FOR CONTROL
 MIN. 18 GA./TWO CONDUCTOR SHIELDED FOR SIGNAL

2. MINIMUM FIELD CONDUIT REQUIRED:

- (1) THERMOCOUPLES
- (1) POWER - 120 V
- (1) POWER - 480 V
- (1) CONTROL SIGNAL
- (1) FLAME SCANNER

3. TERMINAL BLOCKS TO BE ARRANGED IN NUMERICAL ORDER.

4. PROCESSOR LOGIC PROGRAM 03102403

5. WIRING LEGEND:

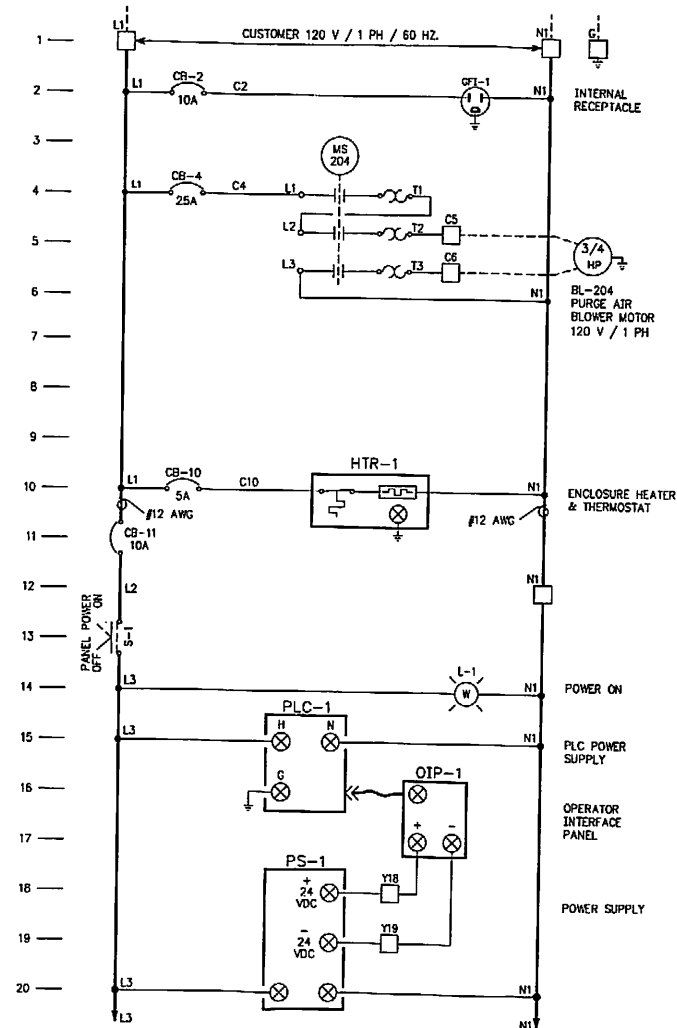
- ⊗ TERMINAL IN PANEL MOUNTED INSTRUMENTS.
- TERMINAL IN FLARE CONTROL PANEL PNL-101
- ⊗ TERMINAL IN JB-203
- △ TERMINAL IN MOTOR CONTROL PANEL PNL-102
- TERMINAL IN IGNITION PANEL PNL-103

WIRING BY JOHN ZINK CO.

WIRING BY OTHERS (NOT BY JOHN ZINK CO.)

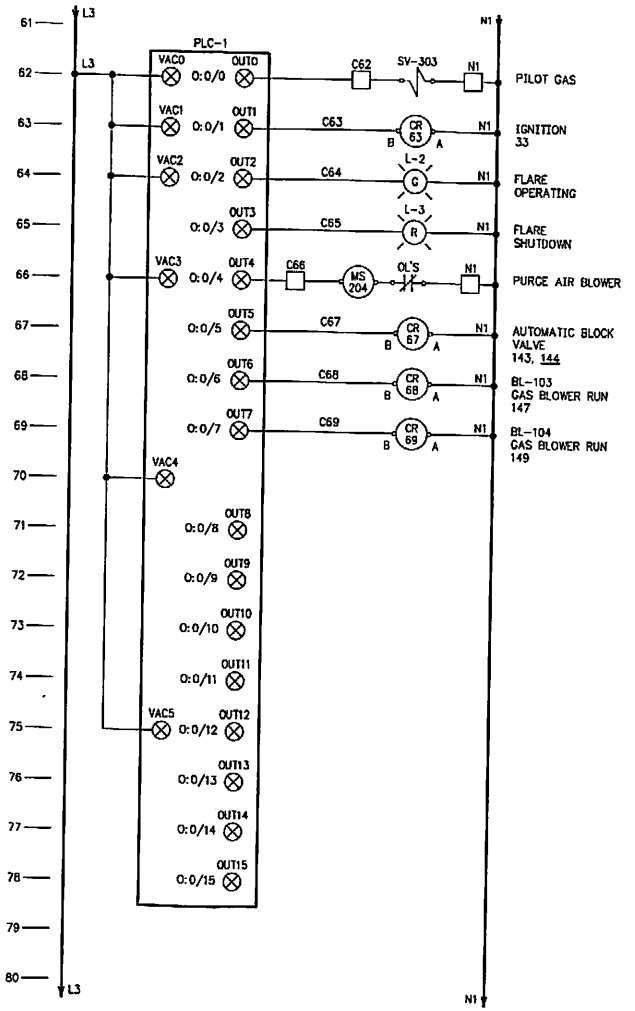
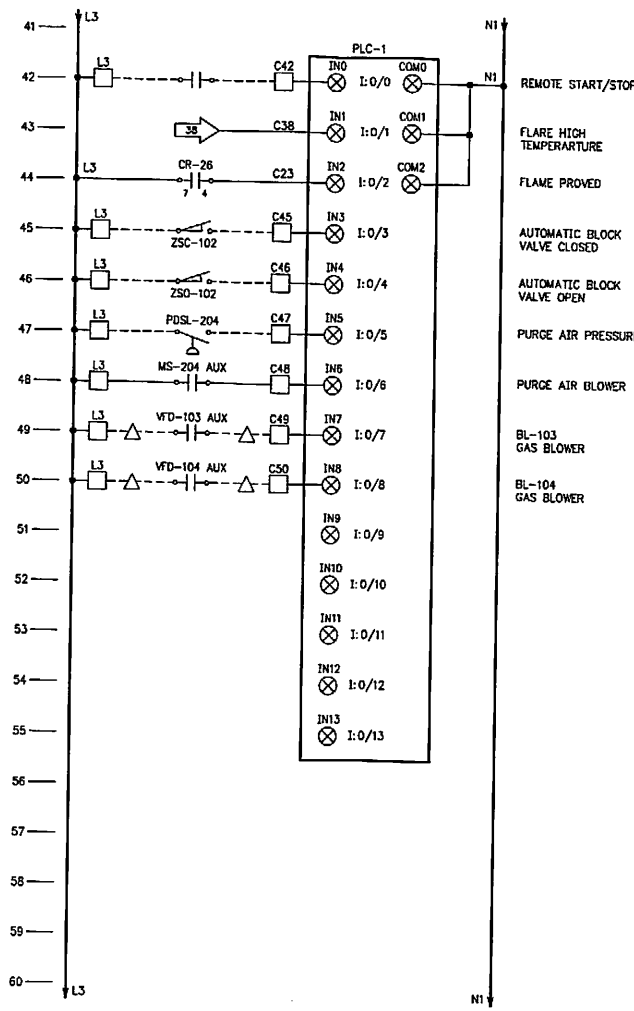
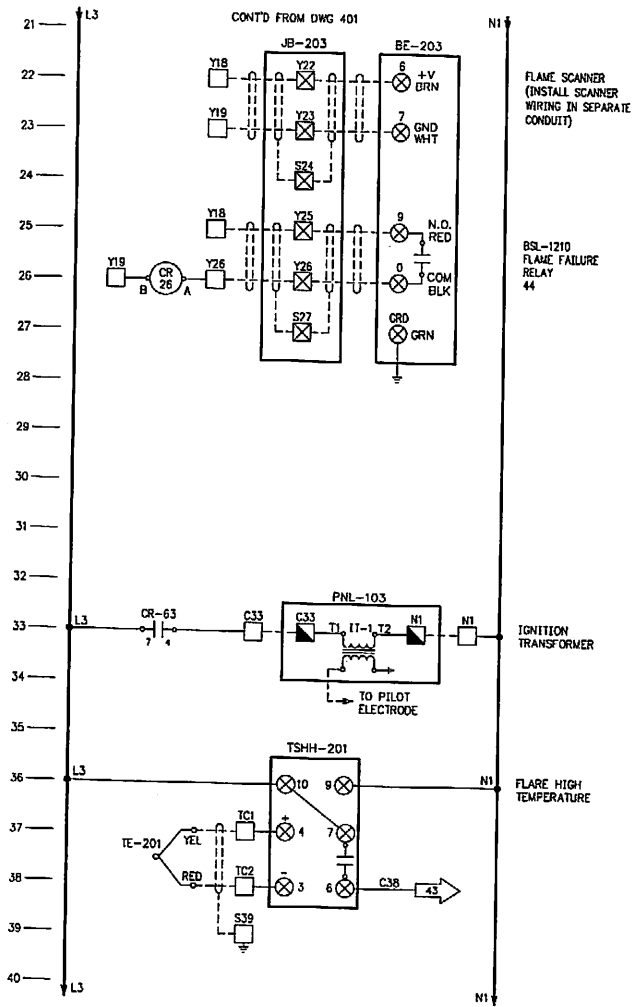
6. ALL WIRING COLORS TO BE AS FOLLOWS UNLESS INDICATED OTHERWISE:

- 120 V POWER BLACK
- 120 V NEUTRAL WHITE
- GROUND GREEN
- 24 V DC POWER BLUE
- 24 V DC COMMON YELLOW
- SHIELDED ANALOG SIGNAL BLACK
- SHIELDED ANALOG COMMON WHITE



CONT'D ON DWG. 402

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<p>S.O. NO. BF-9109403 P.O. NO. 00233010LR</p>				<p>PNL-101 WIRING DIAGRAM FOR AN ENCLOSED ZTof FLARE SYSTEM</p>		
DR.	REV.	DATE: 9-10-10	CERTIFIED	DRAWING NUMBER		
OK.	AJ	DATE: 9-24-10		D-F-9109403-401		
APP.	AJ	DATE: 9-24-10		SCALE	REV. 0	
				NONE	1 of 1	

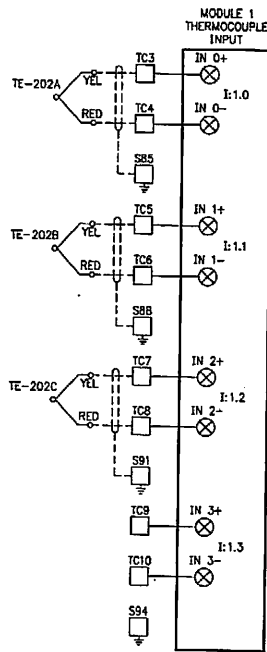


CONTD ON DWG 403

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FOR: MARK HELETI CONTRACTORS USER: SLOBBRY LAUFFEL JOBSITE: WALLA WALLA, WA S.O. NO. 0F-9109403 P.O. NO. 0023010101R			
JOHN ZINK JOHN ZINK COMPANY LLC PARTS AND SERVICE CALL 1-800-735-4292 FAX (509) 234-1988 PNL-101 WIRING DIAGRAM FOR AN ENCLOSED ZTDF FLARE SYSTEM			
NO.	REV	DATE	BY
1	01	9-10-10	RPJ
2	02	9-24-10	AJ
3	03	9-24-10	AJ

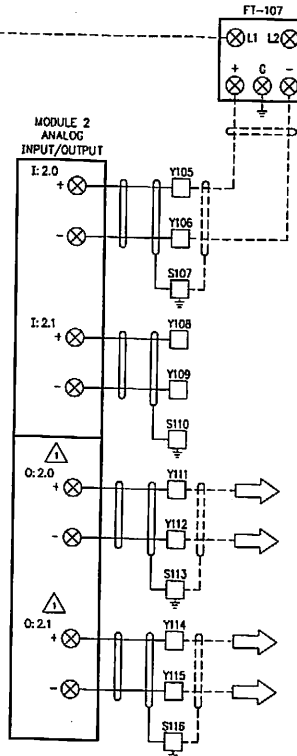
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CONTD FROM DWG 402



TOP THERMOCOUPLE CONTROL
MIDDLE THERMOCOUPLE CONTROL
BOTTOM THERMOCOUPLE CONTROL

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102
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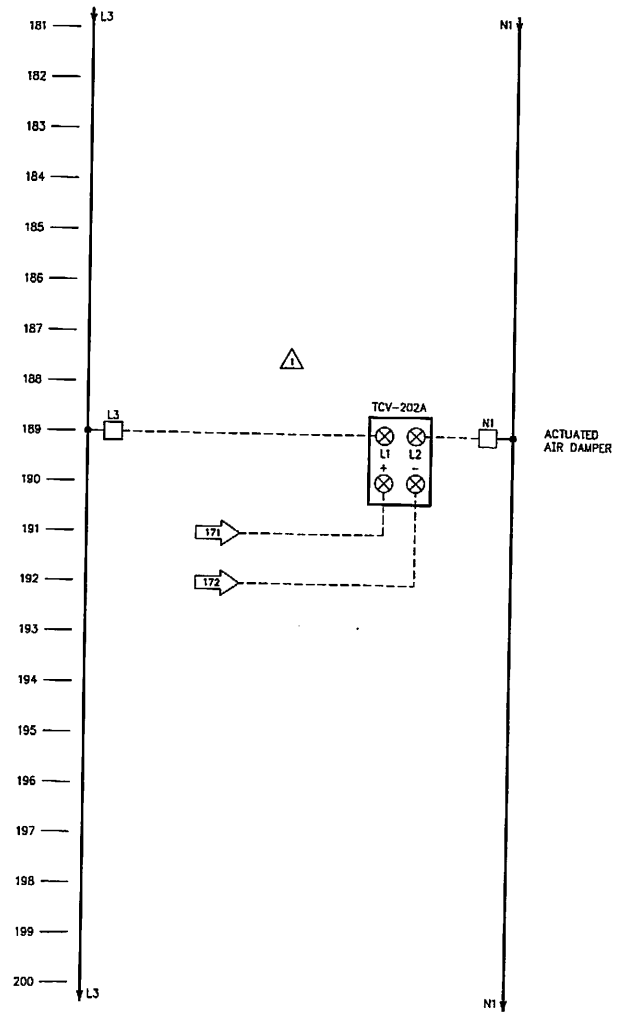
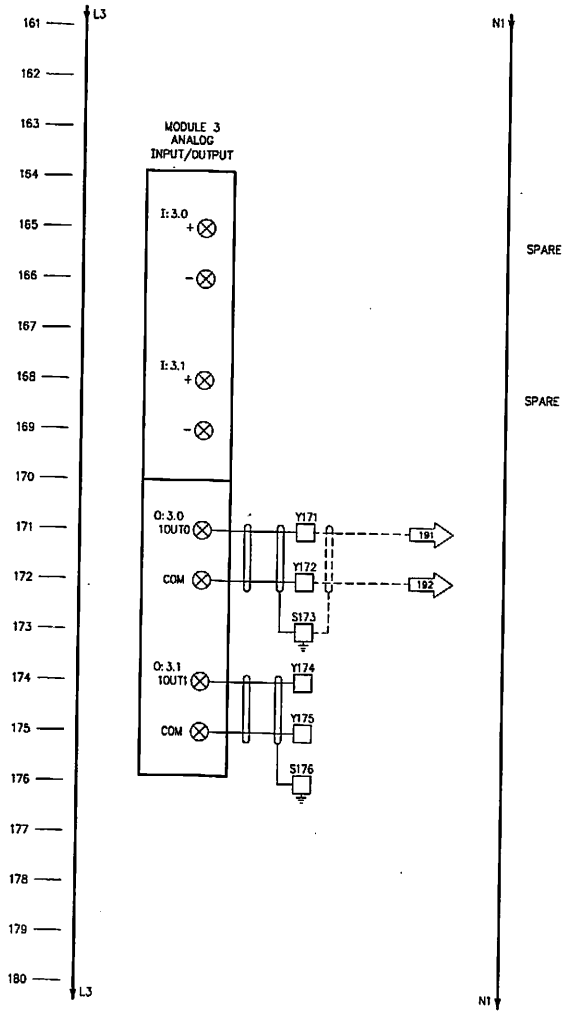
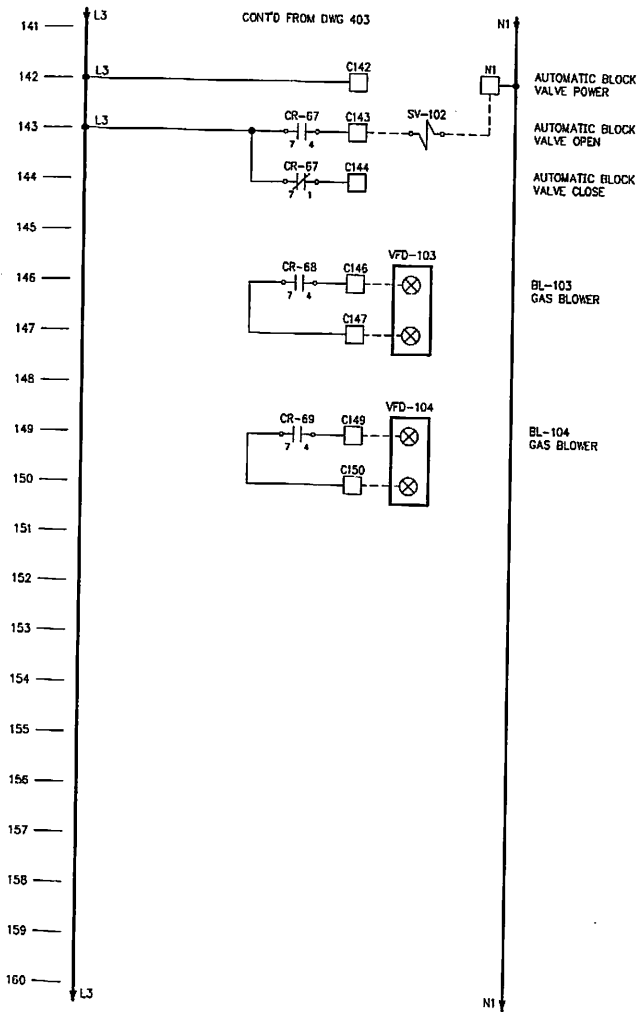


FLOW METER
GAS FLOW
GAS FLOW TO CUSTOMER RECORDER
FLARE TEMPERATURE TO CUSTOMER RECORDER

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CONTD ON DWG 404

DR. RPJ DATE: 8-10-10 CK. AJ DATE: 8-24-10		CERTIFIED DRAWING NUMBER: D-F-8108403-403 SCALE: NONE	
REVISION DESCRIPTION 1 REVISED PER CUSTOMER CHANGE FOR #01		RPJ AJ AJ 11-10-10	DATE: 8-24-10
FOR: MARK HEUETT CONTRACTORS USER: SLOBURY LANDFILL JOBSITE: WALLA WALLA, WA P.O. NO. 002320H0LDR S.O. NO. 8F-8108403 JOHN ZINK COMPANY LLC PARTS AND SERVICE: CALL 1-800-755-4100 FAX (818) 234-1868 PNL-101 WIRING DIAGRAM FOR AN ENCLOSED ZTOP FLARE SYSTEM			



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<p>FOR: MARK HELETTI CONTRACTORS USER: SLOSBURY LANDFILL JOB SITE: WALLA WALLA, WA P.O. NO. 09-9108403 P.O. NO. 0932010378</p>									
<p>DR. RPJ DATE: 9-10-10 OK. AJ DATE: 9-24-10 BY: OK APP. DATE: 9-24-10</p>									
<p>1 REVISED PER ENGINEERING</p>									
<p>REVISION DESCRIPTION</p>									
<p>DR. RPJ DATE: 9-10-10 OK. AJ DATE: 9-24-10 BY: OK APP. DATE: 9-24-10</p>									
<p>FOR AN ENCLOSED ZTDF FLARE SYSTEM</p>									
<p>JOHN ZINK COMPANY LLC PARTS AND SERVICE, CALL 1-800-785-4202 FAX (509) 234-1958 PWL-103 WIRING DIAGRAM</p>									
<p>CERTIFIED DRAWING NUMBER D-F-9108403-404 SCALE NONE 1 of 1</p>									

XIII. SPECIFICATION SHEETS

Project Spec Sheet List

Project # 9109403 Project Site SUDBURY LANDFILL
 Description FBF ZTOF040X40LF 0000 0000
 Customer MARK HEUETT CONTRACTORS
 Location WALLA WALLA, WA
 Cust. PO # LTR 08-23-10

Spec	Page	Of	Revision	Description	Spec Name
1	1	5	0	PNL-101	FLARE CONTROL PANEL
1	2	5	0	PNL-101	FLARE CONTROL PANEL
1	3	5	0	PNL-101	FLARE CONTROL PANEL
1	4	5	0	PNL-101	FLARE CONTROL PANEL
1	5	5	0	PNL-101	RECEIVER INSTRUMENTS
2	1	1	0	PNL-103	IGNITION TRANSFORMER
3	1	2	0	JB-203	JUNCTION BOX
3	2	2	0	BE-203	FLAME DETECTION SYSTEM
4	1	5	0	PR-101	PANEL RACK
4	2	5	0	PCV-302	PRESSURE CONTROL VALVES & REGULATORS
4	3	5	0	SV-303	SOLENOID VALVES
4	4	5	0	HV-304	MANUAL BALL VALVE
4	5	5	0	PI-305	PRESSURE GAGES
5	1	1	0	TCV-202A	ACTUATED CONTROL DAMPER
6	1	1	0	TE-201, TE-202A, TE-202B, TE-202C	THERMOCOUPLES & THERMOWELLS
7	1	1	0	PDSL-204	PRESSURE SWITCHES
8	1	1	0	BL-204	PURGE AIR BLOWER
9	1	1	0	SOV-102, SV-102, ZSC-102, ZSO-102	ACTUATED BUTTERFLY VALVE
10	1	1	0	FA-107	FLASH - BACK ARRESTOR
11	1	1	0	FE-107, FT-107	MASS FLOW METER
12	1	1	0	LG-101	GAGE GLASSES AND COCKS
13	1	1	0	PDI-101	PRESSURE GAGES



JOHN ZINK
JOHN ZINK COMPANY LLC

JZ SPECIFICATION SHEET
FLARE CONTROL PANEL

PNL-101

Spec	Rev	1	0
Page No.	1 of 5		
Project	9109403		

FOR JZ PARTS: (918)234-2751

Project Name: FBF ZTOF040X40LF 0000 0000

Customer Name: MARK HEUETT CONTRACTORS

Project Site: SUDBURY LANDFILL

Customer P.O.: LTR 08-23-10

	Item No.	Qty	Tag Number(s)	Description	JZ Part No.
1	1	1	CE-101	HOFFMAN #C-SD36308 ENCLOSURE, NEMA 4	9000000
2				(36" H X 30" W X 8" D)	A01
3	2	1	----	HOFFMAN #CMFK MOUNTING KIT	----
4	3	1	----	HOFFMAN #C-P3630 SUBPANEL	----
5	4	1	----	HOFFMAN #AWDF2416N4 WINDOW KIT, HINGED, NEMA 4	----
6				(16" H X 24" W)	
7	5	1	HTR-1	HOFFMAN #D-AH4001B HEATER, 400 W	----
8	6	1	GFI-1	LEVITON #7599-I RECEPTACLE, GFCI, 15 A WITH	----
9				#80401-I COVER AND APPLETON #4CS1/2 BOX	
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					

25 Notes:

ALL ITEMS REQUIRE UL LABEL

PANEL MOUNT

Revision	Date	Initials	Revision Description	Date	Name
△				Prepared	09/02/2010 JONES6A
△				Checked	09/13/2010 JONES6A
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Project Name: FBF ZTOF040X40LF 0000 0000	Customer Name: MARK HEUETT CONTRACTORS
Project Site: SUDBURY LANDFILL	Customer P.O.: LTR 08-23-10

	Item No.	Qty	Tag Number(s)	Description	JZ Part No.
1	1	1	L-1	CUTLER HAMMER #10250T181NC12N PILOT LIGHT,	----
2				TRANSFORMER TYPE, NEMA 4X, 120 V, WHITE LENS	
3	2	1	L-2	CUTLER HAMMER #10250T181NC8N PILOT LIGHT,	----
4				TRANSFORMER TYPE, NEMA 4X, 120 V, GREEN LENS	
5	3	1	L-3	CUTLER HAMMER #10250T181NC7N PILOT LIGHT,	----
6				TRANSFORMER TYPE, NEMA 4X, 120 V, RED LENS	
7					
8					
9					
10					
11					
12	4	1	S-1	CUTLER HAMMER #10250T20KB SELECTOR SWITCH, TWO	----
13				POSITION , NEMA 4X, 1-N/O AND 1-N/C CONTACTS	
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					

25 Notes:

ALL ITEMS REQUIRE UL LABEL
PANEL MOUNT

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Project Name: FBF ZTOF040X40LF 0000 0000

Customer Name: MARK HEUETT CONTRACTORS

Project Site: SUDBURY LANDFILL

Customer P.O.: LTR 08-23-10

	Item No.	Qty	Tag Number(s)	Description	JZ Part No.
1	1	1	PLC-1	ALLEN BRADLEY #1762-L40AWAR MICROLOGIX PROCESSOR	1157192
2				WITH DUAL RS-232 PORTS	
3	2	1	PLC-1	ALLEN BRADLEY #1762-IT4 THERMOCOUPLE INPUT MODULE	1127113
4	3	2	PLC-1	ALLEN BRADLEY #1762-IF2OF2 ANALOG INPUT AND OUTPUT	1127117
5				MODULE	
6	4	1	PLC-1	ALLEN BRADLEY #1762-NET-ENI ETHERNET MODULE	1212476
7					
8					
9	5	1	OIP-1	AUTOMATION DIRECT #EA7-S6M TOUCHSCREEN, NEMA 4,	---
10				CAPABLE OF MEMORY MODULE EXPANSION	
11	6	1	----	AUTOMATION DIRECT #EZ-MLOGIX-CBL CABLE	----
12	7	1	PS-1	PHOENIX #2938730 POWER SUPPLY, 24 V DC,	----
13				48 W, 120 V	
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					

25 Notes:

ALL ITEMS REQUIRE UL LABEL
PANEL MOUNT

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Project Name: FBF ZTOF040X40LF 0000 0000	Customer Name: MARK HEUETT CONTRACTORS
Project Site: SUDBURY LANDFILL	Customer P.O.: LTR 08-23-10

	Item No.	Qty	Tag Number(s)	Description	JZ Part No.
1	1	75	----	PHOENIX #3004362 TERMINAL	----
2	2	10	----	PHOENIX #0441504 GROUND TERMINAL	----
3	3	2	----	PHOENIX #3003020 END PLATE	----
4	4	2	----	PHOENIX #0800886 END STOP	----
5	5	1	----	PHOENIX #1051003 MARKER	----
6	6	1	----	PHOENIX #0801733 TRACK	----
7	7	10	----	ENTRELEC MTC6 TERMINAL (P/N 115 206.22)	----
8	8	2	----	PHOENIX #3006043 TERMINAL	----
9	9	1	----	PHOENIX #0443023 GROUND TERMINAL	----
10	10	2	----	PHOENIX #3006027 END PLATE	----
11					
12	11	1	CB-4	SQUARE D #60131 CIRCUIT BREAKER, 25 A	----
13	12	2	CB-2,11	SQUARE D #60110 CIRCUIT BREAKER, 10 A	----
14	13	1	CB-10	SQUARE D #60106 CIRCUIT BREAKER, 5 A	----
15					
16	14	1	MS-204	SQUARE D #LC1D12G7 MOTOR STARTER FOR 3/4 HP	----
17				120 V, 60 HZ MOTOR, 120 V COIL	
18	15	1	----	SQUARE D #LRD21 OVERLOAD RELAY, 12 TO 18 A	----
19				ADJUSTABLE RANGE	
20					
21	16	4	CR-63 67 68 69	IDEC #RR3B-ULCAC120V RELAY, 3 PDT WITH INDICATING	----
22				LIGHT AND PUSH-TO-TEST BUTTON	
23	17	4	----	IDEC #SR3B-05 SOCKET	----
24					

25 Notes:

ALL ITEMS REQUIRE UL LABEL
PANEL MOUNT

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Project Name: FBF ZTOF040X40LF 0000 0000	Customer Name: MARK HEUETT CONTRACTORS
Project Site: SUDBURY LANDFILL	Customer P.O.: LTR 08-23-10

GENERAL	1	Service	TEMPERATURE		INPUTS	25	Input Signals	TYPE K THERMOCOUPLE		
	2					26	No. of Inputs	1		
	3	Function	SWITCH			27	Power for XMTRS			
	4	Case	Color			28	Transmitter Spec. No.			
	5	Mounting	INTERNAL			29	Burnout	UPSCALE		
	6					30				
	7	Enclosure Class	General Purpose			31				
	8	Power Supply	117 V 60 Hz			32				
	9	Chart				33	Alarm Switches: Qty	Form	1	
	10					34	Rating	8 A		
	11	Chart Drive				35	Function	Meas. Var.		
	12	Scales				36	Contact	on Measurement	Open	Increase
	13					37				
CONTROLLER	14	P=Prop(Gain), I=Integral(Auto Reset), D=Derivative(Rate), Sub: s=Slow, f=Fast			OPTIONS	38				
	15	Control Modes				39				
	16	Action				40				
	17	Auto-Man Switch				41				
	18	Set Point Adj.				42				
	19	Manual Reg.				ORDER	43	Manufacturer	WATLOW	
	20	Output					44	Model No.	CV-C6KH-0000-2500-D	
	21						45	Tag No.	TSHH-201	
	22						46	Quantity	1	
	23						47	Mount	PANEL	
	24						48	JZ Part No.	----	

49 Notes:

ALL ITEMS REQUIRE UL LABEL

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Project Name: FBF ZTOF040X40LF 0000 0000	Customer Name: MARK HEUETT CONTRACTORS
Project Site: SUDBURY LANDFILL	Customer P.O.: LTR 08-23-10

TRANSFORMER	1	Manufacturer	DONGAN	ENCLOSURE	13	Manufacturer	KILLARK
	2	Model	A06-SA6		14	Model	XJB-5106
	3	Tag No.	IT-1		15	Enclosure	NEMA 7
	4	Primary	120 V, 60 HZ		16	Dimensions	5" W X 10" H X 6" D
	5	Secondary	6000 V		17	JZ Part No.	0003653
	6	JZ Part No.	0002558		18		
	7				19	Sub-Panel Manufacturer	KILLARK
	8				20	Sub-Panel Model No	7998-4
	9				21	JZ Part No.	0901135
	10				22		
	11				23		
	12				24	Mount	BELOW

25 Notes:

QUANTITY: ONE (1) ASSEMBLY REQUIRED

ALL ITEMS REQUIRE UL LABEL

PANEL MOUNT, THEN SHIP LOOSE FOR FIELD INSTALLATION

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Project Name: FBF ZTOF040X40LF 0000 0000	Customer Name: MARK HEUETT CONTRACTORS
Project Site: SUDBURY LANDFILL	Customer P.O.: LTR 08-23-10

Item No.	Qty	Tag Number(s)	Description	JZ Part No.
1	1	CE-203	HOFFMAN #A1412NF ENCLOSURE, NEMA 4 (14" H X 12" W X 6" D)	0015278
2				
3	1	----	HOFFMAN #A14P12 SUBPANEL	0003527
4	1	----	HUBBELL #SHC1023 CORD CONNECTOR, ALUMINUM, 1/2" NPT HUB FOR 3/8" DIAMETER CABLE COMPRESSION	1101680
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				

25 Notes:

ALL ITEMS REQUIRE UL LABEL
INSTALL CORD CONNECTOR IN BOTTOM OF ENCLOSURE
PANEL MOUNT, THEN SHIP LOOSE FOR FIELD INSTALLATION

Revision	Date	Initials	Revision Description	Date	Name
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Project Name: FBF ZTOF040X40LF 0000 0000	Customer Name: MARK HEUETT CONTRACTORS
Project Site: SUDBURY LANDFILL	Customer P.O.: LTR 08-23-10

FLAME SCANNER	1	Manufacturer	COEN	JZ Part No.
	2	Model No.	DSF-2000-SB	2653-213-05
	3	Quantity	1	
	4	Type	Ultra-Violet	
	5		SELF-CHECKING	
	6	Power Requirement	24 V DC	
	7	Cable	10' LENGTH	
	8	Mounting Connection	1" NPT (PROCESS), 1/2" NPT (CONDUIT)	
	9	Tag Number(s)	BE-203	
	10			
	11			
	12	Electrical Classification	CLASS 1, DIVISION 1, GROUP D	
	13	Mount	SHIP LOOSE FOR FIELD INSTALLATION	

FLAME RELAY	14	Manufacturer		
	15	Model No.		
	16	Quantity		
	17	Description		
	18			
	19			
	20	Power Requirement		
	21	Amplifier		
	22	Wiring Base		
	23	F.F.R.T.		
24				
25				
26	Tag No.(s)			
27	Mount			

28 Notes:

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Project Name: FBF ZTOF040X40LF 0000 0000
Project Site: SUDBURY LANDFILL

Customer Name: MARK HEUETT CONTRACTORS
Customer P.O.: LTR 08-23-10

	Item No.	Qty	Tag Number(s)	Description	JZ Part No.
1	1	25'	---	DELCO #440 IGNITION WIRE, HIGH VOLTAGE	0002167
2	2	400'	---	THERMO SENSORS #PPZS16KX THERMOCOUPLE WIRE,	0403529
3				16 GAGE SHIELDED, MOISTURE RESISTANT	
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					

25 Notes:

ALL ITEMS REQUIRE UL LABEL
SHIP LOOSE FOR FIELD INSTALLATION

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Project Name: FBF ZTOF040X40LF 0000 0000				Customer Name: MARK HEUETT CONTRACTORS						
Project Site: SUDBURY LANDFILL				Customer P.O.: LTR 08-23-10						
LINE	1	Service	PROPANE / NATURAL GAS		28	Filt. Reg.	Supply Gage	NO	NO	
	2	Line No./Vessel No.			29	Line Strainer				
	3	Line Size/Sched. No.	1/2"		30	Housing Vent				
	4	Function	PILOT GAS		31	Internal Relief		NO		
BODY	5	Type of Body	REGULATOR		32					
	6	Body Size	Port Size	1/2"	33					
	7	Guiding	No. of Ports	2	34					
	8	End Conn. & Rating	1/2" NPT		SERVISE	35	Flow Units	SCFH		
	9	Body Material	ALUMINUM.			36	Fluid	PROPANE / NATURAL GAS		
	10	Packing Material				37	Quant. Max	25 / 50		
	11	Lubricator	Isolating Valve			38	Quant. Oper.	22 / 45		
	12	Seal Type				39	Valve Cv	Valve 1	1.33	35.02
	13	Trim Form				40	Norm. Inlet Press.	ΔP	20 PSIG	
	14	Trim Material				41	Max. Inlet Press.	400 PSIG		
15	Seat Material	NITRILE		42		Max. Shut Off ΔP				
16	Required Seat Tightness			43		Temp. Max.	Operating	180	60	
17	Max. Allow. Sound Level dBA			44		Oper. sp. gr.	Mol. Wt.	1.52 / 0.65		
ACTUATOR	18	Type of Actuator	SPRING DIAPHRAGM		45	Oper. Visc.	% Flash			
	19	Pilot			46	% Superheat	% Solids			
	20	Supply to Pilot			47	Vapor Press.	Crit. Press.			
	21	Self Cont.	Ext. Conn.	X	48	Predicted Sound Level dBA				
	22	Diaphragm Material	NITRILE		49					
	23	Diaphragm Rating			ORDER	50	Manufacturer	FISHER		
	24	Spring Range	0 TO 35 PSIG			51	Model No.	67D-27		
	25	Set Point	15 PSIG			52	Mount	RACK		
	26					53	Tag No.	PCV-302		
	27					54	JZ Part No.	1260113		

55 Notes:

QUANTITY: ONE (1) REQUIRED

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Project Name: **FBF ZTOF040X40LF 0000 0000** Customer Name: **MARK HEUETT CONTRACTORS**
Project Site: **SUDBURY LANDFILL** Customer P.O.: **LTR 08-23-10**

GENERAL	1	Tag No.	SV-303		SOLENOID	28	Enclosure	NEMA 4,7		
	2	Service	PILOT GAS			29	Voltage / HZ	120 V	60	
	3					30	Style of Coil	F		
	4	Line No. / Vessel No.				31	Single or Double Coil			
	5	Quantity	1			32				
VALVE BODY	6	Type			SERVICE COND.	33				
	7	Size: Body	Port	1/2"		3/4"	34	Fluid	PROPANE	NATURAL GAS
	8	Rating	Type Conn.			NPT	35	Qty. Maximum	25 SCFH	50 SCFH
	9	Material -- Body	ALUMINUM			36	Oper. Diff. Min / Max	0	20 PSIG	
	10	Material -- Seat	NITRILE			37	Allow. Diff. Min / Max	0	50 PSIG	
	11	Material -- Diaphragm	NITRILE			38	Temp. Norm / Max. F	60	125	
	12	Operation Direct/ Pilot	DIRECT			39	Oper. sp. gr.	1.52	0.65	
	13	Packless or Type Packed	PACKLESS			40	Oper. Viscosity			
	14	Manual Re-Set	NO			41	Required Cv			
	15	Manual Operator				42	Valve Cv	4.4		
	16					43				
	17					44				
WHEN DE-ENERGIZED	18	2-Way Valve Opens/Close		CLOSES	45					
	19	3-Way			46					
	20	Vent Port Opens/Close			47					
	21	Press Port Opens/Clos			48					
	22	4-Way			49					
	23	Press to Cyl.1 / Cyl.2			50					
	24	Exh. from Cyl.1 / Cyl.2			51	Manufacturer	ASCO			
	25				52	Model No.	EF8215G20			
	26				53	Mount	RACK			
	27				54	JZ Part No.	0012004			

55 Notes:

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Project Name: **FBF ZTOF040X40LF 0000 0000**
Project Site: **SUDBURY LANDFILL**

Customer Name: **MARK HEUETT CONTRACTORS**
Customer P.O.: **LTR 08-23-10**

1	Manufacturer	APOLLO
2	Model No.	73A-103-01
3	Process Connections	THREADED
4	Body Material	CARBON STEEL
5	Ball Material	CARBON STEEL
6	Stem Material	CARBON STEEL
7	Seal/Seat Material	TFE/TFE
8	Packing Material	TFE
9	Handle Type	LEVER
10		
11		
12		

34 Notes:

13	Qty	Tag No.	Size	Oper. Press. PSIG	Oper. Temp. ° F	Service	Mount	JZ Part No.
14	1	HV-304	1/2"	15	60	PILOT GAS	RACK	0501519
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								
32								
33								

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Project Name FBF ZTOF040X40LF 0000 0000	Customer Name MARK HEUETT CONTRACTORS
Project Site SUDBURY LANDFILL	Customer P.O.: LTR 08-23-10

1 Type	Direct	13 Process Connection	1/2" BOTTOM
2 Mount Type	Local	14 Operating Temperature	60 F
3 Dial Diamete	4 1/2"	15 OPTIONS	
Color	WHITE	16	
4 Case Material	Phenol	17	
5 Ring Type	Screwed	18	
6 Blow-Out Protection	Back	19	
7 Lens Material	Plastic	20	
8 Accuracy Required	+/- 0.5%	21	
9 Element Type	Bourdon	22	
10 Element Materia	SS	23 Manufacturer	WIKA
11 Socket Material	Steel	24 Model No.	222.34 4.5 30PSI 1/2L
12 Movement Material	SS		

	Quantity	Tag No	Range PSIG	Oper. Press. PSIG	Service	JZ Part No
25						
26	1	PI-305	0 TO 30	15	PILOT GAS	1209636
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						
41						
42						
43						
44						

45 Notes:

RACK MOUNT

Revision	Date	Initials	Revision Description	Date	Name
△				09/02/2010	JONES6A
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△				09/13/2010	JONES6A
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Project Name: **FBF ZTOF040X40LF 0000 0000** Customer Name: **MARK HEUETT CONTRACTORS**
Project Site: **SUDBURY LANDFILL** Customer P.O.: **LTR 08-23-10**

D A M P E R	1	Tag No.	TCV-202A						
	2	Service	AIR						
	3	Manufacturer	AMERICAN WARMING						
	4	Line Size/Sched. No.							
	5	Type of Body	VC-412 OPPOSE BLADE						
	6	Body Size	36" H x 36" W						
	7	Port Size							
	8	End Conn. and Rating							
	9								
M A T E R I A L S	10	Body	GALVANIZED						
	11	Disc							
	12	Shaft							
	13	Bushing							
	14	Trim: Seat							
	15	Packing							
	16								
	17								
	18	Required Seat Tightness							
S E R V I C E	20	Temp °	Max	Min	AMBIENT				
	21	Press.	Max	Min	AMBIENT				
	22	Maximum Shut Off Δ /Pressure							
	23	Max Flow	Cv (Cg)						
	24	Norm. Flow	Cv (Cg)						
	25								
A C T U A T O R	26	Manufacturer	WORCESTER						
	27	Model No.	12H755Z120A20AF4174						
	28	Type	ELECTRIC						
	29								
30									
31									
32	Quantity	1							
33	Location	SHIP LOOSE							
34	JZ Part No.	9109403A05							

35 Notes:

ACTUATED DAMPER TO OPEN AT 4 MA INPUT AND CLOSE AT 20 MA INPUT.

ALSO SUPPLY HONEYWELL #4074ERU GASKET
JOHN ZINK PART NUMBER: 9019000445
QUANTITY: ONE (1) REQUIRED

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Project Name: **FBF ZTOF040X40LF 0000 0000** Customer Name: **MARK HEUETT CONTRACTORS**
Project Site: **SUDBURY LANDFILL** Customer P.O.: **LTR 08-23-10**

ELEMENT	1	Manufacturer	THERMO SENSORS		11	Material	INCONEL 600			
	2	Model No.	494-92716-18-K-1600		12	Construction	STRAIGHT PIPE			
	3	ISA Type	Wire Size	K	14 AWG	13	O.D. Dim.	I.D. Dim.	0.840"	0.622"
	4	Sheath O.D.	Sheath Mat'l	3/8"	INC 600	14	Process Conn.	Internal Conn.	1" NPT	
	5	Type	Ungrounded		15					
HEAD	6	Material	CAST IRON		16	Nipple Length "N"				
	7	Conduit Connection	3/4"		17					
	8	Terminal Block	Single		18	Manufacturer				
	9				19	Model				
	10				20					

	Tag No.	Well Dimes.		Element Length	Single Duplex	Type	Gage	Service	JZ Part No.
		"U"	"T"						
21									
22	TE-201			18"	SINGLE	K	14	HIGH TEMPERATURE	1099113
23	TE-202A			18"	SINGLE	K	14	TEMPERATURE CONTROL	1099113
24	TE-202B								
25	TE-202C								
26									
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									

37 Notes:

QUANTITY: FOUR (4) ASSEMBLIES REQUIRED

SHIP LOOSE FOR FIELD INSTALLATION

Revision	Date	Initials	Revision Description	Date	Name
△				Prepared	09/02/2010 JONES6A
△				Checked	09/13/2010 JONES6A
△				Approved	09/13/2010 JONES6A
△				Quote Attached: <input type="checkbox"/> Yes	Copies of Vendor Literature Req'd: 1

Project Name: FBZ ZTOF040X40LF 0000 0000 Customer Name: MARK HEUETT CONTRACTORS
Project Site: SUDBURY LANDFILL Customer P.O.: LTR 08-23-10

GENERAL	1	Type	Press	11	Type	Snap
	2	Setting	Field	12	Quantity	Single
	3	Dead Band	Fixed	13	Form	SPDT
	4			14	Rating	15 A / 120 V / 60 HZ
	5			15	Load	Non-inductive
ELEMENT	6	Type	Diaphragm	16	Enclosure	Expl. Proof
	7	Material	RUBBER	17	Conduit Connection	1/2" NPT
	8	Connection	1/8" NPT BOTTOM	18		
	9	Mounting	Local	19	Manufacturer	DWYER
	10			20	Model	1950-1-2F

	Tag No.	Process Cond.	Adj. Range	Set Point		Operating		Service	Mount	JZ Part No.
				Process	Signal	Temp. O F	Press. PSI			
21										
22	PDSL-204	Increase	0.4 TO 1.6"	0.5"		AMB.	ATM.	PURGE AIR	FIELD	0024372
23										
24										
25										
26										
27										
28										
29										
30										
31										
32										
33										
34										
35										

36 Notes:

QUANTITY: ONE (1) REQUIRED

Revision	Date	Initials	Revision Description	Date	Name
Δ				Prepared	09/02/2010 JONES6A
Δ				Checked	09/13/2010 JONES6A
Δ				Approved	09/13/2010 JONES6A
Δ				Quote Attached: <input type="checkbox"/> Yes	Copies of Vendor Literature Req'd: 1



JOHN ZINK

JOHN ZINK COMPANY LLC

FOR JZ PARTS: (918)234-2751

JZ SPECIFICATION SHEET

PURGE AIR BLOWER

BL-204

Spec Rev 8 0

Page No. 1 of 1

Project 9109403

Project Name: FBF ZTOF040X40LF 0000 0000

Customer Name: MARK HEUETT CONTRACTORS

Project Site: SUDBURY LANDFILL

Customer P.O.: LTR 08-23-10

1

PURGE AIR BLOWER

MANUFACTURER: AMERICAN FAN COMPANY
MODEL: SC-800
QUANTITY: ONE (1) REQUIRED

ARRANGEMENT: 4-FM
MOTOR: 3/4 HP, 1800 RPM, TOTALLY ENCLOSED EXLOSIONPROOF (TEXP),
56-C FRAME
120/240 V AC, SINGLE PHASE, 60 HZ
SPEED: 1750 RPM @ 0.5 BHP
DUTY: 700 CFM @ 1.7" H₂O
TEMPERATURE: 100 °F

ACCESSORIES: OUTLET FLANGE, INLET SCREEN, 50% CUTOFF DAMPER, DRAIN

JOHN ZINK PART NUMBER: 1063304
TAG: BL-204

SHIP LOOSE FOR FIELD INSTALLATION

Revision	Date	Initials	Revision Description	Date	Name
△				Prepared	09/02/2010 JONES6A
△				Checked	09/13/2010 JONES6A
△				Approved	09/13/2010 JONES6A
△				Quote Attached: <input type="checkbox"/> Yes	Copies of Vendor Literature Req'd: 1

Project Name: **FBF ZTOF040X40LF 0000 0000** Customer Name: **MARK HEUETT CONTRACTORS**
Project Site: **SUDBURY LANDFILL** Customer P.O.: **LTR 08-23-10**

GENERAL	1	Tag No.	SOV-102		POSITIONER	28	Manufacturer	
	2	Service	LANDFILL GAS			29	Model	
	3	Line No./Vessel No.				30	Signal Supply Requirement	
	4	Line Size/Sched. No.	6"			31	Input Signal	
TYPE	5	Type of Body	Body Size	WAFER	6"	32	Output Signal	
	6	Port Size	Valve Cv	6"		33	Electrical Rating	
	7	Shaft Diameter				34		
	8	Face to Face Dimension				35	Filter Regulator	
	9	End Conn. and Rating		6" 150 LB RF		36	Gage Set	
MATERIALS	10	Body		CARBON STEEL		37	Mechanical Travel Stop	
	11	Disc		316 STAINLESS STEEL		38	Instr. Tubing Requirements	STAINLESS STEEL
	12	Shaft		17-4 PH STAINLESS STEEL		39	Position Switch ZSC/O-102	TOPWORX #DXP-M21GNEB
	13	Bushing				40	Solenoid Valve SV-102	ASCO #EF8320G184 120V/60H
	14	Trim Form				41	Other Accessories	SPEED CONTROL VALVE
	15	Trim:	Seat	PTFE		42		
	16		Seal			43		
	17		Packing			44		
	18	Seat Leakage Classification				45	Fluid Type	LANDFILL GAS
ACTUATOR	20	Manufacturer		BETTIS		46	Operating Temperature Range	40 TO 100 F
	21	Model		DS350SR3		47	Operating Flow Rate Range	0 TO 350 SCFM
	22	Type (Pneumatic/Electrical)		PNEUMATIC		48	Operating Pressure Range	-40" H2O
	23	Input Signal (Max/Min)				49	Maximum Shut Off Δ /Pressure	
	24	Action (Spring Return/Double)		SPRING RETURN		50		
	25	Actuator/Valve Orientation				51	Manufacturer	XOMOX
	26	Failure Mode		CLOSED		52	Model Number	6" 801-267-ST2
	27	Minimum Supply Pressure		100 PSIG		53	Mount	SKID
					54	JZ Part No.	1060723	

55 Notes:

QUANTITY: ONE (1) ASSEMBLY REQUIRED

Revision	Date	Initials	Revision Description		Date	Name
Δ				Prepared	09/02/2010	JONES6A
Δ				Checked	09/13/2010	JONES6A
Δ				Approved	09/13/2010	JONES6A
Δ				Quote Attached: <input type="checkbox"/> Yes	Copies of Vendor Literature Req'd: 1	

Project Name: FBF ZTOF040X40LF 0000 0000

Customer Name: MARK HEUETT CONTRACTORS

Project Site: SUDBURY LANDFILL

Customer P.O.: LTR 08-23-10

1	Manufacturer	ENARDO
2	Model No.	E71006/D-AAF-13
3	Process Connections	125 LB FF
4	Body Material	ALUMINUM
5	Element Materia	ALUMINUM
6	Drain Connection	1/2" NPT WITH PLUG
7	Body Configuration	ECCENTRIC
8		
9		
10		
11		
12		

34 Notes:

TWO (2) 1/2" FNPT TAPS WITH PLUG
REQUIRED, ONE ON EACH SIDE OF
ELEMENT.

13	Qty	Tag No.	Size	Oper. Press. H2O	Oper. Temp. ° F	Service	Mount	JZ Part No.
14	1	FA-107	6"	10"	100	LANDFILL GAS	FIELD	1023686
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								
32								

Revision	Date	Initials	Revision Description	Date	Name
Δ				09/02/2010	JONES6A
Δ				09/13/2010	JONES6A
Δ				09/13/2010	JONES6A
Δ				Quote Attached: <input type="checkbox"/> Yes Copies of Vendor Literature Req'd: 1	



JOHN ZINK
JOHN ZINK COMPANY LLC

JZ SPECIFICATION SHEET

MASS FLOW METER

FE-107, FT-107

FOR JZ PARTS: (918)234-2751

Spec	Rev	11	0
Page No:	1 of 1		
Project	9109403		

Project Name: FBF ZTOF040X40LF 0000 0000

Customer Name: MARK HEUETT CONTRACTORS

Project Site: SUDBURY LANDFILL

Customer P.O.: LTR 08-23-10

1

MASS FLOW METER

MANUFACTURER: THERMAL INSTRUMENT COMPANY
 MODEL: 62-9/9500-I-G-1/2-316SS-PG-120-4/20-ND
 QUANTITY: ONE (1) ASSEMBLY REQUIRED

CONNECTION: 3/4" MALE NPT COMPRESSION FITTING
 (316 STAINLESS STEEL BODY AND FERRULE)

MOUNT: TOP
 PROBE LENGTH: 12"
 TUBE MATERIAL: 316 STAINLESS STEEL

POWER: 120 V, SINGLE PHASE, 60 HZ
 ENCLOSURE RATING: NEMA 7/4X
 ENCLOSURE MATERIAL: ALUMINUM
 TRANSMITTER: INTEGRAL
 OUTPUT: 4 TO 20 MA

SERVICE: LANDFILL GAS (50% CH₄, 50% CO₂)
 PIPE: 6" DIAMETER, SDR 17 HDPE
 (5.814" INSIDE DIAMETER)

MINIMUM FLOW RATE: 0 SCFM
 DESIGN FLOW RATE: 350 SCFM
 MAXIMUM FLOW RATE: 385 SCFM

MINIMUM PRESSURE: 0 PSIG
 DESIGN PRESSURE: 10" H₂O
 MAXIMUM PRESSURE: 1 PSIG

MINIMUM TEMPERATURE: 32 °F
 DESIGN TEMPERATURE: 100 °F
 MAXIMUM TEMPERATURE: 120 °F

JOHN ZINK PART NUMBER: 9109403A11
 TAG NUMBER: FE-107, FT-107

SHIP LOOSE FOR FIELD INSTALLATION

Revision	Date	Initials	Revision Description	Date	Name
Δ				Prepared	09/02/2010 JONES6A
Δ				Checked	09/13/2010 JONES6A
Δ				Approved	09/13/2010 JONES6A
Δ				Quote Attached: <input type="checkbox"/> Yes	Copies of Vendor Literature Req'd: 1



JOHN ZINK

JOHN ZINK COMPANY LLC

FOR JZ PARTS: (918)234-2751

JZ SPECIFICATION SHEET
GAGE GLASSES AND COCKS

LG-101

Spec	Rev	12	0
Page No.		1 of 1	
Project		9109403	

Project Name: FBF ZTOF040X40LF 0000 0000

Customer Name: MARK HEUETT CONTRACTORS

Project Site: SUDBURY LANDFILL

Customer P.O.: LTR 08-23-10

G A G E G L A S S	1	Type	Tubular		G A G E C O C K S	11	Type	Straight	
	2	Connection Type	Top & Bottom			12	Connection Vessel	3/4" NPT	
	3	Connection Size: Vent Drain	3/4"	3/4"		13	Connection: Gage Vent Drain	1/4"	1/4"
	4	Material	316 STAINLESS STEEL			14	Material	316 STAINLESS STEEL	
	5	Minimum Rating	-6 psig at 150 ° F			15	Minimum Rating	-6 psig at 150 ° F	
	6	Options	SHIELDED SIGHT GLASS			16	Construction		
	7	Manufacturer	KENCO			17	Bonnet		
	8	Model	EPG-3/4-22" OAL			18	Options	Ball Checks	
	9					19	Manufacturer	KENCO	
	10					20	Model	KTV-75-SS	

	Qty.	Tag No.	Visible Glass	C.L. Conn.	Model No.	Operating		Service	JZ Part No.
						Temp. ° F	Press. H2O		
21									
22	1	LG-101	18"	24"	BELOW	100	-40"	LANDFILL GAS	BELOW
23									
24									
25									
26									
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									

37 Notes:

DESCRIPTION:	ISOLATION VALVES	SHIELDED SIGHT GLASS
MODEL:	KTV-75-SS	EPG-3/4-22" OAL
QUANTITY:	ONE (1) SET REQUIRED	ONE (1) REQUIRED
JOHN ZINK PART NUMBER:	1004970	1006492

CENTER TO CENTER DISTANCE IS 24" BETWEEN TWO (2) 3/4" DIAMETER FEMALE NPT VESSEL CONNECTIONS.

SKID MOUNT

Revision	Date	Initials	Revision Description	Date	Name
Δ				Prepared	09/02/2010 JONES6A
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Δ				Approved	09/13/2010 JONES6A
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JOHN ZINK

JOHN ZINK COMPANY LLC

FOR JZ PARTS: (918)234-2751

JZ SPECIFICATION SHEET

PRESSURE GAGES

PDI-101

Spec Re 13 0

Page No: 1 of 1

Project 9109403

Project Name FBF ZTOF040X40LF 0000 0000

Customer Name MARK HEUETT CONTRACTORS

Project Site SUDBURY LANDFILL

Customer P.O.: LTR 08-23-10

1	Type	DIRECT		13	Process Connection	1/8" NPT
2	Mount Type	LOCAL		14		
3	Dial Diamete	Color	4-3/4" WHITE	15	OPTIONS	
4	Case Material	ALUMINUM		16		
5	Ring Type	SCREWED		17		
6	Blow-Out Protection	BLOWOUT PLUG		18		
7	Lens Material	PLASTIC		19		
8	Accuracy Required	2%		20		
9	Element Type	DIAPHRAGM		21		
10	Element Materia	SILICONE RUBBER		22		
11	Socket Material			23	Manufacturer	DWYER
12	Movement Material			24	Model No.	2005

	Quantity	Tag No	Range H2O	Oper. Press. H2O	Service	JZ Part No
25						
26	1	PDI-101	0 TO 5"	2"	MOISTURE SEPARATOR	0404310
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						
37						
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41						
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43						
44						

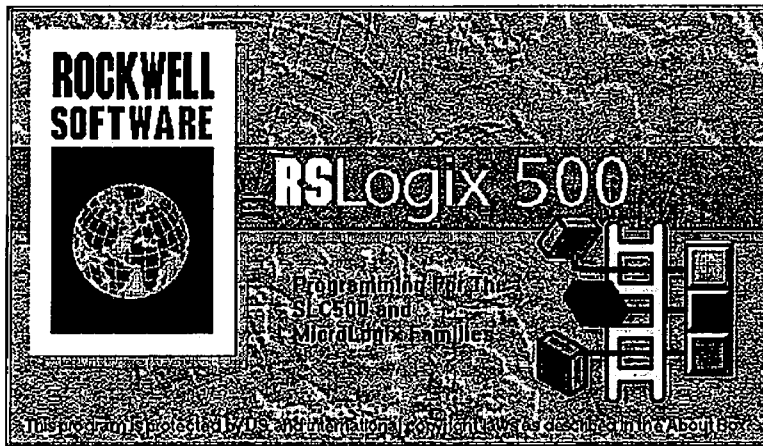
45 Notes:

SKID MOUNT

Revision	Date	Initials	Revision Description	Date	Name
△				09/02/2010	JONES6A
△				09/13/2010	JONES6A
△				09/13/2010	JONES6A
△				Quote Attached: <input type="checkbox"/> Yes Copies of Vendor Literature Req'd: 1	

XIV. PROCESSOR LOGIC PROGRAM

RSLogix500 Project Report

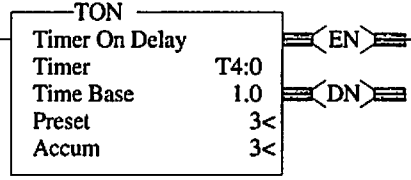


STANDARD PROGRAM FOR LANDFILL N21000000 COPYRIGHT 2004 JOHN ZINK CO LLC

ZTOF FLARE SYSTEM FOR A LANDFILL W/ 2 BLOWERS, THERMOCOUPLE SELECTION IS AUTO. ANALOG OUT FOR GAS FR AND STACK TR. W/ OUTPUTS FOR AUTO DIALER.

0000

POWER UP RESET



0001

OIP RESET
B3:5

RESET PULSE TIME
T4:2

RESET PULSE
B3:0

HIDDEN RESET
I:0

Bul.1762

POWER UP RESET
T4:0

DN

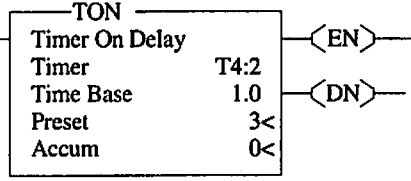
0002

OIP RESET
B3:5

HIDDEN RESET
I:0

Bul.1762

RESET PULSE TIME



0003

FLARE HI TEMP
TSHH-201
I:0

SD SUMMER
B3:4

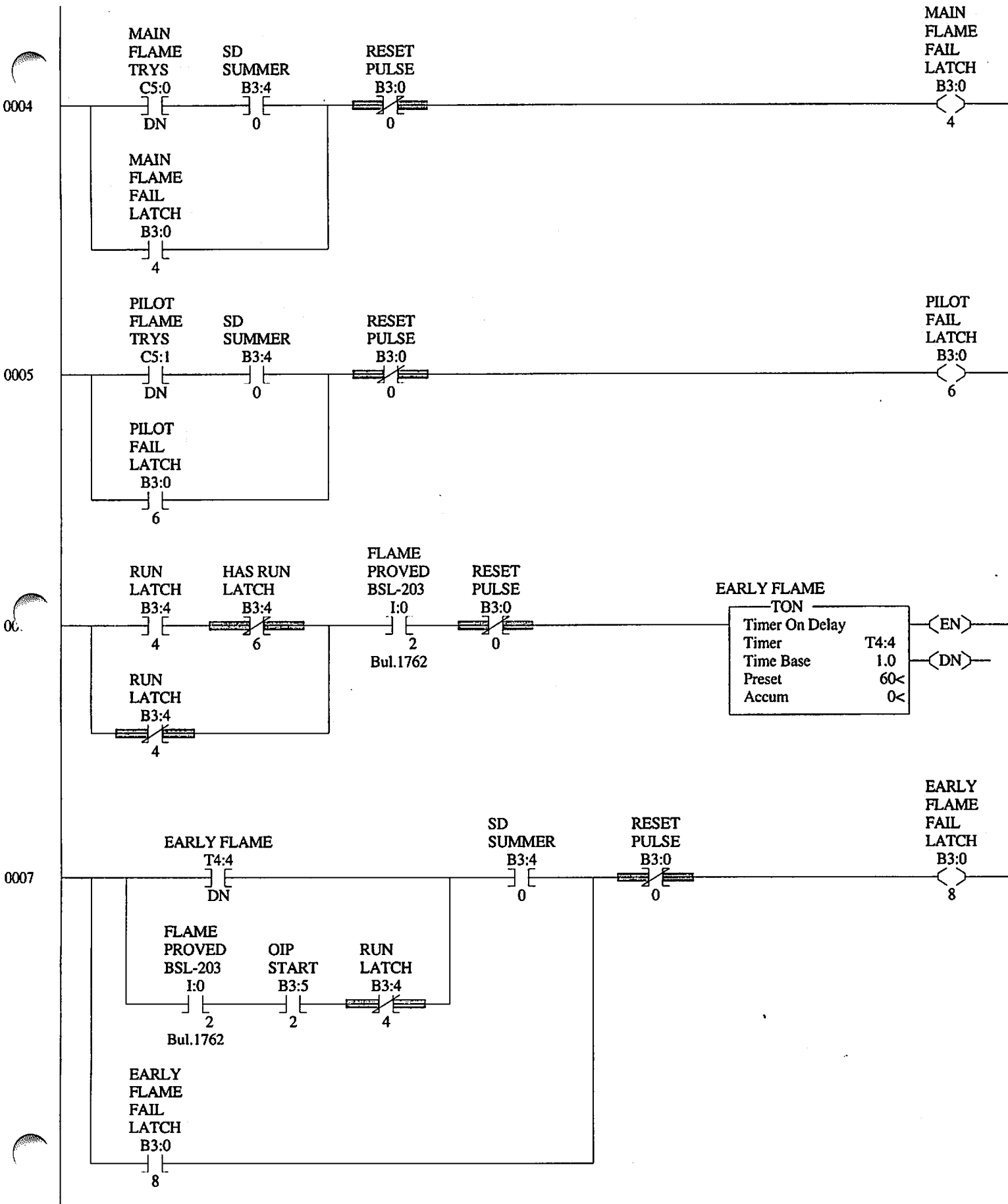
RESET PULSE
B3:0

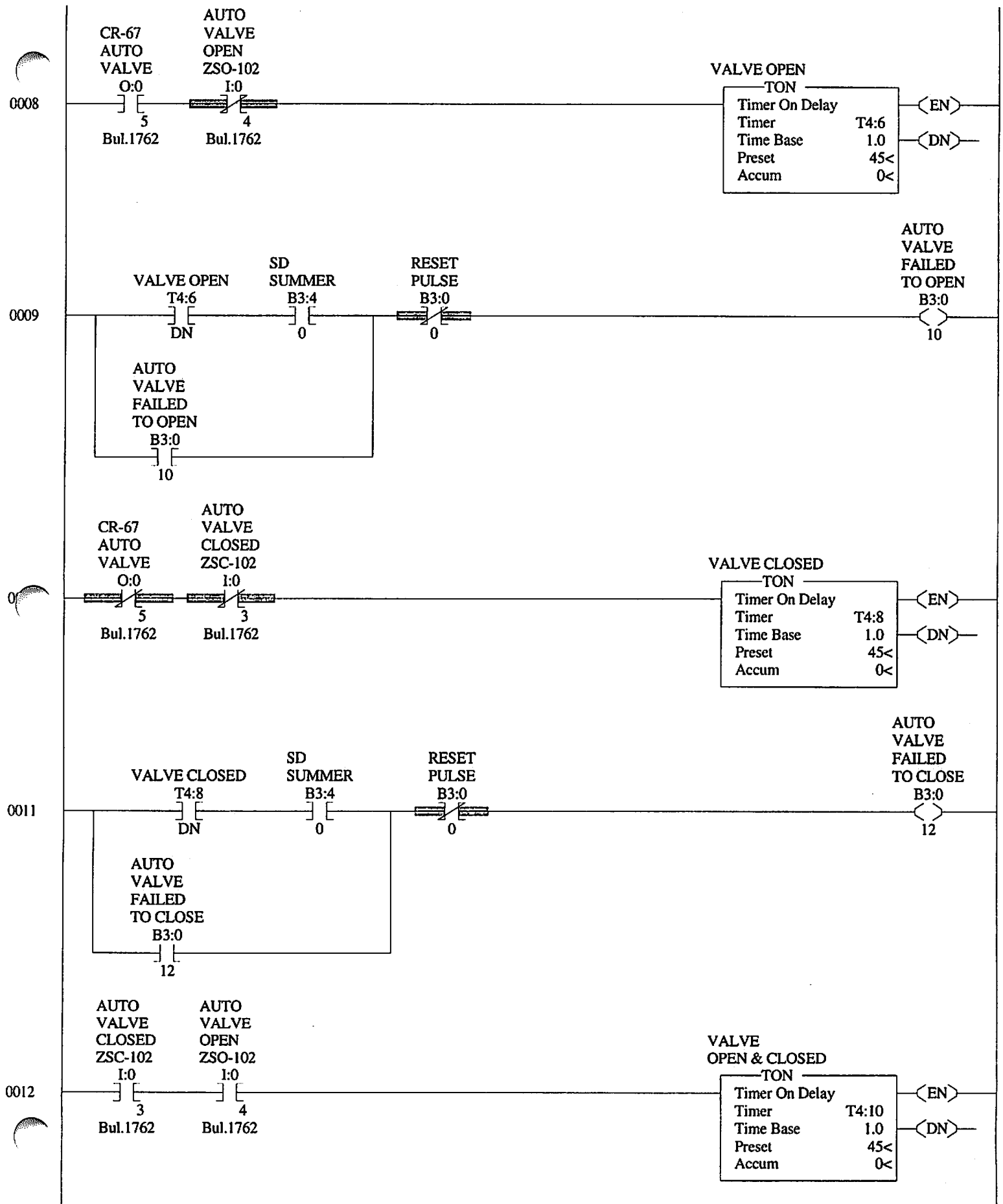
HI TEMP LATCH
B3:0

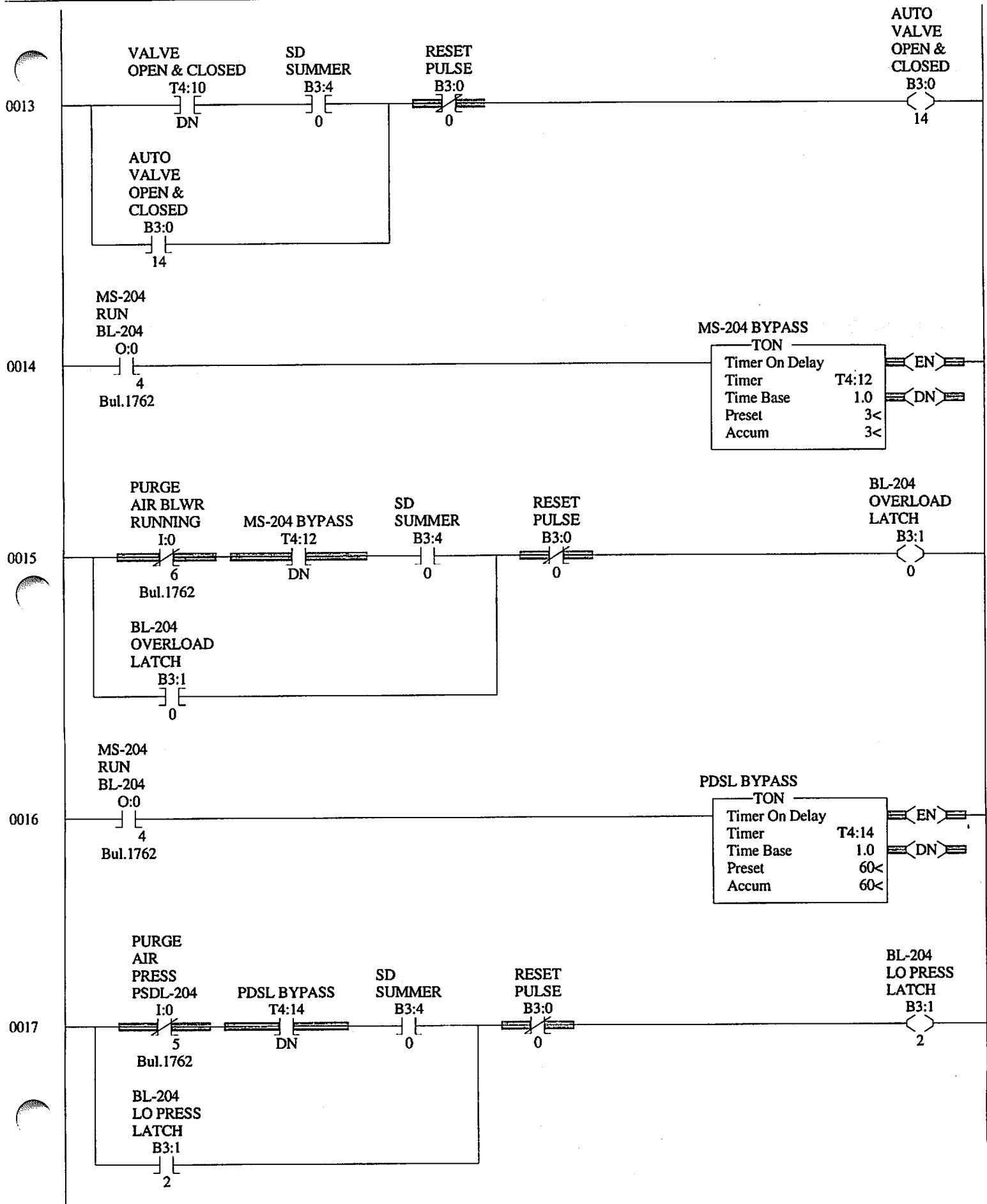
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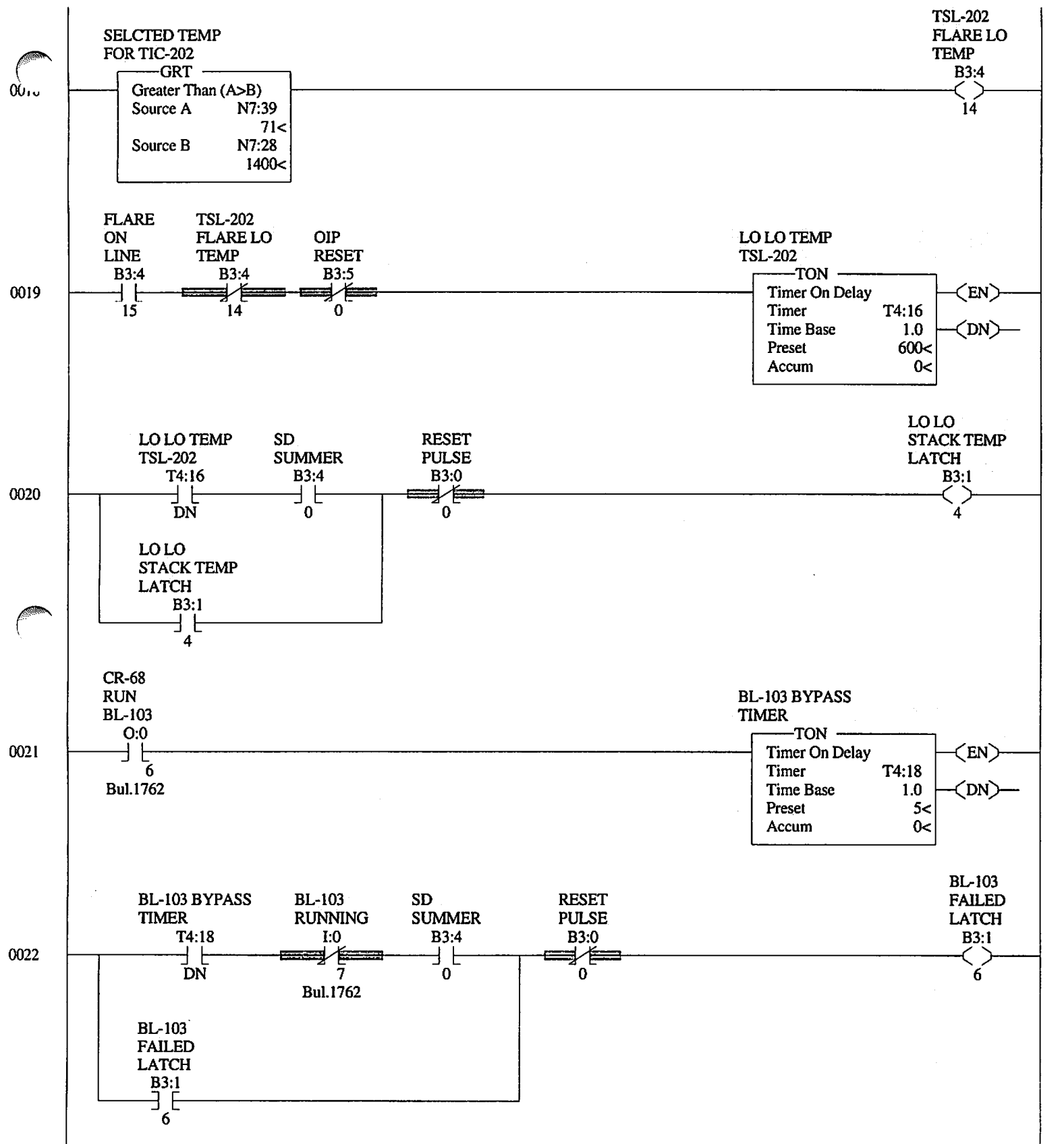
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B3:0

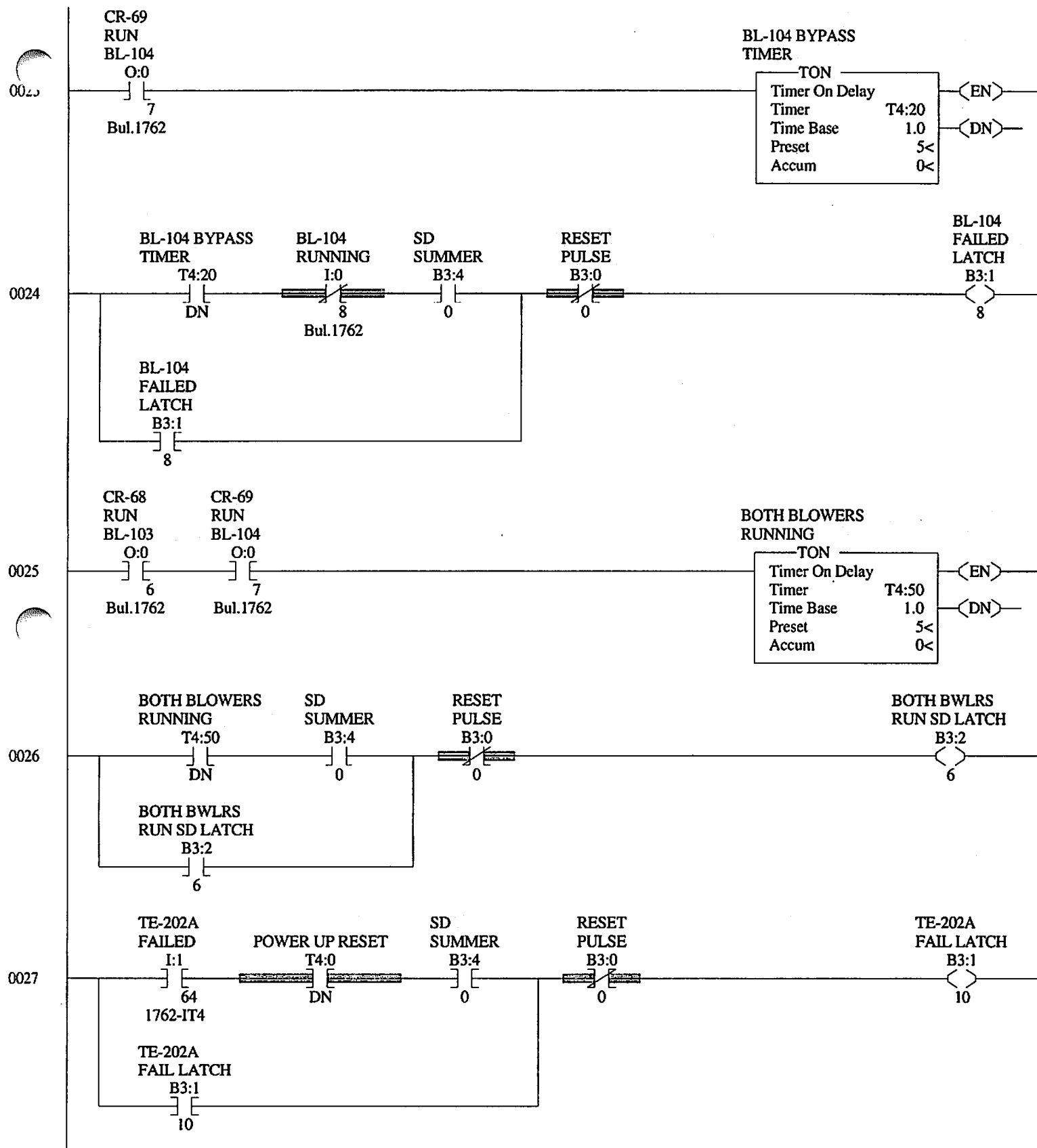
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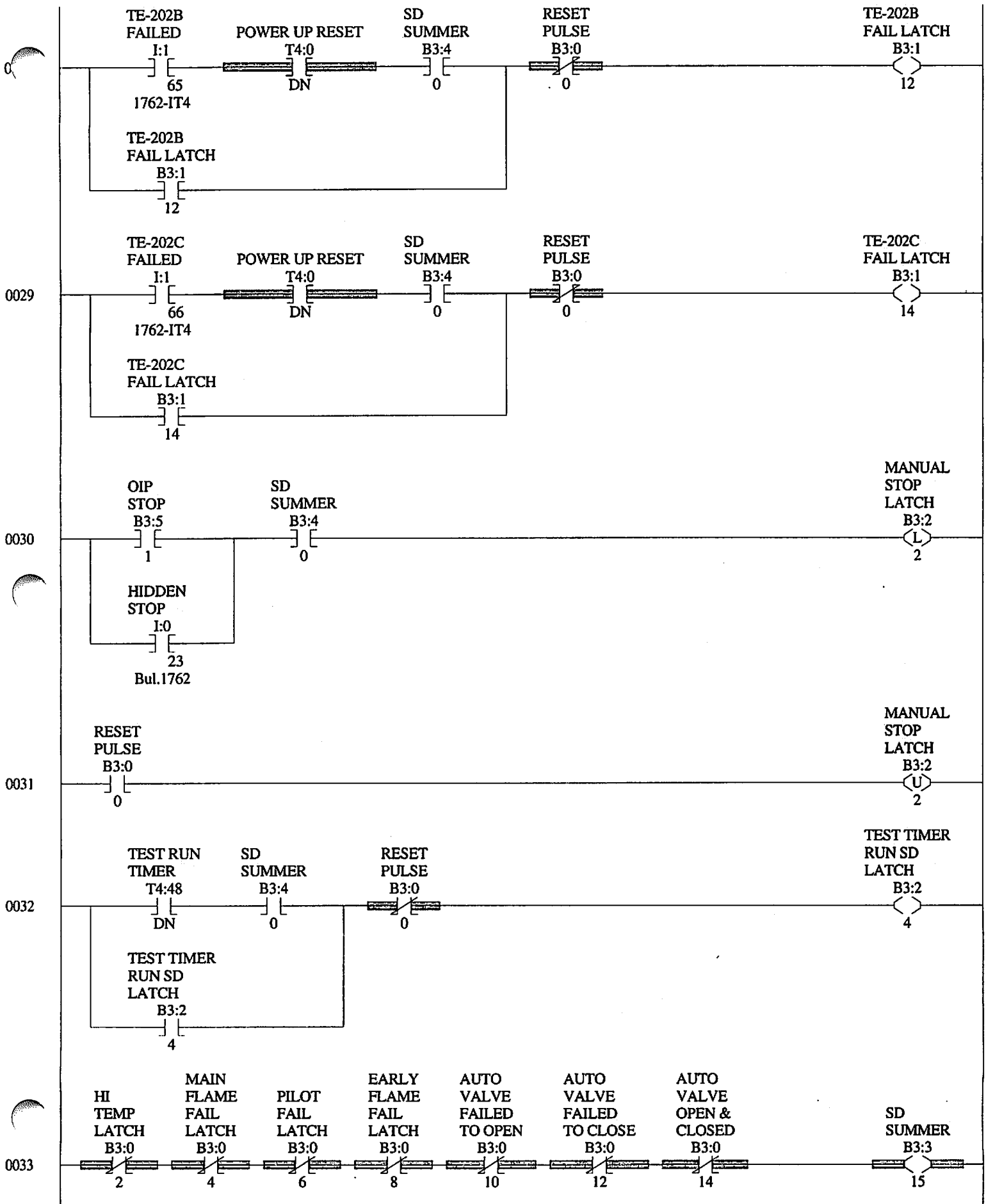


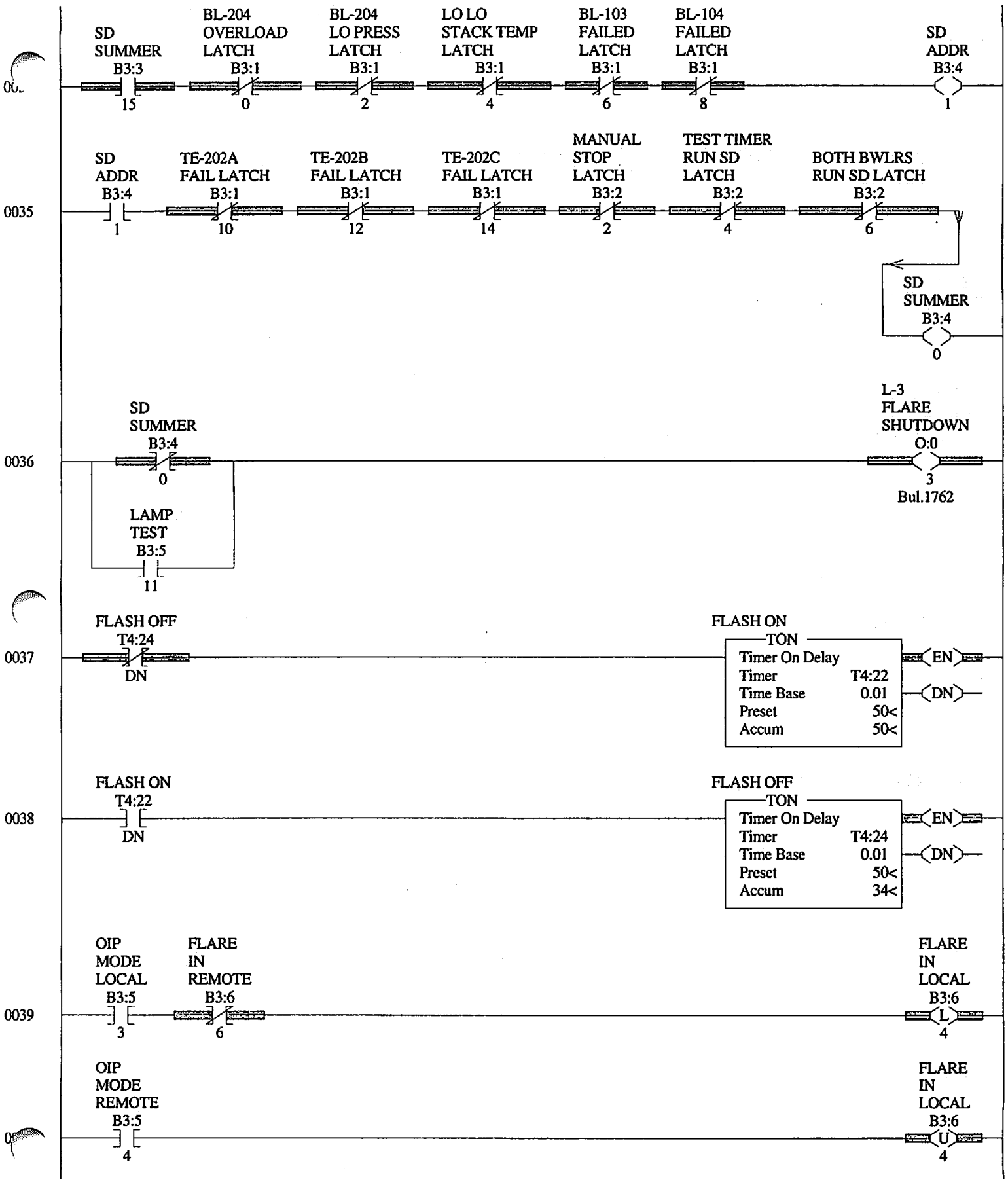


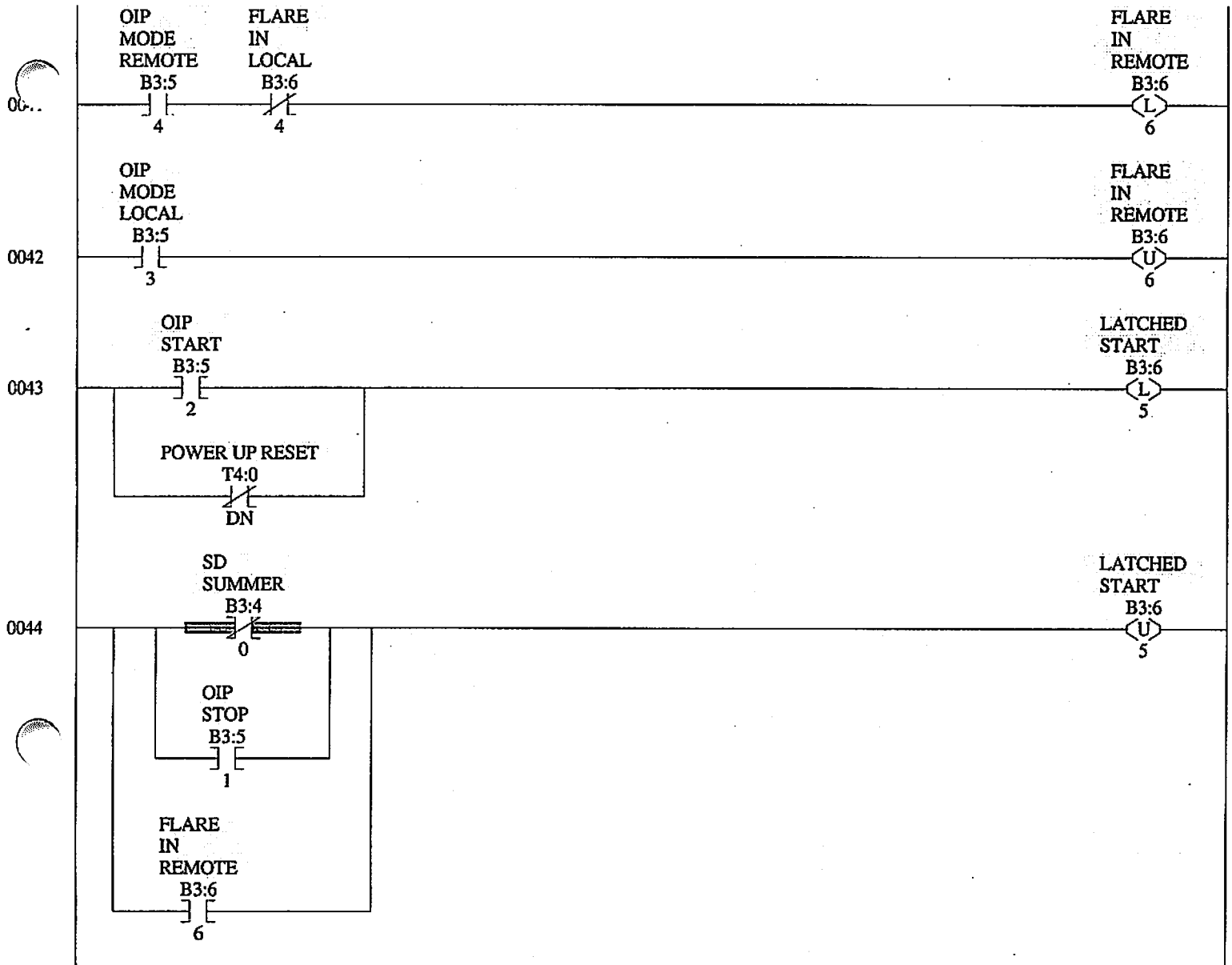


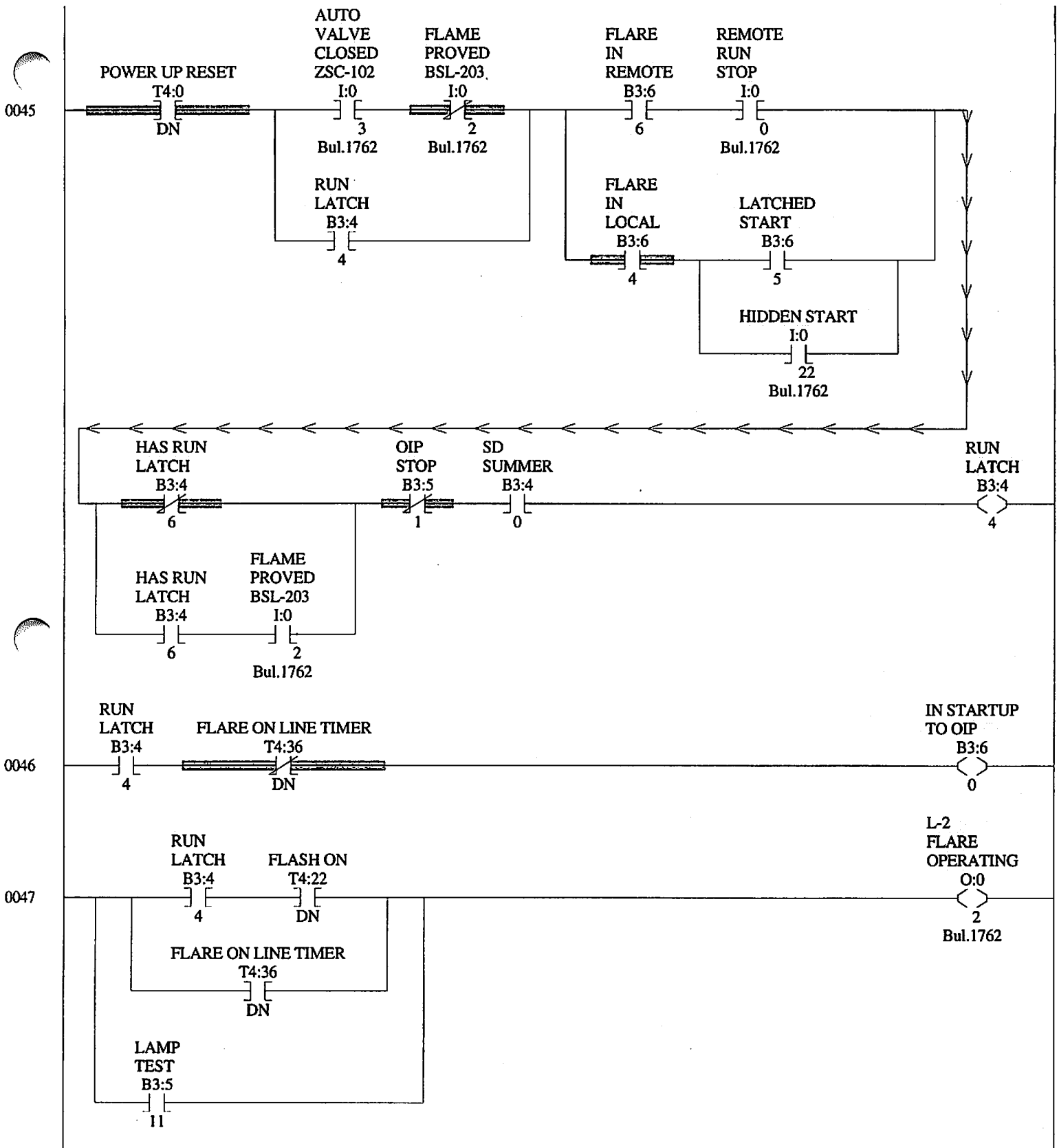


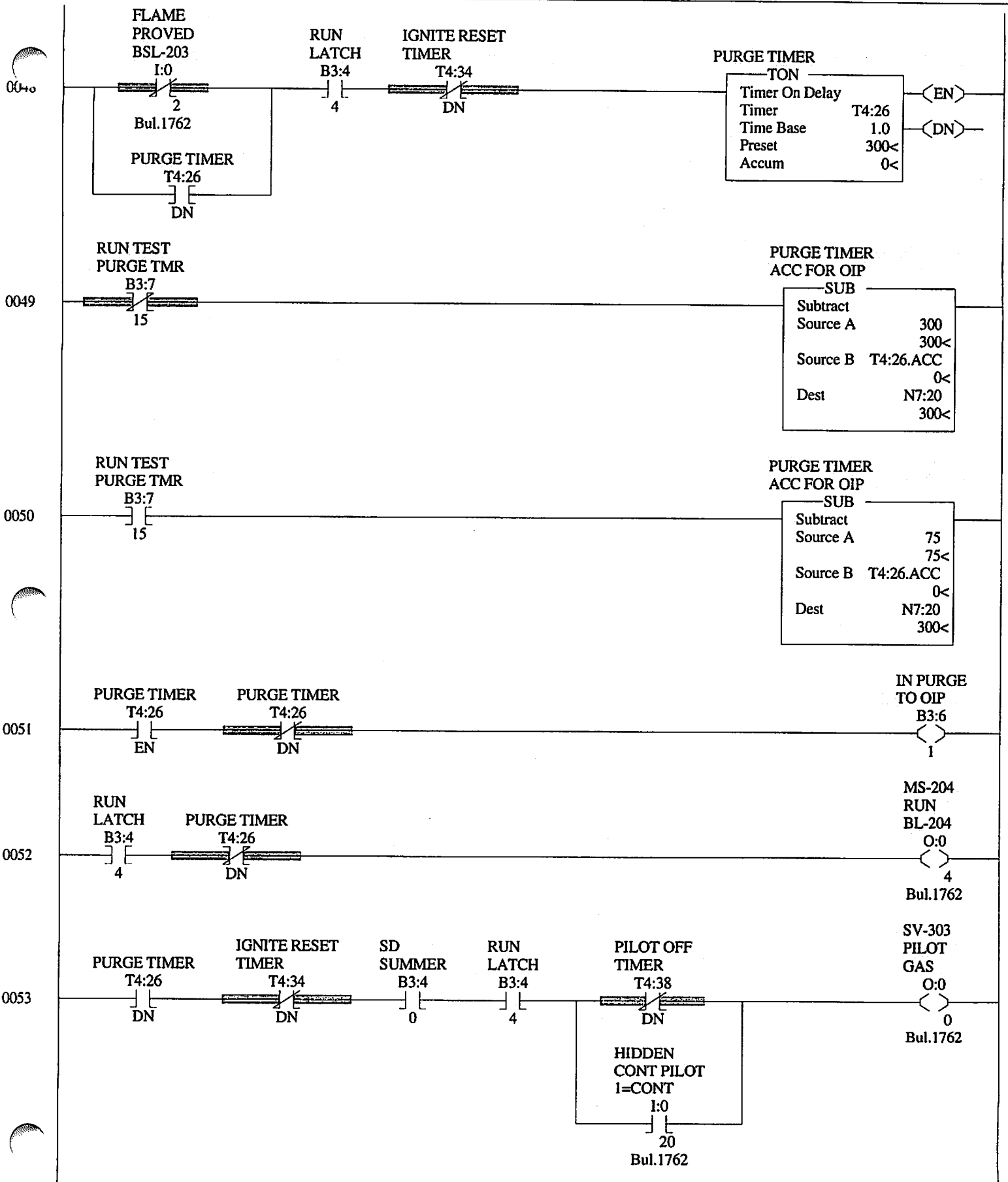


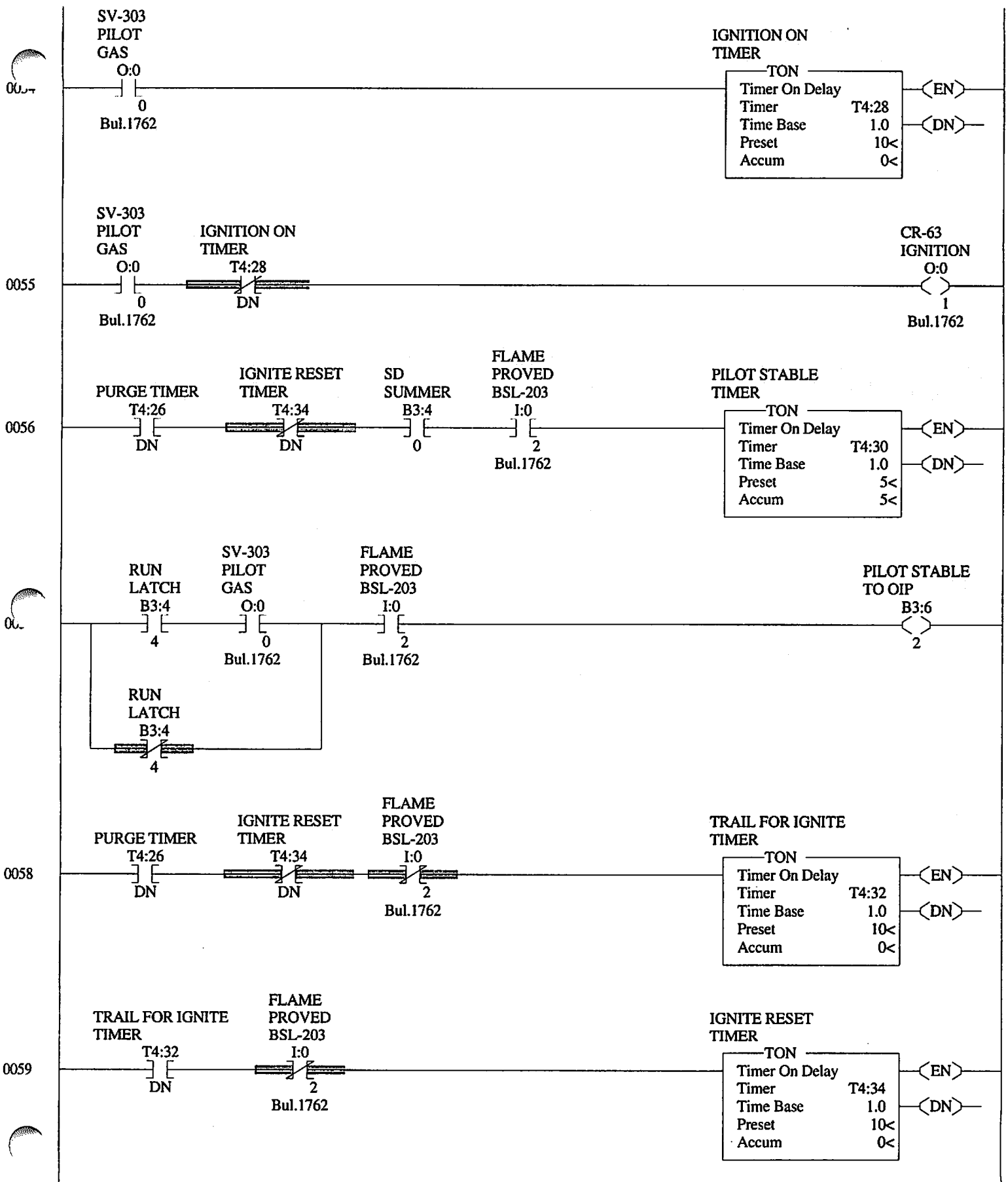


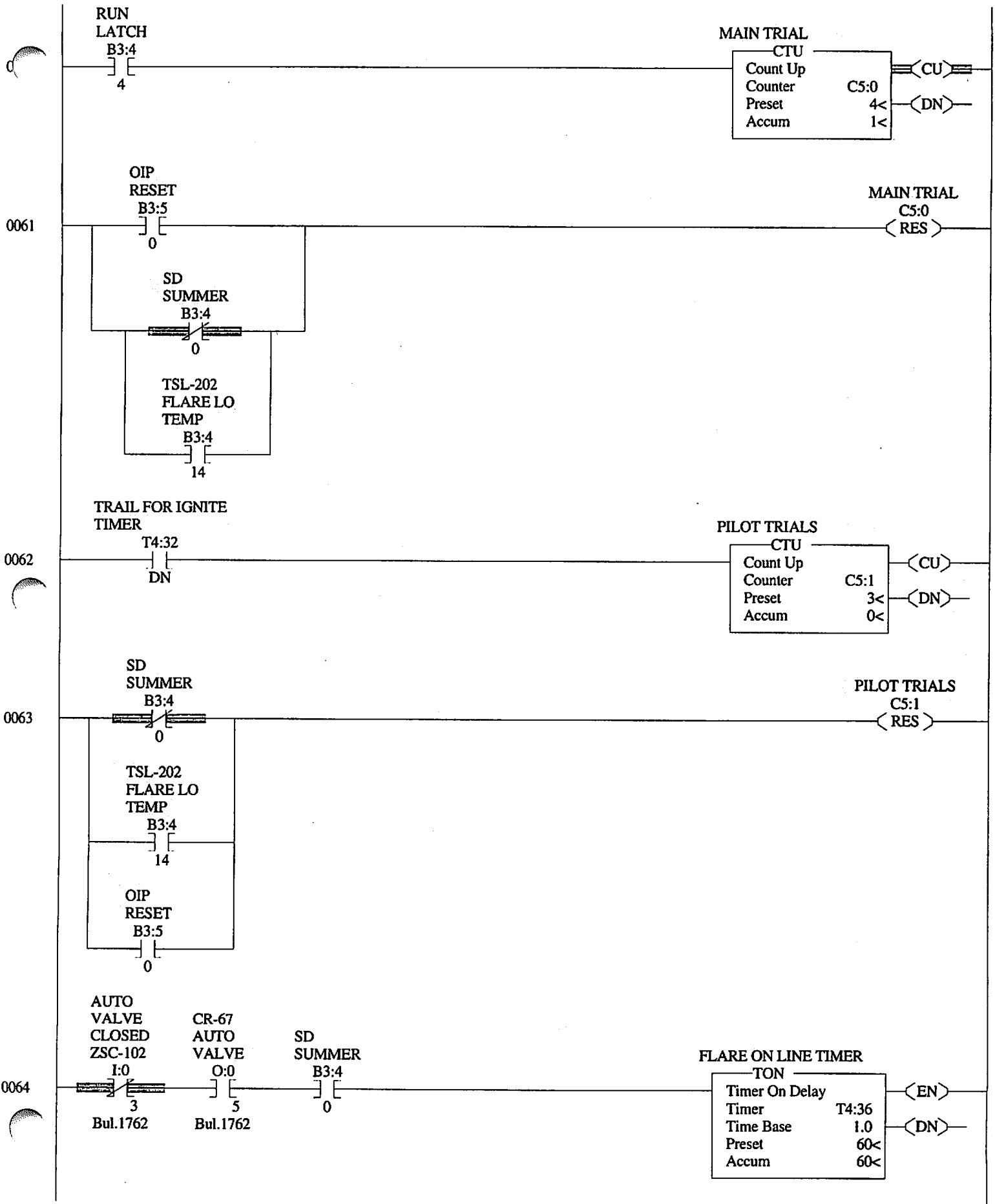


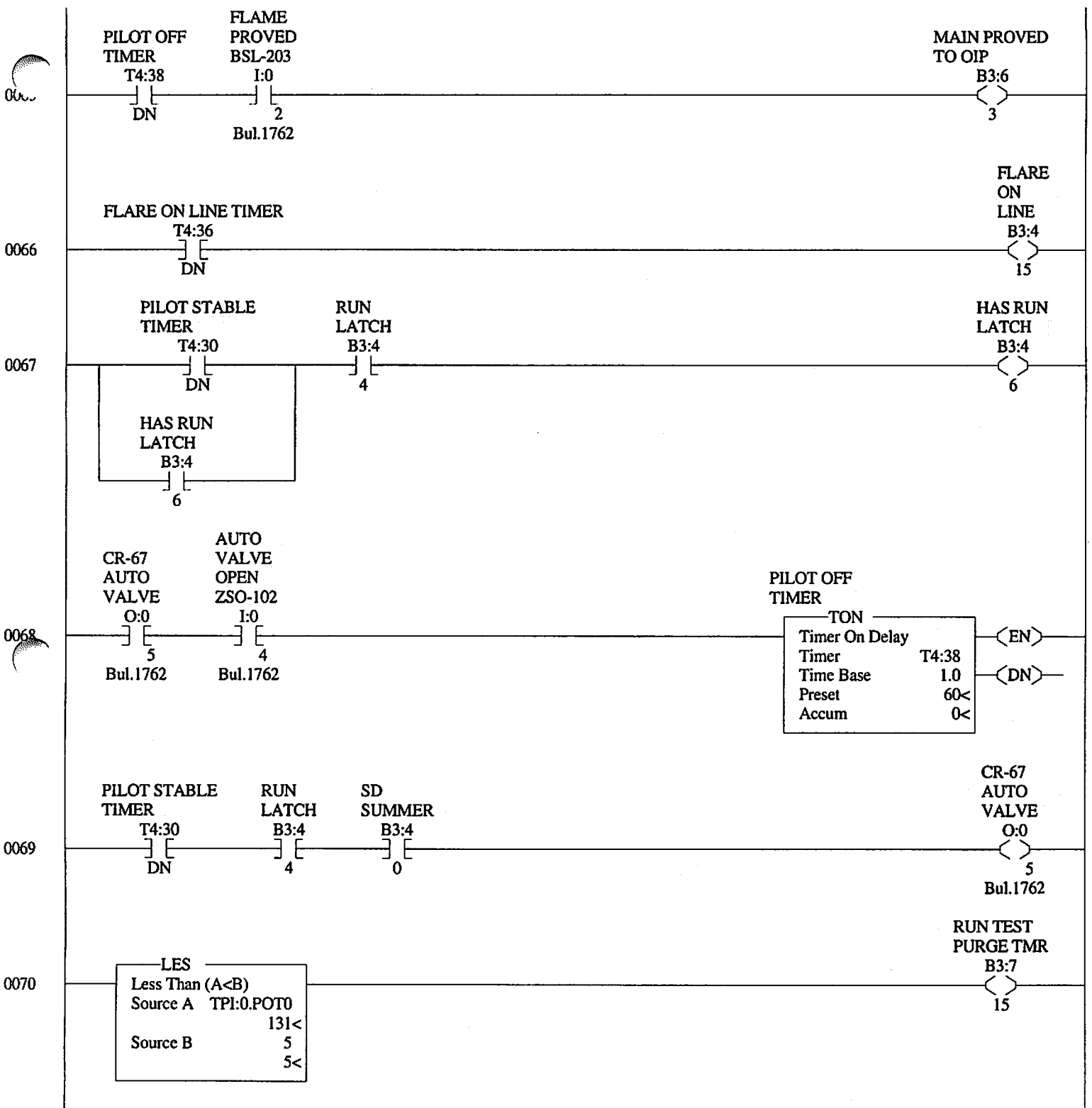


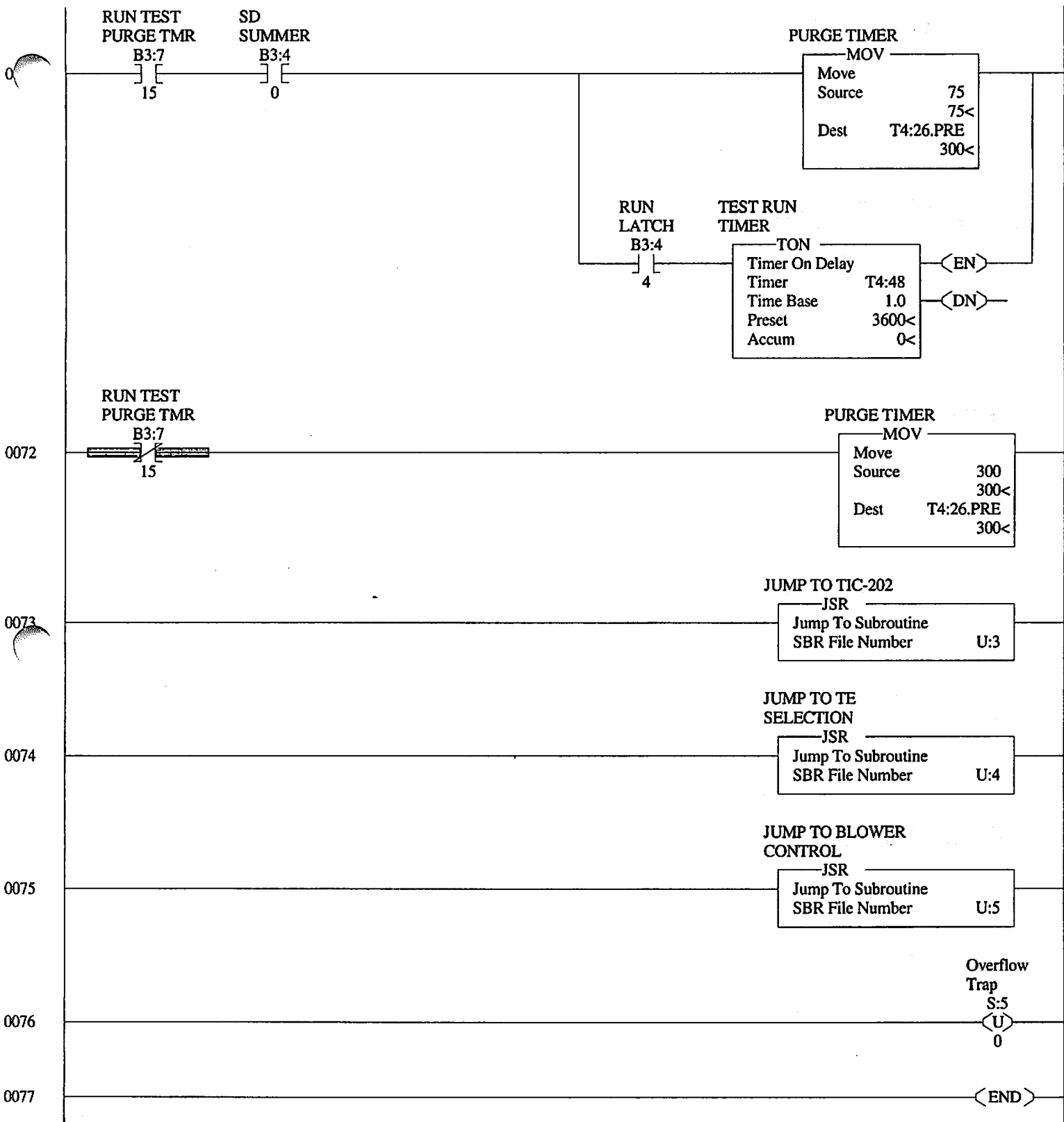


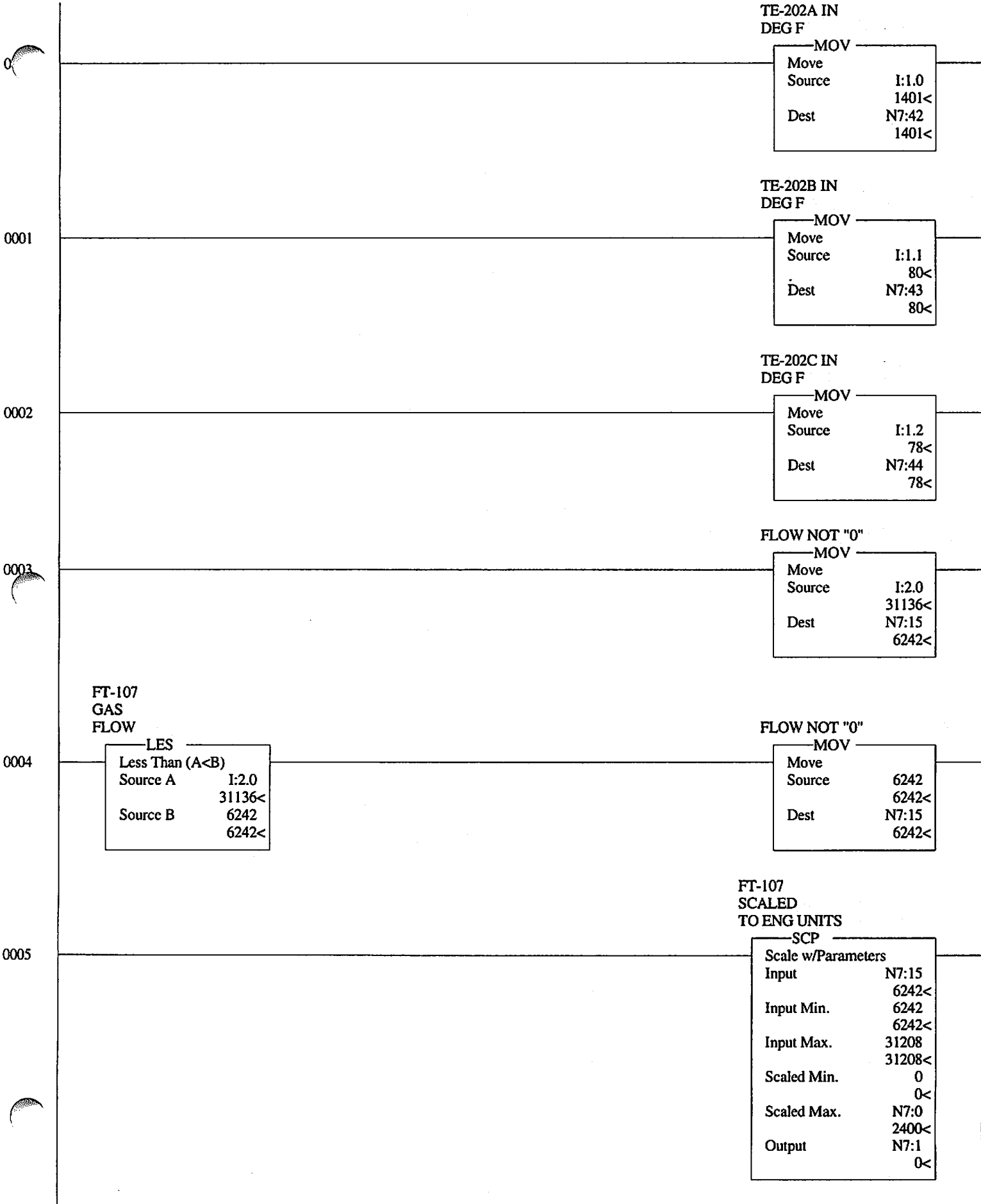


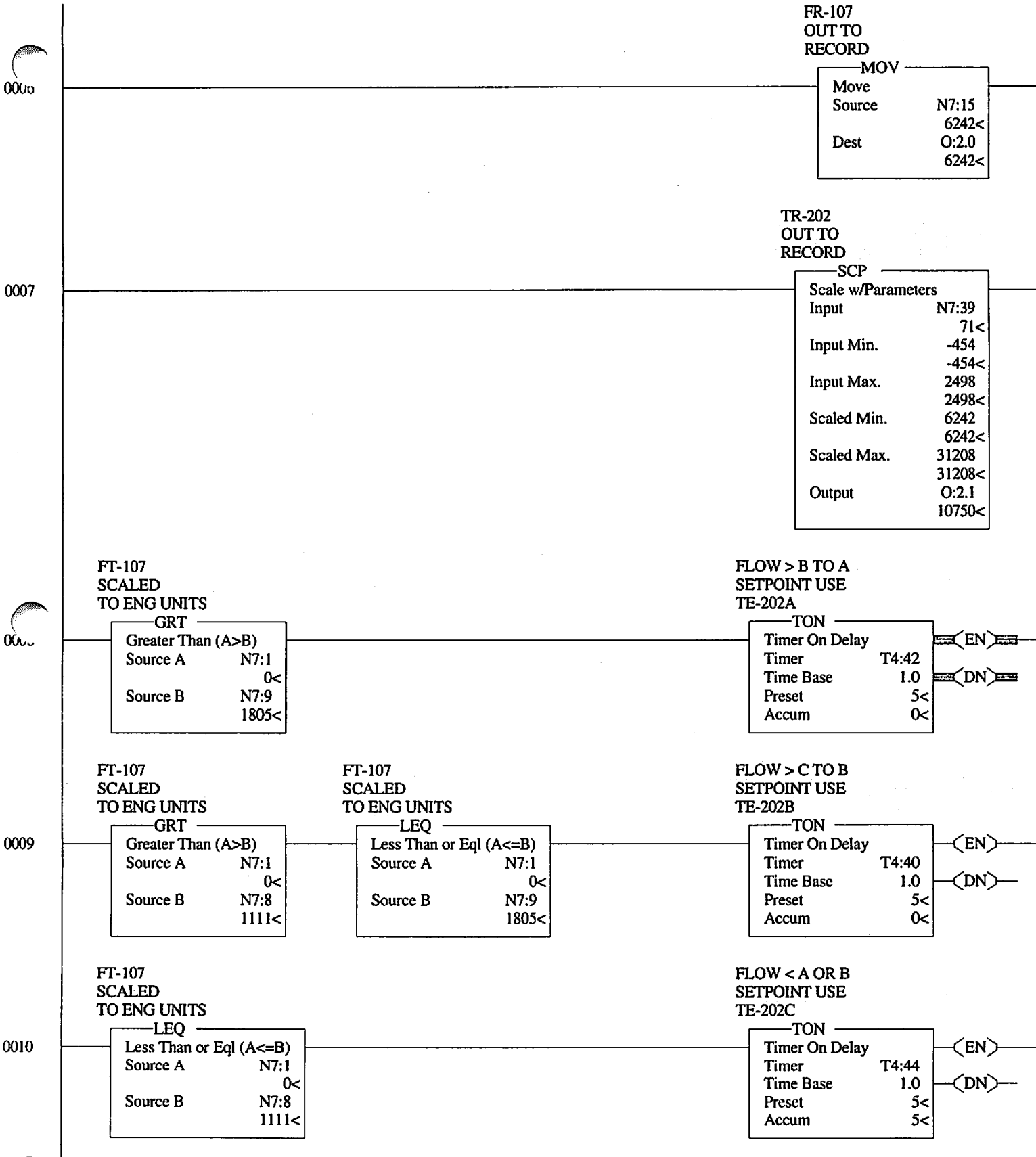












OIP SWITCH
PT C TO B

OIP SWITCH
PT B TO A

GRT
Greater Than (A>B)
Source A N7:8
1111<
Source B N7:9
1805<

MOV
Move
Source N7:8
1111<
Dest N7:9
1805<

0012

TE-202
SELECT
MAN/AUTO
1=MAN
B3:6

OIP PB
TE-202A
MANUAL
SELECTED
B3:6

TE-202A
SELECTED
FOR TIC-202
B3:6

15

12

(L)
9

TE-202
SELECT
MAN/AUTO
1=MAN
B3:6

FLOW > B TO A
SETPOINT USE
TE-202A
T4:42

15

DN

TE-202
SELECT
MAN/AUTO
1=MAN
B3:6

OIP PB
TE-202B
MANUAL
SELECTED
B3:6

TE-202A
SELECTED
FOR TIC-202
B3:6

15

13

(U)
9

TE-202
SELECT
MAN/AUTO
1=MAN
B3:6

FLOW > C TO B
SETPOINT USE
TE-202B
T4:40

15

DN

FLOW < A OR B
SETPOINT USE
TE-202C
T4:44

DN

0013

OIP PB
TE-202C
MANUAL
SELECTED
B3:6

14

0014

TE-202
SELECT
MAN/AUTO
1=MAN

B3:6
15

OIP PB
TE-202B
MANUAL
SELECTED

B3:6
13

TE-202B
SELECTED
FOR TIC-202

B3:6
10

TE-202
SELECT
MAN/AUTO
1=MAN

B3:6
15

FLOW > C TO B
SETPOINT USE
TE-202B

T4:40
DN

FLOW > B TO A
SETPOINT USE
TE-202A

T4:42
DN

0015

TE-202
SELECT
MAN/AUTO
1=MAN

B3:6
15

OIP PB
TE-202A
MANUAL
SELECTED

B3:6
12

TE-202B
SELECTED
FOR TIC-202

B3:6
10

OIP PB
TE-202C
MANUAL
SELECTED

B3:6
14

TE-202
SELECT
MAN/AUTO
1=MAN

B3:6
15

FLOW < A OR B
SETPOINT USE
TE-202C

T4:44
DN

FLOW > B TO A
SETPOINT USE
TE-202A

T4:42
DN

0016

TE-202
SELECT
MAN/AUTO
1=MAN

B3:6
15

OIP PB
TE-202C
MANUAL
SELECTED

B3:6
14

TE-202C
SELECTED
FOR TIC-202

B3:6
11

TE-202
SELECT
MAN/AUTO
1=MAN

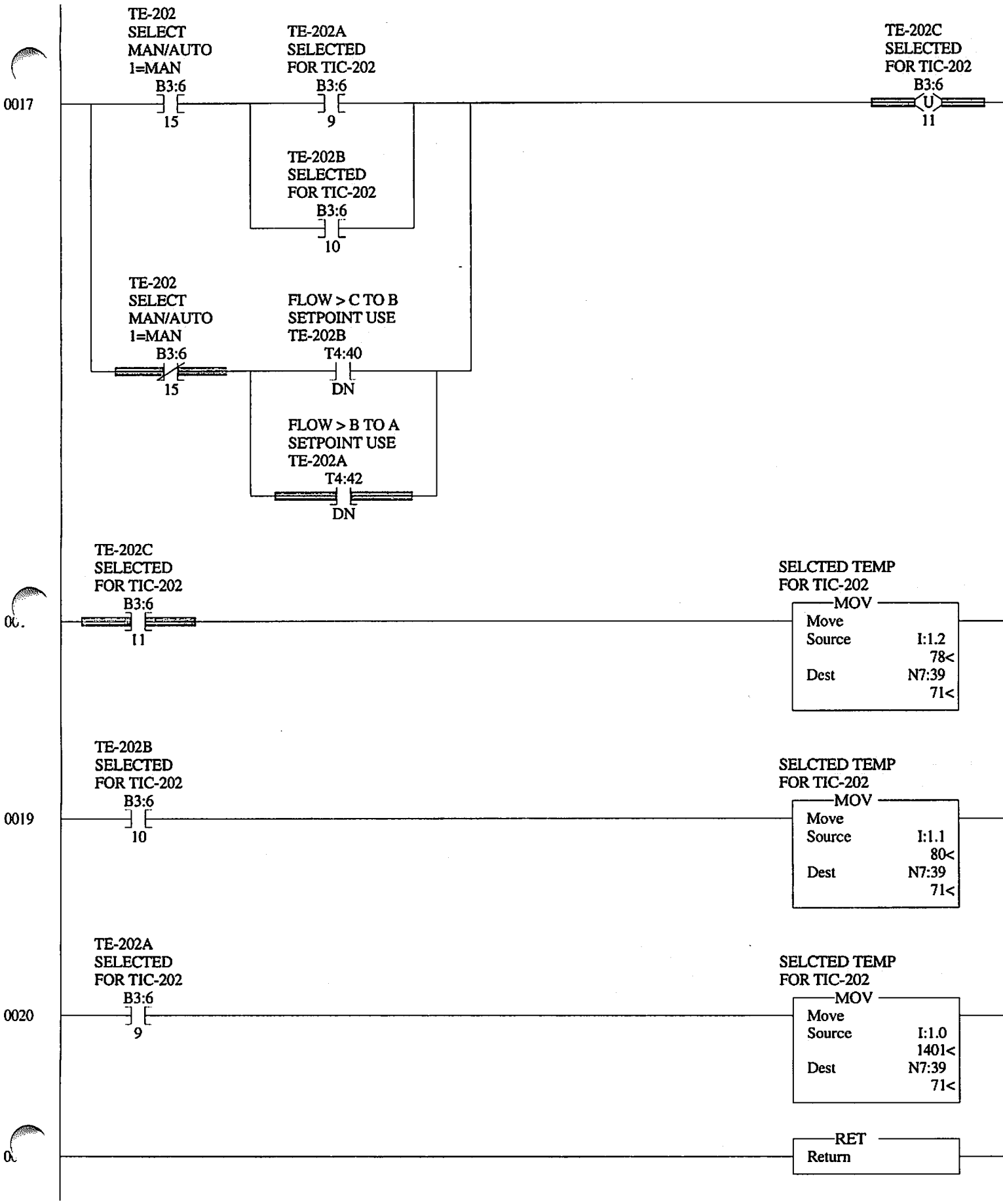
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15

FLOW < A OR B
SETPOINT USE
TE-202C

T4:44
DN

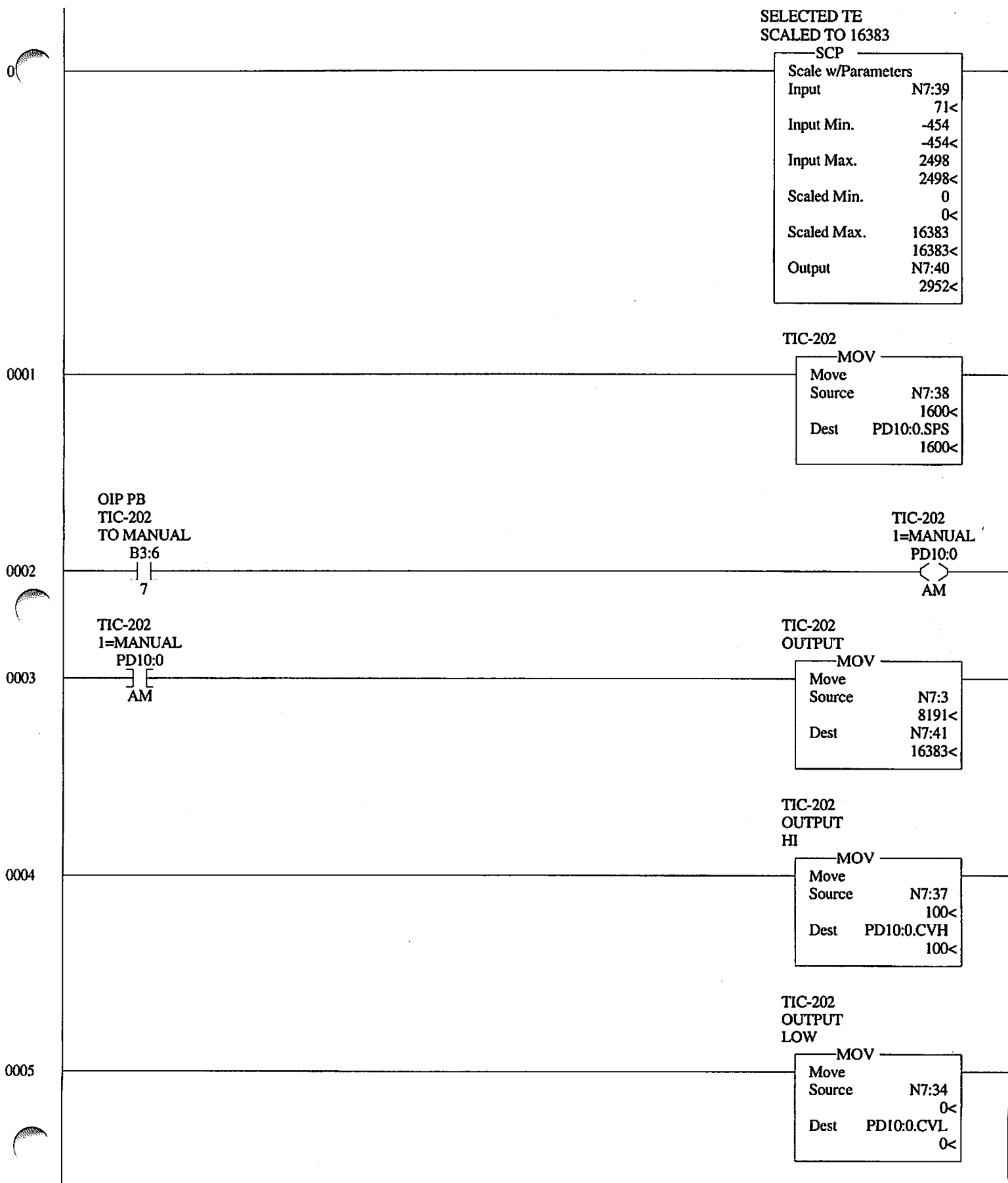
POWER UP RESET

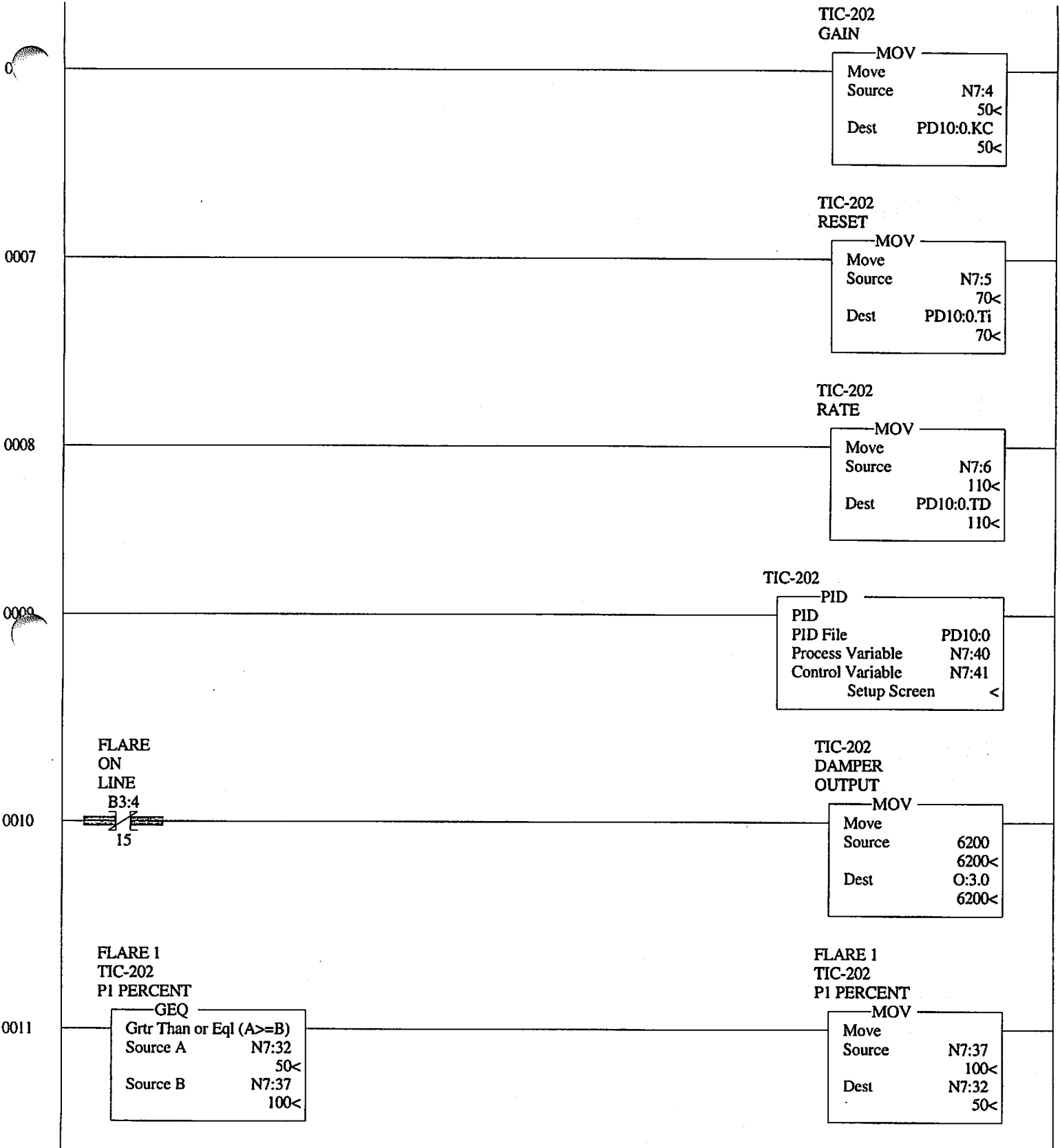
T4:0
DN

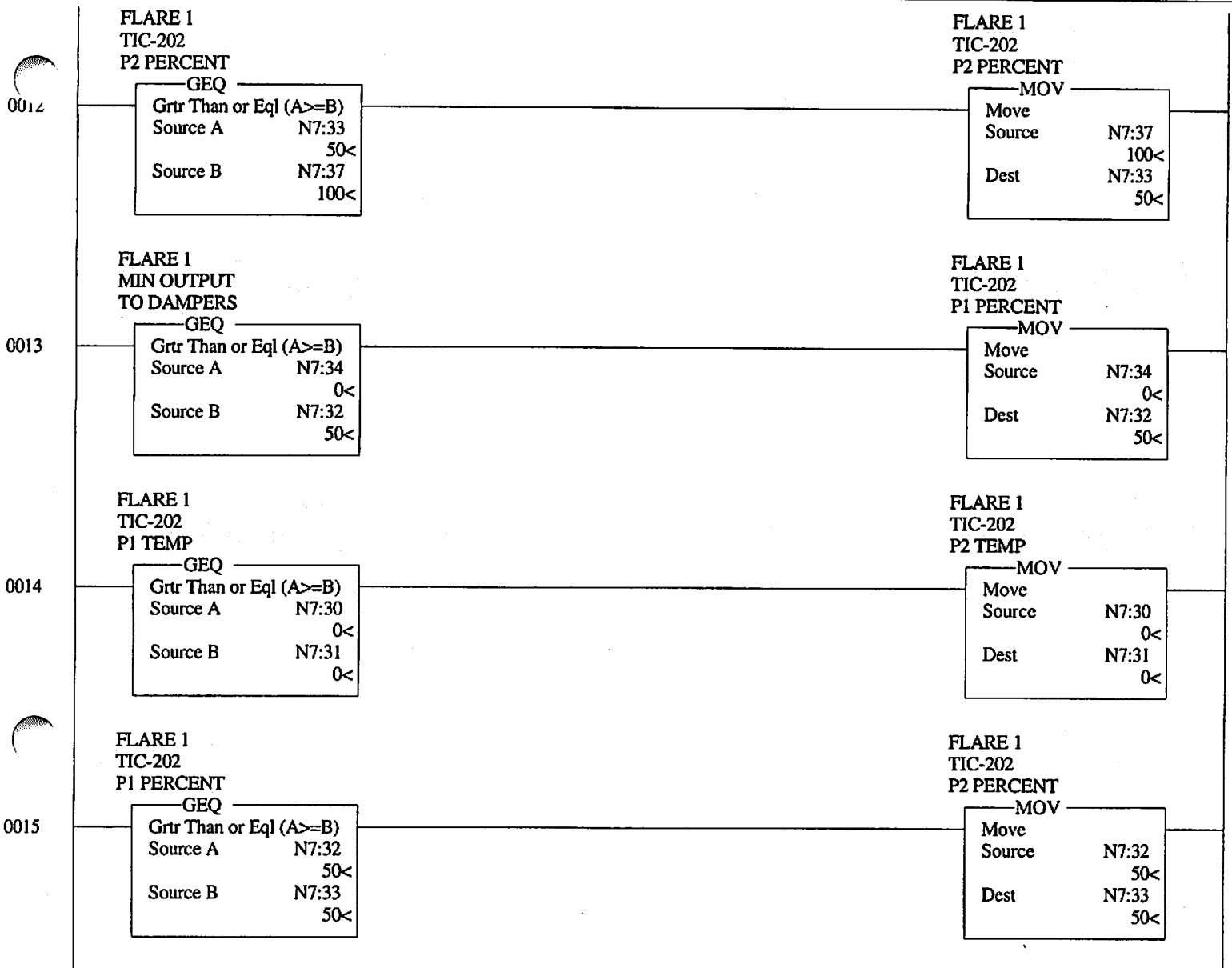


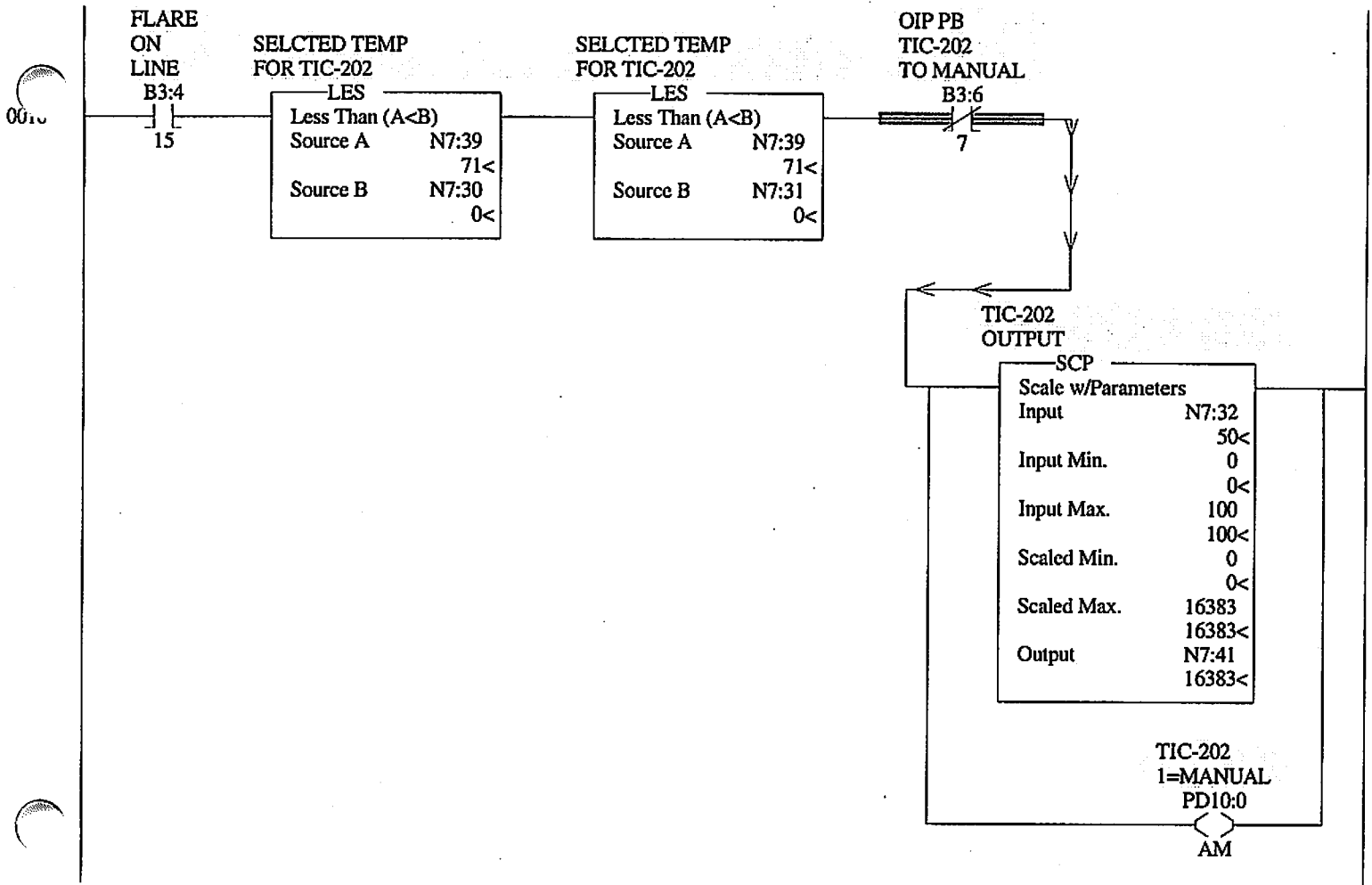
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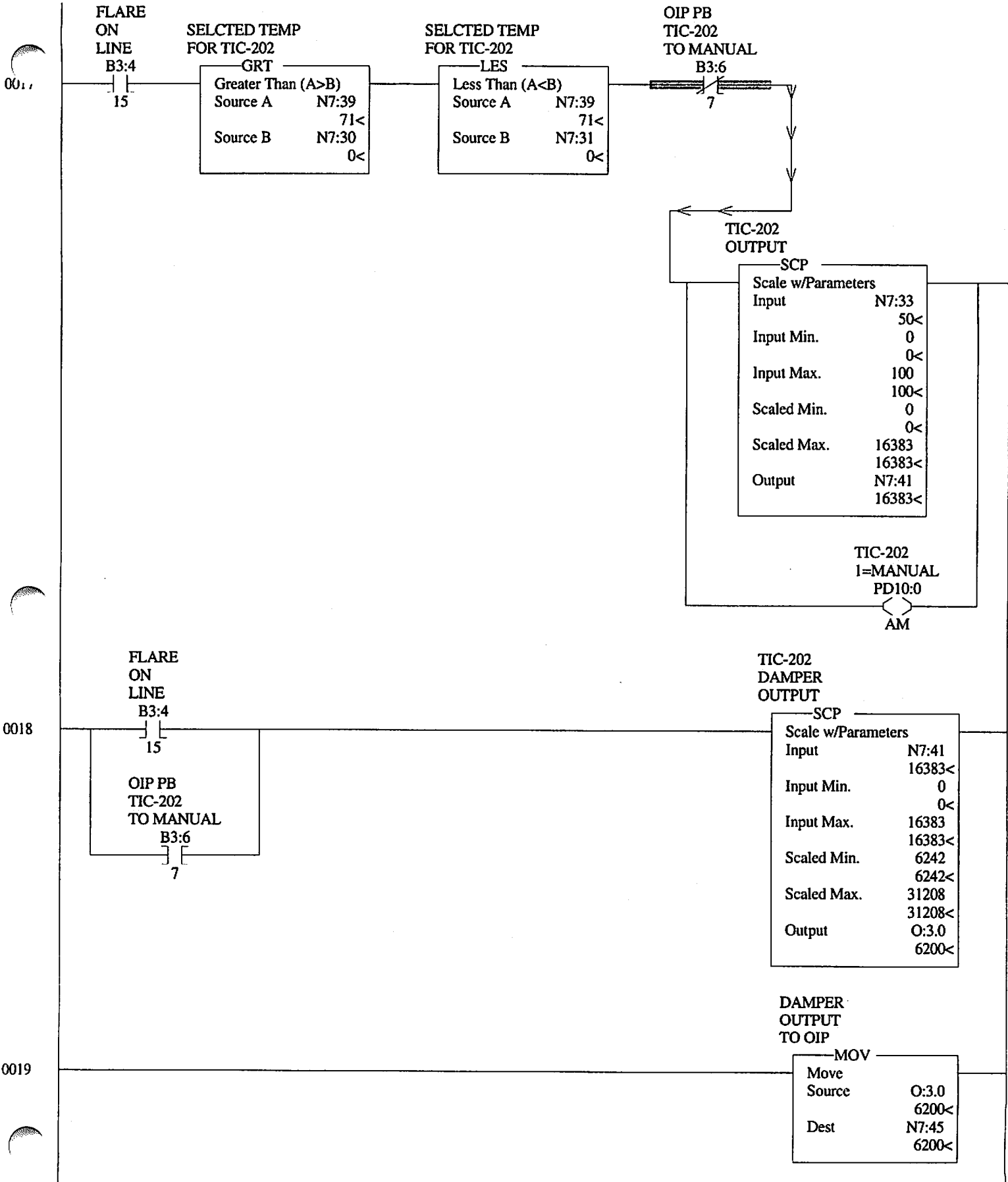
⟨END⟩

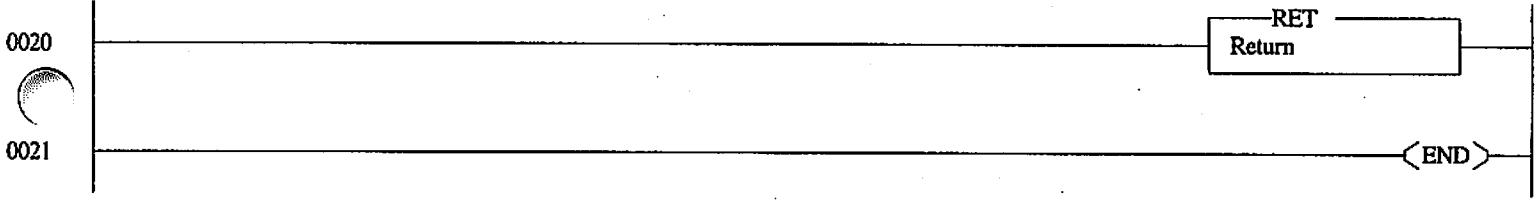


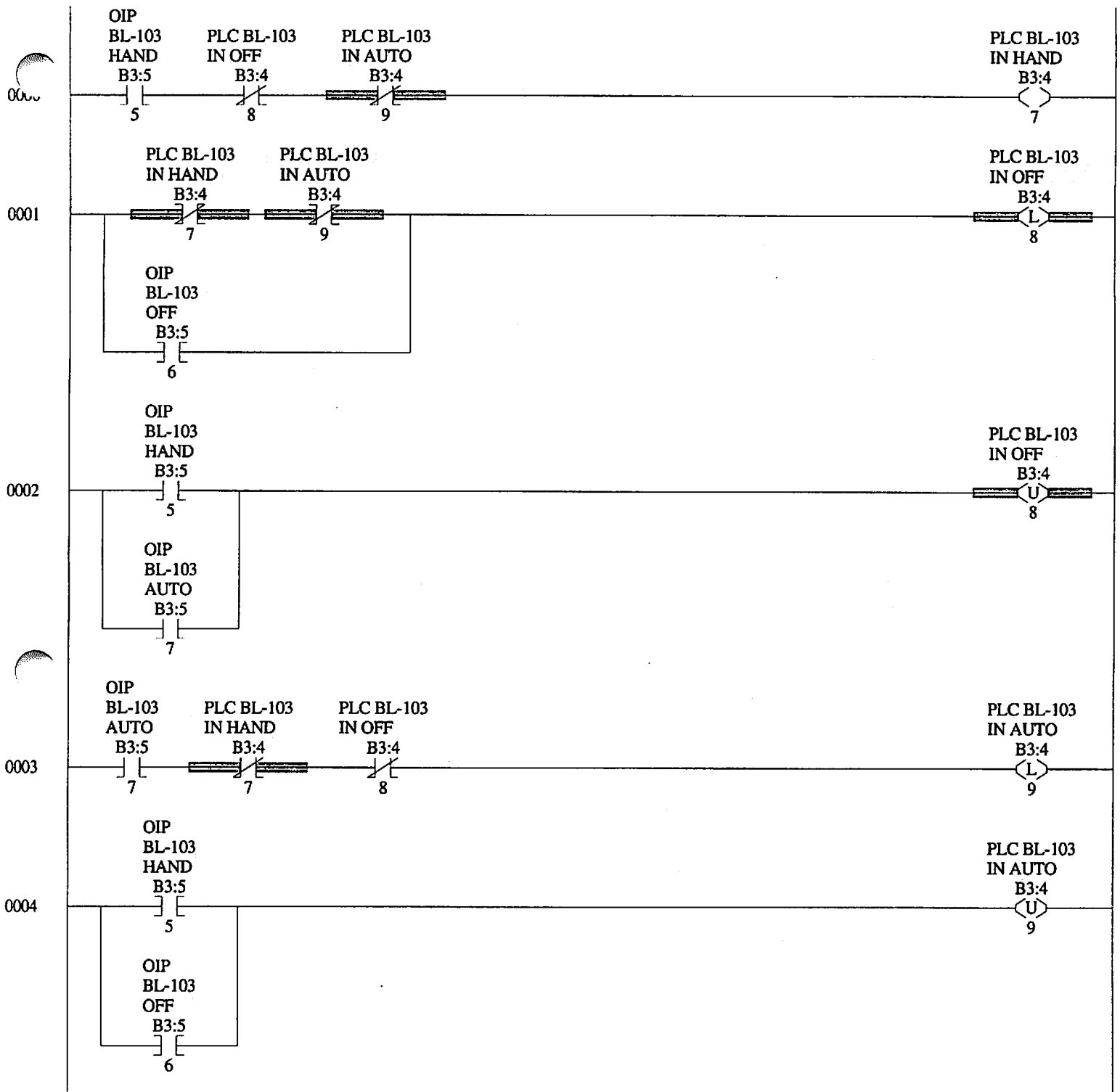


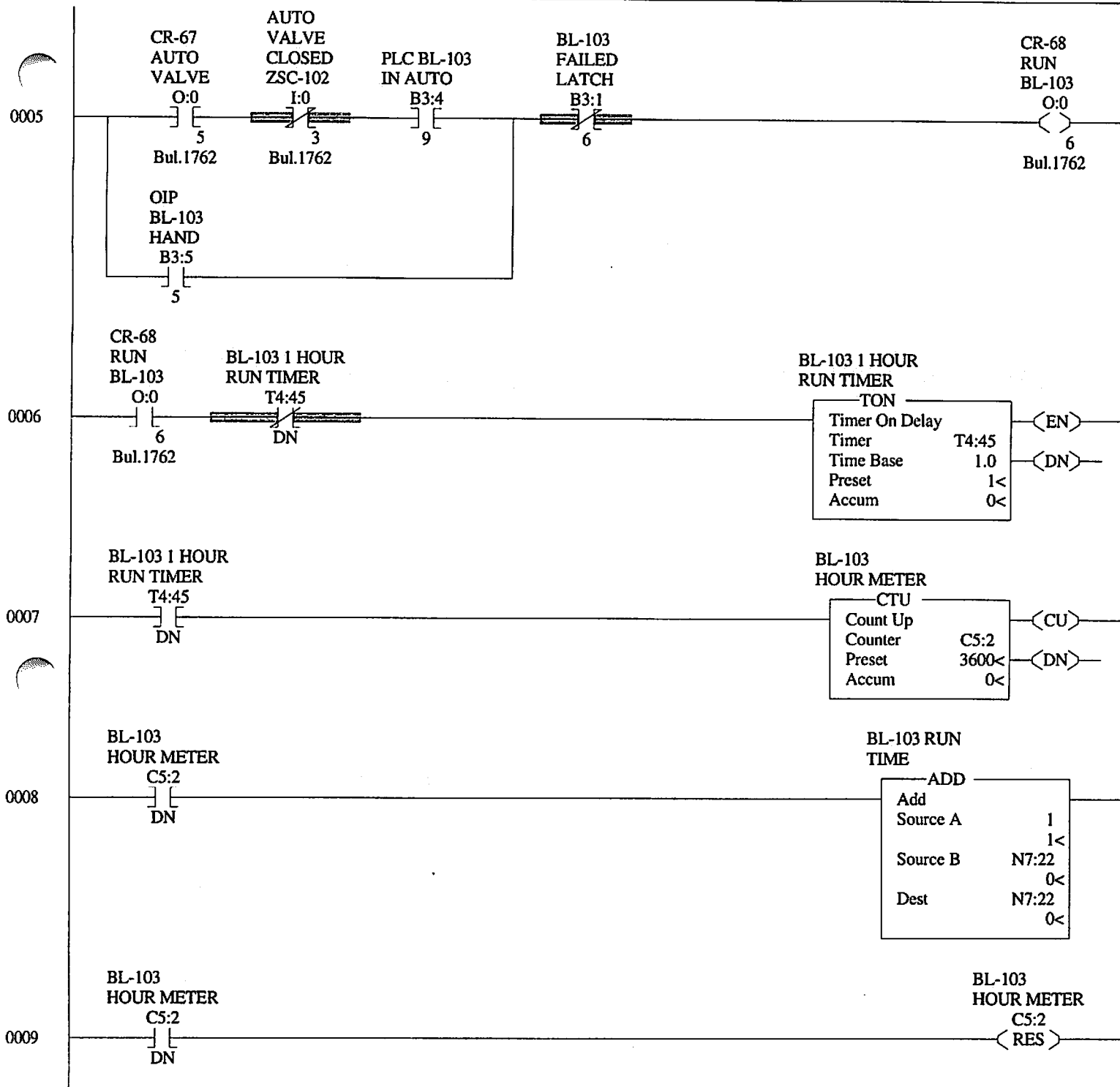


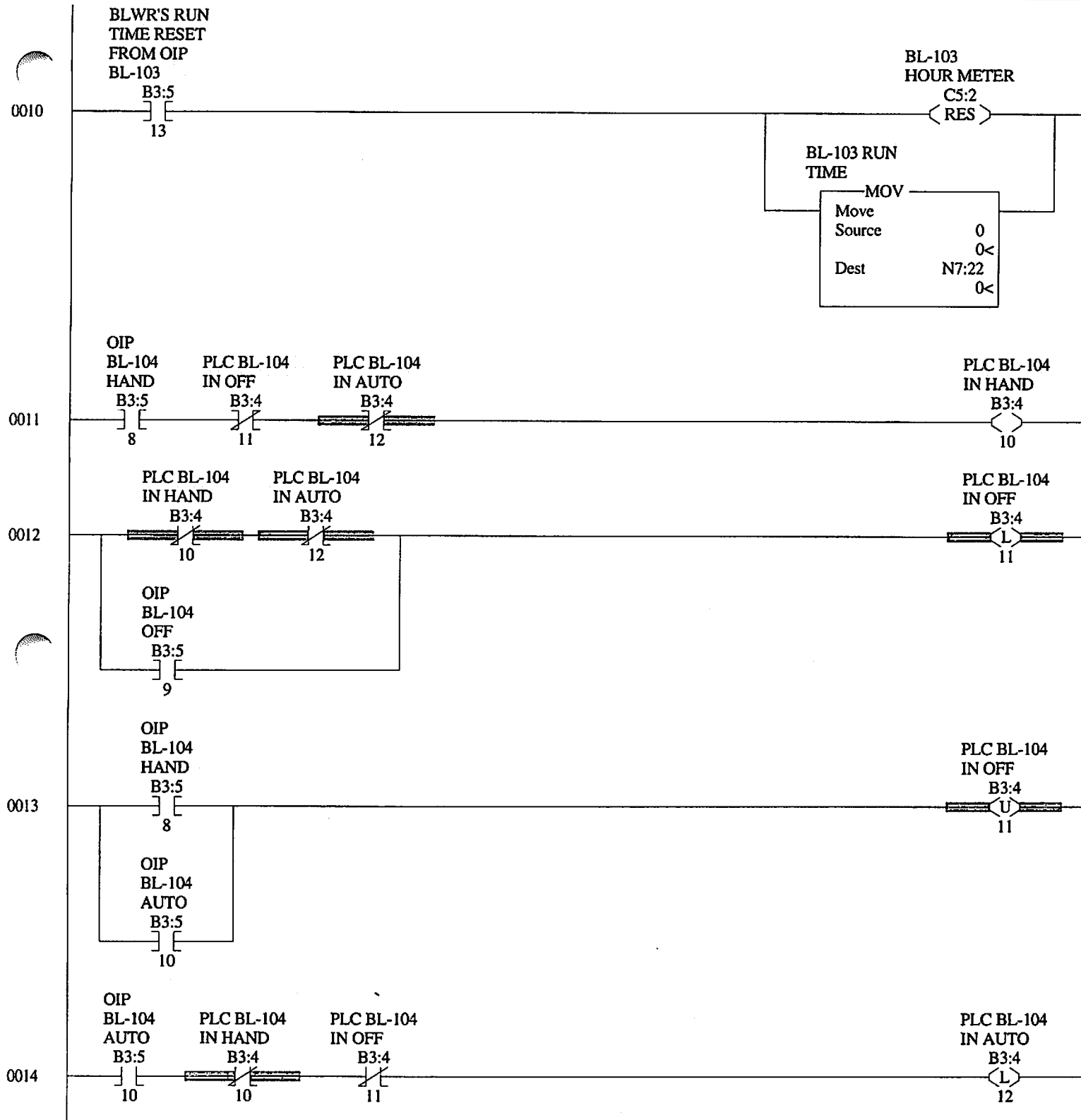


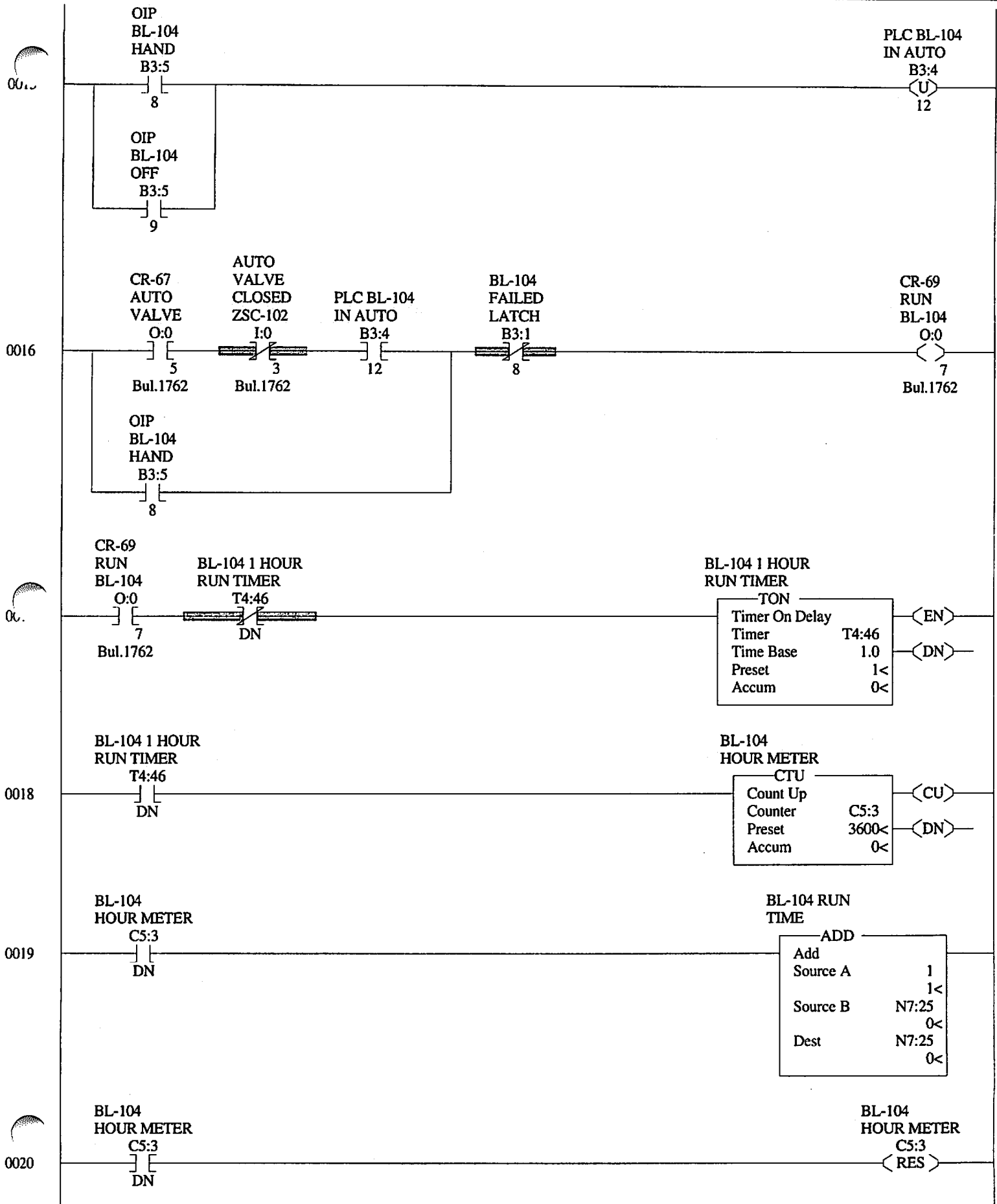


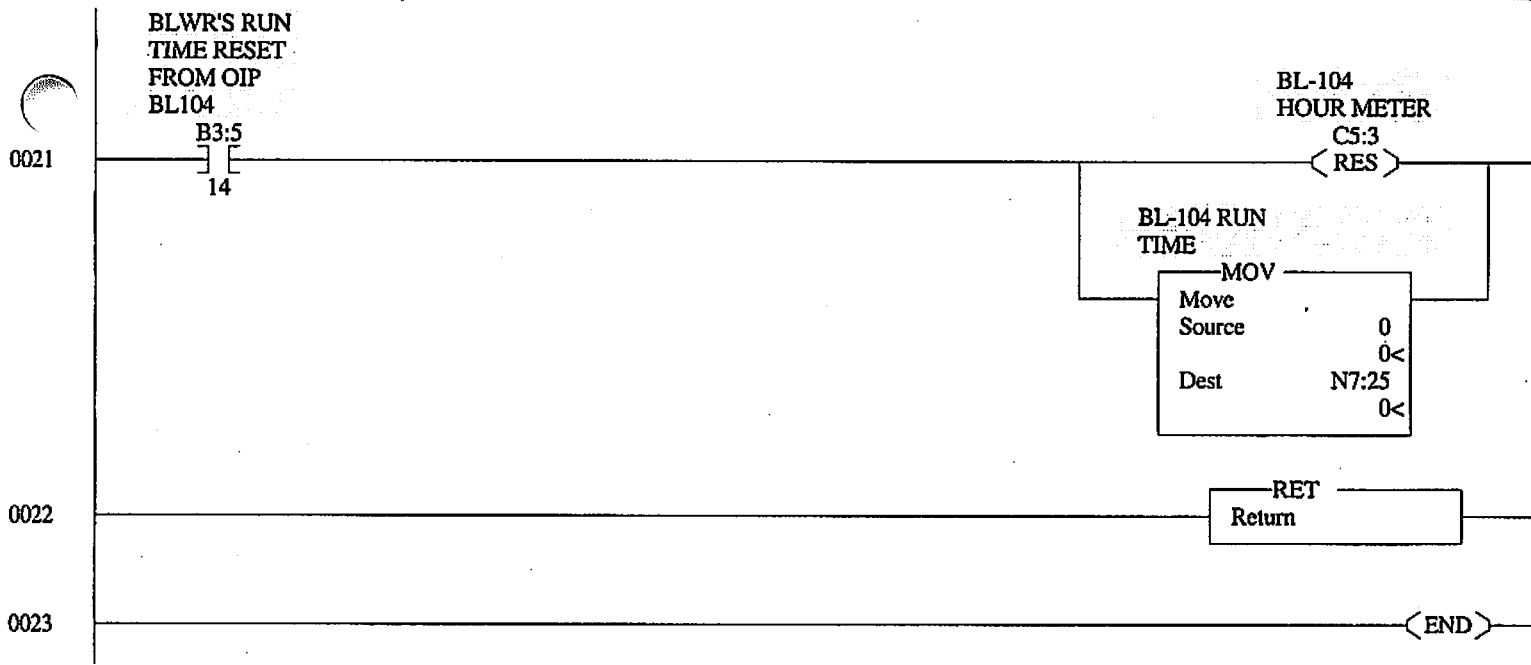












XV. RECOMMENDED SPARE PARTS

<u>Component</u>	<u>Tag Number</u>	<u>Part Number</u>	<u>Quantity</u>
1. Flame Scanner	BE-203	2653-213-05	1
2. Thermocouple Element Only	for TE-201 for TE-202A for TE-202B for TE-202C	1195449	4
3. Pilot Electrode	for ST-11916	0026535	1
4. Pilot Ignition Rod Insulator	for ST-11916	0003587	3
5. Pilot Assembly	ST-11916	1116511	1
6. Ignition Transformer	IT-1	0002558	1
7. Sight Glass Assembly	CA-ST-0600	0008170	1
8. Panel Light Bulb	for PNL-101	1013634	3
9. Pilot Gas Pressure Regulator	PCV-302	1260113	1
10. Pilot Gas Solenoid Valve	SV-303	0012004	1
11. Pilot Gas Pressure Gauge	PI-305	0022961	1
12. Purge Air Pressure Switch	PDSL-204	0024372	1
13. Damper Actuator	for TCV-202A	0001625	1
14. Damper Actuator Gasket Kit	for TCV-202A	9019000445	1

Please call John Zink Company at (918) 234-2751 for spare part assistance.

XVI. MATERIAL SAFETY DATA SHEETS

MATERIAL SAFETY DATA SHEET

B69VZ12
04 00

DATE OF PREPARATION
Sep 8, 2008

SECTION 1 — PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NUMBER

B69VZ12

PRODUCT NAME

ZINC-CLAD® II Plus Inorganic Zinc-Rich Coating (Part A)

MANUFACTURER'S NAME

THE SHERWIN-WILLIAMS COMPANY

101 Prospect Avenue N.W.

Cleveland, OH 44115

Telephone Numbers and Websites

Product Information	www.sherwin-williams.com
Regulatory Information	(216) 566-2902 www.paintdocs.com
Medical Emergency	(216) 566-2917
Transportation Emergency*	(800) 424-9300
*for Chemical Emergency ONLY (spill, leak, fire, exposure, or accident)	

SECTION 2 — COMPOSITION/INFORMATION ON INGREDIENTS

% by Weight	CAS Number	Ingredient	Units	Vapor Pressure
3	64742-94-5	Medium Aromatic Hydrocarbons		
		ACGIH TLV	Not Available	0.12 mm
		OSHA PEL	Not Available	
0.5	91-20-3	Naphthalene		
		ACGIH TLV	10 PPM	1 mm
		ACGIH TLV	15 PPM STEL	
		OSHA PEL	10 PPM	
		OSHA PEL	15 PPM STEL	
6	64-17-5	Ethanol		
		ACGIH TLV	1000 PPM	44 mm
		OSHA PEL	1000 PPM	
3	34590-94-8	2-Methoxymethylethoxypropanol		
		ACGIH TLV	100 ppm (Skin)	0.4 mm
		ACGIH TLV	150 ppm (Skin) STEL	
		OSHA PEL	100 ppm (Skin)	
OSHA PEL	150 ppm (Skin) STEL			
5	110-43-0	Methyl n-Amyl Ketone		
		ACGIH TLV	50 PPM	3.855 mm
		OSHA PEL	100 PPM	
17	78-10-4	Ethyl Silicate		
		ACGIH TLV	Not Available	1 mm
		OSHA PEL	100 PPM	
21	14808-60-7	Quartz		
		ACGIH TLV	0.025 mg/m3 as Resp. Dust	
		OSHA PEL	0.1 mg/m3 as Resp. Dust	
4	7631-86-9	Amorphous Silica		
		ACGIH TLV	10 mg/m3 as Dust	
		OSHA PEL	6 mg/m3 as Dust	
6	12001-26-2	Mica		
		ACGIH TLV	3 mg/m3 as Resp. Dust	
		OSHA PEL	3 mg/m3 as Resp. Dust	

SECTION 3 — HAZARDS IDENTIFICATION

ROUTES OF EXPOSURE

INHALATION of vapor or spray mist.

EYE or SKIN contact with the product, vapor or spray mist.

EFFECTS OF OVEREXPOSURE

- EYES:** Irritation.
- SKIN:** Prolonged or repeated exposure may cause irritation.
- INHALATION:** Irritation of the upper respiratory system.

HMIS Codes

Health	2*
Flammability	3
Reactivity	0

May cause nervous system depression. Extreme overexposure may result in unconsciousness and possibly death. Prolonged overexposure to solvent ingredients in Section 2 may cause adverse effects to the liver, urinary and reproductive systems.

SIGNS AND SYMPTOMS OF OVEREXPOSURE

Headache, dizziness, nausea, and loss of coordination are indications of excessive exposure to vapors or spray mists. Redness and itching or burning sensation may indicate eye or excessive skin exposure.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE

May cause allergic skin reaction in susceptible persons.

CANCER INFORMATION

For complete discussion of toxicology data refer to Section 11.

SECTION 4 — FIRST AID MEASURES

- EYES:** Flush eyes with large amounts of water for 15 minutes. Get medical attention.
- SKIN:** Wash affected area thoroughly with soap and water.
Remove contaminated clothing and laundry before re-use.
- INHALATION:** If affected, remove from exposure. Restore breathing. Keep warm and quiet.
- INGESTION:** Do not induce vomiting. Get medical attention immediately.

SECTION 5 — FIRE FIGHTING MEASURES

FLASH POINT 65° F PMCC **LEL** 0.8 **UEL** 19.0 **FLAMMABILITY CLASSIFICATION** RED LABEL -- Flammable, Flash below 100° F (38 °C)

EXTINGUISHING MEDIA

Carbon Dioxide, Dry Chemical, Foam

UNUSUAL FIRE AND EXPLOSION HAZARDS

Closed containers may explode when exposed to extreme heat. Application to hot surfaces requires special precautions. During emergency conditions overexposure to decomposition products may cause a health hazard. Symptoms may not be immediately apparent. Obtain medical attention.

SPECIAL FIRE FIGHTING PROCEDURES

Full protective equipment including self-contained breathing apparatus should be used. Water spray may be ineffective. If water is used, fog nozzles are preferable. Water may be used to cool closed containers to prevent pressure build-up and possible autoignition or explosion when exposed to extreme heat.

SECTION 6 — ACCIDENTAL RELEASE MEASURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

- Remove all sources of ignition. Ventilate the area.
- Remove with inert absorbent.

SECTION 7 — HANDLING AND STORAGE

STORAGE CATEGORY

DOL Storage Class IB

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

Contents are **FLAMMABLE**. Keep away from heat, sparks, and open flame. During use and until all vapors are gone: Keep area ventilated - Do not smoke - Extinguish all flames, pilot lights, and heaters - Turn off stoves, electric tools and appliances, and any other sources of ignition. Consult NFPA Code. Use approved Bonding and Grounding procedures. Keep container closed when not in use. Transfer only to approved containers with complete and appropriate labeling. Do not take internally. Keep out of the reach of children.

SECTION 8 — EXPOSURE CONTROLS/PERSONAL PROTECTION

PRECAUTIONS TO BE TAKEN IN USE

Use only with adequate ventilation. Avoid contact with skin and eyes. Avoid breathing vapor and spray mist. Wash hands after using. This coating may contain materials classified as nuisance particulates (listed "as Dust" in Section 2) which may be present at hazardous levels only during sanding or abrading of the dried film. If no specific dusts are listed in Section 2, the applicable limits for nuisance dusts are ACGIH TLV 10 mg/m3 (total dust), 3 mg/m3 (respirable fraction), OSHA PEL 15 mg/m3 (total dust), 5 mg/m3 (respirable fraction).

VENTILATION

Local exhaust preferable. General exhaust acceptable if the exposure to materials in Section 2 is maintained below applicable exposure limits. Refer to OSHA Standards 1910.94, 1910.107, 1910.108.

RESPIRATORY PROTECTION

If personal exposure cannot be controlled below applicable limits by ventilation, wear a properly fitted organic vapor/particulate respirator approved by NIOSH/MSHA for protection against materials in Section 2.

When sanding or abrading the dried film, wear a dust/mist respirator approved by NIOSH/MSHA for dust which may be generated from this product, underlying paint, or the abrasive.

PROTECTIVE GLOVES

Wear gloves which are recommended by glove supplier for protection against materials in Section 2.

EYE PROTECTION

Wear safety spectacles with unperforated sideshields.

OTHER PRECAUTIONS

This product must be mixed with other components before use. Before opening the packages, READ AND FOLLOW WARNING LABELS ON ALL COMPONENTS.

Intentional misuse by deliberately concentrating and inhaling the contents can be harmful or fatal.

SECTION 9 — PHYSICAL AND CHEMICAL PROPERTIES

PRODUCT WEIGHT	10.70 lb/gal	1282 g/l
SPECIFIC GRAVITY	1.29	
BOILING POINT	172 - 415° F	77 - 212° C
MELTING POINT	Not Available	
VOLATILE VOLUME	50%	
EVAPORATION RATE	Slower than ether	
VAPOR DENSITY	Heavier than air	
SOLUBILITY IN WATER	N.A.	
VOLATILE ORGANIC COMPOUNDS (VOC Theoretical - As Packaged)		
3.69lb/gal	442g/l	Less Water and Federally Exempt Solvents
3.69lb/gal	442g/l	Emitted VOC

SECTION 10 — STABILITY AND REACTIVITY

STABILITY — Stable

CONDITIONS TO AVOID

None known.

INCOMPATIBILITY

None known.

HAZARDOUS DECOMPOSITION PRODUCTS

By fire: Carbon Dioxide, Carbon Monoxide

HAZARDOUS POLYMERIZATION

Will not occur

SECTION 11 — TOXICOLOGICAL INFORMATION**CHRONIC HEALTH HAZARDS**

Reports have associated repeated and prolonged overexposure to solvents with permanent brain and nervous system damage.

Crystalline Silica (Quartz, Cristobalite) is listed by IARC and NTP. Long term exposure to high levels of silica dust, which can occur only when sanding or abrading the dry film, may cause lung damage (silicosis) and possibly cancer.

TOXICOLOGY DATA

CAS No.	Ingredient Name			
64742-94-5	Medium Aromatic Hydrocarbons	LC50 RAT	4HR	Not Available
		LD50 RAT		Not Available
91-20-3	Naphthalene	LC50 RAT	4HR	Not Available
		LD50 RAT		Not Available
64-17-5	Ethanol	LC50 RAT	4HR	Not Available
		LD50 RAT		7060 mg/kg
34590-94-8	2-Methoxymethylethoxypropanol	LC50 RAT	4HR	Not Available
		LD50 RAT		5135 mg/kg
110-43-0	Methyl n-Amyl Ketone	LC50 RAT	4HR	Not Available
		LD50 RAT		1670 mg/kg
78-10-4	Ethyl Silicate	LC50 RAT	4HR	Not Available
		LD50 RAT		6270 mg/kg
14808-60-7	Quartz	LC50 RAT	4HR	Not Available
		LD50 RAT		Not Available
7631-86-9	Amorphous Silica	LC50 RAT	4HR	Not Available
		LD50 RAT		Not Available
12001-26-2	Mica	LC50 RAT	4HR	Not Available
		LD50 RAT		Not Available

SECTION 12 — ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL INFORMATION
 No data available.

SECTION 13 — DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD
 Waste from this product may be hazardous as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR 261. Waste must be tested for ignitability to determine the applicable EPA hazardous waste numbers. Incinerate in approved facility. Do not incinerate closed container. Dispose of in accordance with Federal, State/Provincial, and Local regulations regarding pollution.

SECTION 14 — TRANSPORT INFORMATION

US Ground (DOT)
 1 Gallon and Less may be Classed as CONSUMER COMMODITY, ORM-D
 Larger Containers are Regulated as:
 UN1263, PAINT, 3, PG II, (ERG#128)
DOT (Dept of Transportation) Hazardous Substances & Reportable Quantities
 Naphthalene 100 lb RQ
Bulk Containers may be Shipped as (check reportable quantities):
 UN1263, PAINT, 3, PG II, (ERG#128)
Canada (TDG)
 UN1263, PAINT, CLASS 3, PG II, (ERG#128)
IMO
 UN1263, PAINT, CLASS 3, PG II, (18 C c.c.), EmS F-E, S-E

SECTION 15 — REGULATORY INFORMATION

SARA 313 (40 CFR 372.65C) SUPPLIER NOTIFICATION

CAS No.	CHEMICAL/COMPOUND	% by WT	% Element
91-20-3	Naphthalene	0.5	

CALIFORNIA PROPOSITION 65

WARNING: This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

TSCA CERTIFICATION

All chemicals in this product are listed, or are exempt from listing, on the TSCA Inventory.

SECTION 16 — OTHER INFORMATION

This product has been classified in accordance with the hazard criteria of the Canadian Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

The above information pertains to this product as currently formulated, and is based on the information available at this time. Addition of reducers or other additives to this product may substantially alter the composition and hazards of the product. Since conditions of use are outside our control, we make no warranties, express or implied, and assume no liability in connection with any use of this information.



A.P. Green, Harbison-Walker and NARCO

Printing date 05/12/2004

Reviewed on 05/12/2004

1 Identification of substance

- **Product details**
- **Trade name:** INSWOOL-HP BLANKET 8#
- **Manufacturer/Supplier:**
ANH Refractories Company
400 Fairway Drive
Moon Township, PA 15108
- **General Phone:** (412)375-6600
- **Information department:** MSDS Technical Information: (412)375-6837
- **Emergency information:** CHEMTREC 24 HOUR EMERGENCY PHONE NUMBER: 1-800-424-9300.

2 Composition/Data on components

- **Chemical characterization:**
- **CAS No. Description**
142844-00-6 refractory ceramic fibers (RCF)
- **Chemical characterization**
- **Description:** Mixture of the substances listed below with nonhazardous additions.

· **Components:**

142844-00-6 refractory ceramic fibers (RCF)	60-100%
---	---------

· **Additional information:**

*This product contains Refractory Ceramic Fibers (RCF) or an RCF wrap or mat. IARC has classified RCFs as a possible human carcinogen, Group 2B. This classification was based on sufficient evidence of carcinogenicity in animals and no available data in humans. NTP classified respirable RCFs as reasonably anticipated carcinogens. Recent industry ongoing epidemiology studies show the general health of workers in the RCF industry was similar to that of workers in other dusty work environments. There have been no reports of mesothelioma, and the lung cancer rate appears similar to background rates, but the number of workers with a long latency period are too few for definitive conclusions. There was a small number of employees with an increased risk of developing pleural plaques (shadows along the inside of the chest wall). These plaques, however, are not known to cause symptoms or disability. ANH recommends that safe handling methods are followed, including air monitoring in areas wherever the potential exists for airborne fibers, minimizing airborne exposures through use of NIOSH approved respirators, and wearing protective clothing, gloves and eye protection.

For the wording of the listed risk phrases refer to section 16.

3 Hazards identification

- **Hazard description:**
Toxic
- **Medical conditions aggravated by exposure to the product:** Asthma, chronic lung disease, and skin irritation.
- **Carcinogenicity Information:**
Refractory ceramic fibers are listed by IARC as Group 2B "Possibly Carcinogenic to Humans."
- **Information pertaining to particular dangers for man and environment:**
The product has to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.

(Contd. on page 2)



A.P. Green, Harbison-Walker and NARCO

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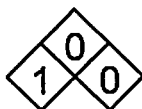
Printing date 05/12/2004

Reviewed on 05/12/2004

Trade name: INSWOOL-HP BLANKET 8#

(Contd. from page 1)

- May cause cancer.
- Irritating to eyes and respiratory system.
- NFPA ratings (scale 0-4)



Health = 1
Fire = 0
Reactivity = 0

HMIS Classification

HEALTH	*1
FIRE	0
REACTIVITY	0

Health: *1
Flammability: 0
Reactivity: 0

4 First aid measures

- After inhalation: Move to fresh air; consult doctor if needed.
- After skin contact: Immediately wash with water and soap and rinse thoroughly.
- After eye contact: Flush eyes with water for 15 minutes. If irritation persists, consult a doctor.
- After swallowing:
This product is intended for industrial applications; in the unlikely event that this product is swallowed, consult a physician if any adverse medical conditions occur.

5 Fire fighting measures

- Suitable extinguishing agents: Use fire fighting measures that suit the environment.
- Protective equipment: No special measures required.

6 Accidental release measures

- Person-related safety precautions: Not required.
- Measures for environmental protection: No special measures required.
- Measures for cleaning/collecting:
Dispose contaminated material as waste according to item 13.
Ensure adequate ventilation.

7 Handling and storage

- Handling:
Information for safe handling: Prevent formation of dust.
Information about protection against explosions and fires: No special measures required.
- Storage:
Requirements to be met by storerooms and containers: No special requirements.
Information about storage in one common storage facility: Not required.

(Contd. on page 3)



MATERIAL SAFETY DATA SHEET

A.P. Green, Harbison-Walker and NARCO

Page 3/6

Printing date 05/12/2004

Reviewed on 05/12/2004

Trade name: **INSWOOL-HP BLANKET 8#**

(Contd. from page 2)

- **Further information about storage conditions:** Store product inside, out of extreme weather conditions.

8 Exposure controls and personal protection

- **Components with limit values that require monitoring at the workplace:**
The product does not contain any relevant quantities of materials with critical values that have to be monitored at the workplace.
- **Personal protective equipment:**
- **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Wash hands before breaks and at the end of work.
Store protective clothing separately.
Avoid contact with the eyes.
Avoid contact with the eyes and skin.
- **Breathing equipment:**



NIOSH approved respirators should be used if dust is present. A respiratory protection program should be implemented if exposures exceed OSHA PELs.

- **Protection of hands:**



Protective gloves recommended

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.

Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

- **Material of gloves**

The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer. As the product is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.

- **Penetration time of glove material**

The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

- **Eye protection:** Safety glasses with side shields recommended

9 Physical and chemical properties

- **General Information**

Form:	Fibers
Color:	White
Odor:	Odorless

(Contd. on page 4)

USA



MATERIAL SAFETY DATA SHEET

A.P. Green, Harbison-Walker and NARCO

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Printing date 05/12/2004

Reviewed on 05/12/2004

Trade name: **INSWOOL-HP BLANKET 8#**

(Contd. from page 3)

- **Change in condition**
Melting point/Melting range: 1760°C (3200°F)
Boiling point/Boiling range: Undetermined.
- **Flash point:** Not applicable.
- **Auto igniting:** Product is not selfigniting.
- **Danger of explosion:** Product does not present an explosion hazard.
- **Density at 20°C (68°F):** 2.73 g/cm³
- **Solubility in / Miscibility with Water:** Insoluble.

10 Stability and reactivity

- **Thermal decomposition / conditions to be avoided:** No decomposition if used according to specifications.
- **Dangerous reactions** No dangerous reactions known.
- **Dangerous products of decomposition:** No dangerous decomposition products known.

11 Toxicological information

- **Acute toxicity:**
- **Primary acute effects:**
- **Skin contact:** No irritant effect.
- **Eye contact:** Irritating effect.
- **Sensitization:** No sensitizing effects known.
- **Additional toxicological information:**
The product shows the following dangers according to internally approved calculation methods for preparations:
Irritant
Carcinogenic.

12 Ecological information

- **General notes:** At present there are no ecotoxicological assessments.

13 Disposal considerations

- **Recommendation for Disposal of Product:**
As sold, this product is not RCRA hazardous. Final used condition must be evaluated prior to disposal. Dispose of waste product in accordance with Federal, State and Local regulations.
- **Recommendation for Disposal of Uncleaned Packaging:** Reuse, recycle or treat as industrial waste.

USA

(Contd. on page 5)



MATERIAL SAFETY DATA SHEET

A.P. Green, Harbison-Walker and NARCO

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Printing date 05/12/2004

Reviewed on 05/12/2004

Trade name: **INSWOOL-HP BLANKET 8#**

(Contd. from page 4)

14 Transport information

• **Transport/Additional information:** Not dangerous according to available information.

15 Regulations

• **SARA 313 TOXIC CHEMICALS**

No material listed in the components in Section 2 of this MSDS is on the SARA 313 list.

• **SARA 302 EXTREMELY HAZARDOUS SUBSTANCES**

No material listed in the components in Section 2 of this MSDS is on the SARA 302 list.

• **TSCA (Toxic Substances Control Act)**

This substance or all the ingredients of this product are on the Chemical Substances Inventory of the Toxic Substances Control Act (TSCA Inventory). The presence on this list does not require any legal reporting.

• **WHMIS Classification**

Class D - Division 2 - Sub Division A

Untested mixture containing a very toxic material

Class D - Division 2 - Sub Division B

Untested mixture containing a toxic material

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

• **Cancerogenity categories**

• **EPA (Environmental Protection Agency)**

None of the ingredients is listed.

• **IARC (International Agency for Research on Cancer)**

142844-00-6 | refractory ceramic fibers (RCF) | 2B

• **NTP (National Toxicology Program)**

142844-00-6 | refractory ceramic fibers (RCF) | R

• **TLV (Threshold Limit Value established by ACGIH)**

None of the ingredients is listed.

• **MAK (German Maximum Workplace Concentration)**

None of the ingredients is listed.

• **NIOSH-Ca (National Institute for Occupational Safety and Health)**

None of the ingredients is listed.

• **OSHA-Ca (Occupational Safety & Health Administration)**

None of the ingredients is listed.

• **Classification according to EU-guidelines**

• **Hazard symbols:**

Toxic

• **Hazard-determining components of labeling:**

refractory ceramic fibers (RCF)

• **Risk phrases:**

May cause cancer.

(Contd. on page 6)



MATERIAL SAFETY DATA SHEET

A.P. Green, Harbison-Walker and NARCO

Page 6/6

Printing date 05/12/2004

Reviewed on 05/12/2004

Trade name: **INSWOOL-HP BLANKET 8#**

(Contd. from page 5)

Irritating to eyes and respiratory system.

• **Safety phrases:**

Do not breathe dust.

Avoid contact with eyes.

After contact with skin, wash immediately with plenty of soap and water

Wear suitable protective clothing and gloves.

• **Special labeling of certain preparations:**

PRODUCT MAY CONTAIN REFRACTORY CERAMIC FIBERS (RCF) OR INCLUDE A WRAP OR MAT WHICH CONTAINS RCF:

Prolonged or repeated inhalation of RCF dust may cause cancer.

Exposure of the product to high temperature may convert fibers to crystalline silica, an IARC and NTP listed carcinogen which can cause silicosis or cancer.

Use with adequate ventilation, wear safety glasses and dust-type respirator if dust is present.

In case of inhalation, remove victim to fresh air.

In case of eye contact, flush with water for 15 minutes.

• **National regulations:**

• **The following ingredients are known in the state of California to be a cancer risk (Proposition 65):**

All ingredients are listed.

16 Other information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

• **Contact:** Patricia A. Kott 412-375-6712

• **Creation date:** 08/14/2000

USA



MATERIAL SAFETY DATA SHEET

A.P. Green, Harbison-Walker and NARCO

Page 1/6

Printing date 05/12/2004

Reviewed on 05/12/2004

1 Identification of substance

• **Product details**

• **Trade name:** INSWOOL-HP BLANKET 6#

• **Manufacturer/Supplier:**
ANH Refractories Company
400 Fairway Drive
Moon Township, PA 15108

General Phone: (412)375-6600

- **Information department:** MSDS Technical Information: (412)375-6837
- **Emergency information:** CHEMTREC 24 HOUR EMERGENCY PHONE NUMBER: 1-800-424-9300.

2 Composition/Data on components

• **Chemical characterization:**

• **CAS No. Description**

142844-00-6 refractory ceramic fibers (RCF)

• **Chemical characterization**

• **Description:** Mixture of the substances listed below with nonhazardous additions.

• **Components:**

142844-00-6	refractory ceramic fibers (RCF)	60-100%
-------------	---------------------------------	---------

• **Additional information:**

*This product contains Refractory Ceramic Fibers (RCF) or an RCF wrap or mat. IARC has classified RCFs as a possible human carcinogen, Group 2B. This classification was based on sufficient evidence of carcinogenicity in animals and no available data in humans. NTP classified respirable RCFs as reasonably anticipated carcinogens. Recent industry ongoing epidemiology studies show the general health of workers in the RCF industry was similar to that of workers in other dusty work environments. There have been no reports of mesothelioma, and the lung cancer rate appears similar to background rates, but the number of workers with a long latency period are too few for definitive conclusions. There was a small number of employees with an increased risk of developing pleural plaques (shadows along the inside of the chest wall). These plaques, however, are not known to cause symptoms or disability. ANH recommends that safe handling methods are followed, including air monitoring in areas wherever the potential exists for airborne fibers, minimizing airborne exposures through use of NIOSH approved respirators, and wearing protective clothing, gloves and eye protection.

For the wording of the listed risk phrases refer to section 16.

3 Hazards identification

• **Hazard description:**

Toxic

• **Medical conditions aggravated by exposure to the product:** Asthma, chronic lung disease, and skin irritation.

• **Carcinogenicity Information:**

Refractory ceramic fibers are listed by IARC as Group 2B "Possibly Carcinogenic to Humans."

• **Information pertaining to particular dangers for man and environment:**

The product has to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.

(Contd. on page 2)

USA



A.P. Green, Harbison-Walker and NARCO

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Printing date 05/12/2004

Reviewed on 05/12/2004

Trade name: INSWOOL-HP BLANKET 6#

(Contd. from page 1)

May cause cancer.
Irritating to eyes and respiratory system.
• NFPA ratings (scale 0-4)



Health = 1
Fire = 0
Reactivity = 0

• HMIS Classification

HEALTH	1
FIRE	0
REACTIVITY	0

Health: *1
Flammability: 0
Reactivity: 0

4 First aid measures

- After inhalation: Move to fresh air; consult doctor if needed.
- After skin contact: Immediately wash with water and soap and rinse thoroughly.
- After eye contact: Flush eyes with water for 15 minutes. If irritation persists, consult a doctor.
- After swallowing:
This product is intended for industrial applications; in the unlikely event that this product is swallowed, consult a physician if any adverse medical conditions occur.

5 Fire fighting measures

- Suitable extinguishing agents: Use fire fighting measures that suit the environment.
- Protective equipment: No special measures required.

6 Accidental release measures

- Person-related safety precautions: Not required.
- Measures for environmental protection: No special measures required.
- Measures for cleaning/collecting:
Dispose contaminated material as waste according to item 13.
Ensure adequate ventilation.

7 Handling and storage

- Handling:
• Information for safe handling: Prevent formation of dust.
• Information about protection against explosions and fires: No special measures required.
- Storage:
• Requirements to be met by storerooms and containers: No special requirements.
• Information about storage in one common storage facility: Not required.

(Contd. on page 3)



Trade name: INSWOOL-HP BLANKET 6#

(Contd. from page 2)

Further information about storage conditions: Store product inside, out of extreme weather conditions.

8 Exposure controls and personal protection

Components with limit values that require monitoring at the workplace:
The product does not contain any relevant quantities of materials with critical values that have to be monitored at the workplace.

Personal protective equipment:

General protective and hygienic measures:

- Keep away from foodstuffs, beverages and feed.
- Wash hands before breaks and at the end of work.
- Store protective clothing separately.
- Avoid contact with the eyes.
- Avoid contact with the eyes and skin.

Breathing equipment:



NIOSH approved respirators should be used if dust is present. A respiratory protection program should be implemented if exposures exceed OSHA PELs.

Protection of hands:



Protective gloves recommended

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.

Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

Material of gloves

The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer. As the product is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.

Penetration time of glove material

The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

Eye protection: Safety glasses with side shields recommended

9 Physical and chemical properties

General Information

Form:	Fibers
Color:	White
Odor:	Odorless

(Contd. on page 4)



MATERIAL SAFETY DATA SHEET

A.P. Green, Harbison-Walker and NARCO

Page 4/6

Printing date 05/12/2004

Reviewed on 05/12/2004

Trade name: INSWOOL-HP BLANKET 6#

(Contd. from page 3)

- **Change in condition**
Melting point/Melting range: 1760°C (3200°F)
Boiling point/Boiling range: Undetermined.
- **Flash point:** Not applicable.
- **Auto igniting:** Product is not selfigniting.
- **Danger of explosion:** Product does not present an explosion hazard.
- **Density at 20°C (68°F):** 2.73 g/cm³
- **Solubility in / Miscibility with Water:** Insoluble.

10 Stability and reactivity

- **Thermal decomposition / conditions to be avoided:** No decomposition if used according to specifications.
- **Dangerous reactions** No dangerous reactions known.
- **Dangerous products of decomposition:** No dangerous decomposition products known.

11 Toxicological information

- **Acute toxicity:**
- **Primary acute effects:**
- **Skin contact:** No irritant effect.
- **Eye contact:** Irritating effect.
- **Sensitization:** No sensitizing effects known.
- **Additional toxicological information:**
The product shows the following dangers according to internally approved calculation methods for preparations:
Irritant
Carcinogenic.

12 Ecological information

- **General notes:** At present there are no ecotoxicological assessments.

13 Disposal considerations

- **Recommendation for Disposal of Product:**
As sold, this product is not RCRA hazardous. Final used condition must be evaluated prior to disposal. Dispose of waste product in accordance with Federal, State and Local regulations.
- **Recommendation for Disposal of Uncleaned Packaging:** Reuse, recycle or treat as industrial waste.

USA

(Contd. on page 5)



MATERIAL SAFETY DATA SHEET

A.P. Green, Harbison-Walker and NARCO

Page 5/6

Printing date 05/12/2004

Reviewed on 05/12/2004

Trade name: INSWOOL-HP BLANKET 6#

(Contd. from page 4)

14 Transport information

• *Transport/Additional information: Not dangerous according to available information.*

15 Regulations

• **SARA 313 TOXIC CHEMICALS**

No material listed in the components in Section 2 of this MSDS is on the SARA 313 list.

• **SARA 302 EXTREMELY HAZARDOUS SUBSTANCES**

No material listed in the components in Section 2 of this MSDS is on the SARA 302 list.

• **TSCA (Toxic Substances Control Act)**

This substance or all the ingredients of this product are on the Chemical Substances Inventory of the Toxic Substances Control Act (TSCA Inventory). The presence on this list does not require any legal reporting.

• **WHMIS Classification**

Class D - Division 2 - Sub Division A

Untested mixture containing a very toxic material

Class D - Division 2 - Sub Division B

Untested mixture containing a toxic material

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

• **Carcinogenicity categories**

• **EPA (Environmental Protection Agency)**

None of the ingredients is listed.

• **IARC (International Agency for Research on Cancer)**

142844-00-6 refractory ceramic fibers (RCF) | 2B

• **NTP (National Toxicology Program)**

142844-00-6 refractory ceramic fibers (RCF) | R

• **TLV (Threshold Limit Value established by ACGIH)**

None of the ingredients is listed.

• **MAK (German Maximum Workplace Concentration)**

None of the ingredients is listed.

• **NIOSH-Ca (National Institute for Occupational Safety and Health)**

None of the ingredients is listed.

• **OSHA-Ca (Occupational Safety & Health Administration)**

None of the ingredients is listed.

• **Classification according to EU-guidelines**

• **Hazard symbols:**

Toxic

• **Hazard-determining components of labeling:**

refractory ceramic fibers (RCF)

• **Risk phrases:**

May cause cancer.

(Contd. on page 6)



MATERIAL SAFETY DATA SHEET

A.P. Green, Harbison-Walker and NARCO

Page 6/6

Printing date 05/12/2004

Reviewed on 05/12/2004

Trade name: **INSWOOL-HP BLANKET 6#**

(Contd. from page 5)

Irritating to eyes and respiratory system.

• **Safety phrases:**

Do not breathe dust.

Avoid contact with eyes.

After contact with skin, wash immediately with plenty of soap and water

Wear suitable protective clothing and gloves.

• **Special labeling of certain preparations:**

PRODUCT MAY CONTAIN REFRACTORY CERAMIC FIBERS (RCF) OR INCLUDE A WRAP OR MAT WHICH CONTAINS RCF:

Prolonged or repeated inhalation of RCF dust may cause cancer.

Exposure of the product to high temperature may convert fibers to crystalline silica, an IARC and NTP listed carcinogen which can cause silicosis or cancer.

Use with adequate ventilation, wear safety glasses and dust-type respirator if dust is present.

In case of inhalation, remove victim to fresh air.

In case of eye contact, flush with water for 15 minutes.

• **National regulations:**

• **The following ingredients are known in the state of California to be a cancer risk (Proposition 65):**

All ingredients are listed.

16 Other information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

• **Contact:** Patricia A. Kott 412-375-6712

• **Creation date:** 12/05/2000

USA

City of Walla Walla Sudbury Landfill

Area 6 Closure 2010 Information

Section

6. Flare Facility

Operation and Maintenance

Manual for a

4' Diameter, 40' High

ENCLOSED ZTOF[®]

BIOGAS FLARE SYSTEM



John Zink Company
11920 East Apache Street
Tulsa, Oklahoma 74116-1300

OPERATION AND MAINTENANCE MANUAL

FOR A

4' DIAMETER, 40' HIGH

ENCLOSED ZTOF[®]

BIOGAS FLARE SYSTEM

FACILITY: Sudbury Landfill
Walla Walla, WA

WARNING

Do not attempt flare operation without first becoming familiar with these instructions. Improper equipment operation may result in personal injury, death, or equipment damage.

Prepared for

Purchasing Company: Mark Heuett Contractors
End User: Sudbury Landfill
Purchase Order: 08232010LTR

Prepared by

John Zink Company
11920 East Apache Street
Tulsa, Oklahoma 74116-1300
Sales Order: 9109403
Date: December 2010

For assistance, please contact John Zink Company as follows:

Service (918) 234-2751

Emergency (918) 234-1800

Spare Parts (918) 234-2751

Facsimile (918) 234-2700

Request field service and spare part assistance during regular office hours, from 8:00 a.m. to 4:30 p.m. (CST).

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II. INTRODUCTION

This manual provides an overview of a John Zink Biogas Flare System. The system consists of an Enclosed ZTOF[®] Biogas Flare and a Flare Control Panel. Pertinent information required to operate and maintain safely the John Zink supplied equipment is located within these instructions.

A John Zink Enclosed ZTOF Biogas Flare offers automated operation and is designed to destroy safely, with automatic temperature control, typical organic compounds generated by solid waste and other biogas processes. The system is controlled with a processor, or programmable logic controller (PLC), which receives and transmits signals with respect to operating conditions. If an unacceptable operating condition occurs, the control system discontinues flow of biogas or adjusts the operating parameters to correct the problem. Control of the Enclosed ZTOF Biogas Flare includes an initial purge cycle, automatic ignition sequence, and fail-safe controls. A self-checking flame scanner monitors pilot flame or main flame and integrated safety shutdown features prevent equipment damage.

Please become familiar with this manual. Contact John Zink Company with any questions or to request additional assistance.

III. SAFETY SUMMARY

The following general safety precautions apply to operating and maintaining a John Zink Biogas Flare System. Instructions contained in this manual are in addition to, and do not replace, the existing operating procedures and policies of the operating company and owner with regard to standard safety precautions for flare operation and maintenance.

WARNING

High voltages capable of causing death are associated with this equipment. Use extreme caution when servicing electrical enclosures or any other electrical components. Disconnect the electrical source of any circuit on which service is being performed and lock open the corresponding disconnect switch. Ensure electrical enclosures and components are grounded properly before applying power.

WARNING

Flare systems may contain or produce toxic gases. Always consider appropriate safety precautions whenever personnel may be exposed to flare gases. In particular, exposure may occur during close inspection of a flare tip or pilot and during removal or maintenance of equipment attached to gas supply pipe.

WARNING

Failure to use proper respiratory protection may result in exposure to hazardous materials. Ceramic fiber blanket insulation contains fibers which may cause cancer. After firing, cristabolite, a ceramic fiber material known to cause cancer, may be present. In addition to proper respiratory protection, refer to Section XVII, "Material Safety Data Sheets" to avoid exposure.

WARNING

Elevated surface temperatures may exist during certain operating conditions. Exercise caution while near equipment to prevent burns.

IV. RECEIPT AND INSTALLATION

Receipt

Upon delivery to the site and prior to installation, carefully examine the equipment for damage. Any damage sustained during shipment will be reimbursed through the freight company and their insurance agent. To assure prompt and accurate processing of any claims, the following is recommended:

1. Inspect each item as it is unloaded or uncrated. Note any damage or shortages on the shipping documentation before signing for delivery acceptance.
2. If the shipment cannot be inspected upon arrival, sign the delivery acceptance documents with the following qualification:

“accepted subject to future inspection”
3. Inspect the delivery as soon as possible, and no later than 10 days after delivery.
4. If damage or shortages are apparent, notify the freight company immediately and supply an itemized damage or shortage list. In addition, notify John Zink Company to initiate prompt replacement or repair procedures.

Installation

Reference Drawings

The following list of drawings are necessary for equipment installation and are located in Section XII, "Reference Drawings". To identify specific components or for additional information, also refer to component specification sheets located in Section XIII, "Specification Sheets".

D-F-9109403-150	Process and Instrument Diagram
D-F-9109403-301	Enclosed ZTOF Biogas Flare
ST-11916	KE-1/ST Pilot
D-F-9109403-303	ZMS Moisture Separator
D-F-9109403-400	Panel Detail
D-F-9109403-401	Wiring Diagram
D-F-9109403-402	Wiring Diagram
D-F-9109403-403	Wiring Diagram
D-F-9109403-404	Wiring Diagram

General

1. Installation, connection, and assembly of the stack, any remaining piping, electrical conduit, wiring, supports, and field or finish painting are not the responsibility of John Zink Company.
2. The foundation is to be level and designed for site soil conditions considering loads the equipment will produce. Required anchor bolt and support locations appear on the reference drawings.
3. Ensure equipment is grounded adequately for site soil conditions and as directed by local electric codes.

4. Review the reference drawings for electrical and process piping connections to the system.
5. Power wires, thermocouple wires, signal wires, and flame scanner wires each are to be installed in separate conduit. Wire separation is necessary to avoid electrical interference problems which may affect equipment performance.
6. The ignition rod insulators in the pilot are fragile. Verify the insulators are not damaged and the rod, insulator bracket, and insulators are secure.
7. Verify the thermocouple assemblies are not damaged.
8. Clean inside all system piping and remove sand, rocks, weld slag, or any other debris immediately prior to assembly or installation. Use high pressure air to clear piping after assembly and installation.
9. If high winds are probable, positioning a windscreen approximately 6 feet in front of each damper is recommended.

CAUTION

EPDM gasket material is not recommended for biogas applications.

Mechanical - Stack

1. Position the flare stack on a concrete foundation by connecting one main crane with spreader bar to the lifting lugs at the top of the stack, and connecting a separate tailing crane near the bottom of the stack.
2. Bolt the stack to the foundation.
3. Install a 6 inch depth of gravel inside the bottom of the stack before initial operation to protect the foundation from radiant heat.
4. Remove all lifting lugs from the stack *prior* to initial operation to avoid unsafe conditions during future usage. Material degradation from high temperature exposure during flare operation may significantly reduce lug integrity.
5. Install all flare tips on the flare manifold with the bolts, nuts, and gaskets provided.
6. Verify the drain plug at the flare inlet, connection C1, is secure.
7. Inspect the internal ceramic blanket insulation for any damage.
8. Install the automatic damper, TCV-202A, to the *hinged* connection N4. Gaskets are not required. Locate the actuator and bracket assembly on the right when facing the damper.
9. Thread the sight glass assembly, CA-ST-0600, to connection C6.
10. Mount the pilot assembly to connection N2 with the bolts and nuts provided. A gasket is not required.
11. Mount the Ignition Panel, PNL-103, to the brackets on the stack exterior with the bolts and nuts provided.
12. Mount the scanner swivel assembly, ST-11065, and flame scanner, BE-203, to connection C5.
13. Mount the purge air blower, BL-204, to connection N3 with the bolts and nuts provided. A gasket is not required.
14. Mount the purge air pressure switch, PDSL-204, to the brackets on the stack exterior with the screws provided.
15. Connect the purge air pressure switch, PDSL-204, to connection C4 with tubing and

- fittings provided.
16. Install the thermocouples, TE-201, TE-202A, TE-202B, and TE-202C, in connections C11, C8, C9, and C10, respectively. Refer to the following table for thermocouple placement information:

Automatic Temperature Control Thermocouple

Flow Rate (SCFM) *	Elevation (ft)
150 – 216	17.00
217 – 283	22.50
284 – 350	28.00

* based on 50% methane concentration

High Temperature Thermocouple

all flow rates	17.00
----------------	-------

17. Verify the sample port plugs contain insulation and are secure in connections C12 and C13.
18. Mount the flame arrester, FA-107, directly to the flare inlet flange, connection N1, with bolts, nuts, and gasket.

Mechanical - Interconnecting Pipe

1. Connect gas supply pipe with supports to the ZMS Moisture Separator, V-101, inlet, connection N20, with bolts, nuts, and gasket.
2. Install gas pipe with supports and an expansion joints, if necessary, between the ZMS Moisture Separator, connection N21, and the flame arrester, FA-107, at the flare inlet.
3. Install automatic block valve SOV-102.
4. Mount the flow meter, FE-107, in the gas pipe. For proper performance, the manufacturer requires a minimum distance of ten pipe diameters of straight, undisturbed flow upstream of the flow meter, and five diameters of straight, undisturbed flow downstream of the flow meter.
5. Connect a compressed air or nitrogen source to the automatic block valve solenoid, SV-102.
6. Connect a natural gas or propane source to the pilot gas pipe spool, containing the pressure regulator, PCV-302, solenoid valve, SV-303, hand valve, HV-304, and pressure gauge, PI-305. Install pilot gas pipe with supports between the pilot gas pipe spool and the pilot, connection C2, mounted in the stack (allow sufficient flexible hose at the pilot for adjustment).

Electrical - Stack

1. Install conduit and connect ignition wire between the Ignition Panel, PNL-103, and the pilot, connection C3.
2. Install conduit and connect power wire between the following components and the panel rack, PR-101:

Ignition Panel, PNL-103
purge air blower, BL-204
purge air pressure switch, PDSL-204
damper actuator, TCV-202A

3. Install conduit and connect signal wire between the following components and the panel rack, PR-101:

flame scanner, BE-203
damper actuator, TCV-202A

4. Install conduit and connect thermocouple wire between the thermocouples, TE-201, TE-202A, TE-202B, and TE-202C, and the panel, PNL-101.

Electrical - Panel

1. Install conduit and connect supply power wire to the panel, PNL-101.

Electrical - Interconnecting Pipe

1. Install conduit and connect power wire between the flow meter, FE-107, and the panel rack, PR-101 (allow sufficient flexible conduit for removal).
2. Install conduit and connect signal wire between the flow meter, FE-107, and the panel rack, PR-101 (allow sufficient flexible conduit for removal).

Miscellaneous

1. Confirm all filter elements, mesh screens, and mist elimination elements are installed properly, if required.
2. Verify all pipe fittings and flanges (with gaskets, if required) are secure and all threaded nuts, bolts, and fittings are tightened properly.
3. If applicable, do not seal electrical conduit connections until the system installation is verified and initial operation is complete.
4. Verify all electrical conduit fittings (with seals, if required) are secure.
5. Verify all external electrical control and power wire is sized correctly and the system contains adequate overload protection.
6. Verify all electrical wiring connections are secure and all threaded terminals are tightened properly.

NOTE

An enclosure heater is installed in the Flare Control Panel, PNL-101, to prevent internal corrosion. Individual electric motors may contain integral heaters also to prevent internal corrosion. Ensure all heaters are connected to a reliable power supply and operated continuously, especially during outside storage or when operation is discontinued for an extended duration. Consult wiring diagrams in Section XII, "Reference Drawings" for additional details.

V. DESIGN BASIS

Gas Stream

Type:	landfill
Composition:	50% CH ₄ (maximum) 50% CO ₂ , air, inert gases
Lower Heating Value:	454 BTU/SCF
Temperature:	100 °F
Flow Rate:	350 SCFM (maximum) 150 SCFM (minimum)
Heat Release *:	9,530,000 BTU/hr (maximum)
* lower heating value basis	

CAUTION

Flame flashback may occur if the gas stream contains an amount of oxygen within the explosive limit.

NOTE

Methane concentrations less than 30% may require the addition of enrichment fuel for stable combustion.

Process Design

Smokeless Capacity:	100%
Destruction Efficiency:	98% (minimum)
Operating Temperature:	1400 °F to 1800 °F (2000 °F shutdown)
Retention Time:	0.7 second at 1800 °F (minimum)
Flare Inlet Pressure:	5" H ₂ O (maximum)
Ambient Pressure:	14.7 psia

Mechanical Design

Wind Speed Classification:	100 mph
Seismic Classification:	zone 4
Ambient Temperature:	32 to 120 °F
Electrical Area Classification:	non-hazardous for control panel PNL-101 Class I Div I on all stack mounted controls Class I Div II for the gas blowers
Site Elevation:	1000 feet AMSL

Utility Requirements

Pilot Gas:	22 SCFH of propane at 10 psig
Compressed Air or Nitrogen:	100 psig (minimum) dry
Electrical:	120 V, single phase, 60 Hz for control components

VI. OPERATIONAL PHILOSOPHY

The following information briefly describes the operating logic and sequence for an Enclosed ZTOF® Flare System.

WARNING

Do not circumvent the purge cycle, any flame management sequence, or any other safety sequence.

Logic

A burner management system, which includes a flame safeguard package, monitors specific parameters and discontinues operation if an unsafe condition occurs. An ultraviolet, self-checking flame scanner detects both pilot flame and main flame. The flame scanner is unable to distinguish between flame sources. Typical shutdown scenarios include:

Flare High Temperature Shutdown

Flare High Temperature Shutdown occurs the moment a temperature above the high temperature switch setpoint value is detected within the flare enclosure by a dedicated high temperature thermocouple. The "Flare Shutdown" light illuminates immediately and system operation discontinues.

Flare Low Temperature Shutdown

Flare Low Temperature Shutdown occurs when a temperature below the low temperature switch setpoint value is detected within the flare enclosure by the selected temperature control thermocouple and exists for ten minutes consecutively. The "Flare Shutdown" light illuminates and system operation discontinues.

Pilot Flame Failure and Shutdown

Pilot Flame Failure occurs, during the ignition sequence, when the flame scanner is unable to detect the presence of flame inside the flare enclosure. When Pilot Flame Failure occurs, system operation is interrupted momentarily. Then the entire purge cycle and ignition sequence are repeated automatically. A Shutdown occurs only after three consecutive Failures, or unsuccessful attempts. Once Pilot Flame Shutdown occurs, the "Flare Shutdown" light illuminates and system operation discontinues.

Main Flame Failure and Shutdown

Main Flame Failure occurs, after the ignition sequence is complete, when the flame scanner is unable to detect the presence of flame inside the flare enclosure. When Main Flame Failure

occurs, system operation is interrupted momentarily. Then the entire purge cycle and ignition sequence are repeated automatically. A Shutdown occurs only after three consecutive Failures, or unsuccessful attempts. Once Main Flame Shutdown occurs, the "Flare Shutdown" light illuminates and system operation discontinues.

Other safety features include:

- Purge Failure
- Automatic Block Valve Failure
- Gas Blower Failure

Upon determining the source of an alarm condition and completing the necessary corrective action, a system reset is required to begin operation again.

Sequence

A typical operating sequence consists of:

System Control Selection

Select either local or remote system control to begin system operation. Local control requires interaction at the control panel to start and stop operation. Remote control allows starting and stopping operation without interaction at the control panel.

Operating Permissives

System operation is permitted only after confirming two safety conditions exist. The closed limit switch for the automatic block valve must be satisfied, proving a closed valve position. Additionally, the flame scanner must not detect the presence of flame inside the flare enclosure.

Purge Cycle

Prior to beginning the ignition sequence, the combustion chamber and flare enclosure must be purged with ambient air to ensure no potentially explosive gas mixture exists inside. To create a safe condition for pilot ignition, the purge air blower operates and the automatic air damper louvers are maintained fully open for five minutes prior to each ignition attempt. When purge air blower operation begins, the "Flare Operating" light flashes.

Ignition Sequence

The ignition sequence begins immediately after the purge cycle is complete. The pilot gas solenoid valve opens automatically, supplying gas to the pilot, and the ignition transformer energizes. The ignition transformer continues for ten seconds and then the flame scanner verifies flame is present.

Gas Supply

Once the flame scanner detects pilot flame, the automatic block valve opens, operation of the selected gas blower begins, supplying gas to the flare. After the open limit switch for the automatic block valve is achieved, the pilot gas solenoid valve closes, and the "Flare Operating" light illuminates. While the flame scanner verifies the presence of flame, system operation continues.

Automatic Air Damper Temperature Control

The operating temperature, or temperature maintained inside the flare enclosure, is controlled by varying the ambient air available through the air damper louvers. The elevation of the temperature control thermocouple is selected depending on the gas flow rate and methane concentration. The operating temperature is maintained by adjusting automatically the position of the louvers. Closing the louvers reduces the amount of air available and increases the operating temperature, while opening the louvers increases the amount of air available and decreases the operating temperature. The louvers are maintained open initially, before beginning automatic temperature control modulation, which introduces air inside the flare enclosure while the enclosure is cold and lacking draft, to minimize smoke during initial operation.

Operator Interface Panel

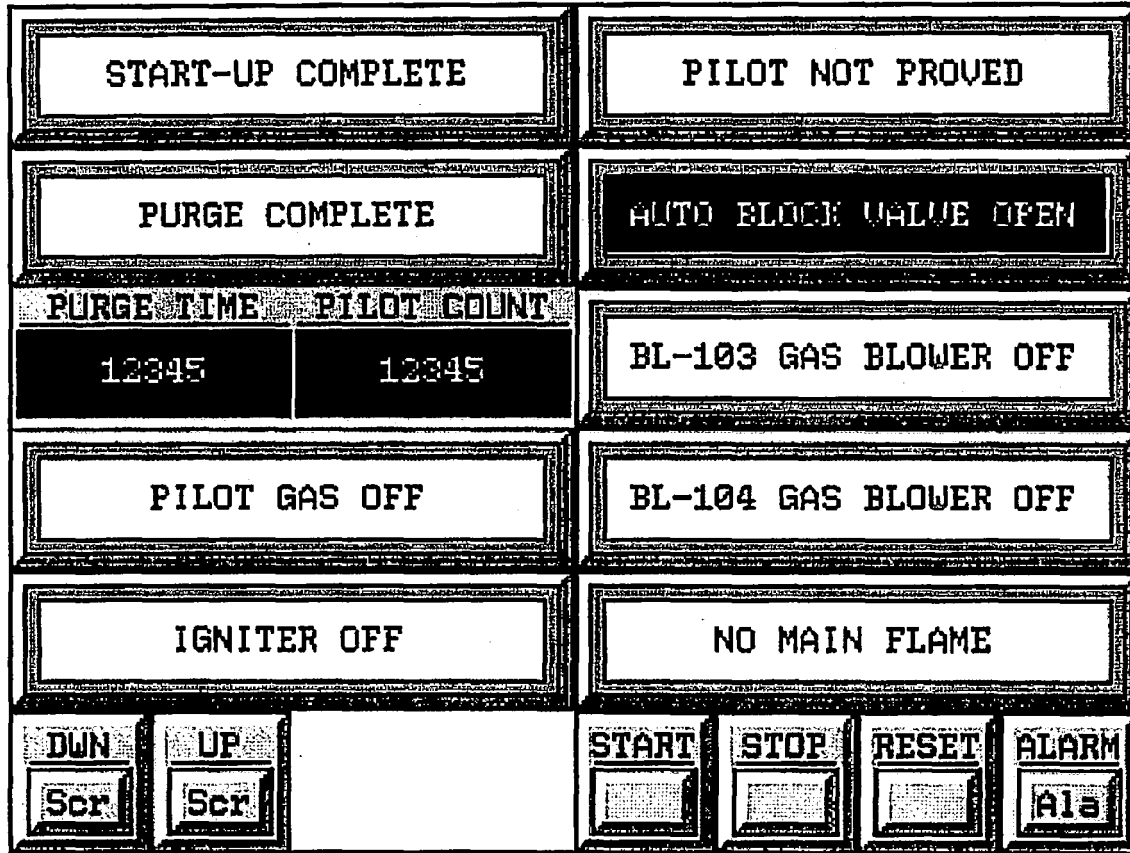
The Flare Control Panel contains an Operator Interface Panel (OIP), or touch screen, which replaces the usual selector switches, indicating lights, and pushbuttons provided to control, operate, and monitor the system equipment.

Contact Screen



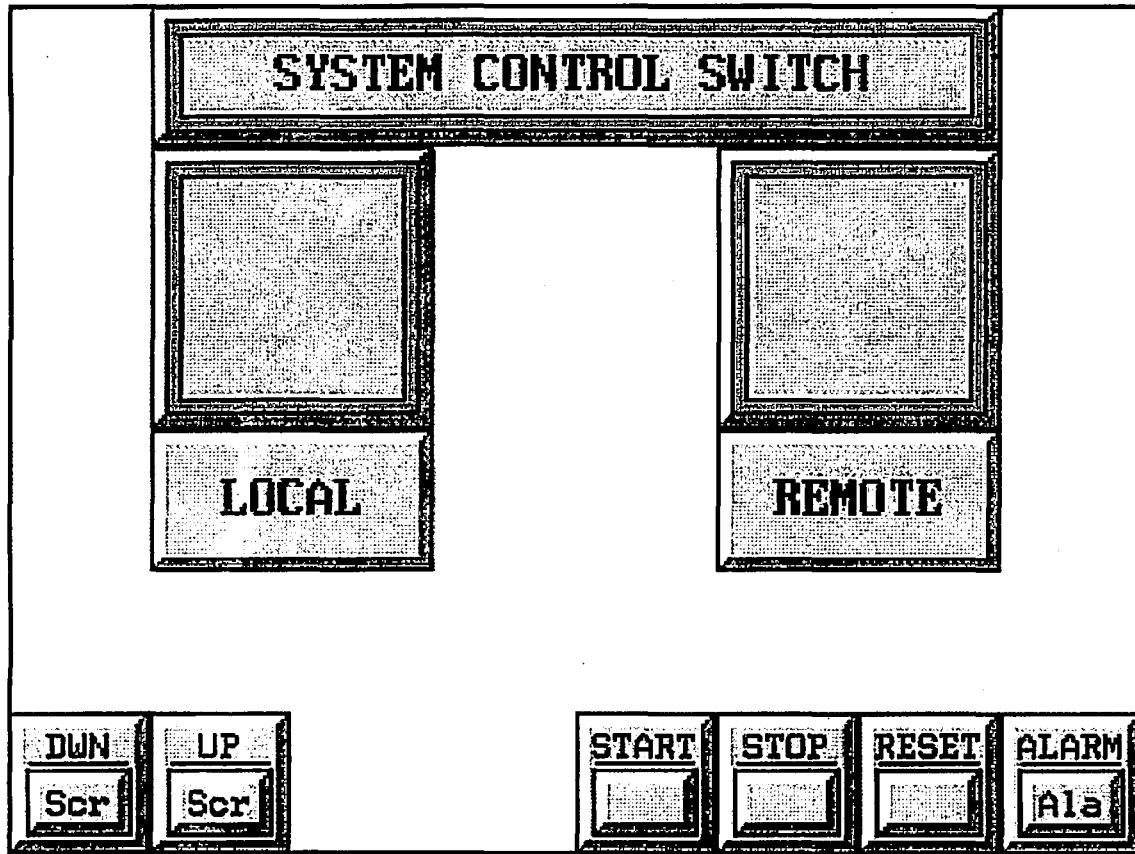
The "Contact" screen displays contact information for John Zink Company and each available screen contains separate buttons for transferring to the various screens or for controlling system operation. Press either button located at the bottom left corner of any screen to activate the next ("Up") or previous ("Down") screen. Press the corresponding buttons located at the bottom right corner of any screen to begin system operation automatically ("Start"), discontinue system operation ("Stop"), reset a fault condition ("Reset"), or access detailed alarm information ("Alarm"). Press the "Lamp" button to confirm all panel indicating lights are functional and press the "Conf" button to access parameters from a separate "Configuration" screen.

Flare Status Screen



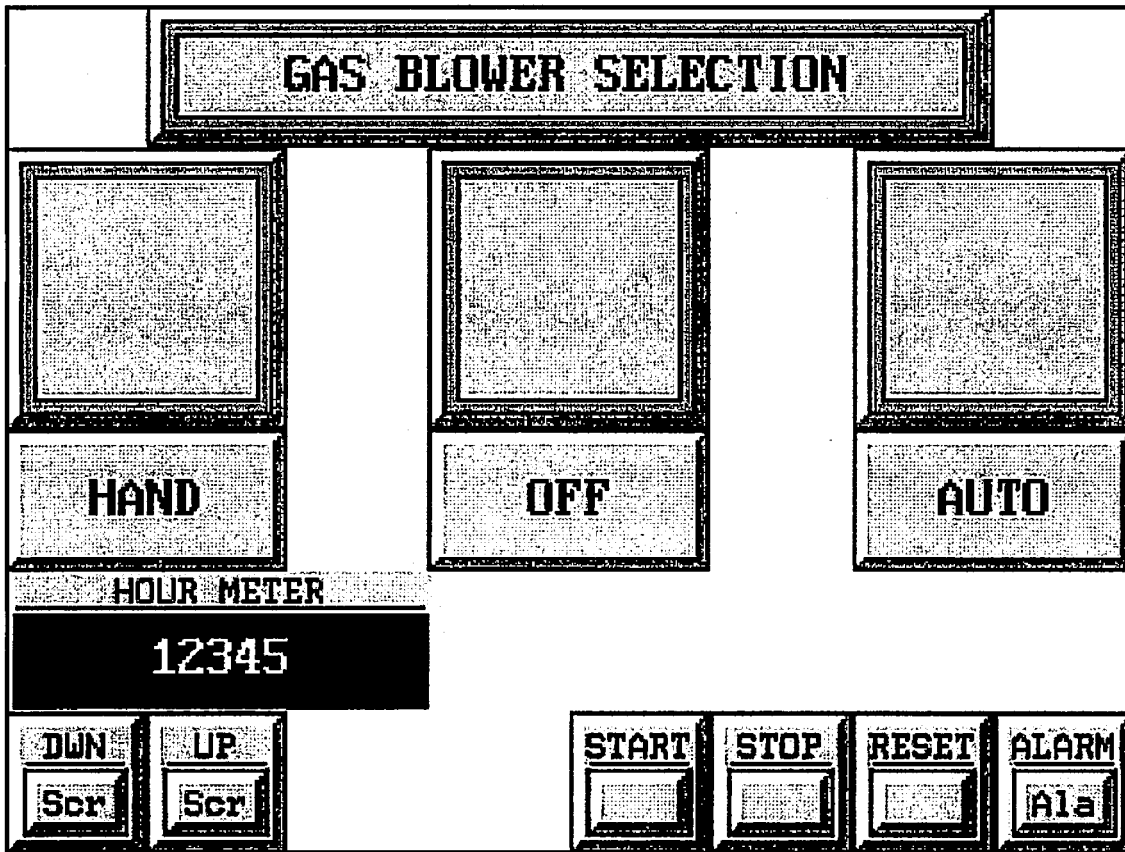
Access the "Flare Status" screen to continuously monitor progression through the flare operating sequence and the current flare operating status. Depress buttons located at the bottom left corner of the screen to activate the next ("Up") or previous ("Down") screen available in the series, or return to the contact ("Home") screen. For a particular series of screens, buttons at the bottom right corner of the screen apply only for that series. Depress these buttons to begin flare operation automatically ("Start"), discontinue flare operation ("Stop"), or reset a flare fault condition ("Reset").

System Control Screen



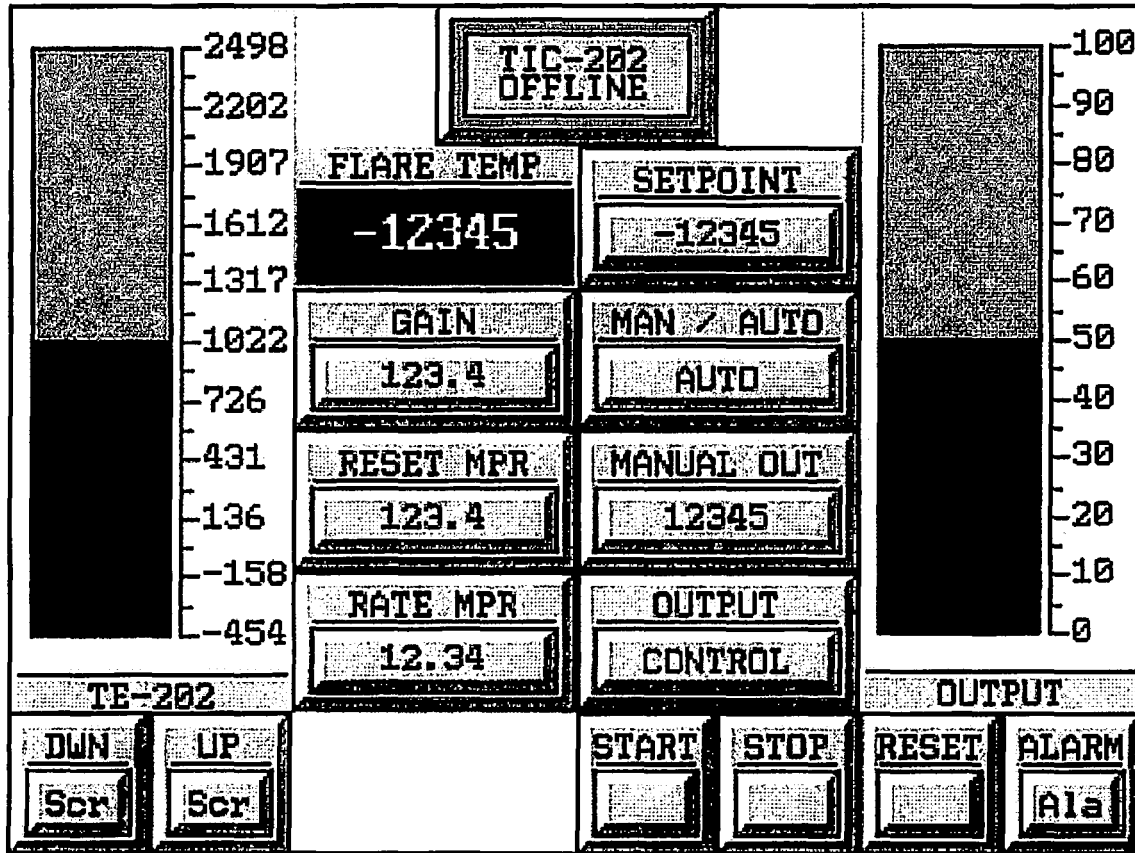
Access the "System Control" screen to select either "Local" or "Remote" system operation.

Blower Selection Screen



Separately access each "Gas Blower Selection" screen to start and stop gas blower operation. A cumulative hour meter for the blower is displayed. Select the blower to operate automatically by pressing the "Auto" button. Blower operation is discontinued by pressing the "Off" button. Verify motor rotation by pressing and holding the "Hand" button.

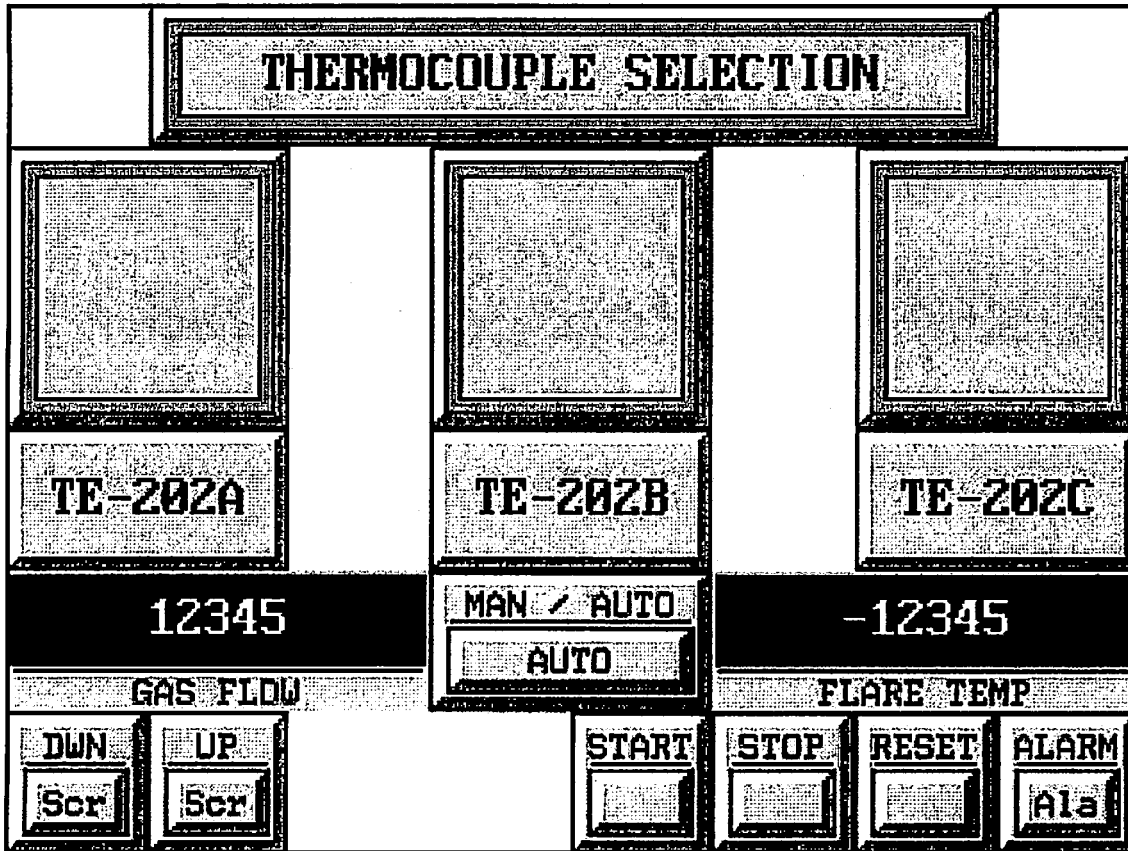
Air Damper Temperature Control Screen



Access the "TIC-202" screen to adjust or monitor the temperature control module. The actual flare temperature detected by the selected control thermocouple (the operating temperature) is labeled "Flare Temp". The operating temperature setpoint is labeled "Setpoint". Press the "Setpoint" value to adjust the operating temperature setpoint. The tuning parameters corresponding to modulation of the air damper louvers are labeled "Gain", "Reset", and "Rate". Press each of the three "Gain", "Reset", or "Rate" values to adjust the corresponding parameter. The signal value controlling the louver position is labeled "Output". The louvers are fully open with a 0% value and fully closed with a 100% value. Press the "Man/Auto" button to adjust the louver position manually. After selecting manual operation, press the "Manual Out" value and the louver position adjusts to the value entered. For automatic operation only, press the "Output Control" button to access more parameters, which allow entering values to restrict the minimum and maximum louver position or maintaining a fixed louver position until exceeding a certain temperature limit.

TIC-202 OUTPUT CONTROL	
OUTPUT LOW LIMIT (°)	OUTPUT HIGH LIMIT (°)
-12345	12345
POSITION 1 (°)	POSITION 1 TEMPERATURE
-12345	-12345
POSITION 2 (°)	POSITION 2 TEMPERATURE
-12345	-12345
TIC 202	START STOP RESET

Thermocouple Selection Screen



Access the "Thermocouple Selection" screen to monitor or select the flare temperature control thermocouples. Values appear for the actual temperature detected by the selected temperature control thermocouple (the operating temperature) and the total gas flow rate to the flare. Either automatic or manual thermocouple selection is available. Automatic thermocouple selection continuously determines the proper elevation of the temperature control thermocouple for maintaining the operating temperature considering the total gas flow rate and any subsequent variation in total gas flow rate. Press the "Man/Auto" button to select the temperature control thermocouple manually. After selecting manual operation, select the proper elevation of the temperature control thermocouple for maintaining the operating temperature by considering the total gas flow rate and pressing the button next to the corresponding thermocouple. Each significant variation in total gas flow rate again will require manual selection of the proper temperature control thermocouple.

CAUTION
Equipment damage may occur if the elevation of the
temperature control thermocouple is selected incorrectly.

Gas Blower Inlet Pressure Control Screen

Access the "PIC-100A" (inlet) screen to adjust or monitor the pressure control module. The actual vacuum detected by the inlet pressure transmitter is labeled "Gas Press". The operating pressure setpoint is labeled "Setpoint". Press the "Setpoint" value to adjust the operating pressure setpoint. The tuning parameters corresponding to modulation of the gas blower variable frequency drives are labeled "Gain", "Reset", and "Rate". Press each of the three "Gain", "Reset", or "Rate" values to adjust the corresponding parameter. The signal value controlling the variable frequency drives is labeled "Output". The variable frequency drives operate the gas blowers at minimum rotational speed with a 0% value and at maximum rotational speed with a 100% value. Press the "Man/Auto" button to adjust the variable frequency drives manually. After selecting manual operation, press the "Manual Out" value and the variable frequency drive adjusts to the value entered. Press the "Output Limit" value and the maximum rotational speed is restricted by the value entered.

Process Variables Screen

The screenshot displays a control interface for the Process Variables screen. At the top, a title box contains the text "PROCESS VARIABLES". Below this, a list of parameters is shown with their current values. The parameters and values are: TIC-202 SETPOINT (-12345), FLARE TEMP (-12345), TE-202A (-12345), TE-202B (-12345), TE-202C (-12345), GAS FLOW (12345), PILOT COUNT (12345), and MAIN COUNT (12345). At the bottom of the screen, there are four sets of control buttons: "DWN Scr", "UP Scr", "START", "STOP", "RESET", and "ALARM Ala".

Parameter	Value
TIC-202 SETPOINT	-12345
FLARE TEMP	-12345
TE-202A	-12345
TE-202B	-12345
TE-202C	-12345
GAS FLOW	12345
PILOT COUNT	12345
MAIN COUNT	12345

Access the "Process Variables" screen to monitor various system parameters. Values appear for the actual temperature detected by each control thermocouple and gas flow rate, along with summarizing other operating information.

Configuration Screen

TSL-202 SETPOINT 1234	BL-103 HOUR METER RESET
FT-107 MAX RANGE SCFM 12345	BL-104 HOUR METER RESET
SWITCH TE-202B TO A SCFM 12345	
SWITCH TE-202C TO B SCFM 12345	
RTN Scr	START STOP RESET

Access the "Configuration" screen by entering a password to adjust various operating parameters. The setpoint appears for the flare low temperature switch and the flow rate values required for automatic thermocouple selection, along with reset buttons for the gas blower cumulative hour meter. Press any of the values to adjust the corresponding setpoint.

VII. COMMISSIONING

The presence of a qualified John Zink Company representative is recommended for initial operation.

Process and Instrument Diagram Review

The equipment is fabricated according to the reference drawings. Operating personnel need to review the Process and Instrument Diagram and become familiar with the equipment.

Mechanical Review

Verify all equipment, including valves and control components, are functional prior to operation. Also, before beginning flare operation, complete the following:

1. Verify all equipment is installed according to the reference drawings.
2. Verify all electrical devices are connected to the proper power sources.
3. For the recommended chromel-alumel type K thermocouples, the red wire is negative (-) and the yellow wire is positive (+). Confirm the thermocouple extension wire is adequate for the radiation exposure and is proper for the particular thermocouple (KX wire with insulation for Type K thermocouples).

NOTE

Cross connecting the red and yellow wires anywhere in the circuit will nullify the thermocouple output.

4. All system pipe must be dry and free of dirt or foreign material, including the pilot gas pipe. Verify the pilot gas pipe is dry and unobstructed by removing the mixer orifice and strainer screen, if applicable, and blowing with clean, dry air. Replace the orifice and screen when clear flow exists.
5. Verify all drain and vent valves are closed and all drain and vent plugs are secure.
6. Close all manual and isolation valves initially.
7. Verify all disconnect handles are in the OFF position.
8. Verify all circuit breakers inside the control panels are in the OFF position.
9. Place all selector switches in the OFF or CLOSED position.
10. Verify the pilot gas pressure is adjusted properly (no pressure is displayed on the pressure gauge until the pilot gas solenoid valve opens).
11. Verify the hand valve supplying compressed air or nitrogen to the automatic block valve solenoid is closed.

12. Confirm operating setpoint values are as follows:

Description	Parameter Tag	Default Value
Flare High Temperature	TSHH-201	2000 °F
Flare Operating Temperature	TIC-202	1600 °F
	G (Gain)	5.0
	I (Reset)	7.0
	D (Rate)	1.1
	Minimum Limit	0%
	Maximum Limit	<100% when all louvers actuated
	Position 1	50% until 880 °F
Position 2	50% until 880 °F	
Flare Low Temperature	TSL-202	1400 °F
Flame Scanner	BS-203	
	Flame Proved (Relay On)	4
	Flame Failure (Relay Ratio)	50%
	Flame Failure Response (FFRT)	3 s
Purge Air Pressure	PDSL-204	0.5" H ₂ O
Compressed Air or Nitrogen Pressure	--	100 psig minimum
Pilot Gas Operating Pressure	PCV-302	10 psig for propane
		15 psig for natural gas
Enclosure Heater Thermostat	HTR-1	70 °F

NOTE

These setpoint values are recommended for initial operation and may require adjustment to satisfy specific operating conditions.

VIII. SYSTEM OPERATION

Preparation

1. Place all circuit breakers inside the control panels in the ON position.
2. Place all disconnect handles in the ON position.
3. Place the "Panel Power" switch in the ON position and the "Power On" light illuminates.
4. Open the hand valve supplying compressed air or nitrogen to the automatic block valve solenoid and set the pressure regulator to 100 psig minimum.
5. Open the pilot gas hand valve.
6. Press the "Auto" button only for the gas blower to be operated.
7. Open fully the manual butterfly valve at the corresponding gas blower inlet and outlet.

Start-up

1. Press the "Reset" button to clear any residual conditions from the program memory.
2. Begin system operation by pressing the "Local" and "Start" buttons, respectively.
3. The purge cycle begins and continues for five minutes. During this cycle, the "Flare Operating" light flashes. Once the purge cycle is complete, the ignition sequence begins.
4. The pilot gas solenoid valve opens and the ignition transformer energizes for ten seconds, igniting the pilot.
5. The flame scanner verifies pilot ignition and the automatic block valve opens.
6. Gas blower operation begins when the closed limit switch for the automatic block valve releases.

WARNING

All personnel stand clear from the flare air damper openings during start-up operations. Flame flashback through these openings is possible until the flare operating temperature is achieved.

8. Modulation of the air damper louvers begins one minute after the closed limit switch for the automatic block valve releases.
9. The pilot gas solenoid valve closes one minute after the open limit switch for the automatic block valve is achieved.

Operation

Flare

1. As the temperature inside the flare enclosure increases, the temperature control module sends a signal to the air damper actuator which adjusts accordingly to maintain the specified operating temperature.
2. Adjust the pilot gas pressure regulator until a stable, light blue flame with a defined cone shape exists.

Gas Blower

1. Manually adjust the output of the selected blower VFD to reach the required vacuum.
2. Simultaneous operation of multiple gas blowers is not allowed. However, operation may be transferred between the gas blowers. If the transfer exceeds ten seconds, the "Flare Shutdown" light illuminates and system operation discontinues.

NOTE

Suction generated from gas blower operation may prevent gravity draining liquid from the ZMS Moisture Separator.

Shutdown

Normal Shutdown

A normal shutdown is available whenever the operator needs to discontinue system operation. Press the "Stop" button, the "Flare Shutdown" light illuminates, and the following occurs:

- a. The pilot gas solenoid valve closes, if open.
- b. The ignition transformer discontinues, if energized.
- c. The automatic block valve closes, if open.
- d. The gas blower discontinues, if operating.
- e. The automatic damper louvers open fully.

When the system is not operating for an extended duration, also complete the following:

1. Place the "Panel Power" switch in the OFF position.
2. Close all manual and isolation valves.
3. Place all selector switches in the OFF or CLOSED position.

NOTE

To start the flare system again after addressing any reason for shutdown, the fault must be cleared by pressing the "Reset" button.

Power Failure

A power failure is caused by disrupting electrical service. The following occurs:

- a. The pilot gas solenoid valve closes, if open.
- b. The ignition transformer discontinues, if energized.
- c. The automatic block valve closes, if open.
- d. The gas blower discontinues, if operating.
- e. The automatic damper louvers are maintained in the last position.

Once power is restored, the system attempts operation automatically.

Fault Conditions

Flare High Temperature Shutdown occurs when the dedicated thermocouple detects temperature above the temperature switch setpoint value.

Flare Low Temperature Shutdown occurs when the selected temperature control thermocouple detects temperature below the temperature switch setpoint value for ten minutes consecutively.

Pilot Flame Failure and Shutdown occur during the ignition sequence, after three unsuccessful attempts, when flame is not detected by the flame scanner.

Main Flame Failure and Shutdown occur once the ignition sequence is complete, after three unsuccessful attempts, when flame is not detected by the flame scanner.

With any of these fault conditions, the "Flare Shutdown" light illuminates and the following occurs:

- a. The pilot gas solenoid valve closes, if open.
- b. The ignition transformer discontinues, if energized.
- c. The automatic block valve closes, if open.
- d. The gas blower discontinues, if operating.
- e. The automatic damper louvers open fully.

An operator reset is required to continue operation.

IX. SYSTEM TESTING

Lamp Test

- a. Press the "Lamp Test" button.
- b. All panel lights illuminate.

Purge Failure

- a. Press the "Stop" button.
- b. Disconnect tubing from the purge air pressure switch.
- c. Press the "Reset" button.
- d. Press the "Start" button.
- e. Purge air blower operation begins and the "Flare Operating" light flashes.
- f. After one minute, the "Flare Operating" light diminishes, the "Flare Shutdown" light illuminates, and system operation discontinues.
- g. Press the "Reset" button.
- h. The "Flare Shutdown" light diminishes.
- i. Connect tubing to the purge air pressure switch.

Pilot Flame Failure and Shutdown

- a. Press the "Stop" button.
- b. Close the pilot gas hand valve.
- c. Press the "Reset" button.
- d. Press the "Start" button and the "Flare Operating" light flashes.
- e. Purge air blower operation begins and the purge cycle continues for five minutes.
- f. Upon completing the purge cycle, the ignition sequence begins.
- g. The pilot gas solenoid opens and the ignition transformer remains energized for ten seconds.
- h. The flame scanner is unable to detect flame.
- i. The pilot gas solenoid closes and the purge cycle and ignition sequence are attempted again automatically.
- j. After the third unsuccessful attempt to detect pilot flame, the "Flare Operating" light diminishes, the "Flare Shutdown" light illuminates, and system operation discontinues.
- k. Press the "Reset" button.
- l. The "Flare Shutdown" light diminishes.
- m. Open the pilot gas hand valve.

Flare High Temperature Shutdown

- a. Press the "Stop" button.
- b. Place the "Panel Power" switch in the OFF position.
- c. Inside the Flare Control Panel adjust the dial on the flare high temperature switch to approximately 200 °F.
- d. Place the "Panel Power" switch in the ON position.
- e. Press the "Reset" button.
- f. Press the "Start" button and the "Flare Operating" light flashes.
- g. Allow the purge cycle to complete and the pilot to ignite.
- h. After the automatic block valve opens and gas blower operation begins, monitor the value appearing on the temperature control module.
- i. Upon exceeding the setpoint on the flare high temperature switch the "Flare Operating" light diminishes, the "Flare Shutdown" light illuminates, and system operation discontinues.

- j. Press the "Reset" button.
- k. The "Flare Shutdown" light diminishes.
- l. Place the "Panel Power" switch in the OFF position.
- m. Inside the Flare Control Panel return the dial on the flare high temperature switch to 2000 °F.

Automatic Block Valve Failure

- a. Press the "Stop" button.
- b. Disconnect the compressed air or nitrogen source from the automatic block valve solenoid.
- c. Press the "Reset" button.
- d. Press the "Start" button and the "Flare Operating" light flashes.
- e. Allow the purge cycle to complete and the pilot to ignite.
- f. The automatic block valve is unable to open.
- g. After 45 seconds, the open limit switch for the automatic block valve is not achieved.
- h. The "Flare Operating" light diminishes and the "Flare Shutdown" light illuminates.
- i. Press the "Reset" button.
- j. The "Flare Shutdown" light diminishes.
- k. Connect the compressed air or nitrogen source to the automatic block valve solenoid.

X. TROUBLESHOOTING

Problem: The "Panel On" light does not illuminate.

Possible Causes:

- a. The main circuit breaker is off.
- b. The "Panel Power" switch is off.
- c. The light bulb is defective.
- d. Power is not connected to the panel.
- e. The connecting wires are loose.

Problem: The purge cycle does not begin.

Possible Causes:

- a. The automatic block valve limit switches are not satisfied.
- b. The flame scanner detects flame.
- c. Power is not connected to the motor starter or motor.
- d. The motor starter circuit breaker is off.
- e. The motor starter contact is not closed.
- f. The motor starter holding coil is defective.
- g. The motor starter overload relay requires resetting.

Problem: The purge cycle fails.

Possible Causes:

- a. The pressure switch contact is not satisfied.
- b. The pressure switch tube is plugged or disconnected.
- c. Power is not connected to the pressure switch.
- d. The connecting wires are loose.

Problem: The pilot does not ignite.

Possible Causes:

- a. The pilot gas hand valve is closed.
- b. The pilot gas source is insufficient.
- c. The pilot orifice is plugged.
- d. The ignition wire is loose or broken.
- e. The ignition transformer is defective.
- f. The pilot electrode is defective.
- g. The pilot insulators are broken.
- h. The pilot gas pressure regulator requires adjustment.
- i. The pilot gas solenoid valve is not functioning properly.
- j. Power is not connected to the pilot gas solenoid.

Problem: The pilot flame is not detected after igniting the pilot.

Possible Causes:

- a. The flame scanner relay is not functioning properly.
- b. The flame scanner is not sensing flame.
- c. The scanner lens is dirty.
- d. The flame scanner amplifier is not functioning properly.
- e. The scanner is not installed properly.
- f. The scanner is not functioning properly.
- g. The connecting wires are loose.

Problem: The gas blower fails.

Possible Causes:

- a. Power is not connected to the variable frequency drive or motor.
- b. The variable frequency drive circuit breaker is off.
- c. The variable frequency drive circuit breaker is not adjusted properly.
- d. A variable frequency drive fault occurs.
- e. The connecting wires are loose.

Problem: The automatic block valve does not open.

Possible Causes:

- a. The compressed air or nitrogen source is insufficient.
- b. The automatic block valve solenoid is not wired correctly.
- c. Valve motion is obstructed inside the pipe.
- d. Power is not connected to the automatic block valve solenoid.
- e. The corresponding control relay is not functioning properly.
- f. The connecting wires are loose.

Problem: The automatic damper does not operate correctly.

Possible Causes:

- a. The signal wire is loose or broken.
- b. The temperature control module is not functioning properly.
- c. The actuator is defective.
- d. The thermocouple input to the control module is defective.
- e. The corresponding control relay is not functioning properly.

Problem: Flame Failure or Shutdown occurs.

Possible Causes:

- a. The gas flow rate or methane content is low.
- b. The flame scanner failed.
- c. The flame scanner amplifier failed.
- d. The automatic damper actuator failed.
- e. The gas blower failed.
- f. The flame arrester is plugged.
- g. The flare tips are plugged.

Problem: Flare High Temperature Shutdown occurs.

Possible Causes:

- a. A thermocouple is damaged.
- b. The gas flow rate or methane content is high.
- c. The thermocouple wires are reversed.
- d. The automatic damper actuator is not operating properly.
- e. The high temperature switch is not set or operating properly.
- f. The connecting wires are loose.

Problem: Flare Low Temperature Shutdown occurs.

Possible Causes:

- a. The gas flow rate or methane content is low.
- b. The incorrect temperature control thermocouple elevation is selected.
- c. The thermocouple wires are reversed.
- d. The low temperature setpoint is incorrect.
- e. The automatic damper actuator is not operating properly.
- f. The gas blower failed.
- g. The flame arrester is plugged.
- h. The flare tips are plugged.
- i. The connecting wires are loose.

XI. MAINTENANCE

The following maintenance summary is designed only as a guideline and does not identify all areas or components requiring maintenance attention. A maintenance program must be developed considering existing company policy, operational experience, and manufacturer requirements. This operating manual is to be used in conjunction with, and does not replace, any company policies.

General

1. Refer to the manufacturer literature in Section XVIII, "Manufacturer Information" for specific maintenance requirements of individual components.
2. Review operation and calibration procedures for individual instruments in Section XVIII, "Manufacturer Information" as recommended by the manufacturer.
3. Inspect all flanges and connections for indications of leaking. Repair or replace if necessary.

Flare

1. Visually inspect the flare tips and flare stack for damage or deterioration.
2. Inspect the exterior surface for indications of heat degradation. Paint discoloration may indicate insulation damage.
3. Assess the overall integrity of the internal insulation once a month. Torn or worn insulation may result in equipment damage. Repair if necessary.
4. Remove the flare tip for cleaning if an obstruction is suspected. Measure the pressure differential between the flare inlet flange and the flare tip exit. If the value exceeds 5" H₂O, then clean the tips.
5. Inspect all thermocouple assemblies and replace at least once each year.
6. Inspect the pilot assembly, ignition rod, electrode, and insulators for damage once every three months. Repair or replace if necessary.
7. Verify pilot gas supply pressure and pilot ignition.
8. Inspect the flame detection components. Clean the flame scanner lens and vent port.
9. Verify proper operation of the air damper louvers and lubricate if necessary.
10. Remove the flame arrester element for cleaning every six months. Measure the pressure differential across the flame arrester element. If the value exceeds 5" H₂O, then clean the element.

Panel

1. Confirm the control logic is functioning properly and all input and output signals are correct.
2. Verify all safety shutdown devices every three months per Section IX, "System Testing".
3. Inspect all electrical enclosures for any apparent corrosion or moisture.
4. Confirm all enclosure and actuator heaters are functioning.
5. Confirm the integrity of conduit seals, if applicable.
6. Verify the supply power voltage.
7. Verify power to motor starters.
8. During operation, measure gas blower line current and voltage.
9. Confirm chart recorder operation.

Miscellaneous

1. Remove and clean any filter elements or mesh strainers every three months.
2. Verify approximately 2" H₂O appears on the differential pressure gauge. If the value exceeds 5" H₂O, then clean the mist elimination element inside the ZMS Moisture Separator.
3. Press the "Hand" button for the gas blower to verify proper operation.
4. Verify sufficient pressure is available from the compressed air or nitrogen source.
5. Inspect any gauges and valves for deterioration.

NOTE

An enclosure heater is installed in the Flare Control Panel, PNL-101, to prevent internal corrosion. Individual electric motors may contain integral heaters also to prevent internal corrosion. Ensure all heaters are connected to a reliable power supply and operated continuously, especially during outside storage or when operation is discontinued for an extended duration. Consult wiring diagrams in Section XII, "Reference Drawings" for additional details.

XII. REFERENCE DRAWINGS

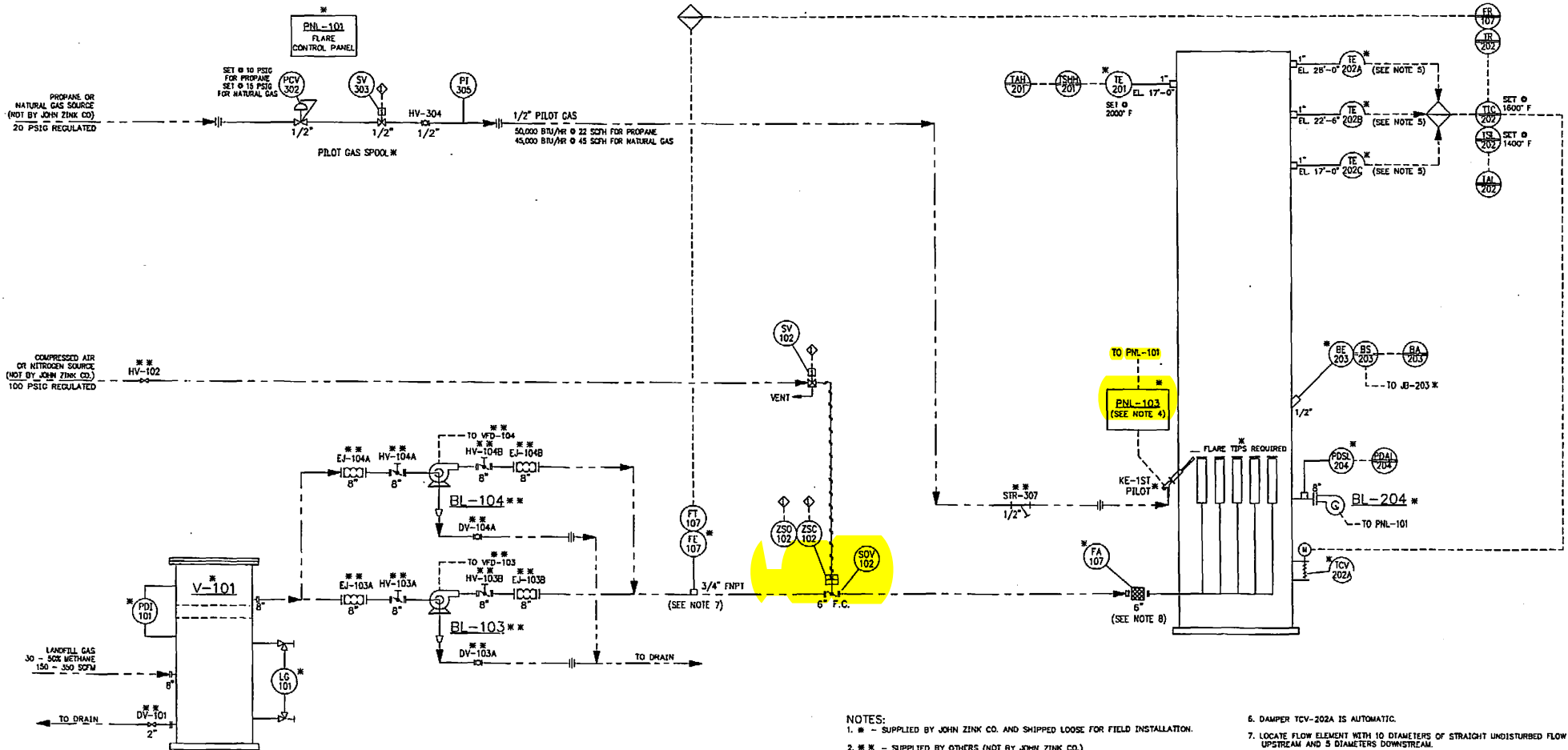
D-F-9109403-150	Process and Instrument Diagram
D-F-9109403-301	Enclosed ZTOF Biogas Flare
ST-11916	KE-1/ST Pilot
D-F-9109403-303	ZMS Moisture Separator
D-F-9109403-400	Panel Detail
D-F-9109403-401	Wiring Diagram
D-F-9109403-402	Wiring Diagram
D-F-9109403-403	Wiring Diagram
D-F-9109403-404	Wiring Diagram

V-101
ZMS MOISTURE SEPARATOR
2' x 8'

BL-103, BL-104
GAS BLOWERS

ENCLOSED
ZTOF FLARE
4' x 40'

BL-204
PURGE AIR BLOWER
3/4 HP



NOTES:

- * - SUPPLIED BY JOHN ZINK CO. AND SHIPPED LOOSE FOR FIELD INSTALLATION.
- ** - SUPPLIED BY OTHERS (NOT BY JOHN ZINK CO.)
- ELECTRICAL AREA CLASSIFICATION: NON-HAZARDOUS
- IGNITION TRANSFORMER IS INSIDE PNL-103 AND MOUNTED ON FLARE.
- TEMPERATURE CONTROL THERMOCOUPLE (TE-202) IS SELECTED DEPENDING ON GAS FLOW RATE TO FLARE. EQUIPMENT DAMAGE MAY OCCUR IF THE IMPROPER ELEVATION IS SELECTED.
- DAMPER TCV-202A IS AUTOMATIC.
- LOCATE FLOW ELEMENT WITH 10 DIAMETERS OF STRAIGHT UNDISTURBED FLOW UPSTREAM AND 5 DIAMETERS DOWNSTREAM.
- LOCATE FLAME ARRESTER WITH 5 DIAMETERS OF STRAIGHT UNDISTURBED FLOW UPSTREAM.
- THERMOCOUPLE WIRE AND IGNITION WIRE SUPPLIED BY JOHN ZINK CO. AND SHIPPED LOOSE FOR FIELD INSTALLATION.

HIGH TEMPERATURE SHUTDOWN THERMOCOUPLE LOCATION

GAS FLOW (SCFM)	TE-201 ELEVATION (FT)
ALL FLOW RATES	17'-0"

TEMPERATURE CONTROL THERMOCOUPLE LOCATION AT MAXIMUM METHANE CONCENTRATION

GAS FLOW (SCFM)	TE-202 ELEVATION (FT)
150 - 216	17'-0"
217 - 283	22'-6"
284 - 350	28'-0"

FIELD MOUNTED INSTRUMENT

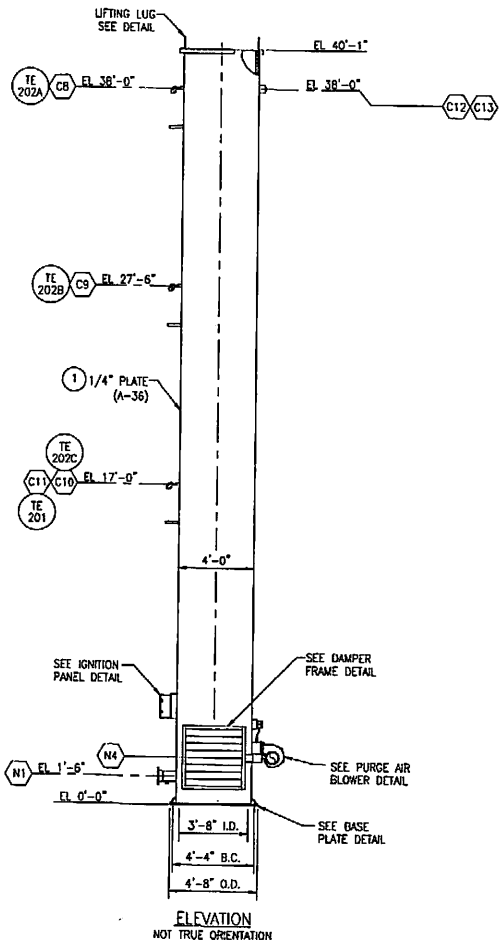
- REMOTE PANEL MOUNTED NORMALLY ACCESSIBLE TO OPERATOR
- LOCAL PANEL MOUNTED NORMALLY ACCESSIBLE TO OPERATOR
- REMOTE SUB-PANEL MOUNTED NORMALLY INACCESSIBLE TO OPERATOR
- LOCAL SUB-PANEL MOUNTED NORMALLY INACCESSIBLE TO OPERATOR

LEGEND

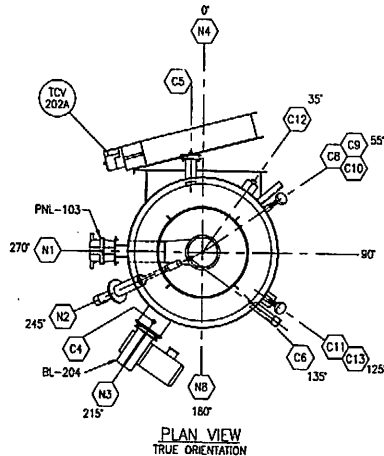
- LOCATED IN THE PLC
- INTERLOCK TO/FROM CONTROL PANEL
- PIPE & FITTINGS BY OTHERS (NOT BY JOHN ZINK CO.)
- ELECTRICAL INTERCONNECTIONS
- INSTRUMENT CONTROL AIR LINE
- PIPE & FITTINGS BY JOHN ZINK CO.

NO.	REVISION DESCRIPTION	BY	CHK.	APP.	DATE

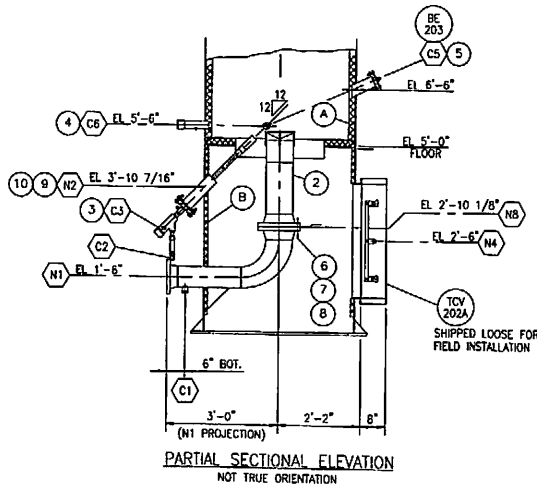
FOR: MARK HELETT CONTRACTORS		<p>JOHN ZINK COMPANY LLC PARTS AND SERVICE, CALL 1-800-755-4252 FAX (915) 234-1958 PROCESS & INSTRUMENT DIAGRAM FOR AN ENCLOSED ZTOF FLARE SYSTEM</p>						
USER: SLOBBARY LANDFILL								
JUSTICE WALLA WALLA, WA								
S.O. NO. 07-010403	DATE: 9-10-10	<table border="1"> <tr> <td>CERTIFIED</td> <td>DRAWING NUMBER</td> <td>REV.</td> </tr> <tr> <td> </td> <td>D-1-0109403-150</td> <td> </td> </tr> </table>	CERTIFIED	DRAWING NUMBER	REV.		D-1-0109403-150	
CERTIFIED	DRAWING NUMBER		REV.					
	D-1-0109403-150							
P.O. NO. 02320101R	DATE: 9-24-10	SCALE: NONE						
DATE: 9-24-10	DATE: 9-24-10	1 of 1						



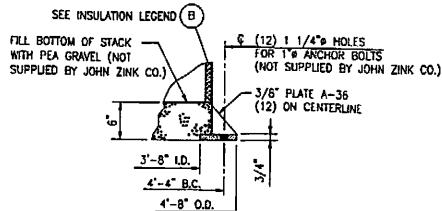
ELEVATION
NOT TRUE ORIENTATION



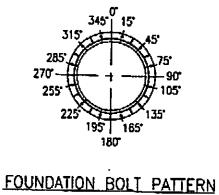
PLAN VIEW
TRUE ORIENTATION



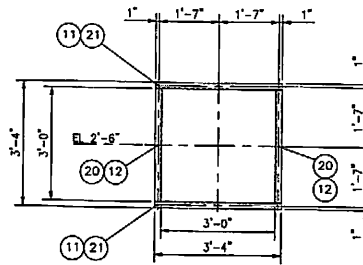
PARTIAL SECTIONAL ELEVATION
NOT TRUE ORIENTATION



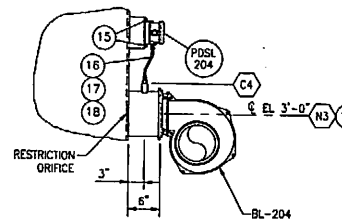
BASE PLATE DETAIL



FOUNDATION BOLT PATTERN

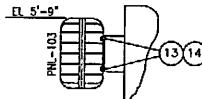


DAMPER FRAME DETAIL



PURGE AIR BLOWER DETAIL

SHIPPED LOOSE FOR FIELD INSTALLATION



IGNITION PANEL DETAIL

SHIPPED LOOSE FOR FIELD INSTALLATION



LIFTING LUG DETAIL

(2 REQ'D. LOCATED AT 90° AND 270°)
(NOTE: CUT OFF LUGS AFTER STACK ERECTION)

PARTS LIST				
ITEM	QTY	DESCRIPTION	MK. NO	MATERIAL
1	1	ENCLOSED ZTDF FLARE	D-701-1	
2	1	8" FLARE TIP ASSEMBLY	D-ST-1328-1	
3	1	PILOT ASSEMBLY	ST11916-1	
4	1	2" SIGHT PORT	CA-ST-0600-1	
5	1	SWIVEL SCANNER MOUNT ASSEMBLY	CB-150-R	NON-ASB
6	1	GASKE: 8" 150# RF x 1/16" THK	SB-6-4 1/2	A-193-B7
7	8	BOLT, STUD: 3/4" x 4 1/2" LG (PLATED)	HN-5	A-307
8	18	NUT, HVY HEX: 3/4-10NC (PLATED)	HN-5	A-307
9	4	BOLT, HEX HD: 5/8" x 2 1/2" LG (PLATED)	HB-5-2 1/2	A-307
10	4	NUT, REG HEX: 5/8-11NC (PLATED)	HN-5	A-307
11	2	BOLT, HEX HD: 3/8" x 1 1/4" LG (PLATED)	HB-3-1 1/4	A-307
12	10	NUT, REG HEX: 3/8-16NC (PLATED)	HN-3	A-307
13	4	BOLT, HEX HD: 1/4" x 1" LG (PLATED)	HB-2-1	A-307
14	4	NUT, REG HEX: 1/4-20NC (PLATED)	HN-2	A-307
15	2	SCREW, HEX HD MACH: #10-24NC x 3/4" LG (PLATED)	HCS-#10-3/4	A-307
16	1	3/8" COPPER TUBING x 1'-0" LG		COPPER
17	1	MALE CONNECTOR, 1/8" NPT x 3/8" TUBING		BRASS
18	1	MALE ELBOW CONNECTOR, 1/2" NPT x 3/8" TUBING		BRASS
19	1	GAL ZINC CLAD II PLUS #B69V12/B69V15/B69D11 (TOUGH-UP)		PAINT
20	6	SCREW, FLAT HD, SL: 3/8-NC x 1" LG (PLATED)	FN-3-1	A-307
21	2	WING NUT: 3/8-16NC (PLATED)	WN-3	A-307

NOZZLE LEGEND	
MK	DESCRIPTION
N1	GAS CONNECTION: 8" 150# F.F.
N2	PILOT MTC CONN: 3/8" PLATE FLG W/ 3" 150# DRILLING
N3	BLOWER - 6" CONN 10" O.D. x 3/8" PL W/ (4) 3/8" STUDS ON 9 1/8" B.C.
N4	DAMPER CONN - SEE DETAIL. (HS KINGED)
N8	FLARE TIP CONN - 8" 150# RF
C1	DRAIN - 1" FNPT WITH PLUG
C2	PILOT GAS CONN - 1/2" FNPT
C3	PILOT CONDUIT CONN - 1/2" FNPT
C4	PURGE AIR PRESSURE CONN - 1/2" FNPT
C5	SCANNER CONN - 1" MNPT
C6	SIGHT PORT - 2" MNPT
C8-11	THERMOCOUPLE CONN - 1" FNPT
C12-13	SAMPLE PORT 4" FNPT WITH PLUG

DESIGN DATA	
WINDLOAD (PER ASCE 7-95, EXP. C)	110 M.P.H.
SEISMIC (PER UBC-1994)	ZONE 4
SHEAR @ BASE	7.0 K
MOMENT @ BASE	130.0 K-FT
DEADLOAD	8.5 K
SHELL DESIGN TEMPERATURE	500° F
CORROSION ALLOWANCE	0.0

LIFTING NOTES
 A: MAIN CRANE AT TOP REQUIRES SPREADER BAR. (NOT SUPPLIED BY JOHN ZINK CO.)
 B: CHOKO STACK AT APPROX. 5'-0" EL WITH TAILING CRANE
 C: LIFTING LUGS DESIGNED FOR 13 1/2 TON CROSBY ANCHOR SHACKLE AND VERTICAL SLINGS.

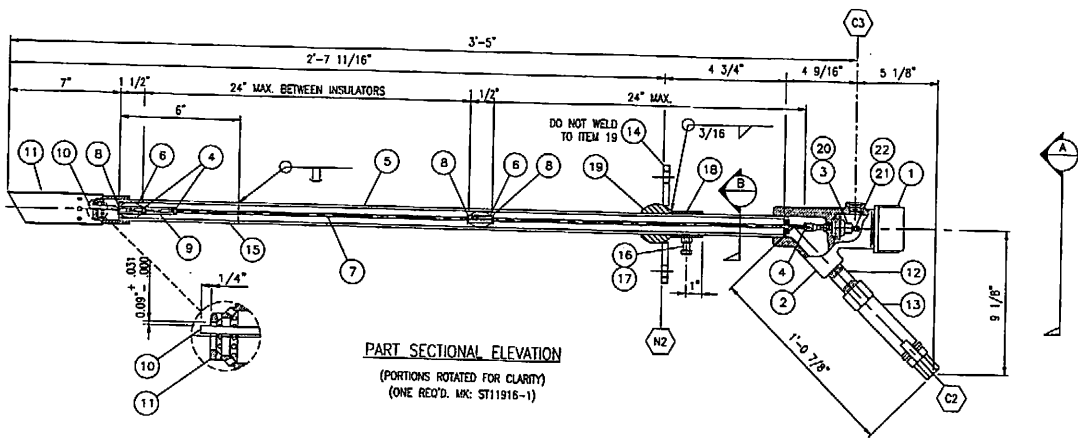
INSULATION LEGEND
 A: (1) OVERLAPPING LAYER OF 1" THICK 8 LB DENSITY, 2300° F. BACKED WITH (1) LAYER, 1" THICK 6 LB DENSITY, 2300° F. ON INCONEL PINS AND KEEPERS.
 B: (1) OVERLAPPING LAYER OF 1" THICK 6 LB DENSITY, 2300° F. ON INCONEL PINS AND KEEPERS.

GENERAL NOTES
 1. TAG NUMBERS TO BE PRECEDED BY JOHN ZINK SALES ORDER NUMBER.
 2. FLARE ASSEMBLY IS NOT TO BE USED AS AN ANCHOR POINT FOR CUSTOMER PIPING.
 3. PRE-TENSION ANCHOR BOLTS BY THE "TURN OF THE NUT" METHOD/ASC.
 4. BOLT HOLES TO STRADDLE NORMAL CENTER LINES UNLESS NOTED.
 5. FINISH EXTERIOR CARBON STEEL, INSIDE OF SKIRT, BOTTOM OF FLOOR PLATE, AND MANFOLD, SANDBLAST PER SSPC-SP-6 AND PRIME WITH SHERWIN WILLIAMS ZINC CLAD II PLUS #B69V12/B69V15/B69D11 (3-4 MILS D.F.T.)

REVISION		DATE		BY		CHK		APP.		DATE	
NO.											

DRAWING NUMBER		SCALE		REV	
D-F-9109403	301	1	OF 1	0	

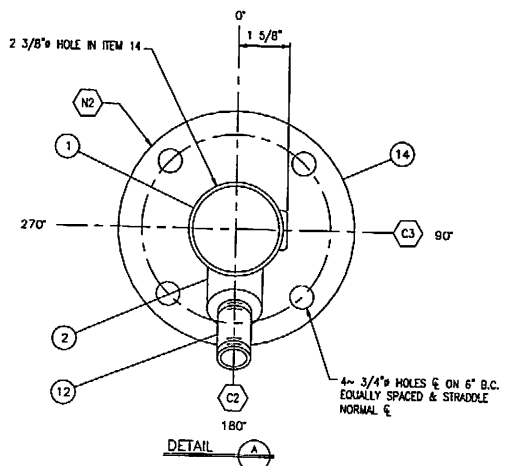




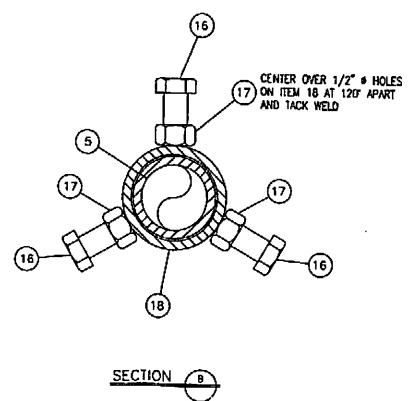
PART SECTIONAL ELEVATION
(PORTIONS ROTATED FOR CLARITY)
(ONE REQ'D. MK: ST11916-1)

PARTS LIST				
ITEM	QTY	DESCRIPTION	MK: NO	MATERIAL
1	1	PIPE CAP (2"-150#)		A-187
2	1	WEATHERHEAD (KE-1)	A-PAT-0697	DUCT.
3	1	SPARK PLUG (WCC-12-1)		
4	3	NUT, REG HEX (#10-24)		A-307
5	1	PIPE, 1" SCH 40		A-106-B
6	2	INSULATOR	CA-PAT-1714	A-106-B
7	1	IGNITION ROD EXTENSION		CERAMIC
8	3	3/16" PUSH ON RETAINER	S-10228-4	316 SS
9	1	CONNECTOR COUPLING	CA-PAT-1720	STL
10	1	IGNITION ROD	CA-ST-0907	416 SS
11	1	PILOT TIP ST-1S (PER CA-ST-1118)	CA-ST-0606	316 SS
12	1	PIPE, NIPPLE		SS
13	1	PILOT MIXER ASSEMBLY	CA-ST-0619-60	A-106-B
14	1	PLATE FLANGE		A-36
15	1	GAS NIPPLE		304 SS
16	3	BOLT, HEX 3/8-NC x 1" LG (PLATED)		A-307
17	3	NUT, REG HEX: 3/8-16NC (PLATED)		A-307
18	1	PIPE, 1 1/4" S40		A-106-B
19	1	PIVOT BALL	CA-PAT-1903	CR-1213
20	1	CONN. SPARK PLUG STRT BARE T199		
21	1	ANCHOR BASE STUD (TERMINAL NUT 548)		ALUM
22	1	LOCK WASHER #8		C.S.
23	1 PT	GRAY ALKYL PRIMER #850WZ3		PAINT

NOZZLE LEGEND		
MK	QTY	DESCRIPTION
C2	1	PILOT GAS CONN: 1/2" FNPT
C3	1	PILOT CONDUIT CONN: 1/2" FNPT
N2	1	PILOT MOUNT CONN: 3/8" PLATE P.L.C. W/ 3" 150 LB DRILLING

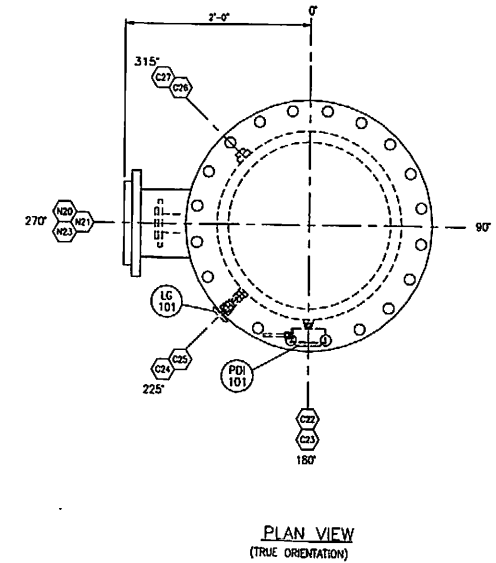
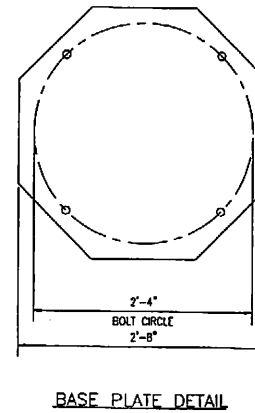
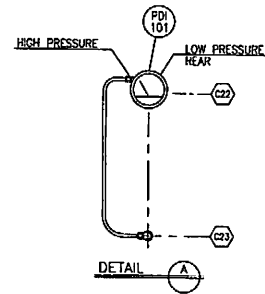
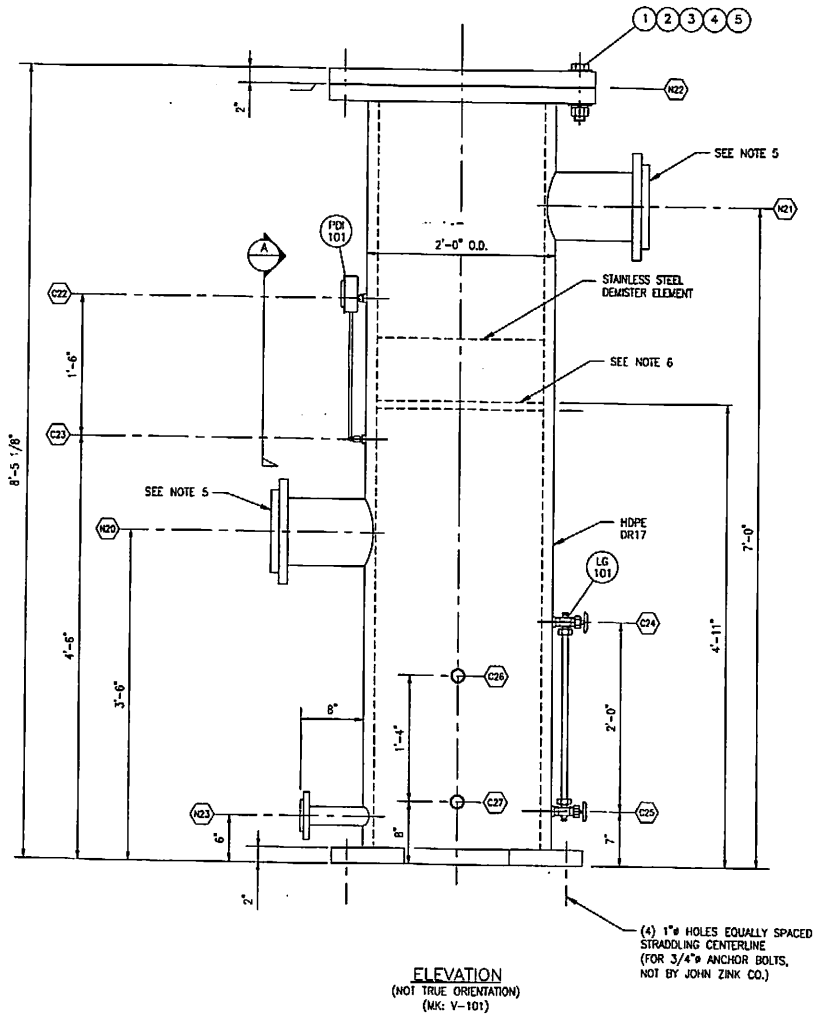


(TRUE ORIENTATION, MIXER NOT SHOWN)
ORIENT MIXER BELOW THE CONDUIT
CONNECTION FOR FREE LIQUID DRAINING



- NOTES:
- PILOT ORIFICE IS DRILLED MTD 60
 - FUEL GAS MUST BE FILTERED TO ELIMINATE FOREIGN MATTER ABOVE 0.01 INCH EFFECTIVE DIAMETER. A FILTER, ACCESSIBLE WITHOUT INTERRUPTING OPERATION, IS RECOMMENDED.
 - NATURAL GAS USAGE 45 SCFH @ 15 PSIG
PROPANE GAS USAGE 22 SCFH @ 10 PSIG
 - PREPARE CARBON STEEL SURFACES SSPC-SP-2 PRIME WITH GRAY ALKYL

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FOR: _____ USER: _____ JOB: _____ S.O. NO. _____ P.O. NO. _____		
DR. CFC DATE: 11-24-09 DC. JPR DATE: 11-24-09 APP. JPR DATE: 11-24-09		KE-1ST PILOT ASSEMBLY DRAWING NUMBER: ST11916 SCALE: _____ 1. of 1



PARTS LIST				
ITEM	QTY	DESCRIPTION	MK: DWG	MATERIAL
1	1	GASKET, 1/8" THICK		NEOPRENE
2	20	HEX BOLT, 1 1/4" x 8 1/2" LG (PLATED)		A-307
3	20	NUT, REG HEX, 1 1/4" (PLATED)		A-307
4	40	WASHER, 1 1/4" FLAT (PLATED)		A-569
5	20	WASHER, 1 1/4" LOCK (PLATED)		A-569

NOZZLE LEGEND	
MK	DESCRIPTION
N20	INLET: 8" FLANGE ADAPTER WITH 150# BACK-UP RING
N21	OUTLET: 8" FLANGE ADAPTER WITH 150# BACK-UP RING
N22	FLANGED TOP: 32" O.D. WITH (20) 1 3/8" HOLES ON 28 1/2" B.C.
N23	DRAIN: 2" FLANGE ADAPTER WITH 150# BACK-UP RING
C22	PRESSURE CONNECTION: 1/2" FNPT (SS)
C23	PRESSURE CONNECTION: 1/2" FNPT (SS)
C24	LIQUID LEVEL GAUGE CONNECTION: 3/4" FNPT (SS)
C25	LIQUID LEVEL GAUGE CONNECTION: 3/4" FNPT (SS)
C26	LIQUID LEVEL SWITCH CONNECTION: 1" FNPT WITH SS PLUG
C27	LIQUID LEVEL SWITCH CONNECTION: 1" FNPT WITH SS PLUG

- NOTES**
- BOLT HOLES TO STRADDLE NORMAL CENTERLINES UNLESS NOTED.
 - MOISTURE SEPARATOR IS NOT TO BE USED AS AN ANCHOR POINT FOR CUSTOMER PIPING.
 - PRE-TENSION ANCHOR BOLTS BY THE "TURN OF THE NUT" METHOD/AISC.
 - TAG NUMBERS TO BE PRECEDED BY JOHN ZINK SALES ORDER NUMBER.
 - FLANGE ADAPTERS TO BE SDR-17 AND BACK-UP RINGS TO BE PAINTED.
 - DEMISTER MOUNTING RING 1" THICK X 2" WIDE WITH (8) 1/4" BOLT HOLES.

DESIGN DATA

VACUUM _____ -5 PSI

EMPTY WEIGHT _____ 700 LB.

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FOR: MARK HEYDT CONTRACTORS
USER: SUDARY LAMPELL
ADDRESS: WALLA WALLA, WA

JOHN ZINK
JOHN ZINK COMPANY LLC
PARTS AND SERVICE: CALL 1-800-755-2292 FAX (509) 234-1968
ZMS MOISTURE SEPARATOR
2" O.D. x 8" HIGH

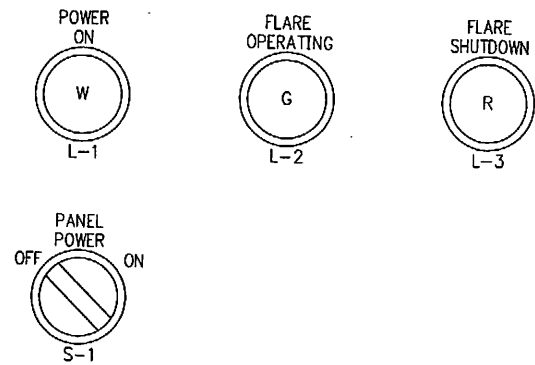
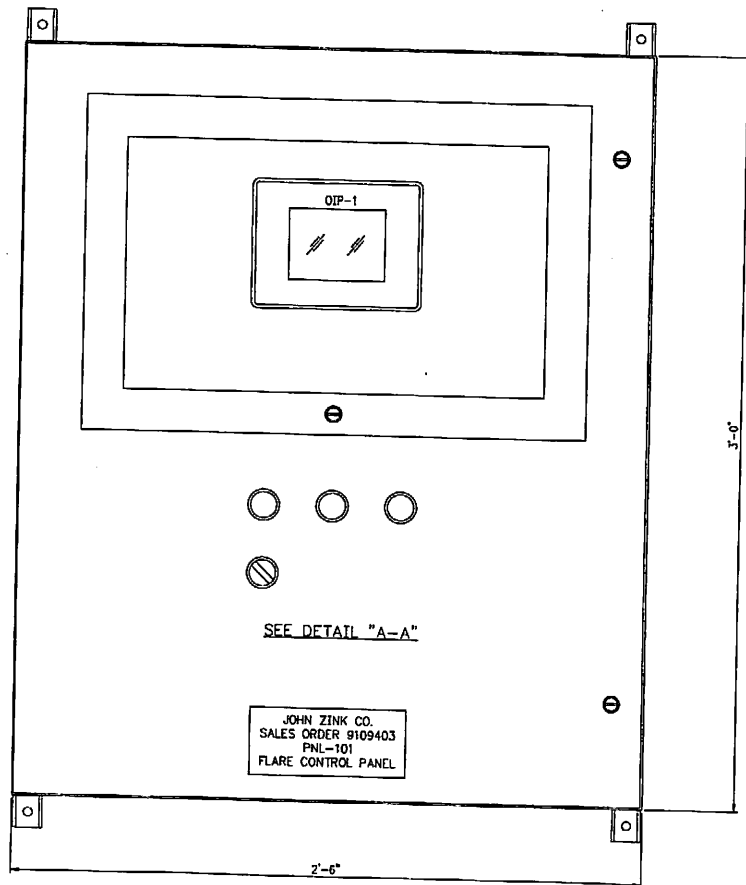
S.O. NO. 07-9109403
P.O. NO. 0223020202

DR. MED. DATE: 09-13-10
CK. SAH. DATE: 09-16-10

APPROVED: [Signature] DATE: 09-24-10

REVISION DESCRIPTION BY DATE

DRAWING NUMBER: B-F-9109403-303
SCALE: 1 of 1



DETAIL "A-A"

NOTE:

1. ELECTRICAL AREA CLASSIFICATION: NON-HAZARDOUS.

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FOR: MARK HELETTI CONTRACTORS USER: SUDBURY LANDFILL JOB SITE: WALLA WALLA, WA S.O. NO. 0F-9109403 P.O. NO. 08232010L1R			
JOHN ZINK COMPANY LLC PARTS AND SERVICE, CALL 1-800-795-4252 FAX (918) 234-1983 PANEL DETAIL (PNL-101) FOR AN ENCLOSED ZTGF FLARE SYSTEM			
DR. RPL	DATE: 8-10-10	CERTIFIED	DRAWING NUMBER
DC. AJ	DATE: 8-24-10		D-F-9109403-400
APP. AJ	DATE: 8-24-10	SCALE: NONE	REV. 0
NO.	REVISION DESCRIPTION	BY	CHK. APP. DATE

NOTES:

1. ALL WIRING TO BE AS FOLLOWS UNLESS INDICATED OTHERWISE:

WIRE SIZING PER NEC
 MIN. 18 GA./7000 V/TBHN OR THIN FOR CONTROL
 MIN. 18 GA./TWO CONDUCTOR SHIELDED FOR SIGNAL

2. MINIMUM FIELD CONDUIT REQUIRED:

- (1) THERMOCOUPLES
- (1) POWER - 120 V
- (1) POWER - 480 V
- (1) CONTROL SIGNAL
- (1) FLAME SCANNER

3. TERMINAL BLOCKS TO BE ARRANGED IN NUMERICAL ORDER.

4. PROCESSOR LOGIC PROGRAM 03102403

5. WIRING LEGEND:

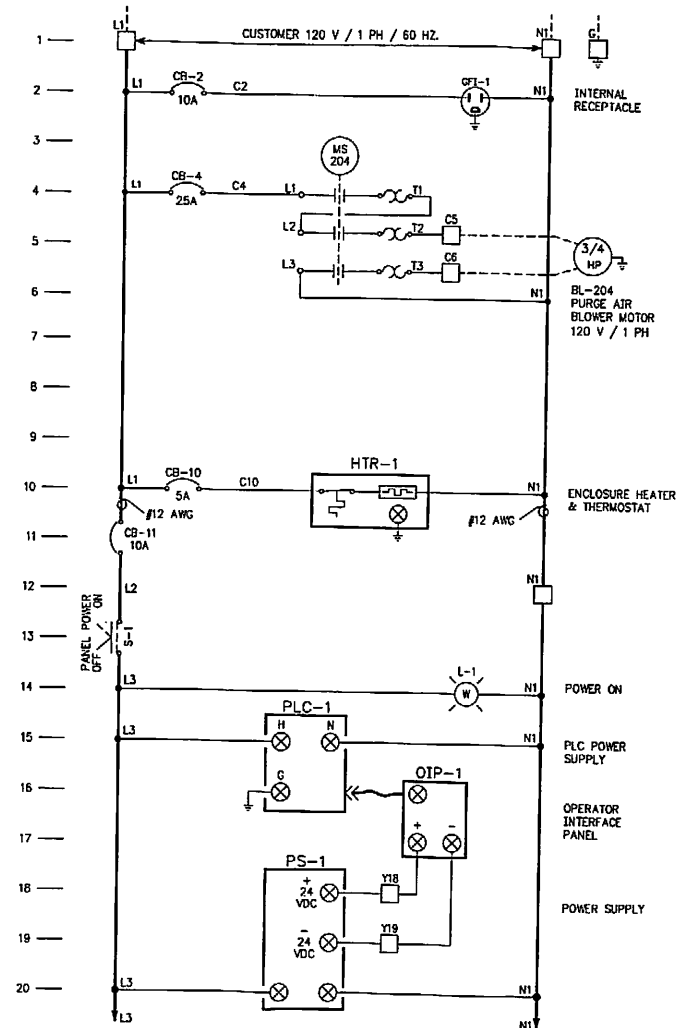
- ⊗ TERMINAL IN PANEL MOUNTED INSTRUMENTS.
- TERMINAL IN FLARE CONTROL PANEL PNL-101
- ⊗ TERMINAL IN JB-203
- △ TERMINAL IN MOTOR CONTROL PANEL PNL-102
- TERMINAL IN IGNITION PANEL PNL-103

WIRING BY JOHN ZINK CO.

WIRING BY OTHERS (NOT BY JOHN ZINK CO.)

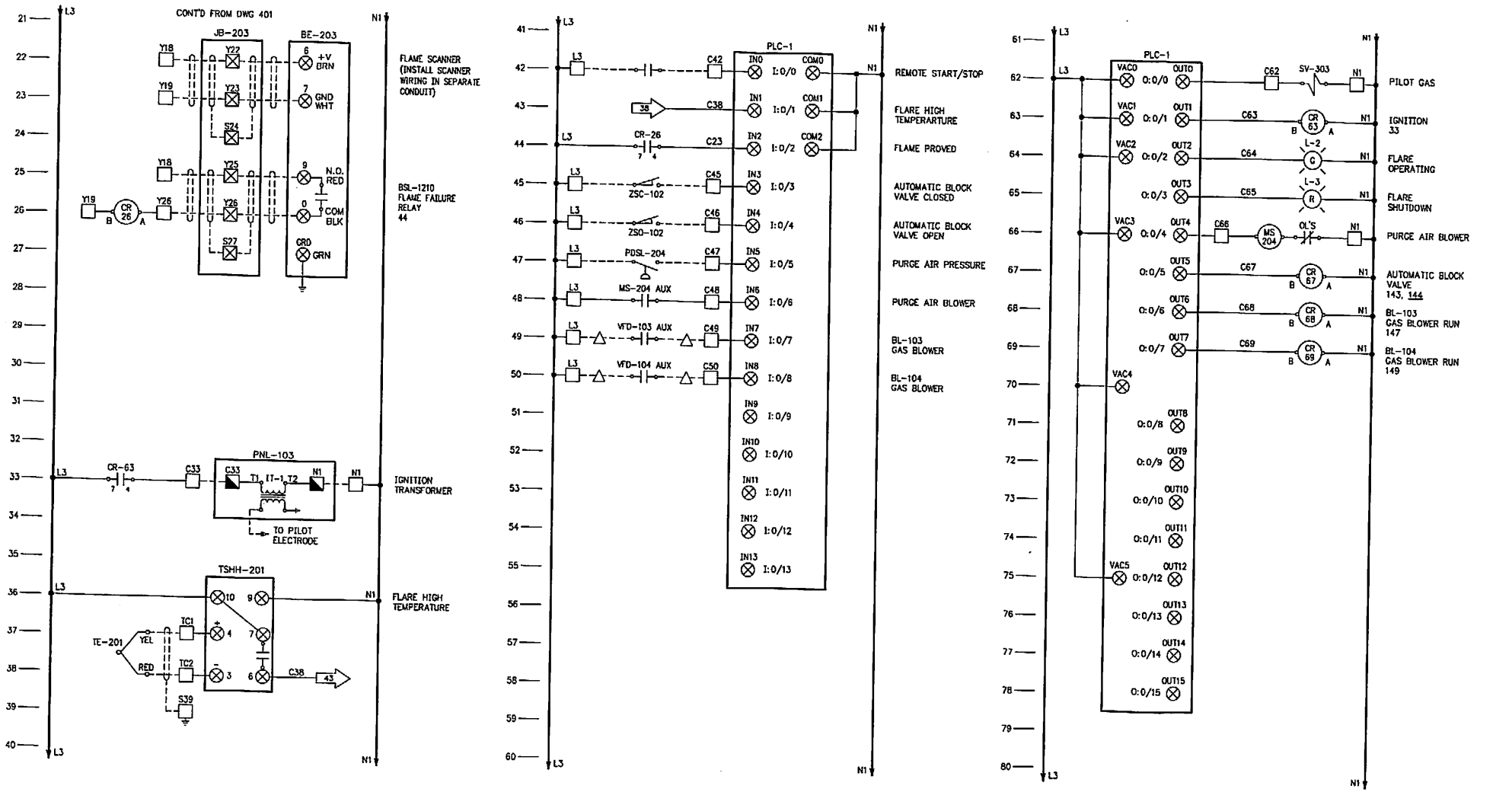
6. ALL WIRING COLORS TO BE AS FOLLOWS UNLESS INDICATED OTHERWISE:

- 120 V POWER BLACK
- 120 V NEUTRAL WHITE
- GROUND GREEN
- 24 V DC POWER BLUE
- 24 V DC COMMON YELLOW
- SHIELDED ANALOG SIGNAL BLACK
- SHIELDED ANALOG COMMON WHITE

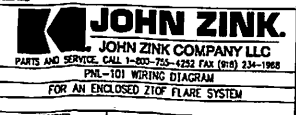


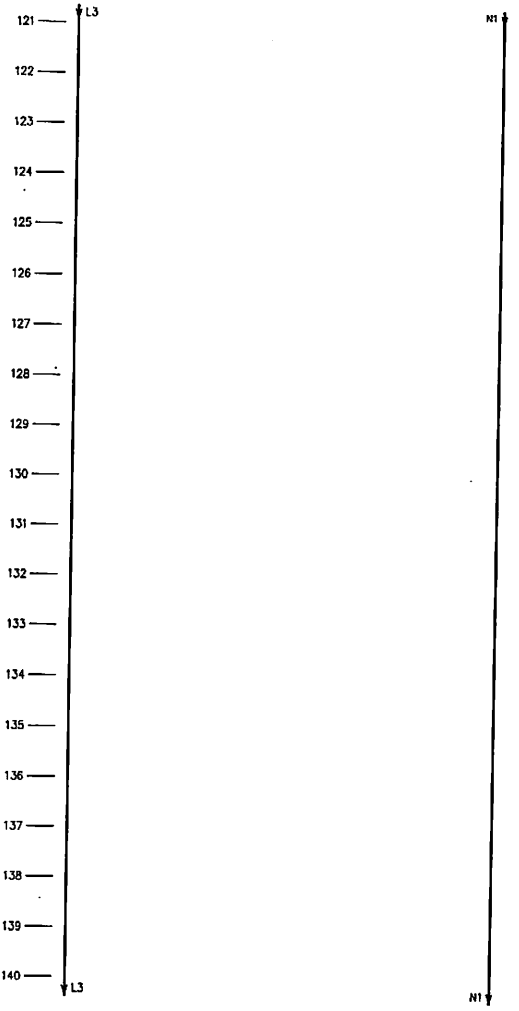
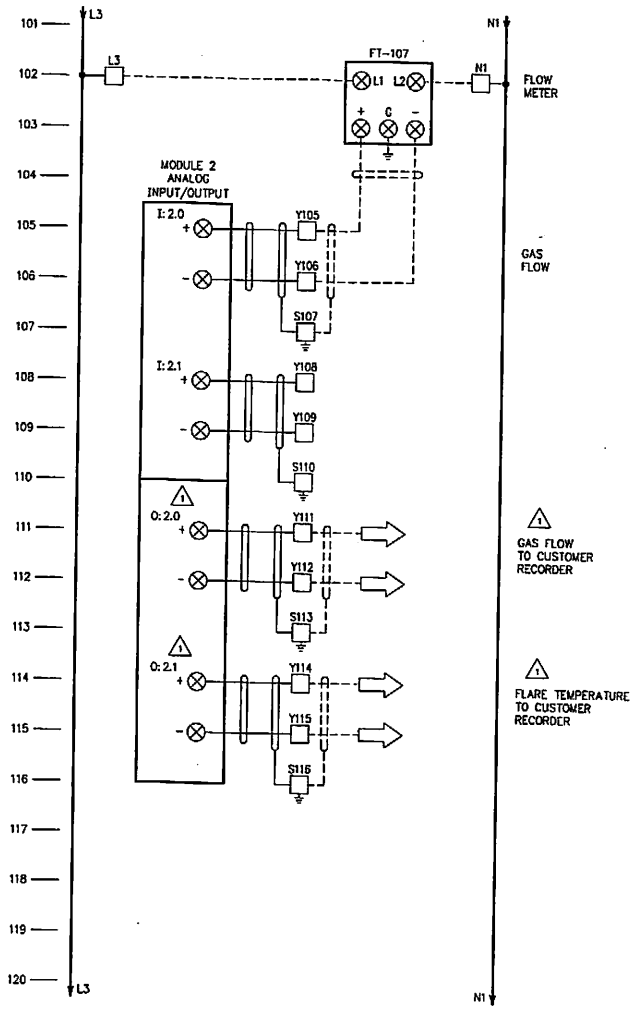
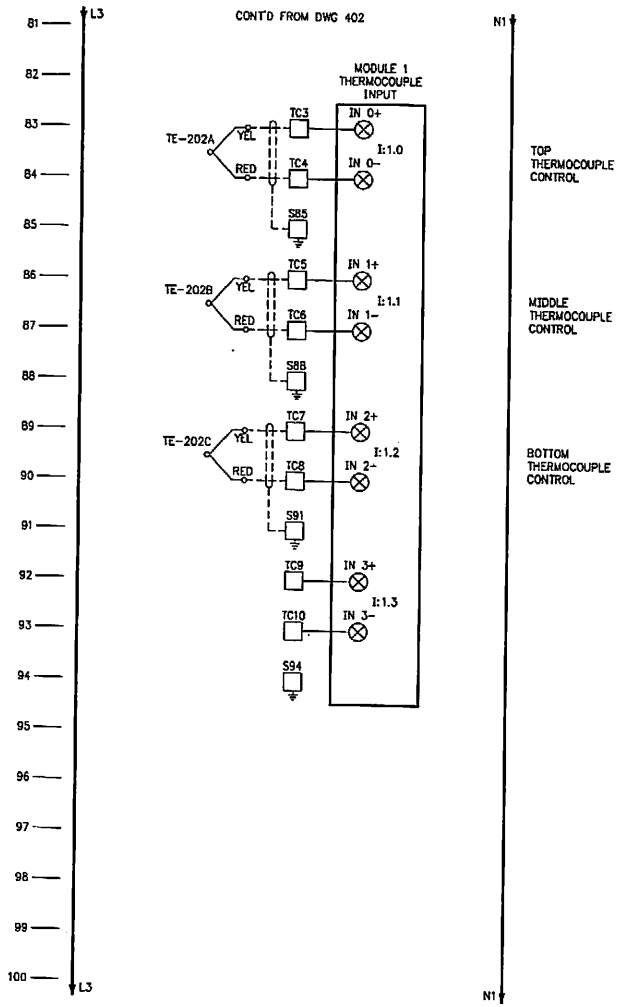
CONT'D ON DWG. 402

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<p>S.O. NO. BF-9109403 P.O. NO. 00233010LR</p>				<p>PNL-101 WIRING DIAGRAM FOR AN ENCLOSED ZTof FLARE SYSTEM</p>		<p>DR. REV. DATE: 9-10-10 CK. AJ DATE: 9-24-10 APP. AJ DATE: 9-24-10</p>	
<p>NO. REVISION DESCRIPTION BY CK. APP. DATE</p>				<p>CERTIFIED</p>		<p>DRAWING NUMBER D-F-9109403-401 SCALE NONE 1 of 1</p>	



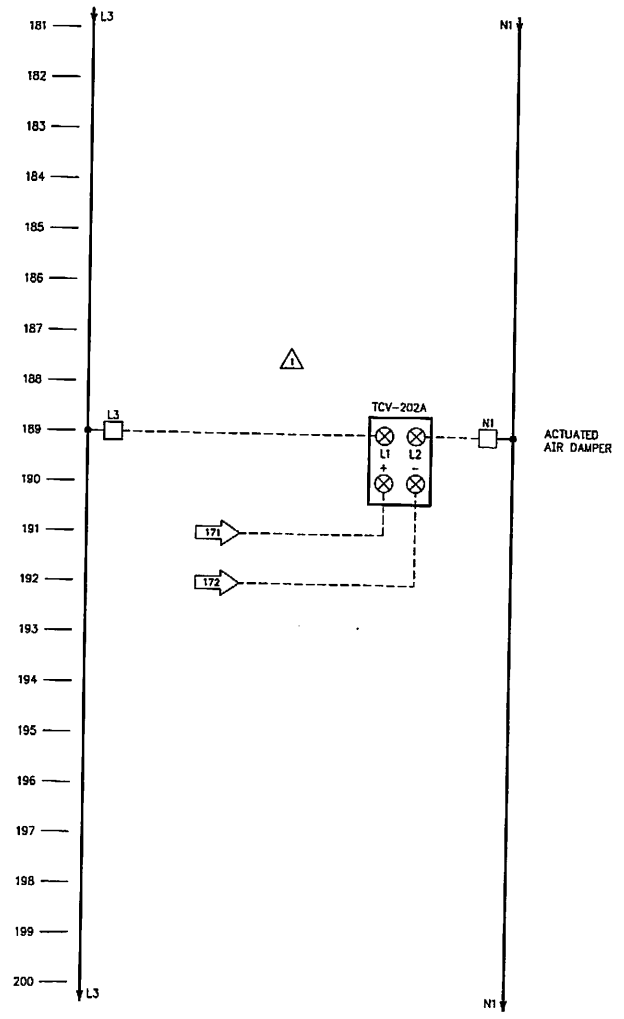
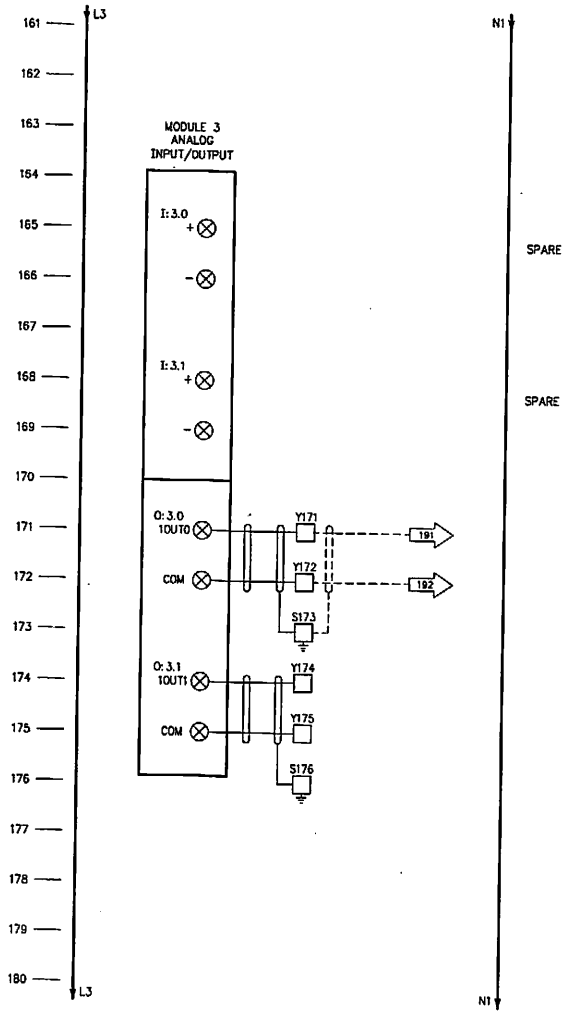
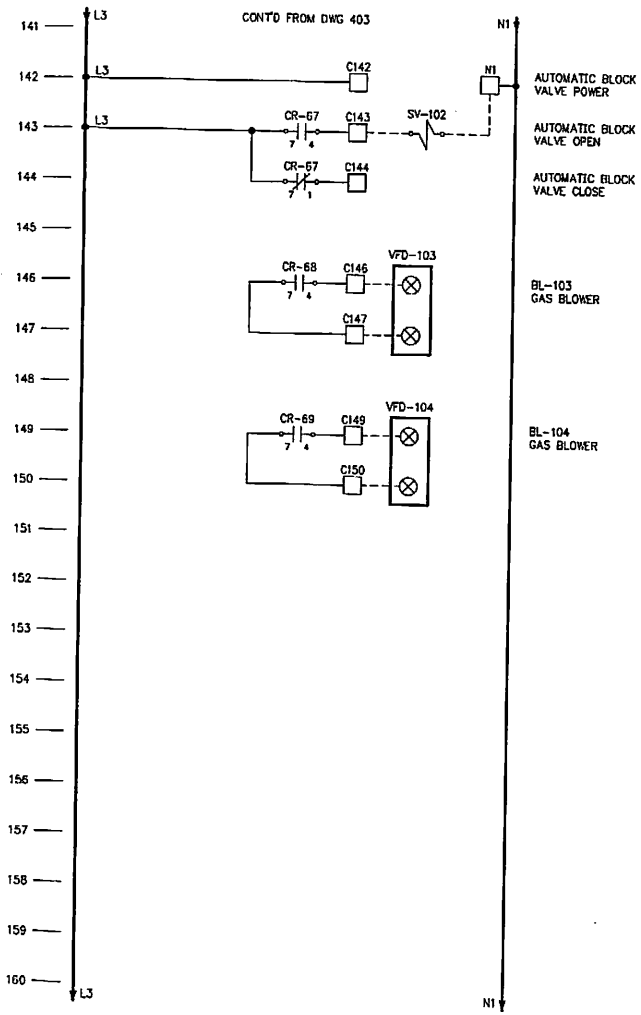
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FOR: MARK HELLETI CONTRACTORS USER: SLODBURY LAWFILL JOBSITE: WALLA WALLA, WA			
S.O. NO. 02-9109403 P.O. NO. 0023010101R			
DR. RPJ	DATE: 9-10-10	CERTIFIED DR. AJ DATE: 9-24-10	DRAWING NUMBER D-F-9109403-402
CK. AJ	DATE: 9-24-10		
NO.	REVISION DESCRIPTION	BY	DATE





CONTD ON DWG 404

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<p>FOR: MARK HEUETT CONTRACTORS USER: SLOBBURY LANDFILL JOB SITE: WALLA WALLA, WA P.O. NO. 89-8109403 P.O. NO. 002120101010</p>									
<p>SCALE: NONE</p>									
<p>DATE: 8-10-10 DATE: 8-24-10 DATE: 8-24-10</p>									
<p>REVISION DESCRIPTION</p>									
<p>DATE: 8-10-10 DATE: 8-24-10 DATE: 8-24-10</p>									
<p>JOHN ZINK COMPANY LLC PARTS AND SERVICE: CALL 1-800-755-4100 FAX (509) 234-1968 PWL-101 WIRING DIAGRAM FOR AN ENCLOSED ZT OF FLARE SYSTEM</p>									
<p>DR. RPJ DATE: 8-10-10 CK. AJ DATE: 8-24-10 APP. AJ DATE: 8-24-10</p>									
<p>CERTIFIED DRAWING NUMBER: D-F-8109403-403 SCALE: NONE REV: 1</p>									



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<p>FOR: MARK HELETT CONTRACTORS USER: SLOSBURY LANDFILL JOB SITE: WALLA WALLA, WA P.O. NO. 09-9108403 P.O. NO. 09332010178</p>									
<p>DR. RPJ DATE: 9-10-10 OK. AJ DATE: 9-24-10 BY: OK. APP. DATE: 9-24-10</p>									
<p>1 REVISED PER ENGINEERING</p>									
<p>REVISION DESCRIPTION</p>									
<p>DR. RPJ DATE: 9-10-10 OK. AJ DATE: 9-24-10 BY: OK. APP. DATE: 9-24-10</p>									
<p>FOR AN ENCLOSED ZTDF FLARE SYSTEM</p>									
<p>JOHN ZINK COMPANY LLC PARTS AND SERVICE, CALL 1-800-785-4202 FAX (509) 234-1958 PWL-101 WIRING DIAGRAM</p>									
<p>CERTIFIED DRAWING NUMBER D-F-9108403-404 SCALE NONE 1 of 1</p>									

XIII. SPECIFICATION SHEETS

Project Spec Sheet List

Project # 9109403 Project Site SUDBURY LANDFILL
 Description FBF ZTOF040X40LF 0000 0000
 Customer MARK HEUETT CONTRACTORS
 Location WALLA WALLA, WA
 Cust. PO # LTR 08-23-10

Spec	Page	Of	Revision	Description	Spec Name
1	1	5	0	PNL-101	FLARE CONTROL PANEL
1	2	5	0	PNL-101	FLARE CONTROL PANEL
1	3	5	0	PNL-101	FLARE CONTROL PANEL
1	4	5	0	PNL-101	FLARE CONTROL PANEL
1	5	5	0	PNL-101	RECEIVER INSTRUMENTS
2	1	1	0	PNL-103	IGNITION TRANSFORMER
3	1	2	0	JB-203	JUNCTION BOX
3	2	2	0	BE-203	FLAME DETECTION SYSTEM
4	1	5	0	PR-101	PANEL RACK
4	2	5	0	PCV-302	PRESSURE CONTROL VALVES & REGULATORS
4	3	5	0	SV-303	SOLENOID VALVES
4	4	5	0	HV-304	MANUAL BALL VALVE
4	5	5	0	PI-305	PRESSURE GAGES
5	1	1	0	TCV-202A	ACTUATED CONTROL DAMPER
6	1	1	0	TE-201, TE-202A, TE-202B, TE-202C	THERMOCOUPLES & THERMOWELLS
7	1	1	0	PDSL-204	PRESSURE SWITCHES
8	1	1	0	BL-204	PURGE AIR BLOWER
9	1	1	0	SOV-102, SV-102, ZSC-102, ZSO-102	ACTUATED BUTTERFLY VALVE
10	1	1	0	FA-107	FLASH - BACK ARRESTOR
11	1	1	0	FE-107, FT-107	MASS FLOW METER
12	1	1	0	LG-101	GAGE GLASSES AND COCKS
13	1	1	0	PDI-101	PRESSURE GAGES



JOHN ZINK
JOHN ZINK COMPANY LLC

JZ SPECIFICATION SHEET
FLARE CONTROL PANEL

PNL-101

Spec	Rev	1	0
Page No.	1 of 5		
Project	9109403		

FOR JZ PARTS: (918)234-2751

Project Name: FBF ZTOF040X40LF 0000 0000

Customer Name: MARK HEUETT CONTRACTORS

Project Site: SUDBURY LANDFILL

Customer P.O.: LTR 08-23-10

	Item No.	Qty	Tag Number(s)	Description	JZ Part No.
1	1	1	CE-101	HOFFMAN #C-SD36308 ENCLOSURE, NEMA 4	9000000
2				(36" H X 30" W X 8" D)	A01
3	2	1	----	HOFFMAN #CMFK MOUNTING KIT	----
4	3	1	----	HOFFMAN #C-P3630 SUBPANEL	----
5	4	1	----	HOFFMAN #AWDF2416N4 WINDOW KIT, HINGED, NEMA 4	----
6				(16" H X 24" W)	
7	5	1	HTR-1	HOFFMAN #D-AH4001B HEATER, 400 W	----
8	6	1	GFI-1	LEVITON #7599-I RECEPTACLE, GFCI, 15 A WITH	----
9				#80401-I COVER AND APPLETON #4CS1/2 BOX	
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					

25 Notes:

ALL ITEMS REQUIRE UL LABEL

PANEL MOUNT

Revision	Date	Initials	Revision Description	Date	Name
Δ				Prepared	09/02/2010 JONES6A
Δ				Checked	09/13/2010 JONES6A
Δ				Approved	09/13/2010 JONES6A
Δ				Quote Attached: <input type="checkbox"/> Yes	Copies of Vendor Literature Req'd: 1

Project Name: FBF ZTOF040X40LF 0000 0000
Project Site: SUDBURY LANDFILL

Customer Name: MARK HEUETT CONTRACTORS
Customer P.O.: LTR 08-23-10

	Item No.	Qty	Tag Number(s)	Description	JZ Part No.
1	1	1	L-1	CUTLER HAMMER #10250T181NC12N PILOT LIGHT,	----
2				TRANSFORMER TYPE, NEMA 4X, 120 V, WHITE LENS	
3	2	1	L-2	CUTLER HAMMER #10250T181NC8N PILOT LIGHT,	----
4				TRANSFORMER TYPE, NEMA 4X, 120 V, GREEN LENS	
5	3	1	L-3	CUTLER HAMMER #10250T181NC7N PILOT LIGHT,	----
6				TRANSFORMER TYPE, NEMA 4X, 120 V, RED LENS	
7					
8					
9					
10					
11					
12	4	1	S-1	CUTLER HAMMER #10250T20KB SELECTOR SWITCH, TWO	----
13				POSITION , NEMA 4X, 1-N/O AND 1-N/C CONTACTS	
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					

25 Notes:

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PANEL MOUNT

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Project Name: FBF ZTOF040X40LF 0000 0000

Customer Name: MARK HEUETT CONTRACTORS

Project Site: SUDBURY LANDFILL

Customer P.O.: LTR 08-23-10

	Item No.	Qty	Tag Number(s)	Description	JZ Part No.
1	1	1	PLC-1	ALLEN BRADLEY #1762-L40AWAR MICROLOGIX PROCESSOR	1157192
2				WITH DUAL RS-232 PORTS	
3	2	1	PLC-1	ALLEN BRADLEY #1762-IT4 THERMOCOUPLE INPUT MODULE	1127113
4	3	2	PLC-1	ALLEN BRADLEY #1762-IF2OF2 ANALOG INPUT AND OUTPUT	1127117
5				MODULE	
6	4	1	PLC-1	ALLEN BRADLEY #1762-NET-ENI ETHERNET MODULE	1212476
7					
8					
9	5	1	OIP-1	AUTOMATION DIRECT #EA7-S6M TOUCHSCREEN, NEMA 4,	---
10				CAPABLE OF MEMORY MODULE EXPANSION	
11	6	1	----	AUTOMATION DIRECT #EZ-MLOGIX-CBL CABLE	----
12	7	1	PS-1	PHOENIX #2938730 POWER SUPPLY, 24 V DC,	----
13				48 W, 120 V	
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					

25 Notes:

ALL ITEMS REQUIRE UL LABEL
PANEL MOUNT

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Project Name: FBF ZTOF040X40LF 0000 0000	Customer Name: MARK HEUETT CONTRACTORS
Project Site: SUDBURY LANDFILL	Customer P.O.: LTR 08-23-10

	Item No.	Qty	Tag Number(s)	Description	JZ Part No.
1	1	75	----	PHOENIX #3004362 TERMINAL	----
2	2	10	----	PHOENIX #0441504 GROUND TERMINAL	----
3	3	2	----	PHOENIX #3003020 END PLATE	----
4	4	2	----	PHOENIX #0800886 END STOP	----
5	5	1	----	PHOENIX #1051003 MARKER	----
6	6	1	----	PHOENIX #0801733 TRACK	----
7	7	10	----	ENTRELEC MTC6 TERMINAL (P/N 115 206.22)	----
8	8	2	----	PHOENIX #3006043 TERMINAL	----
9	9	1	----	PHOENIX #0443023 GROUND TERMINAL	----
10	10	2	----	PHOENIX #3006027 END PLATE	----
11					
12	11	1	CB-4	SQUARE D #60131 CIRCUIT BREAKER, 25 A	----
13	12	2	CB-2,11	SQUARE D #60110 CIRCUIT BREAKER, 10 A	----
14	13	1	CB-10	SQUARE D #60106 CIRCUIT BREAKER, 5 A	----
15					
16	14	1	MS-204	SQUARE D #LC1D12G7 MOTOR STARTER FOR 3/4 HP	----
17				120 V, 60 HZ MOTOR, 120 V COIL	
18	15	1	----	SQUARE D #LRD21 OVERLOAD RELAY, 12 TO 18 A	----
19				ADJUSTABLE RANGE	
20					
21	16	4	CR-63 67 68 69	IDEC #RR3B-ULCAC120V RELAY, 3 PDT WITH INDICATING	----
22				LIGHT AND PUSH-TO-TEST BUTTON	
23	17	4	----	IDEC #SR3B-05 SOCKET	----
24					

25 Notes:

ALL ITEMS REQUIRE UL LABEL
PANEL MOUNT

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Project Name: FBF ZTOF040X40LF 0000 0000	Customer Name: MARK HEUETT CONTRACTORS
Project Site: SUDBURY LANDFILL	Customer P.O.: LTR 08-23-10

GENERAL	1	Service	TEMPERATURE		INPUTS	25	Input Signals	TYPE K THERMOCOUPLE			
	2					26	No. of Inputs	1			
	3	Function	SWITCH			27	Power for XMTRS				
	4	Case	Color			28	Transmitter Spec. No.				
	5	Mounting	INTERNAL			29	Burnout	UPSCALE			
	6					30					
	7	Enclosure Class	General Purpose			31					
	8	Power Supply	117 V 60 Hz			32					
	9	Chart				OPTIONS	33	Alarm Switches: Qty	Form	1	
	10						34	Rating	8 A		
	11	Chart Drive					35	Function	Meas. Var.		
	12	Scales					36	Contact	on Measurement	Open	Increase
	13						37				
14		P=Prop(Gain), I=Integral(Auto Reset), D=Derivative(Rate), Sub: s=Slow, f=Fast		38							
CONTROLLER	15	Control Modes			39						
	16	Action			40						
	17	Auto-Man Switch			41						
	18	Set Point Adj.			42						
	19	Manual Reg.			ORDER	43	Manufacturer	WATLOW			
	20	Output				44	Model No.	CV-C6KH-0000-2500-D			
	21					45	Tag No.	TSHH-201			
	22					46	Quantity	1			
	23					47	Mount	PANEL			
	24					48	JZ Part No.	----			

49 Notes:

ALL ITEMS REQUIRE UL LABEL

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Project Name: FBF ZTOF040X40LF 0000 0000

Customer Name: MARK HEUETT CONTRACTORS

Project Site: SUDBURY LANDFILL

Customer P.O.: LTR 08-23-10

TRANSFORMER	1	Manufacturer	DONGAN	ENCLOSURE	13	Manufacturer	KILLARK
	2	Model	A06-SA6		14	Model	XJB-5106
	3	Tag No.	IT-1		15	Enclosure	NEMA 7
	4	Primary	120 V, 60 HZ		16	Dimensions	5" W X 10" H X 6" D
	5	Secondary	6000 V		17	JZ Part No.	0003653
	6	JZ Part No.	0002558		18		
	7				19	Sub-Panel Manufacturer	KILLARK
	8				20	Sub-Panel Model No	7998-4
	9				21	JZ Part No.	0901135
	10				22		
	11				23		
	12				24	Mount	BELOW

25 Notes:

QUANTITY: ONE (1) ASSEMBLY REQUIRED

ALL ITEMS REQUIRE UL LABEL

PANEL MOUNT, THEN SHIP LOOSE FOR FIELD INSTALLATION

Revision	Date	Initials	Revision Description	Date	Name
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Project Name: FBF ZTOF040X40LF 0000 0000	Customer Name: MARK HEUETT CONTRACTORS
Project Site: SUDBURY LANDFILL	Customer P.O.: LTR 08-23-10

Item No.	Qty	Tag Number(s)	Description	JZ Part No.
1	1	CE-203	HOFFMAN #A1412NF ENCLOSURE, NEMA 4 (14" H X 12" W X 6" D)	0015278
2				
3	1	----	HOFFMAN #A14P12 SUBPANEL	0003527
4	1	----	HUBBELL #SHC1023 CORD CONNECTOR, ALUMINUM, 1/2" NPT HUB FOR 3/8" DIAMETER CABLE COMPRESSION	1101680
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				

25 Notes:

- ALL ITEMS REQUIRE UL LABEL
- INSTALL CORD CONNECTOR IN BOTTOM OF ENCLOSURE
- PANEL MOUNT, THEN SHIP LOOSE FOR FIELD INSTALLATION

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Project Name: FBF ZTOF040X40LF 0000 0000	Customer Name: MARK HEUETT CONTRACTORS
Project Site: SUDBURY LANDFILL	Customer P.O.: LTR 08-23-10

FLAME SCANNER	1	Manufacturer	COEN	JZ Part No.
	2	Model No.	DSF-2000-SB	2653-213-05
	3	Quantity	1	
	4	Type	Ultra-Violet	
	5		SELF-CHECKING	
	6	Power Requirement	24 V DC	
	7	Cable	10' LENGTH	
	8	Mounting Connection	1" NPT (PROCESS), 1/2" NPT (CONDUIT)	
	9	Tag Number(s)	BE-203	
	10			
	11			
	12	Electrical Classification	CLASS 1, DIVISION 1, GROUP D	
	13	Mount	SHIP LOOSE FOR FIELD INSTALLATION	

FLAME RELAY	14	Manufacturer		
	15	Model No.		
	16	Quantity		
	17	Description		
	18			
	19			
	20	Power Requirement		
	21	Amplifier		
	22	Wiring Base		
	23	F.F.R.T.		
24				
25				
26	Tag No.(s)			
27	Mount			

28 Notes:

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Project Name: FBF ZTOF040X40LF 0000 0000
Project Site: SUDBURY LANDFILL

Customer Name: MARK HEUETT CONTRACTORS
Customer P.O.: LTR 08-23-10

	Item No.	Qty	Tag Number(s)	Description	JZ Part No.
1	1	25'	---	DELCO #440 IGNITION WIRE, HIGH VOLTAGE	0002167
2	2	400'	---	THERMO SENSORS #PPZS16KX THERMOCOUPLE WIRE,	0403529
3				16 GAGE SHIELDED, MOISTURE RESISTANT	
4					
5					
6					
7					
8					
9					
10					
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12					
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17					
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19					
20					
21					
22					
23					
24					

25 Notes:

ALL ITEMS REQUIRE UL LABEL
SHIP LOOSE FOR FIELD INSTALLATION

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Project Name: FBF ZTOF040X40LF 0000 0000				Customer Name: MARK HEUETT CONTRACTORS						
Project Site: SUDBURY LANDFILL				Customer P.O.: LTR 08-23-10						
LINE	1	Service	PROPANE / NATURAL GAS		28	Filt. Reg.	Supply Gage	NO	NO	
	2	Line No./Vessel No.			29	Line Strainer				
	3	Line Size/Sched. No.	1/2"		30	Housing Vent				
	4	Function	PILOT GAS		31	Internal Relief		NO		
BODY	5	Type of Body	REGULATOR		32					
	6	Body Size	Port Size	1/2"	33					
	7	Guiding	No. of Ports	2	34					
	8	End Conn. & Rating	1/2" NPT		SERVISE	35	Flow Units	SCFH		
	9	Body Material	ALUMINUM.			36	Fluid	PROPANE / NATURAL GAS		
	10	Packing Material				37	Quant. Max	25 / 50		
	11	Lubricator	Isolating Valve			38	Quant. Oper.	22 / 45		
	12	Seal Type				39	Valve Cv	Valve 1	1.33	35.02
	13	Trim Form				40	Norm. Inlet Press.	ΔP	20 PSIG	
	14	Trim Material				41	Max. Inlet Press.	400 PSIG		
15	Seat Material	NITRILE		42		Max. Shut Off ΔP				
16	Required Seat Tightness			43		Temp. Max.	Operating	180	60	
17	Max. Allow. Sound Level dBA			44		Oper. sp. gr.	Mol. Wt.	1.52 / 0.65		
ACTUATOR	18	Type of Actuator	SPRING DIAPHRAGM		45	Oper. Visc.	% Flash			
	19	Pilot			46	% Superheat	% Solids			
	20	Supply to Pilot			47	Vapor Press.	Crit. Press.			
	21	Self Cont.	Ext. Conn.	X	48	Predicted Sound Level dBA				
	22	Diaphragm Material	NITRILE		49					
	23	Diaphragm Rating			ORDER	50	Manufacturer	FISHER		
	24	Spring Range	0 TO 35 PSIG			51	Model No.	67D-27		
	25	Set Point	15 PSIG			52	Mount	RACK		
	26					53	Tag No.	PCV-302		
	27					54	JZ Part No.	1260113		

55 Notes:

QUANTITY: ONE (1) REQUIRED

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Project Name: **FBF ZTOF040X40LF 0000 0000** Customer Name: **MARK HEUETT CONTRACTORS**
Project Site: **SUDBURY LANDFILL** Customer P.O.: **LTR 08-23-10**

GENERAL	1	Tag No.	SV-303		SOLENOID	28	Enclosure	NEMA 4,7		
	2	Service	PILOT GAS			29	Voltage / HZ	120 V	60	
	3					30	Style of Coil	F		
	4	Line No. / Vessel No.				31	Single or Double Coil			
	5	Quantity	1			32				
VALVE BODY	6	Type			SERVICE COND.	33				
	7	Size: Body	Port	1/2"		3/4"	34	Fluid	PROPANE	NATURAL GAS
	8	Rating	Type Conn.			NPT	35	Qty. Maximum	25 SCFH	50 SCFH
	9	Material -- Body	ALUMINUM			36	Oper. Diff. Min / Max	0	20 PSIG	
	10	Material -- Seat	NITRILE			37	Allow. Diff. Min / Max	0	50 PSIG	
	11	Material -- Diaphragm	NITRILE			38	Temp. Norm / Max. F	60	125	
	12	Operation Direct/ Pilot	DIRECT			39	Oper. sp. gr.	1.52	0.65	
	13	Packless or Type Packed	PACKLESS			40	Oper. Viscosity			
	14	Manual Re-Set	NO			41	Required Cv			
	15	Manual Operator				42	Valve Cv	4.4		
	16					43				
	17					44				
WHEN DE-ENERGIZED	18	2-Way Valve Opens/Close		CLOSES	45					
	19	3-Way			46					
	20	Vent Port Opens/Close			47					
	21	Press Port Opens/Clos			48					
	22	4-Way			49					
	23	Press to Cyl.1 / Cyl.2			50					
	24	Exh. from Cyl.1 / Cyl.2			51	Manufacturer	ASCO			
	25				52	Model No.	EF8215G20			
	26				53	Mount	RACK			
	27				54	JZ Part No.	0012004			

55 Notes:

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Project Name: **FBF ZTOF040X40LF 0000 0000**
Project Site: **SUDBURY LANDFILL**

Customer Name: **MARK HEUETT CONTRACTORS**
Customer P.O.: **LTR 08-23-10**

1	Manufacturer	APOLLO
2	Model No.	73A-103-01
3	Process Connections	THREADED
4	Body Material	CARBON STEEL
5	Ball Material	CARBON STEEL
6	Stem Material	CARBON STEEL
7	Seal/Seat Material	TFE/TFE
8	Packing Material	TFE
9	Handle Type	LEVER
10		
11		
12		

34 Notes:

13	Qty	Tag No.	Size	Oper. Press. PSIG	Oper. Temp. ° F	Service	Mount	JZ Part No.
14	1	HV-304	1/2"	15	60	PILOT GAS	RACK	0501519
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								
32								
33								

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Project Name FBF ZTOF040X40LF 0000 0000	Customer Name MARK HEUETT CONTRACTORS
Project Site SUDBURY LANDFILL	Customer P.O.: LTR 08-23-10

1 Type	Direct	13 Process Connection	1/2" BOTTOM
2 Mount Type	Local	14 Operating Temperature	60 F
3 Dial Diamete	4 1/2"	15 OPTIONS	
Color	WHITE	16	
4 Case Material	Phenol	17	
5 Ring Type	Screwed	18	
6 Blow-Out Protection	Back	19	
7 Lens Material	Plastic	20	
8 Accuracy Required	+/- 0.5%	21	
9 Element Type	Bourdon	22	
10 Element Materia	SS	23 Manufacturer	WIKA
11 Socket Material	Steel	24 Model No.	222.34 4.5 30PSI 1/2L
12 Movement Material	SS		

	Quantity	Tag No	Range PSIG	Oper. Press. PSIG	Service	JZ Part No
25						
26	1	PI-305	0 TO 30	15	PILOT GAS	1209636
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						
41						
42						
43						
44						

45 Notes:

RACK MOUNT

Revision	Date	Initials	Revision Description	Date	Name
△				09/02/2010	JONES6A
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△				09/13/2010	JONES6A
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Project Name: **FBF ZTOF040X40LF 0000 0000** Customer Name: **MARK HEUETT CONTRACTORS**
Project Site: **SUDBURY LANDFILL** Customer P.O.: **LTR 08-23-10**

D A M P E R	1	Tag No.	TCV-202A						
	2	Service	AIR						
	3	Manufacturer	AMERICAN WARMING						
	4	Line Size/Sched. No.							
	5	Type of Body	VC-412 OPPOSE BLADE						
	6	Body Size	36" H x 36" W						
	7	Port Size							
	8	End Conn. and Rating							
	9								
M A T E R I A L S	10	Body	GALVANIZED						
	11	Disc							
	12	Shaft							
	13	Bushing							
	14	Trim: Seat							
	15	Packing							
	16								
	17								
	18	Required Seat Tightness							
S E R V I C E	20	Temp °	Max	Min	AMBIENT				
	21	Press.	Max	Min	AMBIENT				
	22	Maximum Shut Off Δ /Pressure							
	23	Max Flow	Cv (Cg)						
	24	Norm. Flow	Cv (Cg)						
	25								
A C T U A T O R	26	Manufacturer	WORCESTER						
	27	Model No.	12H755Z120A20AF4174						
	28	Type	ELECTRIC						
	29								
30									
31									
32	Quantity	1							
33	Location	SHIP LOOSE							
34	JZ Part No.	9109403A05							

35 Notes:

ACTUATED DAMPER TO OPEN AT 4 MA INPUT AND CLOSE AT 20 MA INPUT.

ALSO SUPPLY HONEYWELL #4074ERU GASKET
JOHN ZINK PART NUMBER: 9019000445
QUANTITY: ONE (1) REQUIRED

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Project Name: **FBF ZTOF040X40LF 0000 0000** Customer Name: **MARK HEUETT CONTRACTORS**
Project Site: **SUDBURY LANDFILL** Customer P.O.: **LTR 08-23-10**

ELEMENT	1	Manufacturer	THERMO SENSORS		11	Material	INCONEL 600			
	2	Model No.	494-92716-18-K-1600		12	Construction	STRAIGHT PIPE			
	3	ISA Type	Wire Size	K	14 AWG	13	O.D. Dim.	I.D. Dim.	0.840"	0.622"
	4	Sheath O.D.	Sheath Mat'l	3/8"	INC 600	14	Process Conn.	Internal Conn.	1" NPT	
	5	Type	Ungrounded		15					
HEAD	6	Material	CAST IRON		16	Nipple Length "N"				
	7	Conduit Connection	3/4"		17					
	8	Terminal Block	Single		18	Manufacturer				
	9				19	Model				
	10				20					

	Tag No.	Well Dimes.		Element Length	Single Duplex	Type	Gage	Service	JZ Part No.
		"U"	"T"						
21									
22	TE-201			18"	SINGLE	K	14	HIGH TEMPERATURE	1099113
23	TE-202A			18"	SINGLE	K	14	TEMPERATURE CONTROL	1099113
24	TE-202B								
25	TE-202C								
26									
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									

37 Notes:

QUANTITY: FOUR (4) ASSEMBLIES REQUIRED

SHIP LOOSE FOR FIELD INSTALLATION

Revision	Date	Initials	Revision Description	Date	Name
△				Prepared	09/02/2010 JONES6A
△				Checked	09/13/2010 JONES6A
△				Approved	09/13/2010 JONES6A
△				Quote Attached: <input type="checkbox"/> Yes	Copies of Vendor Literature Req'd: 1

Project Name: FBZ ZTOF040X40LF 0000 0000 Customer Name: MARK HEUETT CONTRACTORS
Project Site: SUDBURY LANDFILL Customer P.O.: LTR 08-23-10

GENERAL	1	Type	Press	11	Type	Snap
	2	Setting	Field	12	Quantity	Single
	3	Dead Band	Fixed	13	Form	SPDT
	4			14	Rating	15 A / 120 V / 60 HZ
	5			15	Load	Non-inductive
ELEMENT	6	Type	Diaphragm	16	Enclosure	Expl. Proof
	7	Material	RUBBER	17	Conduit Connection	1/2" NPT
	8	Connection	1/8" NPT BOTTOM	18		
	9	Mounting	Local	19	Manufacturer	DWYER
	10			20	Model	1950-1-2F

	Tag No.	Process Cond.	Adj. Range	Set Point		Operating		Service	Mount	JZ Part No.
				Process	Signal	Temp. O F	Press. PSI			
21										
22	PDSL-204	Increase	0.4 TO 1.6"	0.5"		AMB.	ATM.	PURGE AIR	FIELD	0024372
23										
24										
25										
26										
27										
28										
29										
30										
31										
32										
33										
34										
35										

36 Notes:

QUANTITY: ONE (1) REQUIRED

Revision	Date	Initials	Revision Description	Date	Name
Δ				Prepared	09/02/2010 JONES6A
Δ				Checked	09/13/2010 JONES6A
Δ				Approved	09/13/2010 JONES6A
Δ				Quote Attached: <input type="checkbox"/> Yes	Copies of Vendor Literature Req'd: 1



JOHN ZINK

JOHN ZINK COMPANY LLC

FOR JZ PARTS: (918)234-2751

JZ SPECIFICATION SHEET

PURGE AIR BLOWER

BL-204

Spec	Rev	8	0
Page No.		1 of 1	
Project		9109403	

Project Name: FBF ZTOF040X40LF 0000 0000

Customer Name: MARK HEUETT CONTRACTORS

Project Site: SUDBURY LANDFILL

Customer P.O.: LTR 08-23-10

1

PURGE AIR BLOWER

MANUFACTURER: AMERICAN FAN COMPANY
 MODEL: SC-800
 QUANTITY: ONE (1) REQUIRED

ARRANGEMENT: 4-FM
 MOTOR: 3/4 HP, 1800 RPM, TOTALLY ENCLOSED EXLOSIONPROOF (TEXP),
 56-C FRAME
 120/240 V AC, SINGLE PHASE, 60 HZ

SPEED: 1750 RPM @ 0.5 BHP
 DUTY: 700 CFM @ 1.7" H₂O
 TEMPERATURE: 100 °F

ACCESSORIES: OUTLET FLANGE, INLET SCREEN, 50% CUTOFF DAMPER, DRAIN

JOHN ZINK PART NUMBER: 1063304
 TAG: BL-204

SHIP LOOSE FOR FIELD INSTALLATION

Revision	Date	Initials	Revision Description	Date	Name
△				Prepared	09/02/2010 JONES6A
△				Checked	09/13/2010 JONES6A
△				Approved	09/13/2010 JONES6A
△				Quote Attached: <input type="checkbox"/> Yes	Copies of Vendor Literature Req'd: 1

Project Name: **FBF ZTOF040X40LF 0000 0000** Customer Name: **MARK HEUETT CONTRACTORS**
Project Site: **SUDBURY LANDFILL** Customer P.O.: **LTR 08-23-10**

GENERAL	1	Tag No.	SOV-102		POSITIONER	28	Manufacturer	
	2	Service	LANDFILL GAS			29	Model	
	3	Line No./Vessel No.				30	Signal Supply Requirement	
	4	Line Size/Sched. No.	6"			31	Input Signal	
TYPE	5	Type of Body	Body Size	WAFER	6"	32	Output Signal	
	6	Port Size	Valve Cv	6"		33	Electrical Rating	
	7	Shaft Diameter				34		
	8	Face to Face Dimension				35	Filter Regulator	
	9	End Conn. and Rating		6" 150 LB RF		36	Gage Set	
MATERIALS	10	Body		CARBON STEEL		37	Mechanical Travel Stop	
	11	Disc		316 STAINLESS STEEL		38	Instr. Tubing Requirements	STAINLESS STEEL
	12	Shaft		17-4 PH STAINLESS STEEL		39	Position Switch ZSC/O-102	TOPWORX #DXP-M21GNEB
	13	Bushing				40	Solenoid Valve SV-102	ASCO #EF8320G184 120V/60H
	14	Trim Form				41	Other Accessories	SPEED CONTROL VALVE
	15	Trim:	Seat	PTFE		42		
	16		Seal			43		
	17		Packing			44		
	18	Seat Leakage Classification				45	Fluid Type	LANDFILL GAS
ACTUATOR	20	Manufacturer		BETTIS		46	Operating Temperature Range	40 TO 100 F
	21	Model		DS350SR3		47	Operating Flow Rate Range	0 TO 350 SCFM
	22	Type (Pneumatic/Electrical)		PNEUMATIC		48	Operating Pressure Range	-40" H2O
	23	Input Signal (Max/Min)				49	Maximum Shut Off Δ /Pressure	
	24	Action (Spring Return/Double)		SPRING RETURN		50		
	25	Actuator/Valve Orientation				51	Manufacturer	XOMOX
	26	Failure Mode		CLOSED		52	Model Number	6" 801-267-ST2
	27	Minimum Supply Pressure		100 PSIG		53	Mount	SKID
					54	JZ Part No.	1060723	

55 Notes:

QUANTITY: ONE (1) ASSEMBLY REQUIRED

Revision	Date	Initials	Revision Description	Date	Name
Δ				Prepared	09/02/2010 JONES6A
Δ				Checked	09/13/2010 JONES6A
Δ				Approved	09/13/2010 JONES6A
Δ				Quote Attached: <input type="checkbox"/> Yes	Copies of Vendor Literature Req'd: 1

Project Name: FBF ZTOF040X40LF 0000 0000

Customer Name: MARK HEUETT CONTRACTORS

Project Site: SUDBURY LANDFILL

Customer P.O.: LTR 08-23-10

1	Manufacturer	ENARDO
2	Model No.	E71006/D-AAF-13
3	Process Connections	125 LB FF
4	Body Material	ALUMINUM
5	Element Materia	ALUMINUM
6	Drain Connection	1/2" NPT WITH PLUG
7	Body Configuration	ECCENTRIC
8		
9		
10		
11		
12		

34 Notes:

TWO (2) 1/2" FNPT TAPS WITH PLUG REQUIRED, ONE ON EACH SIDE OF ELEMENT.

13	Qty	Tag No.	Size	Oper. Press. H2O	Oper. Temp. ° F	Service	Mount	JZ Part No.
14	1	FA-107	6"	10"	100	LANDFILL GAS	FIELD	1023686
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								
32								

Revision	Date	Initials	Revision Description	Date	Name
Δ				09/02/2010	JONES6A
Δ				09/13/2010	JONES6A
Δ				09/13/2010	JONES6A
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JOHN ZINK
JOHN ZINK COMPANY LLC

FOR JZ PARTS: (918)234-2751

JZ SPECIFICATION SHEET

MASS FLOW METER

FE-107, FT-107

Spec	Rev	11	0
Page No:	1 of 1		
Project	9109403		

Project Name: FBF ZTOF040X40LF 0000 0000

Customer Name: MARK HEUETT CONTRACTORS

Project Site: SUDBURY LANDFILL

Customer P.O.: LTR 08-23-10

1

MASS FLOW METER

MANUFACTURER: THERMAL INSTRUMENT COMPANY
 MODEL: 62-9/9500-I-G-1/2-316SS-PG-120-4/20-ND
 QUANTITY: ONE (1) ASSEMBLY REQUIRED

CONNECTION: 3/4" MALE NPT COMPRESSION FITTING
 (316 STAINLESS STEEL BODY AND FERRULE)

MOUNT: TOP
 PROBE LENGTH: 12"
 TUBE MATERIAL: 316 STAINLESS STEEL

POWER: 120 V, SINGLE PHASE, 60 HZ
 ENCLOSURE RATING: NEMA 7/4X
 ENCLOSURE MATERIAL: ALUMINUM
 TRANSMITTER: INTEGRAL
 OUTPUT: 4 TO 20 MA

SERVICE: LANDFILL GAS (50% CH₄, 50% CO₂)
 PIPE: 6" DIAMETER, SDR 17 HDPE
 (5.814" INSIDE DIAMETER)

MINIMUM FLOW RATE: 0 SCFM
 DESIGN FLOW RATE: 350 SCFM
 MAXIMUM FLOW RATE: 385 SCFM

MINIMUM PRESSURE: 0 PSIG
 DESIGN PRESSURE: 10" H₂O
 MAXIMUM PRESSURE: 1 PSIG

MINIMUM TEMPERATURE: 32 °F
 DESIGN TEMPERATURE: 100 °F
 MAXIMUM TEMPERATURE: 120 °F

JOHN ZINK PART NUMBER: 9109403A11
 TAG NUMBER: FE-107, FT-107

SHIP LOOSE FOR FIELD INSTALLATION

Revision	Date	Initials	Revision Description	Date	Name
Δ				Prepared	09/02/2010 JONES6A
Δ				Checked	09/13/2010 JONES6A
Δ				Approved	09/13/2010 JONES6A
Δ				Quote Attached: <input type="checkbox"/> Yes	Copies of Vendor Literature Req'd: 1



JOHN ZINK

JOHN ZINK COMPANY LLC

FOR JZ PARTS: (918)234-2751

JZ SPECIFICATION SHEET
GAGE GLASSES AND COCKS

LG-101

Spec	Rev	12	0
Page No.		1 of 1	
Project		9109403	

Project Name: FBF ZTOF040X40LF 0000 0000

Customer Name: MARK HEUETT CONTRACTORS

Project Site: SUDBURY LANDFILL

Customer P.O.: LTR 08-23-10

G A G E G L A S S	1	Type	Tubular		G A G E C O C K S	11	Type	Straight	
	2	Connection Type	Top & Bottom			12	Connection Vessel	3/4" NPT	
	3	Connection Size: Vent Drain	3/4"	3/4"		13	Connection: Gage Vent Drain	1/4"	1/4"
	4	Material	316 STAINLESS STEEL			14	Material	316 STAINLESS STEEL	
	5	Minimum Rating	-6 psig at 150 ° F			15	Minimum Rating	-6 psig at 150 ° F	
	6	Options	SHIELDED SIGHT GLASS			16	Construction		
	7	Manufacturer	KENCO			17	Bonnet		
	8	Model	EPG-3/4-22" OAL			18	Options	Ball Checks	
	9					19	Manufacturer	KENCO	
	10					20	Model	KTV-75-SS	

	Qty.	Tag No.	Visible Glass	C.L. Conn.	Model No.	Operating		Service	JZ Part No.
						Temp. ° F	Press. H2O		
21									
22	1	LG-101	18"	24"	BELOW	100	-40"	LANDFILL GAS	BELOW
23									
24									
25									
26									
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									

37 Notes:

DESCRIPTION:	ISOLATION VALVES	SHIELDED SIGHT GLASS
MODEL:	KTV-75-SS	EPG-3/4-22" OAL
QUANTITY:	ONE (1) SET REQUIRED	ONE (1) REQUIRED
JOHN ZINK PART NUMBER:	1004970	1006492

CENTER TO CENTER DISTANCE IS 24" BETWEEN TWO (2) 3/4" DIAMETER FEMALE NPT VESSEL CONNECTIONS.

SKID MOUNT

Revision	Date	Initials	Revision Description	Date	Name
Δ				Prepared	09/02/2010 JONES6A
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Δ				Approved	09/13/2010 JONES6A
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JOHN ZINK

JOHN ZINK COMPANY LLC

FOR JZ PARTS: (918)234-2751

JZ SPECIFICATION SHEET

PRESSURE GAGES

PDI-101

Spec Re 13 0

Page No: 1 of 1

Project 9109403

Project Name FBF ZTOF040X40LF 0000 0000

Customer Name MARK HEUETT CONTRACTORS

Project Site SUDBURY LANDFILL

Customer P.O.: LTR 08-23-10

1	Type	DIRECT		13	Process Connection	1/8" NPT
2	Mount Type	LOCAL		14		
3	Dial Diamete	Color	4-3/4" WHITE	15	OPTIONS	
4	Case Material	ALUMINUM		16		
5	Ring Type	SCREWED		17		
6	Blow-Out Protection	BLOWOUT PLUG		18		
7	Lens Material	PLASTIC		19		
8	Accuracy Required	2%		20		
9	Element Type	DIAPHRAGM		21		
10	Element Materia	SILICONE RUBBER		22		
11	Socket Material			23	Manufacturer	DWYER
12	Movement Material			24	Model No.	2005

	Quantity	Tag No	Range H2O	Oper. Press. H2O	Service	JZ Part No
25						
26	1	PDI-101	0 TO 5"	2"	MOISTURE SEPARATOR	0404310
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						
41						
42						
43						
44						

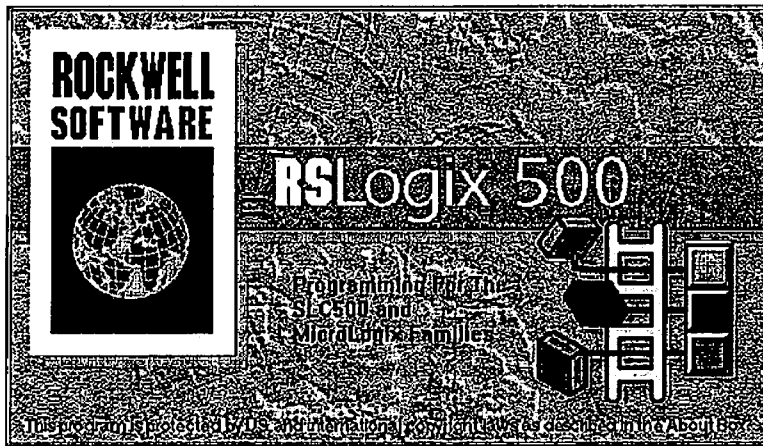
45 Notes:

SKID MOUNT

Revision	Date	Initials	Revision Description	Date	Name
△				09/02/2010	JONES6A
△				09/13/2010	JONES6A
△				09/13/2010	JONES6A
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XIV. PROCESSOR LOGIC PROGRAM

RSLogix500 Project Report



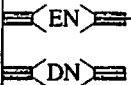
STANDARD PROGRAM FOR LANDFILL N21000000 COPYRIGHT 2004 JOHN ZINK CO LLC

ZTOF FLARE SYSTEM FOR A LANDFILL W/ 2 BLOWERS, THERMOCOUPLE SELECTION IS AUTO. ANALOG OUT FOR GAS FR AND STACK TR. W/ OUTPUTS FOR AUTO DIALER.

0000

POWER UP RESET

TON	
Timer On Delay	
Timer	T4:0
Time Base	1.0
Preset	3<
Accum	3<



0001

OIP RESET
B3:5

RESET PULSE TIME
T4:2

RESET PULSE
B3:0



HIDDEN RESET
I:0

Bul.1762

POWER UP RESET
T4:0

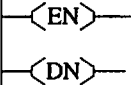


0002

OIP RESET
B3:5

RESET PULSE TIME

TON	
Timer On Delay	
Timer	T4:2
Time Base	1.0
Preset	3<
Accum	0<



HIDDEN RESET
I:0

Bul.1762

FLARE HI TEMP
TSHH-201
I:0

SD SUMMER
B3:4

RESET PULSE
B3:0

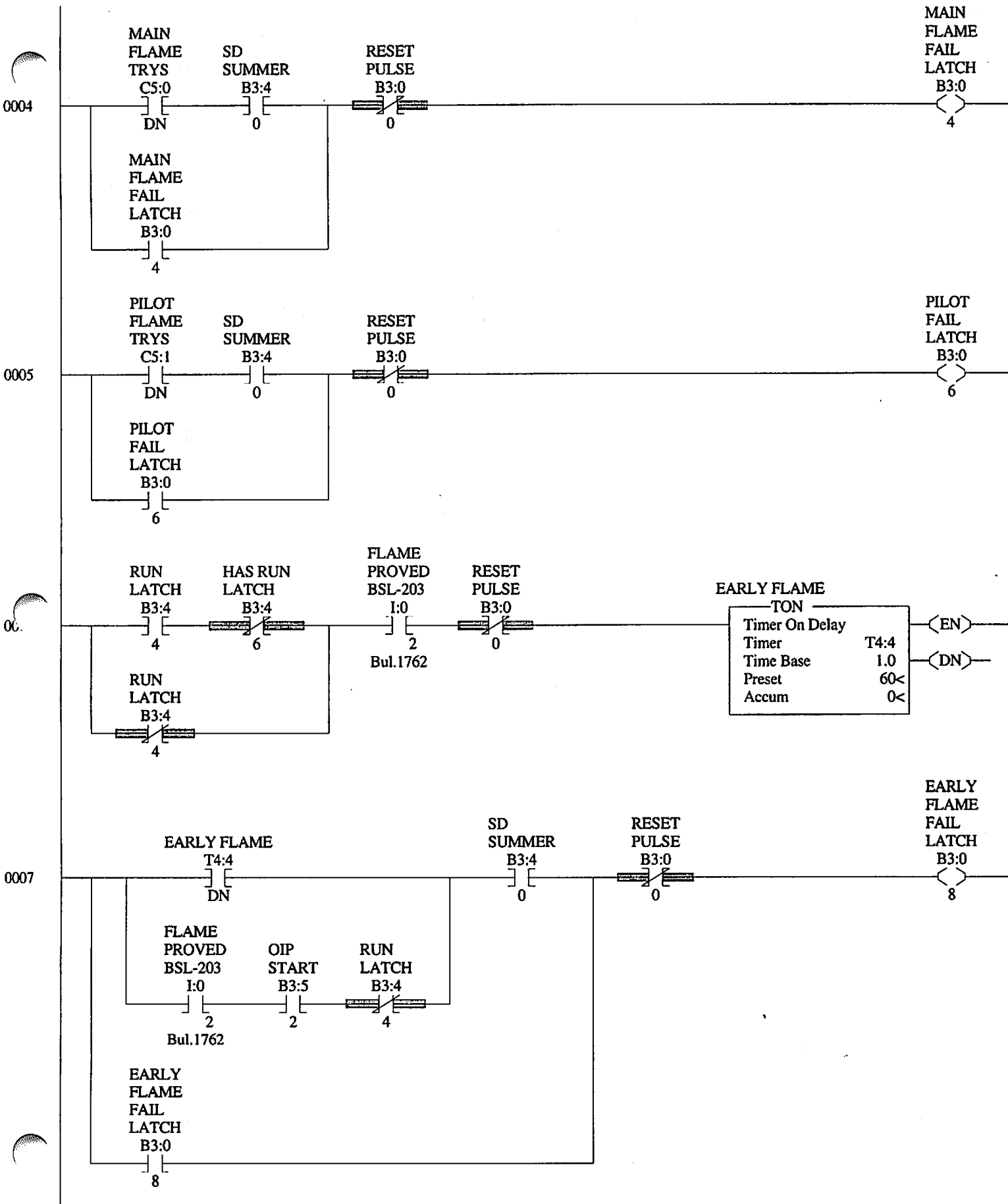
HI TEMP LATCH
B3:0

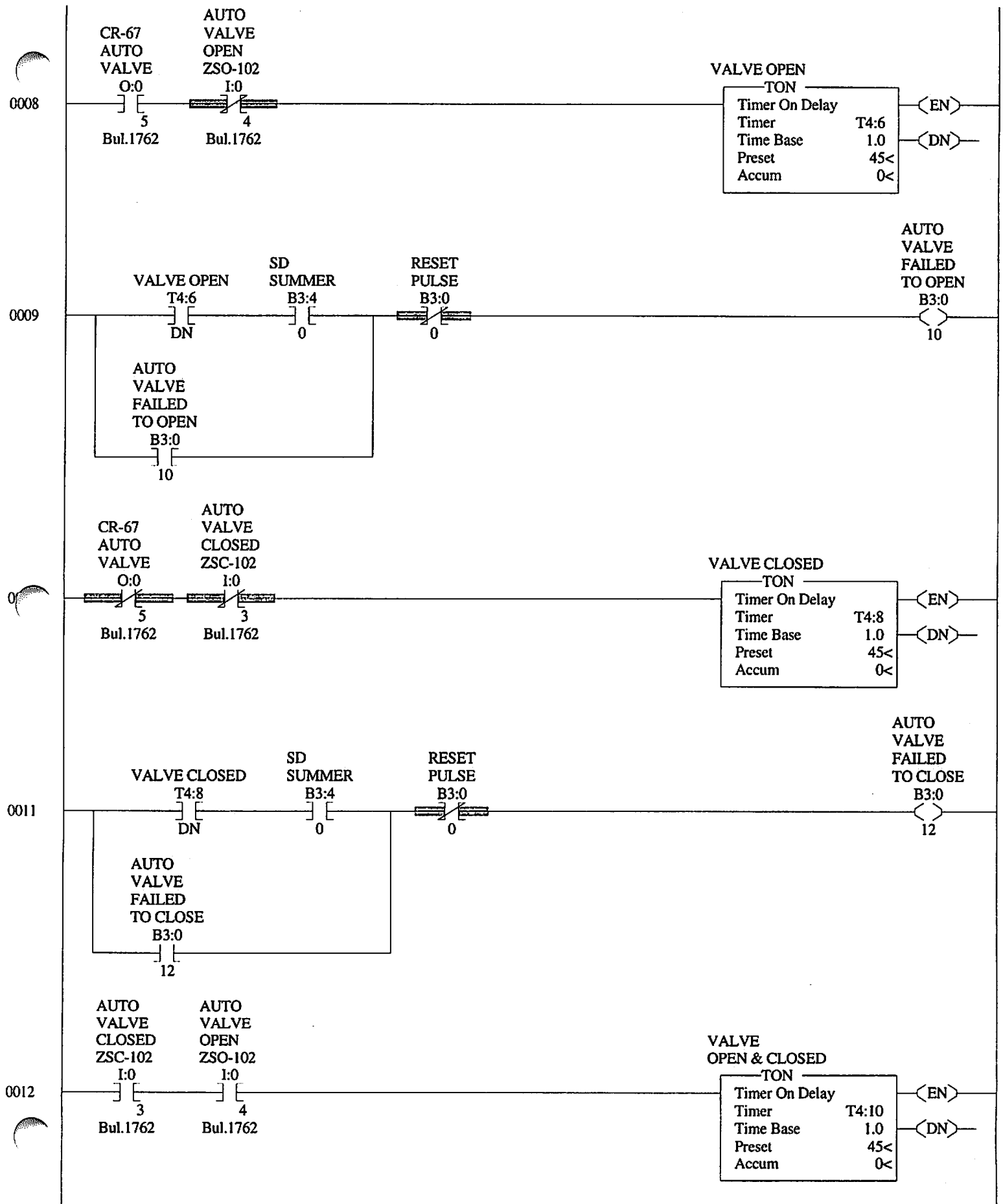


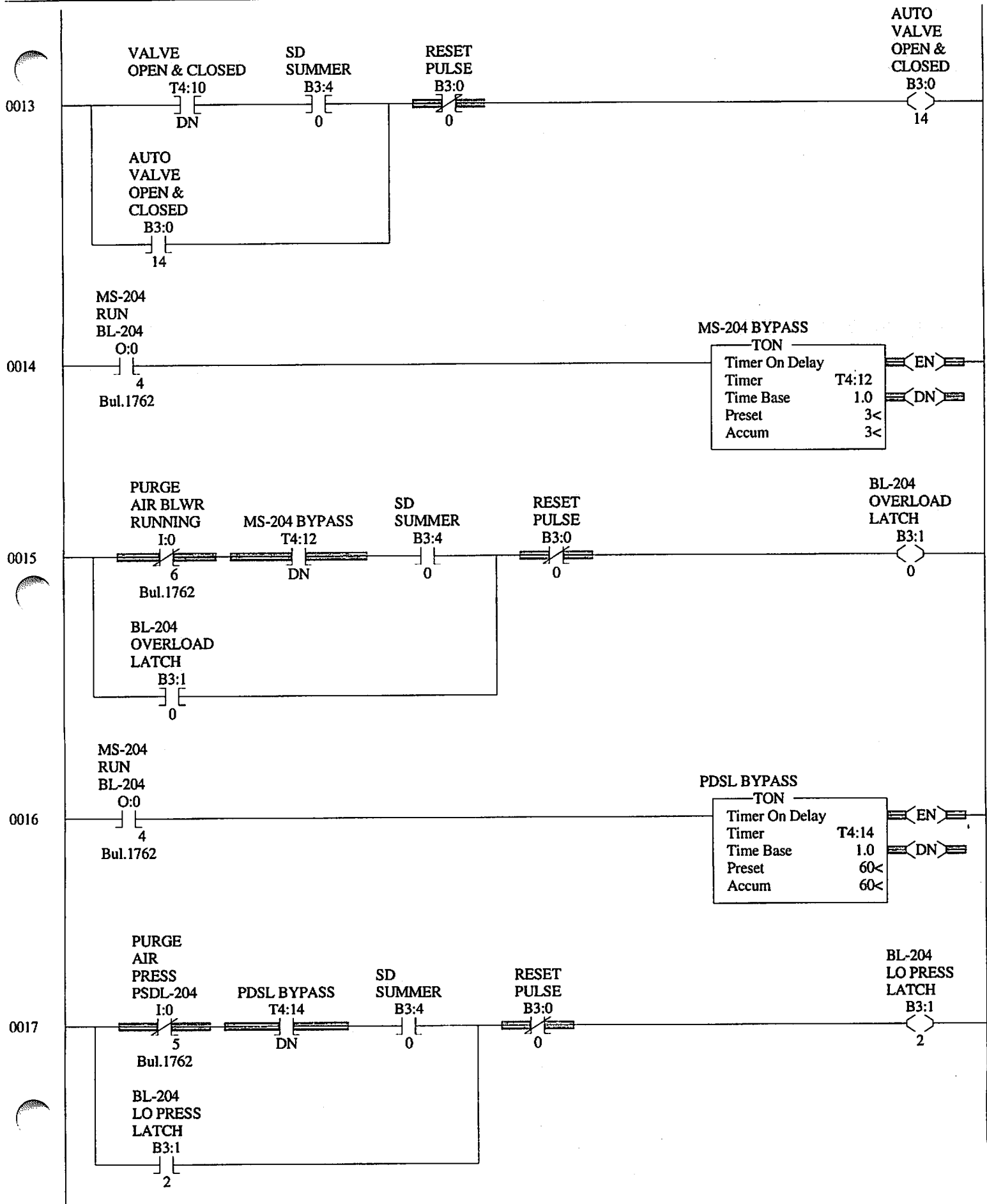
HI TEMP LATCH
B3:0

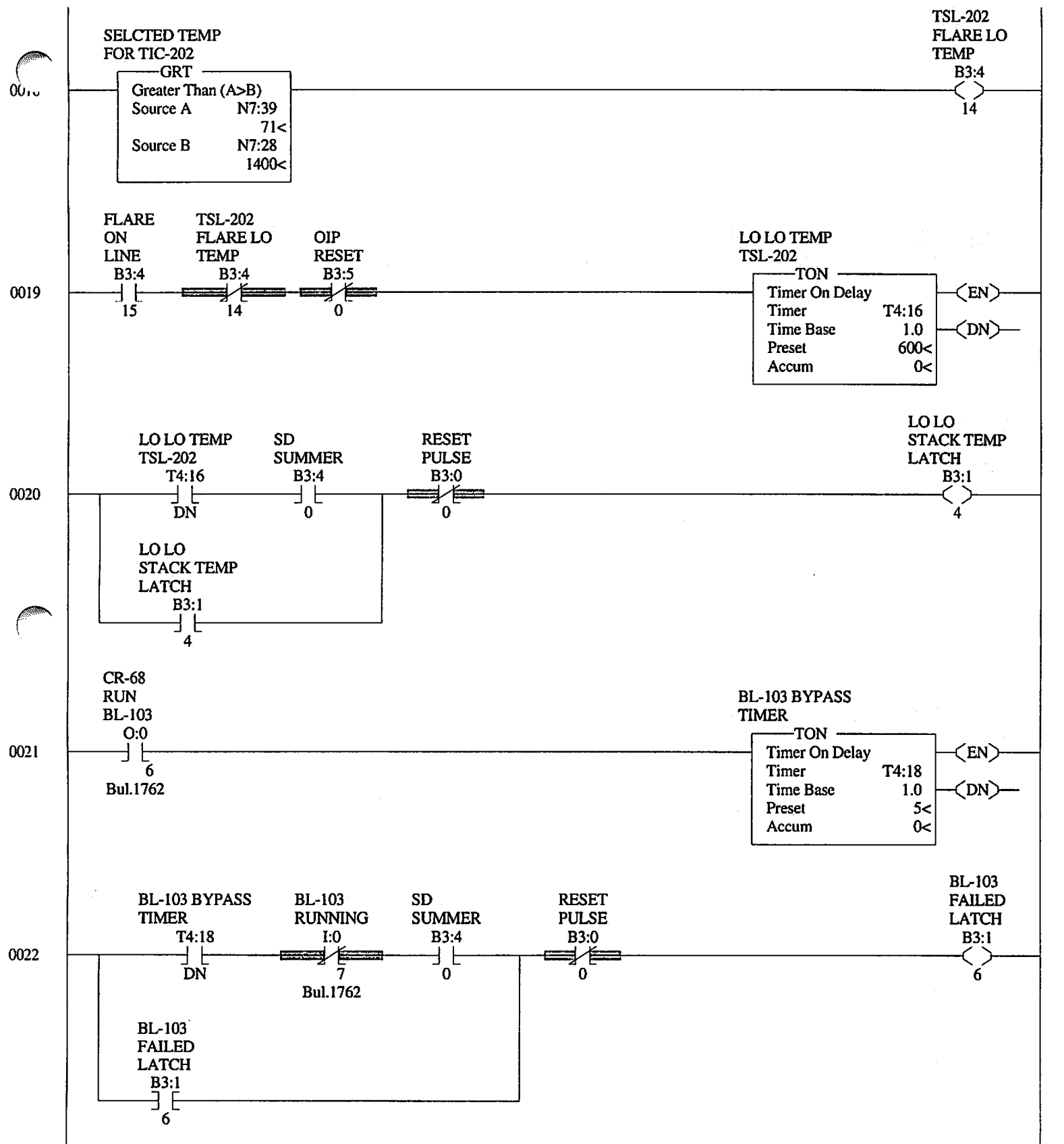


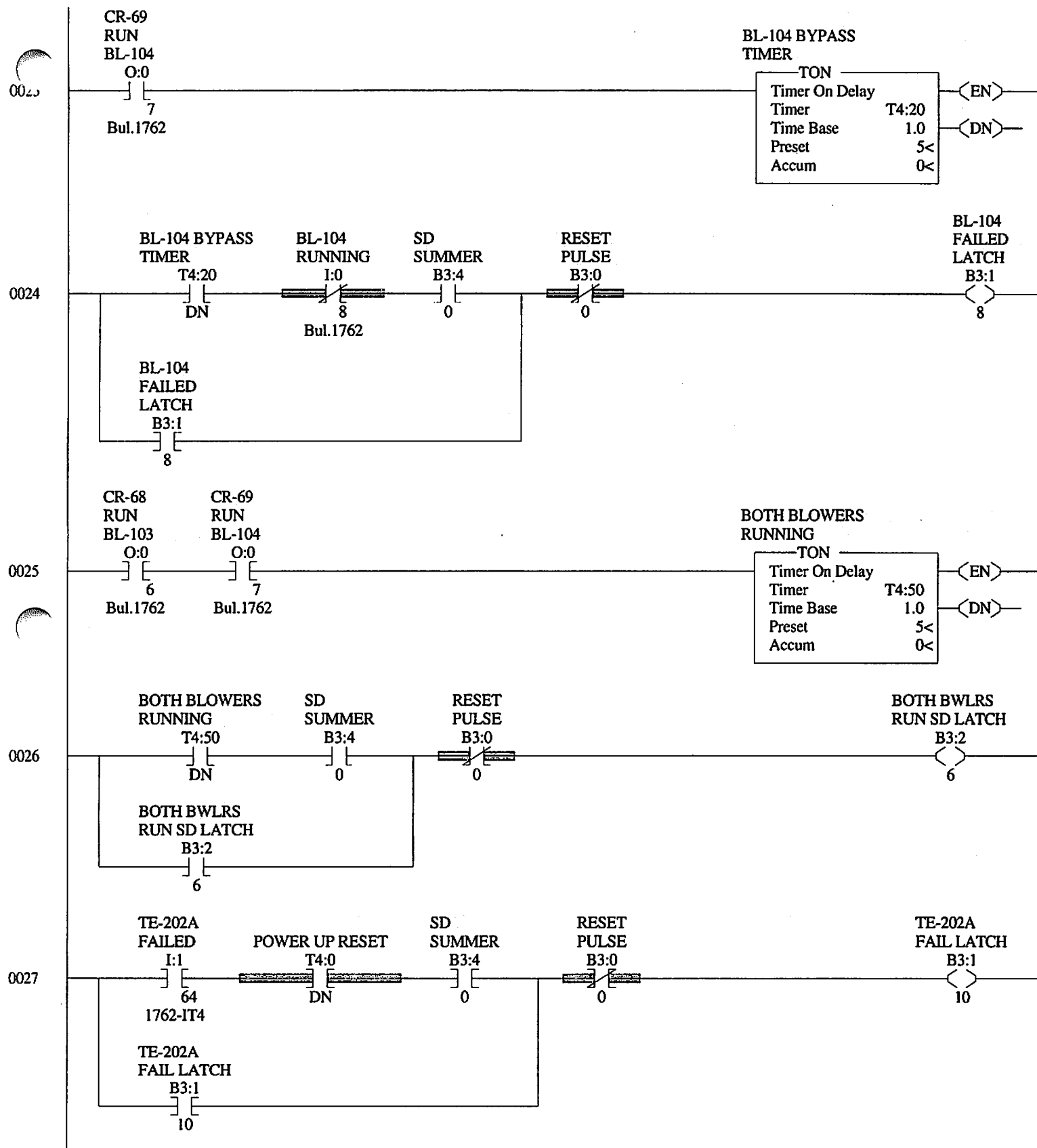
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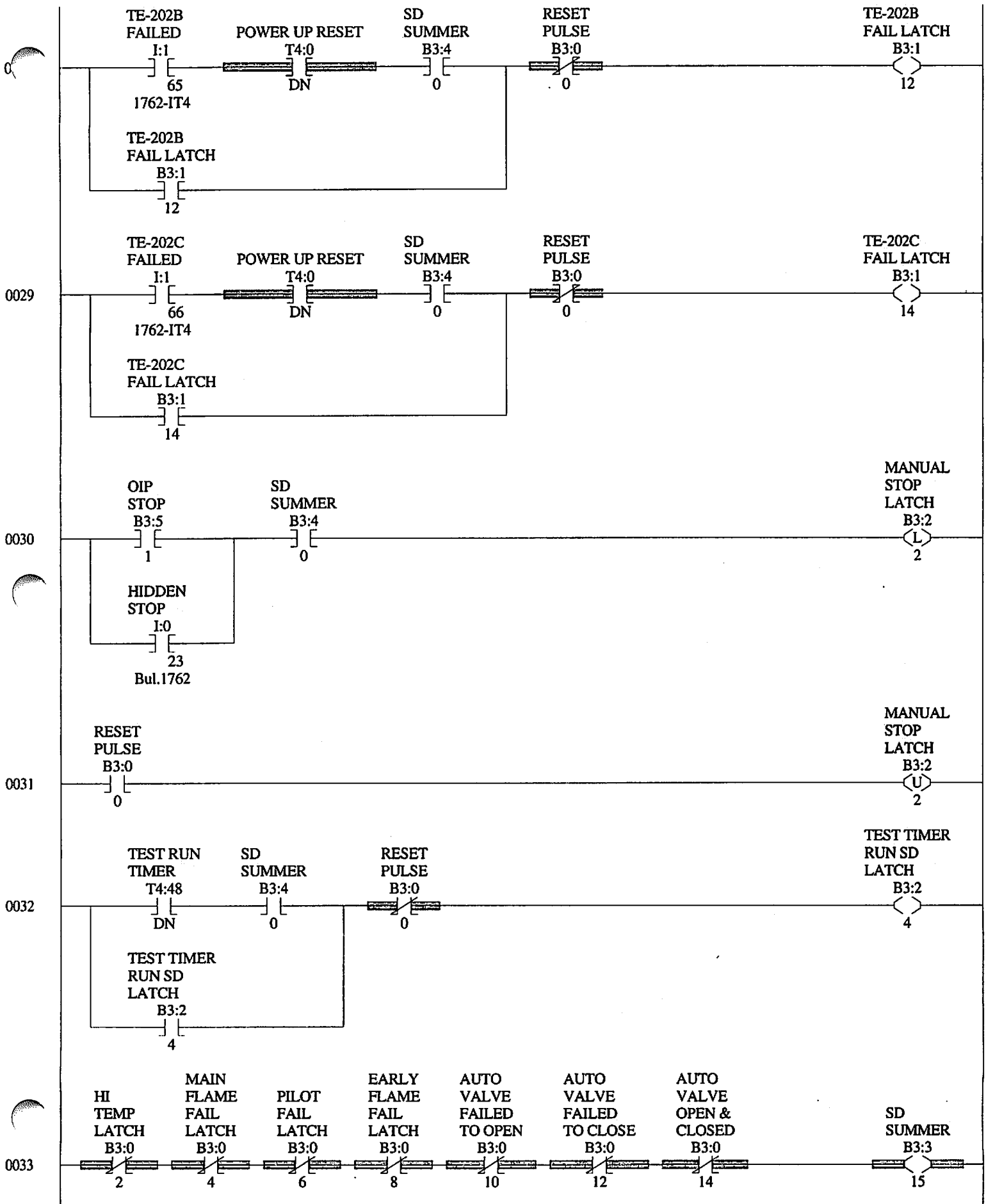


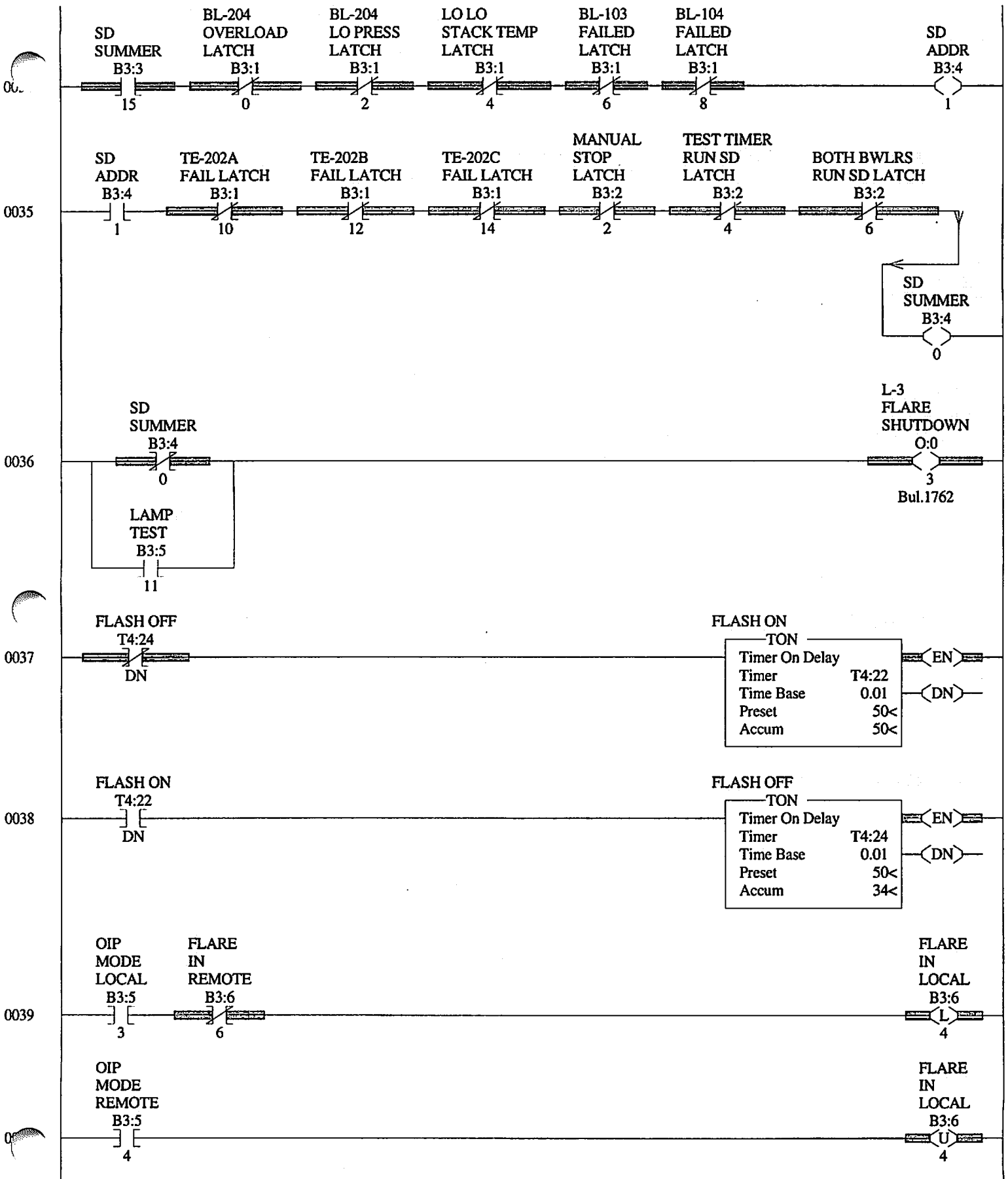


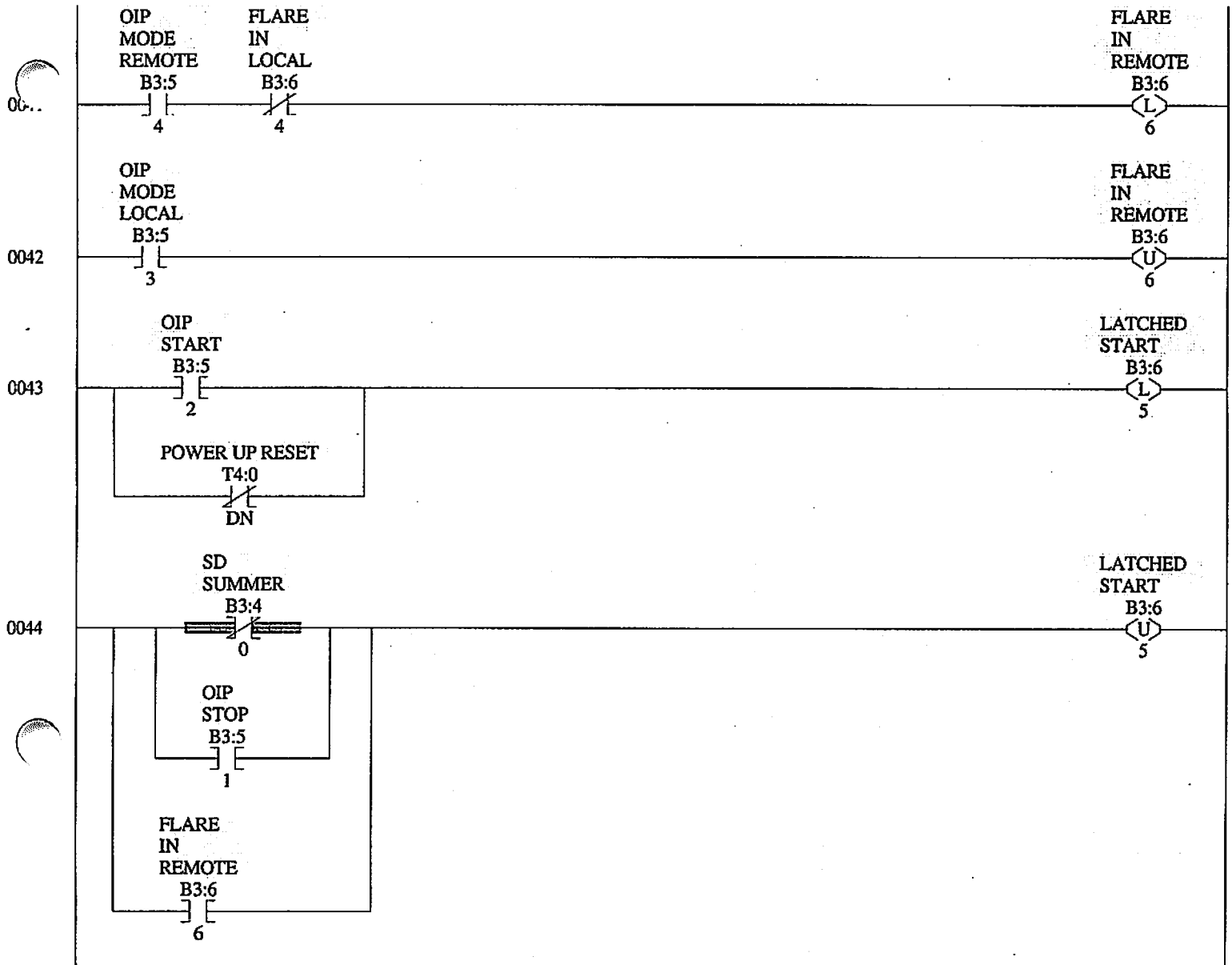


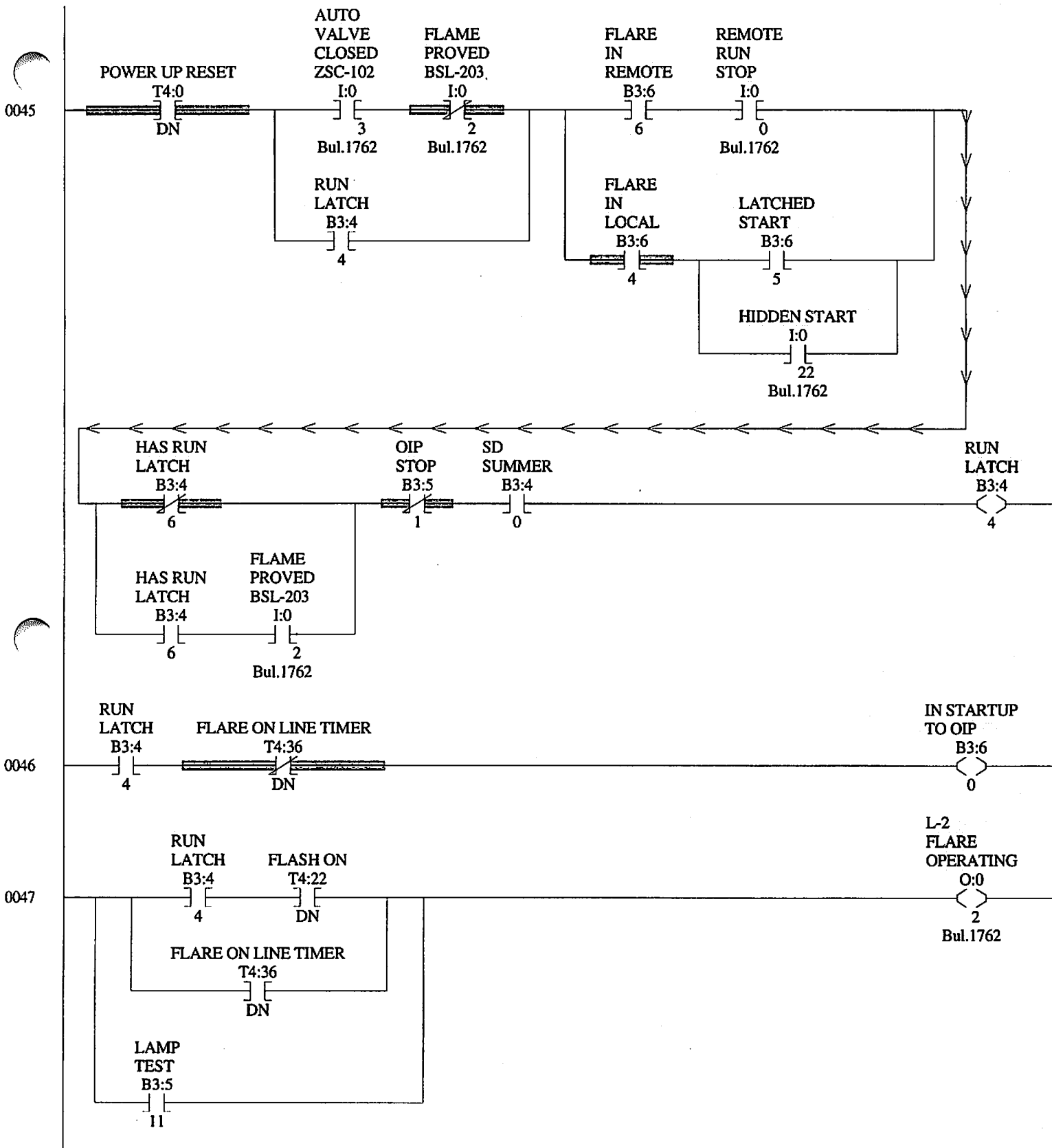


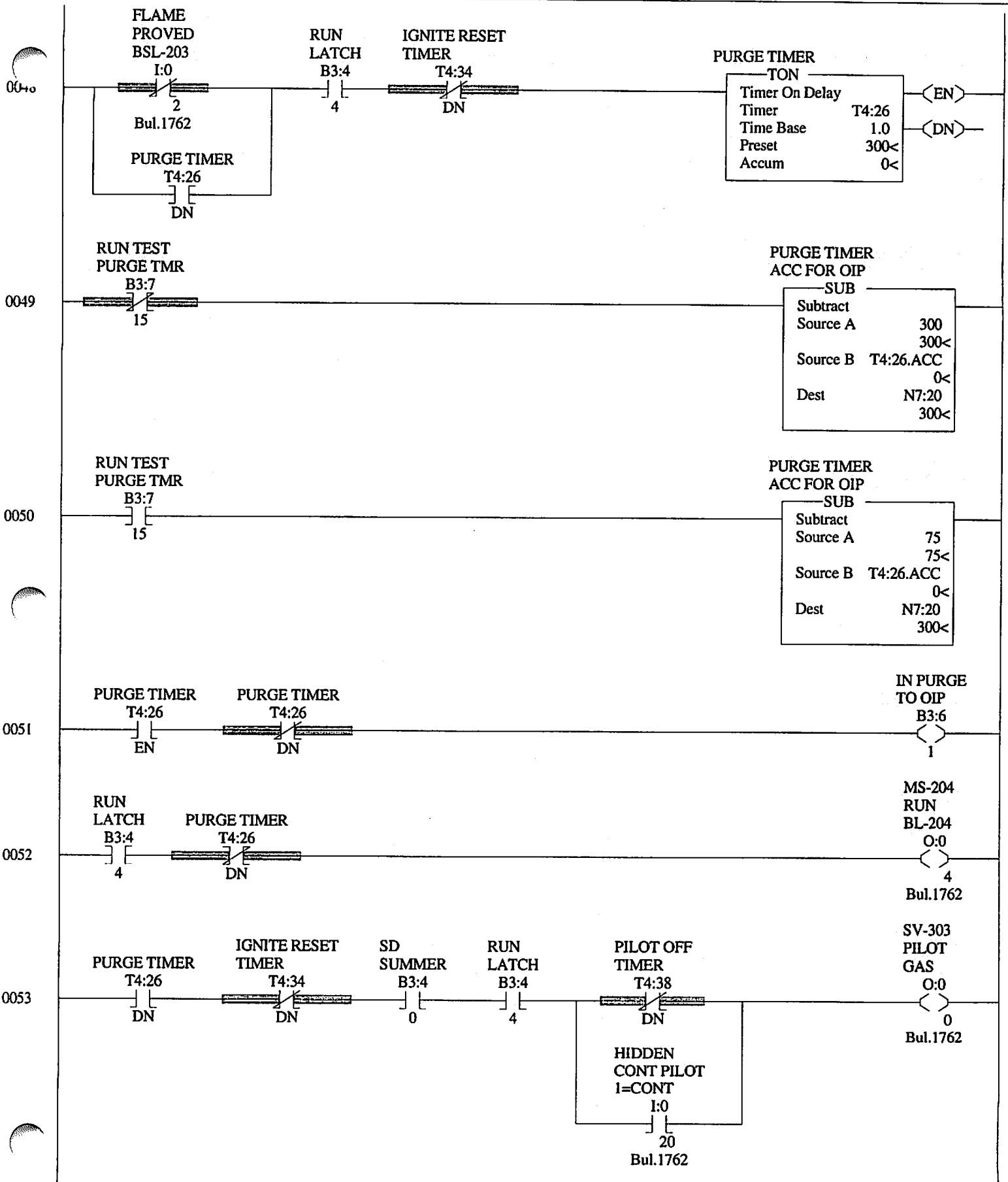


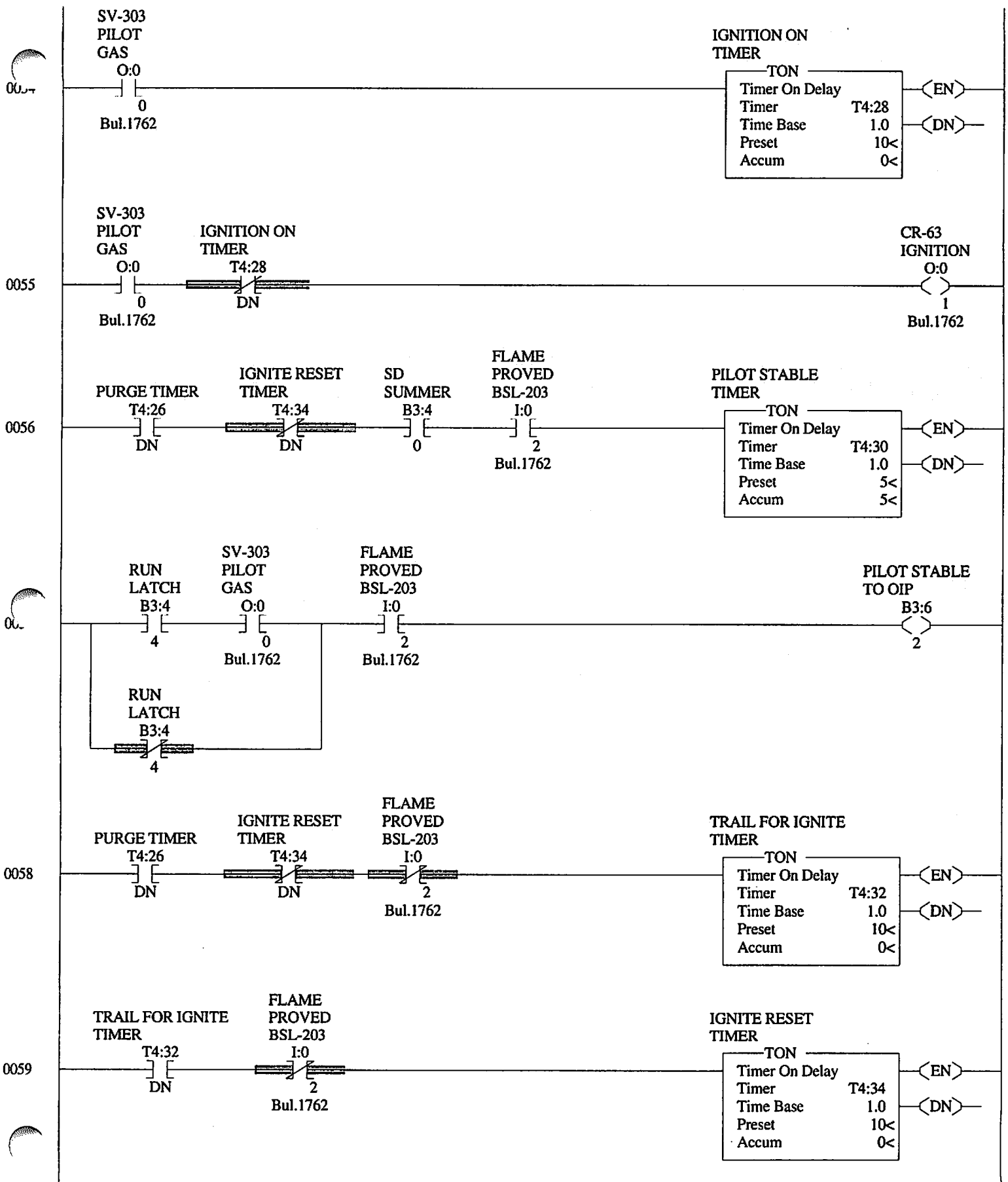


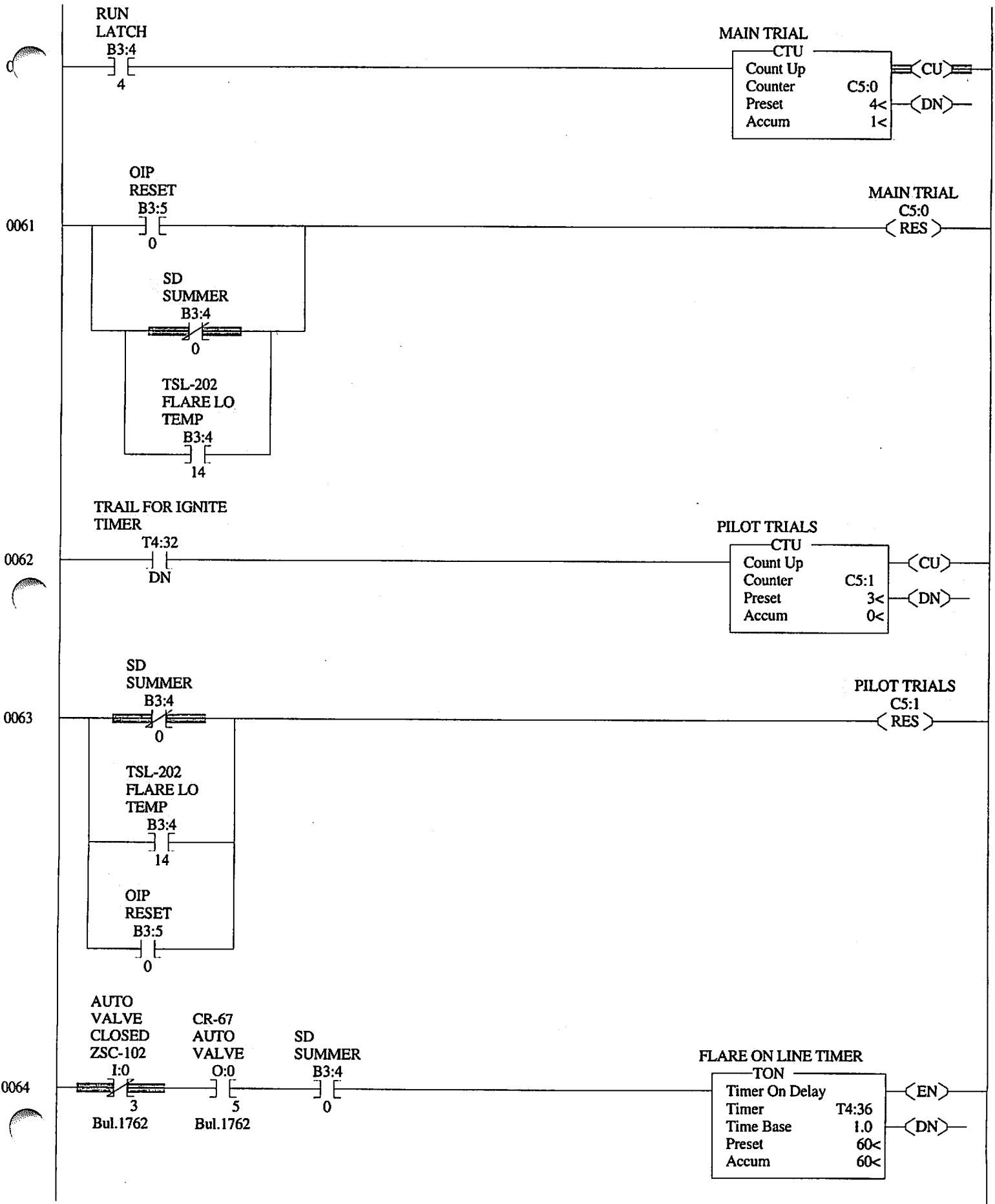


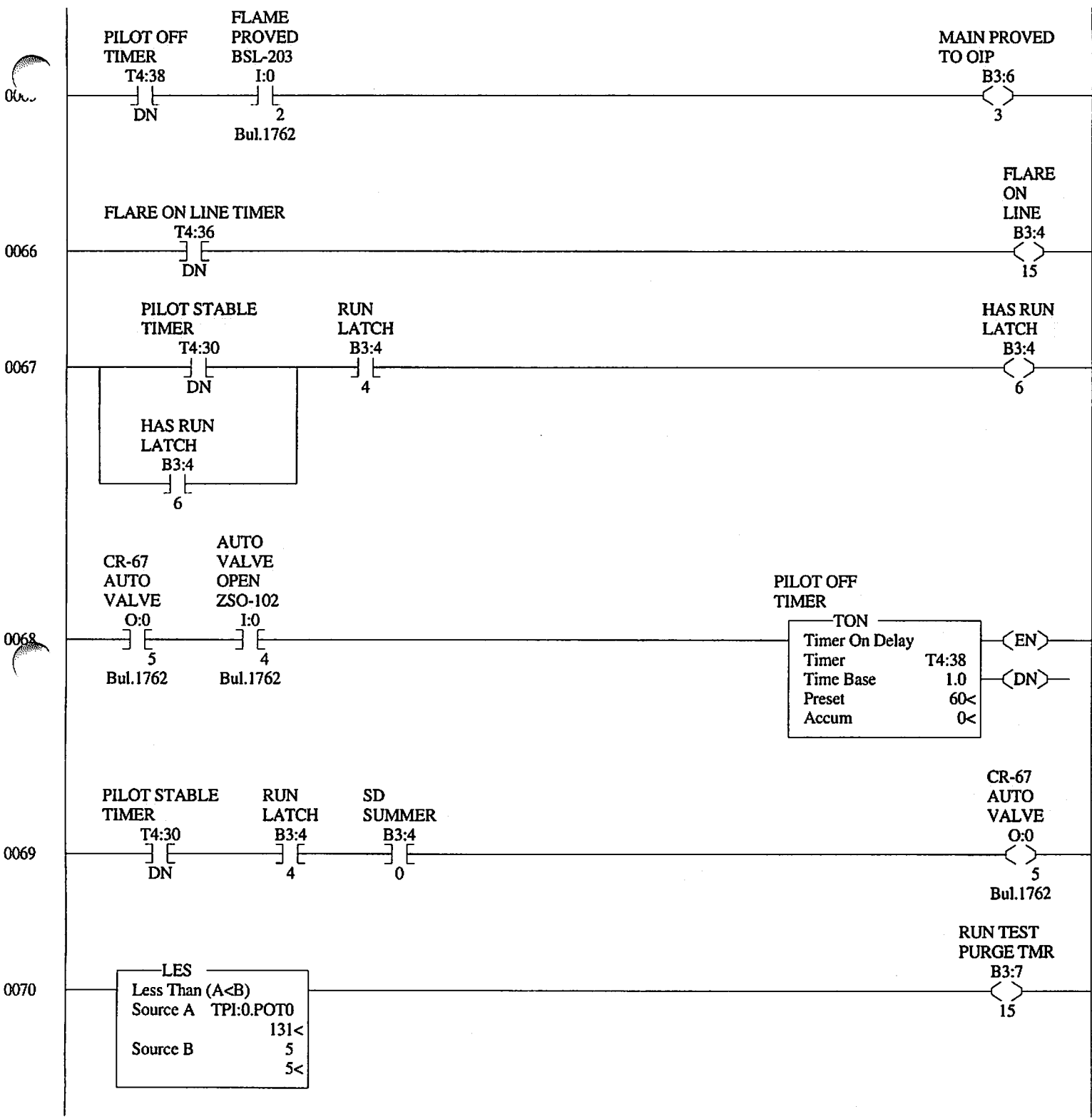


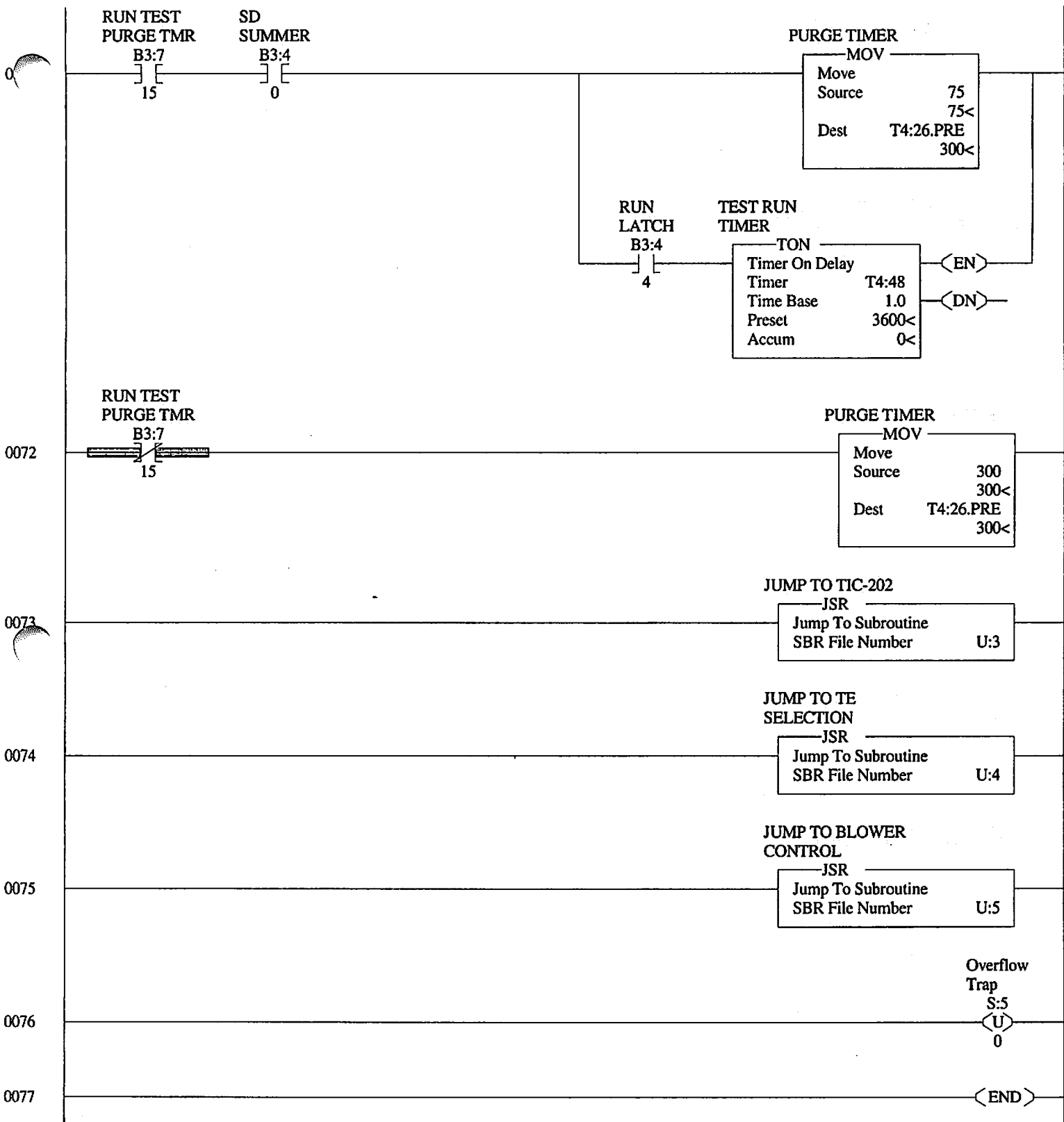


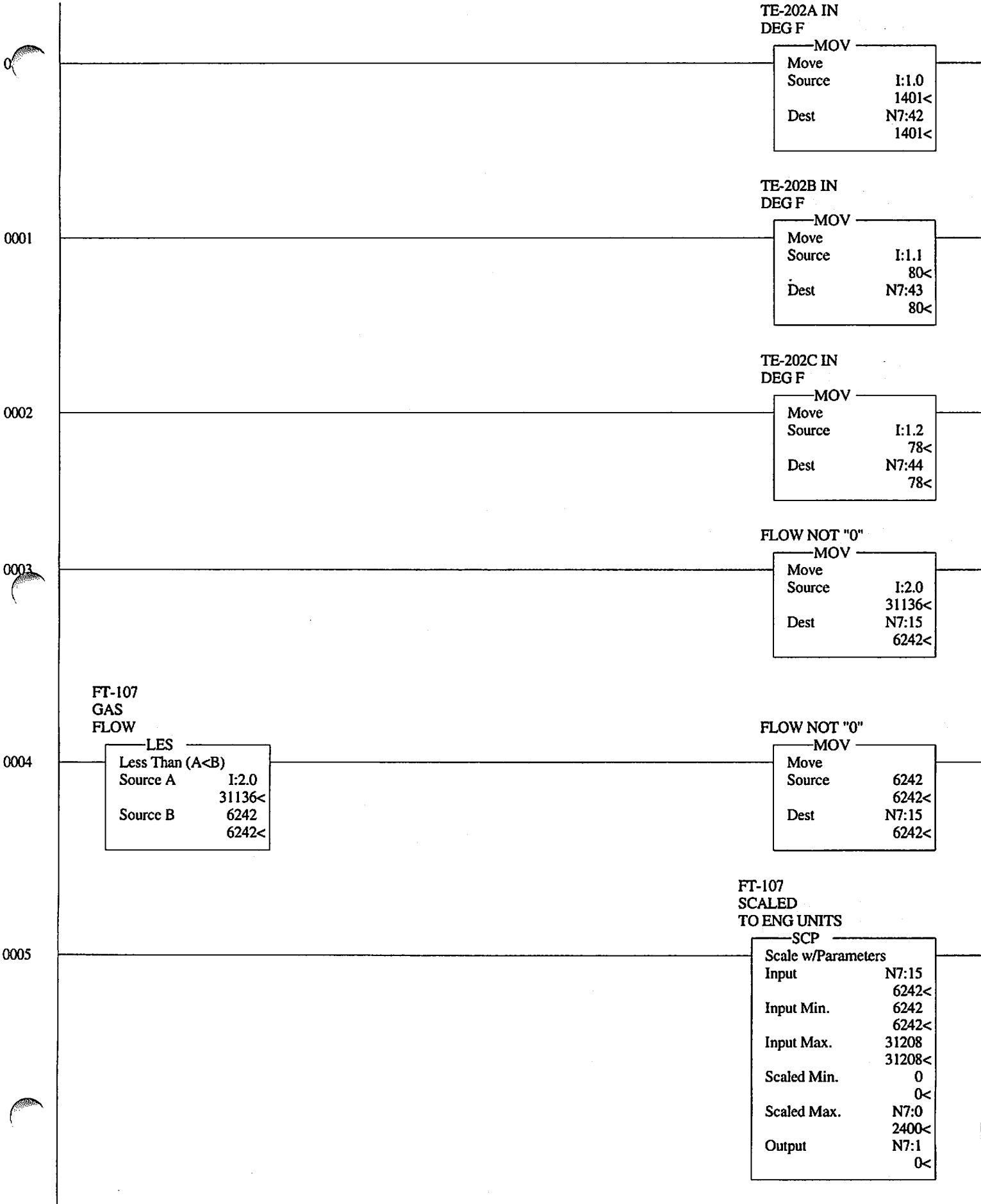


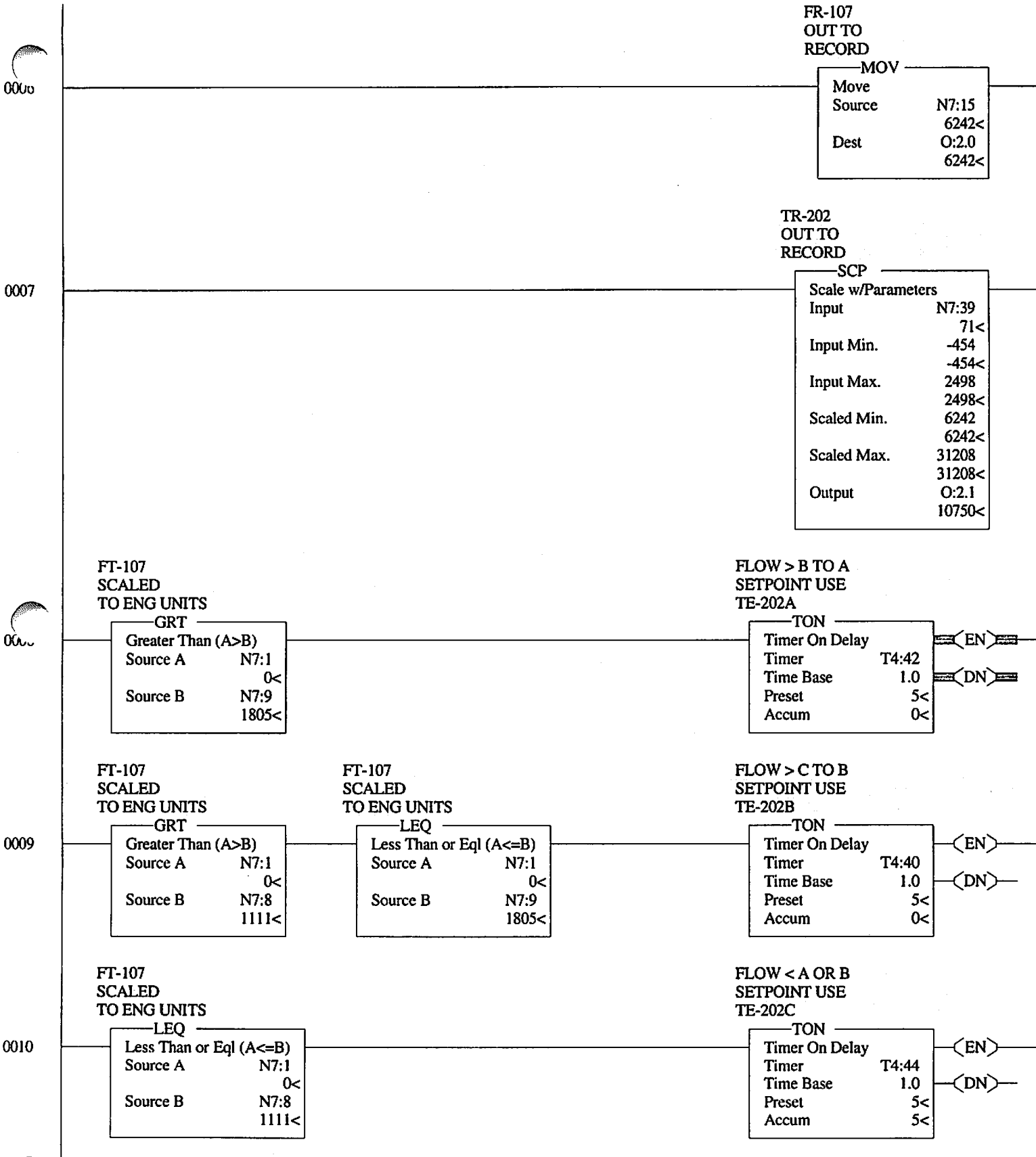












OIP SWITCH
PT C TO B

OIP SWITCH
PT B TO A

GRT
Greater Than (A>B)
Source A N7:8
1111<
Source B N7:9
1805<

MOV
Move
Source N7:8
1111<
Dest N7:9
1805<

0012

TE-202
SELECT
MAN/AUTO
1=MAN
B3:6

OIP PB
TE-202A
MANUAL
SELECTED
B3:6

TE-202A
SELECTED
FOR TIC-202
B3:6

15

12

(L)
9

TE-202
SELECT
MAN/AUTO
1=MAN
B3:6

FLOW > B TO A
SETPOINT USE
TE-202A
T4:42

15

DN

0013

TE-202
SELECT
MAN/AUTO
1=MAN
B3:6

OIP PB
TE-202B
MANUAL
SELECTED
B3:6

TE-202A
SELECTED
FOR TIC-202
B3:6

15

13

(U)
9

OIP PB
TE-202C
MANUAL
SELECTED
B3:6

14

TE-202
SELECT
MAN/AUTO
1=MAN
B3:6

FLOW > C TO B
SETPOINT USE
TE-202B
T4:40

15

DN

FLOW < A OR B
SETPOINT USE
TE-202C
T4:44

DN

0014

TE-202
SELECT
MAN/AUTO
1=MAN



OIP PB
TE-202B
MANUAL
SELECTED



TE-202B
SELECTED
FOR TIC-202



TE-202
SELECT
MAN/AUTO
1=MAN



FLOW > C TO B
SETPOINT USE
TE-202B



FLOW > B TO A
SETPOINT USE
TE-202A



0015

TE-202
SELECT
MAN/AUTO
1=MAN



OIP PB
TE-202A
MANUAL
SELECTED



TE-202B
SELECTED
FOR TIC-202



OIP PB
TE-202C
MANUAL
SELECTED



TE-202
SELECT
MAN/AUTO
1=MAN



FLOW < A OR B
SETPOINT USE
TE-202C



FLOW > B TO A
SETPOINT USE
TE-202A



0016

TE-202
SELECT
MAN/AUTO
1=MAN



OIP PB
TE-202C
MANUAL
SELECTED



TE-202C
SELECTED
FOR TIC-202



TE-202
SELECT
MAN/AUTO
1=MAN

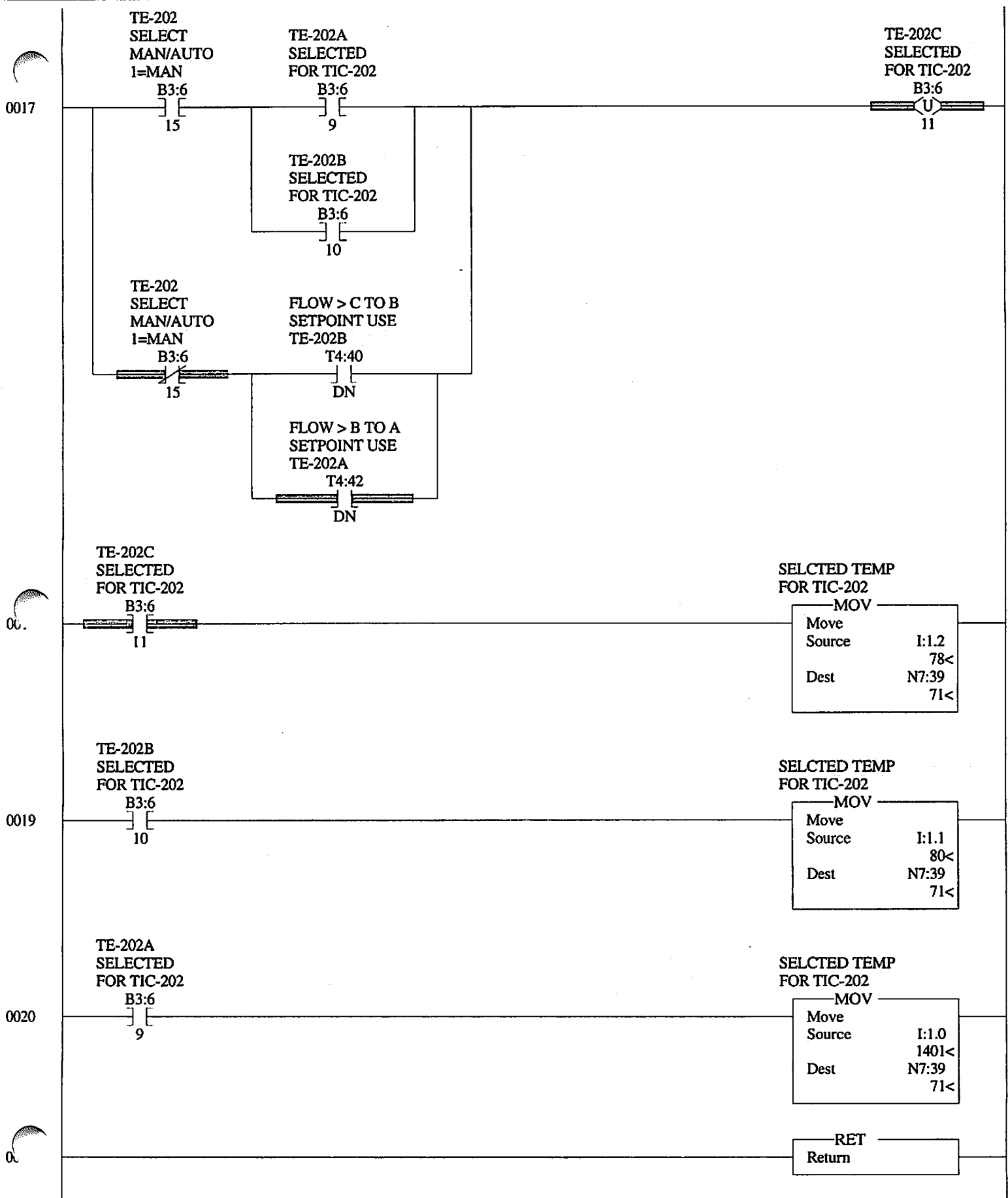


FLOW < A OR B
SETPOINT USE
TE-202C



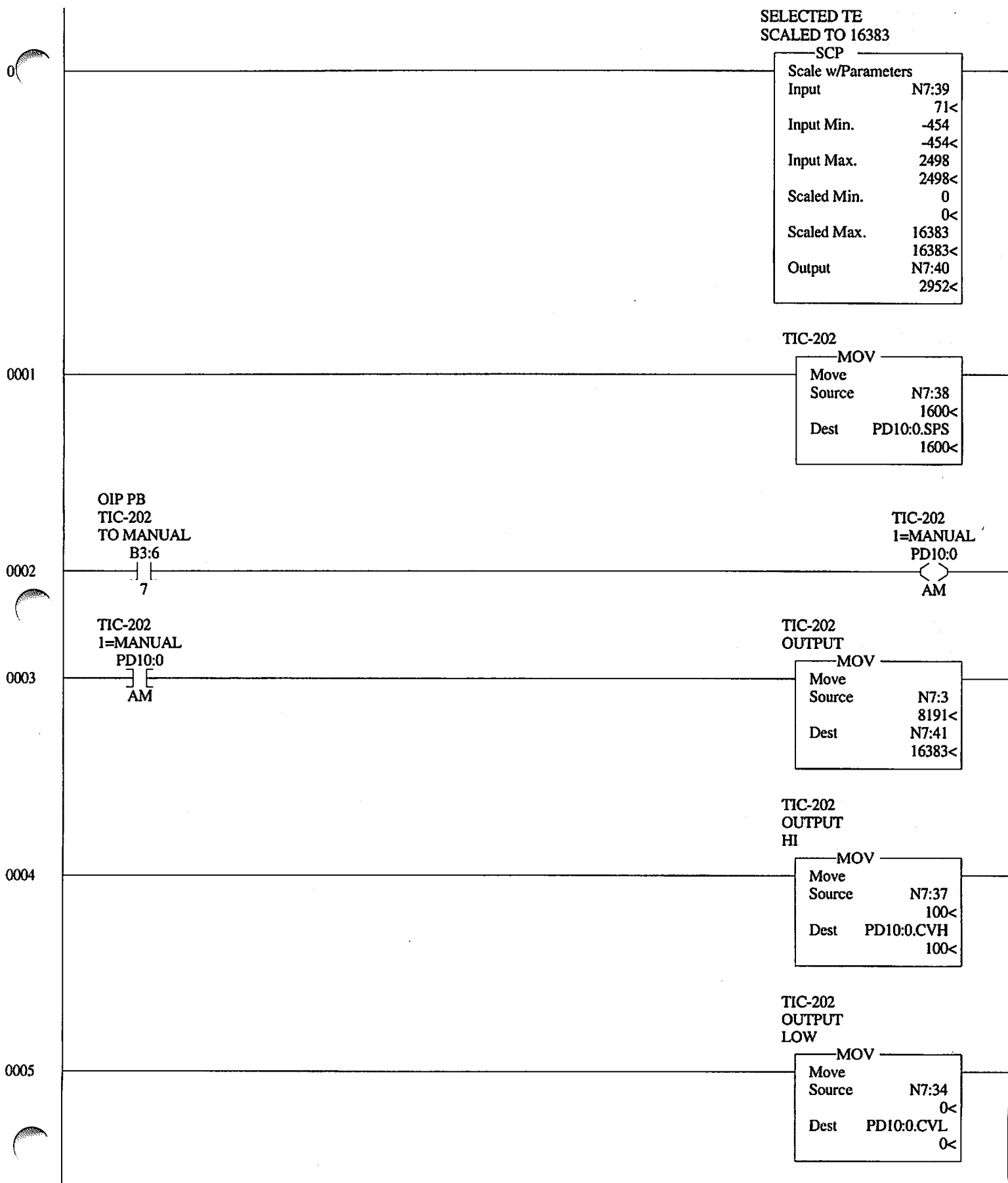
POWER UP RESET

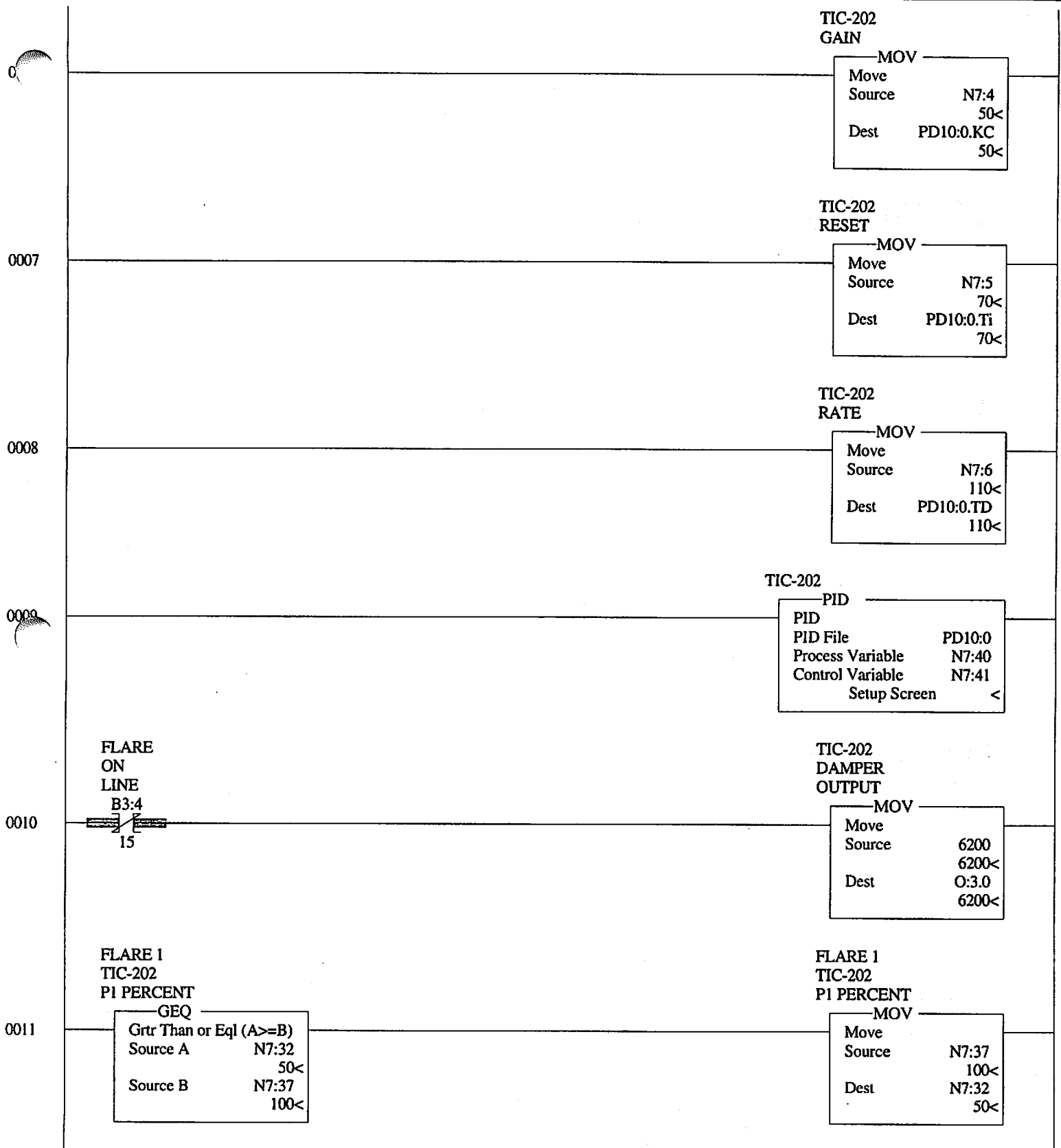


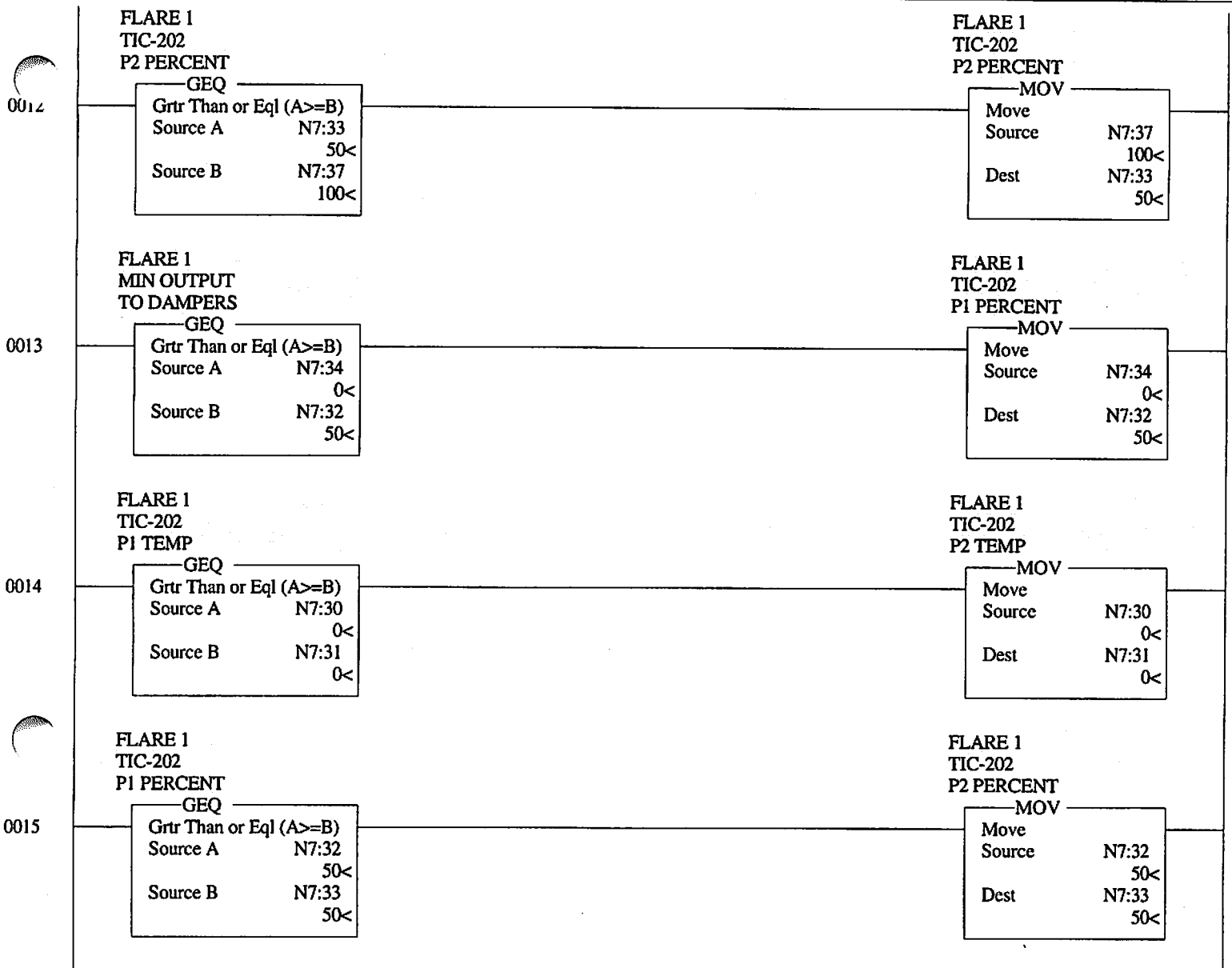


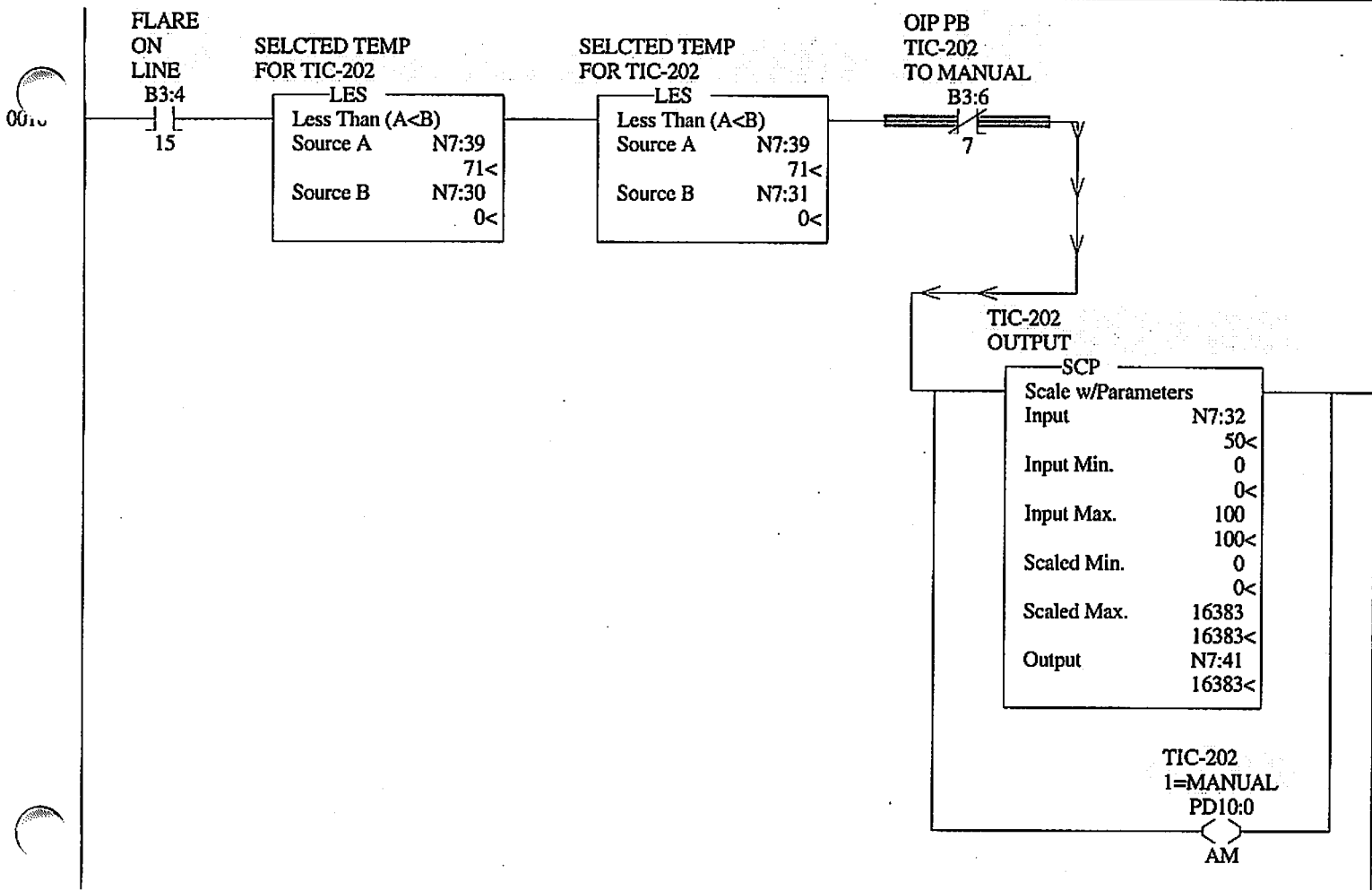
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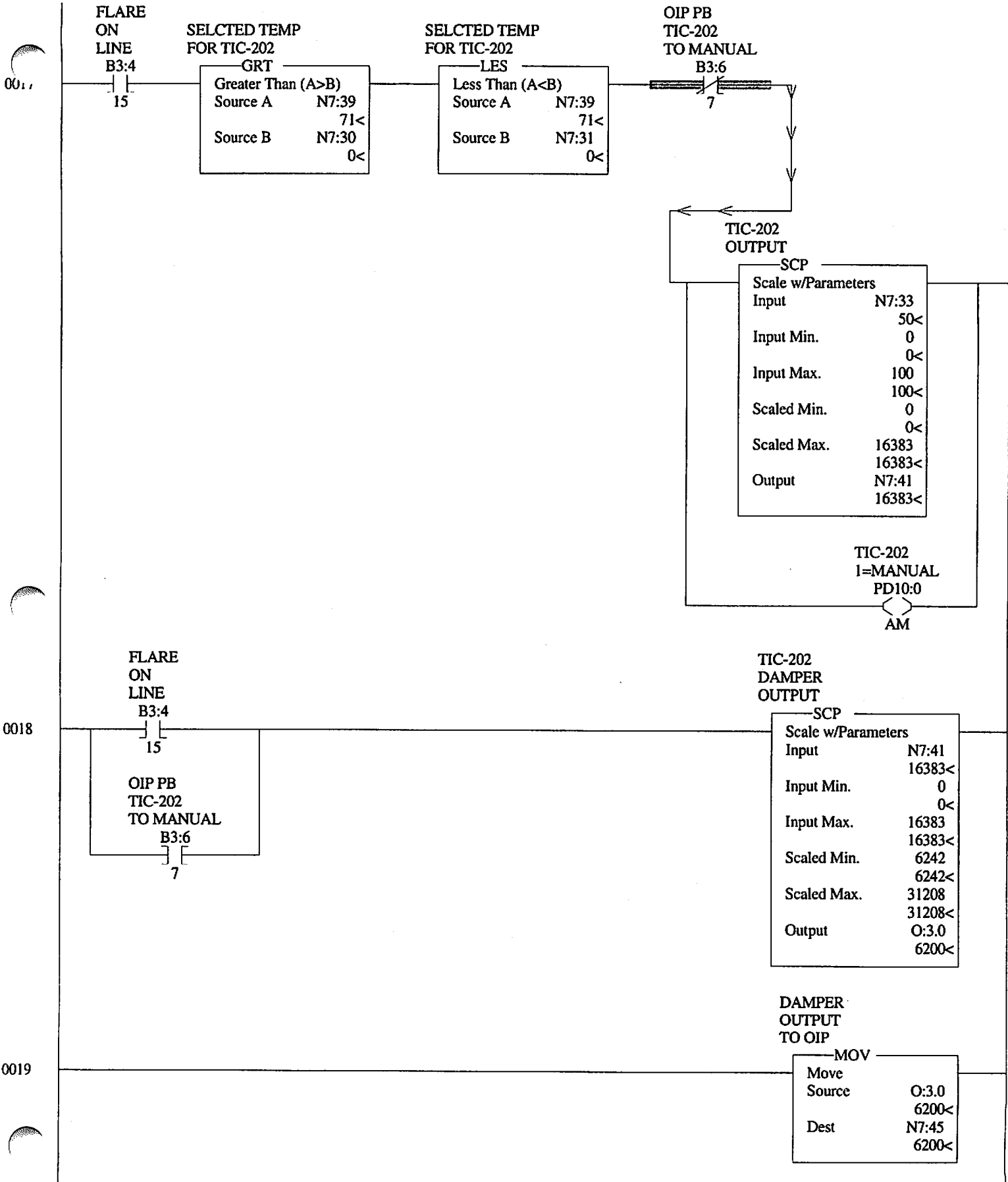
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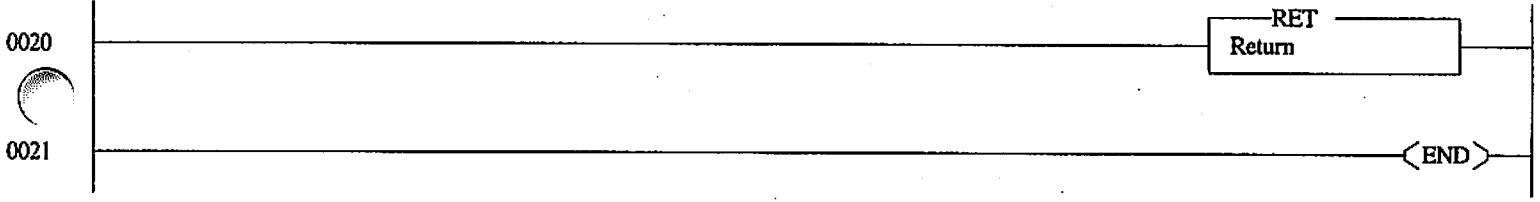


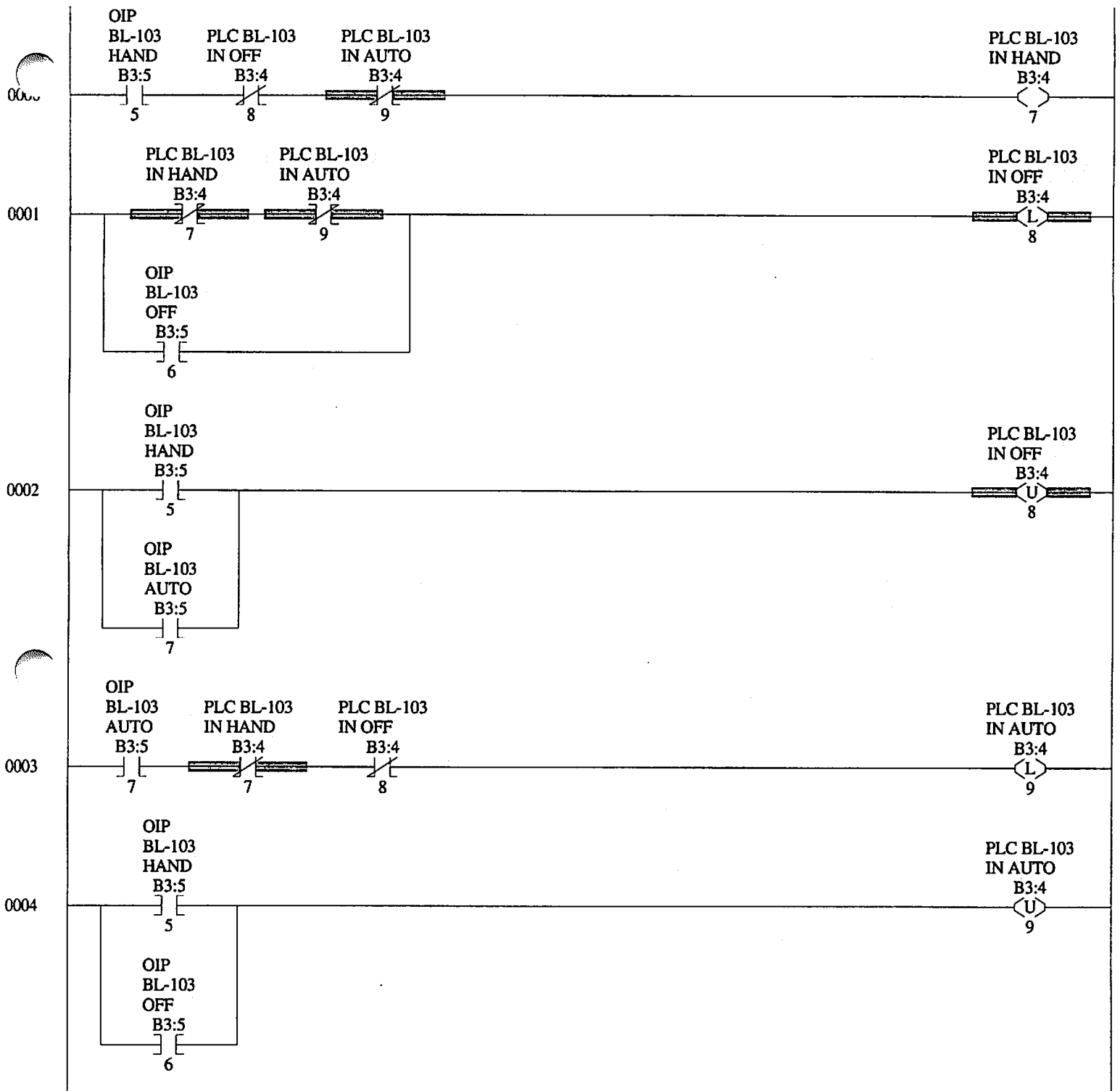


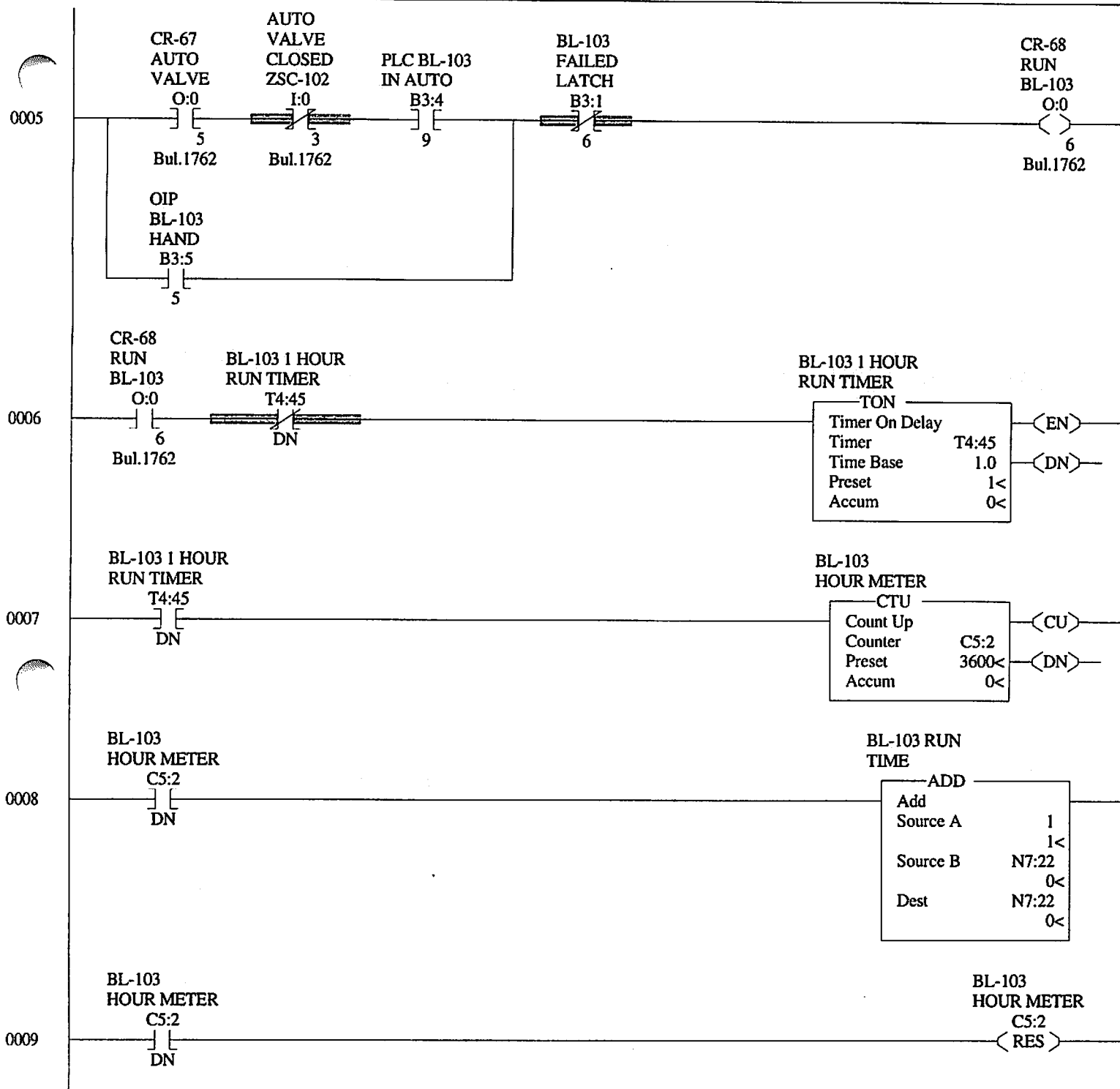


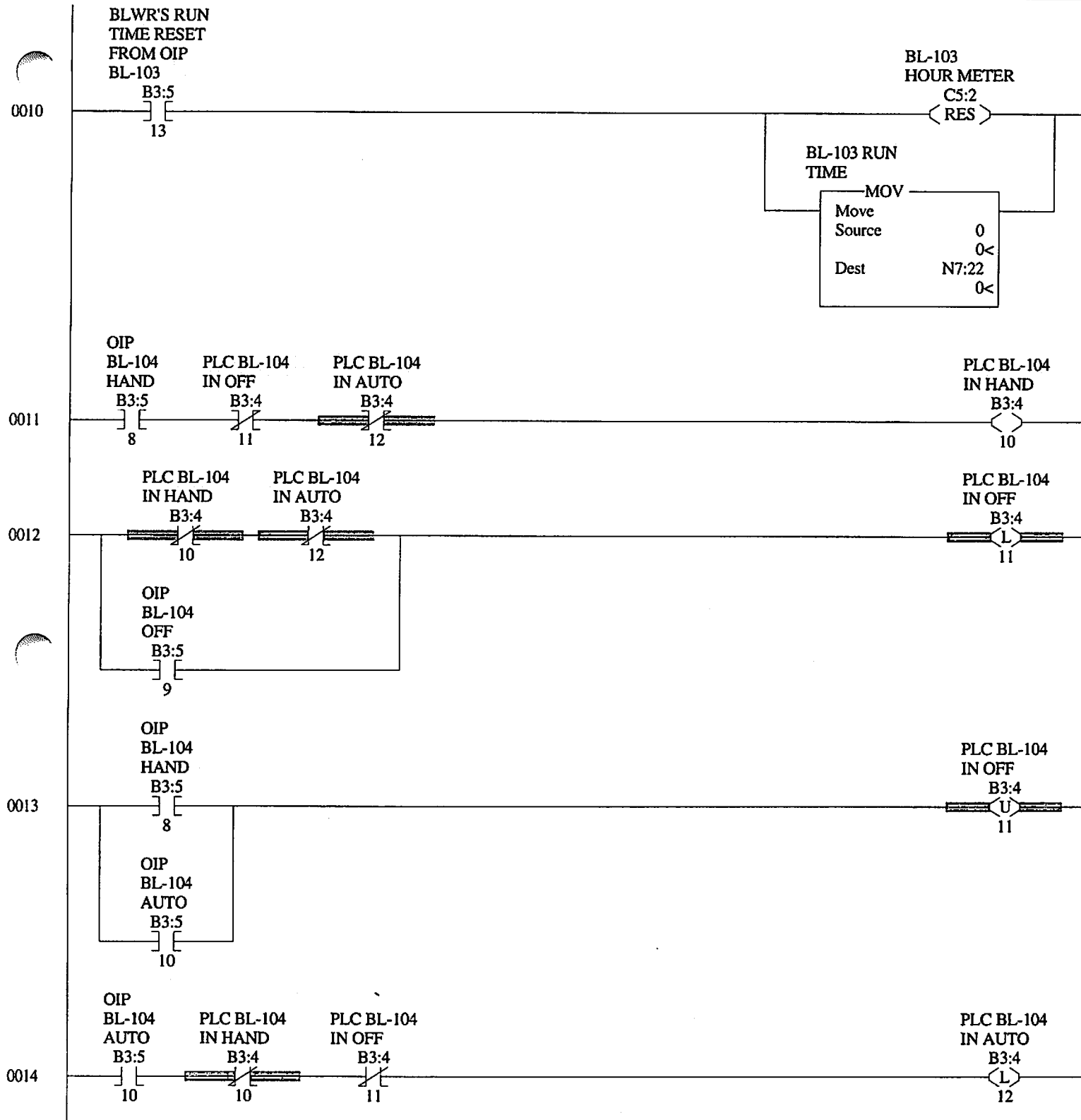




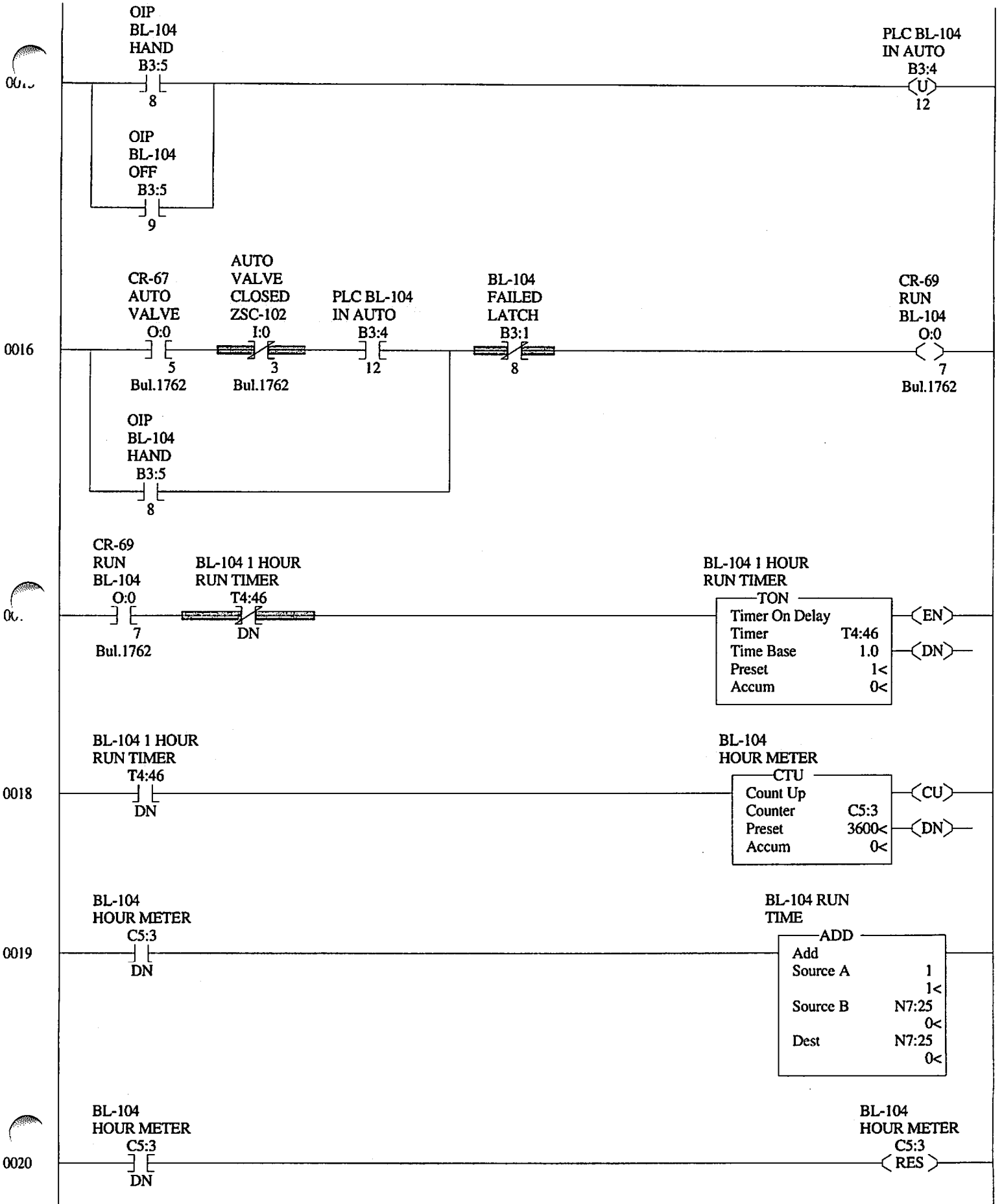


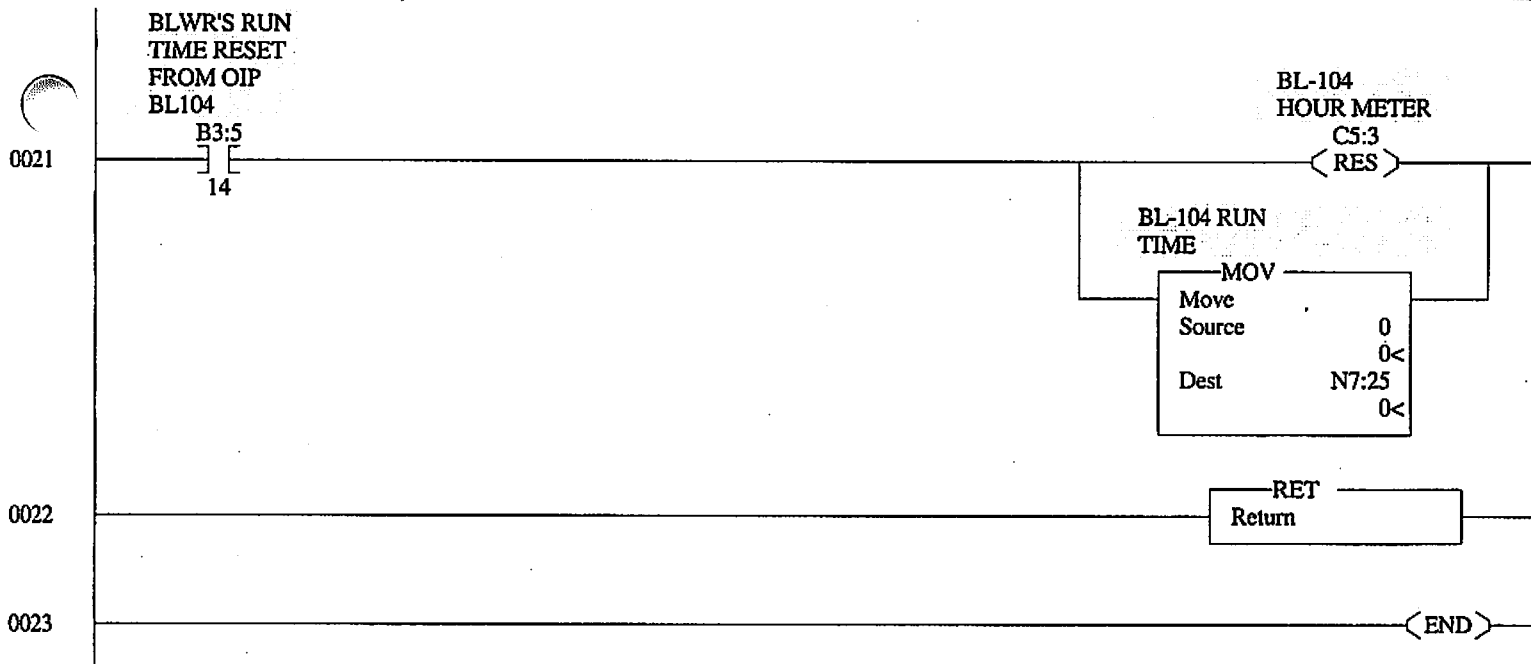






LAD 5 - BLOWER - BLOWER SELECT AND RUN --- Total Rungs in File = 24





XV. RECOMMENDED SPARE PARTS

<u>Component</u>	<u>Tag Number</u>	<u>Part Number</u>	<u>Quantity</u>
1. Flame Scanner	BE-203	2653-213-05	1
2. Thermocouple Element Only	for TE-201 for TE-202A for TE-202B for TE-202C	1195449	4
3. Pilot Electrode	for ST-11916	0026535	1
4. Pilot Ignition Rod Insulator	for ST-11916	0003587	3
5. Pilot Assembly	ST-11916	1116511	1
6. Ignition Transformer	IT-1	0002558	1
7. Sight Glass Assembly	CA-ST-0600	0008170	1
8. Panel Light Bulb	for PNL-101	1013634	3
9. Pilot Gas Pressure Regulator	PCV-302	1260113	1
10. Pilot Gas Solenoid Valve	SV-303	0012004	1
11. Pilot Gas Pressure Gauge	PI-305	0022961	1
12. Purge Air Pressure Switch	PDSL-204	0024372	1
13. Damper Actuator	for TCV-202A	0001625	1
14. Damper Actuator Gasket Kit	for TCV-202A	9019000445	1

Please call John Zink Company at (918) 234-2751 for spare part assistance.

XVI. MATERIAL SAFETY DATA SHEETS

MATERIAL SAFETY DATA SHEET

B69VZ12
04 00

DATE OF PREPARATION
Sep 8, 2008

SECTION 1 — PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NUMBER

B69VZ12

PRODUCT NAME

ZINC-CLAD® II Plus Inorganic Zinc-Rich Coating (Part A)

MANUFACTURER'S NAME

THE SHERWIN-WILLIAMS COMPANY

101 Prospect Avenue N.W.

Cleveland, OH 44115

Telephone Numbers and Websites

Product Information	www.sherwin-williams.com
Regulatory Information	(216) 566-2902 www.paintdocs.com
Medical Emergency	(216) 566-2917
Transportation Emergency*	(800) 424-9300
*for Chemical Emergency ONLY (spill, leak, fire, exposure, or accident)	

SECTION 2 — COMPOSITION/INFORMATION ON INGREDIENTS

% by Weight	CAS Number	Ingredient	Units	Vapor Pressure
3	64742-94-5	Medium Aromatic Hydrocarbons		
		ACGIH TLV	Not Available	0.12 mm
		OSHA PEL	Not Available	
0.5	91-20-3	Naphthalene		
		ACGIH TLV	10 PPM	1 mm
		ACGIH TLV	15 PPM STEL	
		OSHA PEL	10 PPM	
		OSHA PEL	15 PPM STEL	
6	64-17-5	Ethanol		
		ACGIH TLV	1000 PPM	44 mm
		OSHA PEL	1000 PPM	
3	34590-94-8	2-Methoxymethylethoxypropanol		
		ACGIH TLV	100 ppm (Skin)	0.4 mm
		ACGIH TLV	150 ppm (Skin) STEL	
		OSHA PEL	100 ppm (Skin)	
OSHA PEL	150 ppm (Skin) STEL			
5	110-43-0	Methyl n-Amyl Ketone		
		ACGIH TLV	50 PPM	3.855 mm
		OSHA PEL	100 PPM	
17	78-10-4	Ethyl Silicate		
		ACGIH TLV	Not Available	1 mm
		OSHA PEL	100 PPM	
21	14808-60-7	Quartz		
		ACGIH TLV	0.025 mg/m3 as Resp. Dust	
		OSHA PEL	0.1 mg/m3 as Resp. Dust	
4	7631-86-9	Amorphous Silica		
		ACGIH TLV	10 mg/m3 as Dust	
		OSHA PEL	6 mg/m3 as Dust	
6	12001-26-2	Mica		
		ACGIH TLV	3 mg/m3 as Resp. Dust	
		OSHA PEL	3 mg/m3 as Resp. Dust	

SECTION 3 — HAZARDS IDENTIFICATION

ROUTES OF EXPOSURE

INHALATION of vapor or spray mist.

EYE or SKIN contact with the product, vapor or spray mist.

EFFECTS OF OVEREXPOSURE

- EYES:** Irritation.
- SKIN:** Prolonged or repeated exposure may cause irritation.
- INHALATION:** Irritation of the upper respiratory system.

HMIS Codes	
Health	2*
Flammability	3
Reactivity	0

May cause nervous system depression. Extreme overexposure may result in unconsciousness and possibly death. Prolonged overexposure to solvent ingredients in Section 2 may cause adverse effects to the liver, urinary and reproductive systems.

SIGNS AND SYMPTOMS OF OVEREXPOSURE

Headache, dizziness, nausea, and loss of coordination are indications of excessive exposure to vapors or spray mists. Redness and itching or burning sensation may indicate eye or excessive skin exposure.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE

May cause allergic skin reaction in susceptible persons.

CANCER INFORMATION

For complete discussion of toxicology data refer to Section 11.

SECTION 4 — FIRST AID MEASURES

- EYES:** Flush eyes with large amounts of water for 15 minutes. Get medical attention.
- SKIN:** Wash affected area thoroughly with soap and water.
Remove contaminated clothing and laundry before re-use.
- INHALATION:** If affected, remove from exposure. Restore breathing. Keep warm and quiet.
- INGESTION:** Do not induce vomiting. Get medical attention immediately.

SECTION 5 — FIRE FIGHTING MEASURES

FLASH POINT 65° F PMCC **LEL** 0.8 **UEL** 19.0 **FLAMMABILITY CLASSIFICATION** RED LABEL -- Flammable, Flash below 100° F (38 °C)

EXTINGUISHING MEDIA

Carbon Dioxide, Dry Chemical, Foam

UNUSUAL FIRE AND EXPLOSION HAZARDS

Closed containers may explode when exposed to extreme heat. Application to hot surfaces requires special precautions. During emergency conditions overexposure to decomposition products may cause a health hazard. Symptoms may not be immediately apparent. Obtain medical attention.

SPECIAL FIRE FIGHTING PROCEDURES

Full protective equipment including self-contained breathing apparatus should be used. Water spray may be ineffective. If water is used, fog nozzles are preferable. Water may be used to cool closed containers to prevent pressure build-up and possible autoignition or explosion when exposed to extreme heat.

SECTION 6 — ACCIDENTAL RELEASE MEASURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

- Remove all sources of ignition. Ventilate the area.
- Remove with inert absorbent.

SECTION 7 — HANDLING AND STORAGE

STORAGE CATEGORY

DOL Storage Class IB

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE

Contents are **FLAMMABLE**. Keep away from heat, sparks, and open flame. During use and until all vapors are gone: Keep area ventilated - Do not smoke - Extinguish all flames, pilot lights, and heaters - Turn off stoves, electric tools and appliances, and any other sources of ignition. Consult NFPA Code. Use approved Bonding and Grounding procedures. Keep container closed when not in use. Transfer only to approved containers with complete and appropriate labeling. Do not take internally. Keep out of the reach of children.

SECTION 8 — EXPOSURE CONTROLS/PERSONAL PROTECTION

PRECAUTIONS TO BE TAKEN IN USE

Use only with adequate ventilation. Avoid contact with skin and eyes. Avoid breathing vapor and spray mist. Wash hands after using. This coating may contain materials classified as nuisance particulates (listed "as Dust" in Section 2) which may be present at hazardous levels only during sanding or abrading of the dried film. If no specific dusts are listed in Section 2, the applicable limits for nuisance dusts are ACGIH TLV 10 mg/m3 (total dust), 3 mg/m3 (respirable fraction), OSHA PEL 15 mg/m3 (total dust), 5 mg/m3 (respirable fraction).

VENTILATION

Local exhaust preferable. General exhaust acceptable if the exposure to materials in Section 2 is maintained below applicable exposure limits. Refer to OSHA Standards 1910.94, 1910.107, 1910.108.

RESPIRATORY PROTECTION

If personal exposure cannot be controlled below applicable limits by ventilation, wear a properly fitted organic vapor/particulate respirator approved by NIOSH/MSHA for protection against materials in Section 2.

When sanding or abrading the dried film, wear a dust/mist respirator approved by NIOSH/MSHA for dust which may be generated from this product, underlying paint, or the abrasive.

PROTECTIVE GLOVES

Wear gloves which are recommended by glove supplier for protection against materials in Section 2.

EYE PROTECTION

Wear safety spectacles with unperforated sideshields.

OTHER PRECAUTIONS

This product must be mixed with other components before use. Before opening the packages, READ AND FOLLOW WARNING LABELS ON ALL COMPONENTS.

Intentional misuse by deliberately concentrating and inhaling the contents can be harmful or fatal.

SECTION 9 — PHYSICAL AND CHEMICAL PROPERTIES

PRODUCT WEIGHT	10.70 lb/gal	1282 g/l
SPECIFIC GRAVITY	1.29	
BOILING POINT	172 - 415° F	77 - 212° C
MELTING POINT	Not Available	
VOLATILE VOLUME	50%	
EVAPORATION RATE	Slower than ether	
VAPOR DENSITY	Heavier than air	
SOLUBILITY IN WATER	N.A.	
VOLATILE ORGANIC COMPOUNDS (VOC Theoretical - As Packaged)		
3.69lb/gal	442g/l	Less Water and Federally Exempt Solvents
3.69lb/gal	442g/l	Emitted VOC

SECTION 10 — STABILITY AND REACTIVITY

STABILITY — Stable

CONDITIONS TO AVOID

None known.

INCOMPATIBILITY

None known.

HAZARDOUS DECOMPOSITION PRODUCTS

By fire: Carbon Dioxide, Carbon Monoxide

HAZARDOUS POLYMERIZATION

Will not occur

SECTION 11 — TOXICOLOGICAL INFORMATION**CHRONIC HEALTH HAZARDS**

Reports have associated repeated and prolonged overexposure to solvents with permanent brain and nervous system damage.

Crystalline Silica (Quartz, Cristobalite) is listed by IARC and NTP. Long term exposure to high levels of silica dust, which can occur only when sanding or abrading the dry film, may cause lung damage (silicosis) and possibly cancer.

TOXICOLOGY DATA

CAS No.	Ingredient Name			
64742-94-5	Medium Aromatic Hydrocarbons	LC50 RAT	4HR	Not Available
		LD50 RAT		Not Available
91-20-3	Naphthalene	LC50 RAT	4HR	Not Available
		LD50 RAT		Not Available
64-17-5	Ethanol	LC50 RAT	4HR	Not Available
		LD50 RAT		7060 mg/kg
34590-94-8	2-Methoxymethylethoxypropanol	LC50 RAT	4HR	Not Available
		LD50 RAT		5135 mg/kg
110-43-0	Methyl n-Amyl Ketone	LC50 RAT	4HR	Not Available
		LD50 RAT		1670 mg/kg
78-10-4	Ethyl Silicate	LC50 RAT	4HR	Not Available
		LD50 RAT		6270 mg/kg
14808-60-7	Quartz	LC50 RAT	4HR	Not Available
		LD50 RAT		Not Available
7631-86-9	Amorphous Silica	LC50 RAT	4HR	Not Available
		LD50 RAT		Not Available
12001-26-2	Mica	LC50 RAT	4HR	Not Available
		LD50 RAT		Not Available

SECTION 12 — ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL INFORMATION
 No data available.

SECTION 13 — DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD
 Waste from this product may be hazardous as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR 261. Waste must be tested for ignitability to determine the applicable EPA hazardous waste numbers. Incinerate in approved facility. Do not incinerate closed container. Dispose of in accordance with Federal, State/Provincial, and Local regulations regarding pollution.

SECTION 14 — TRANSPORT INFORMATION

US Ground (DOT)
 1 Gallon and Less may be Classed as CONSUMER COMMODITY, ORM-D
 Larger Containers are Regulated as:
 UN1263, PAINT, 3, PG II, (ERG#128)
DOT (Dept of Transportation) Hazardous Substances & Reportable Quantities
 Naphthalene 100 lb RQ
Bulk Containers may be Shipped as (check reportable quantities):
 UN1263, PAINT, 3, PG II, (ERG#128)
Canada (TDG)
 UN1263, PAINT, CLASS 3, PG II, (ERG#128)
IMO
 UN1263, PAINT, CLASS 3, PG II, (18 C c.c.), EmS F-E, S-E

SECTION 15 — REGULATORY INFORMATION

SARA 313 (40 CFR 372.65C) SUPPLIER NOTIFICATION

CAS No.	CHEMICAL/COMPOUND	% by WT	% Element
91-20-3	Naphthalene	0.5	

CALIFORNIA PROPOSITION 65

WARNING: This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

TSCA CERTIFICATION

All chemicals in this product are listed, or are exempt from listing, on the TSCA Inventory.

SECTION 16 — OTHER INFORMATION

This product has been classified in accordance with the hazard criteria of the Canadian Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

The above information pertains to this product as currently formulated, and is based on the information available at this time. Addition of reducers or other additives to this product may substantially alter the composition and hazards of the product. Since conditions of use are outside our control, we make no warranties, express or implied, and assume no liability in connection with any use of this information.



A.P. Green, Harbison-Walker and NARCO

Printing date 05/12/2004

Reviewed on 05/12/2004

1 Identification of substance

- **Product details**
- **Trade name:** INSWOOL-HP BLANKET 8#
- **Manufacturer/Supplier:**
ANH Refractories Company
400 Fairway Drive
Moon Township, PA 15108
- **General Phone:** (412)375-6600
- **Information department:** MSDS Technical Information: (412)375-6837
- **Emergency information:** CHEMTREC 24 HOUR EMERGENCY PHONE NUMBER: 1-800-424-9300.

2 Composition/Data on components

- **Chemical characterization:**
- **CAS No. Description**
142844-00-6 refractory ceramic fibers (RCF)
- **Chemical characterization**
- **Description:** Mixture of the substances listed below with nonhazardous additions.

· **Components:**

142844-00-6 refractory ceramic fibers (RCF)	60-100%
---	---------

· **Additional information:**

*This product contains Refractory Ceramic Fibers (RCF) or an RCF wrap or mat. IARC has classified RCFs as a possible human carcinogen, Group 2B. This classification was based on sufficient evidence of carcinogenicity in animals and no available data in humans. NTP classified respirable RCFs as reasonably anticipated carcinogens. Recent industry ongoing epidemiology studies show the general health of workers in the RCF industry was similar to that of workers in other dusty work environments. There have been no reports of mesothelioma, and the lung cancer rate appears similar to background rates, but the number of workers with a long latency period are too few for definitive conclusions. There was a small number of employees with an increased risk of developing pleural plaques (shadows along the inside of the chest wall). These plaques, however, are not known to cause symptoms or disability. ANH recommends that safe handling methods are followed, including air monitoring in areas wherever the potential exists for airborne fibers, minimizing airborne exposures through use of NIOSH approved respirators, and wearing protective clothing, gloves and eye protection.

For the wording of the listed risk phrases refer to section 16.

3 Hazards identification

- **Hazard description:**
Toxic
- **Medical conditions aggravated by exposure to the product:** Asthma, chronic lung disease, and skin irritation.
- **Carcinogenicity Information:**
Refractory ceramic fibers are listed by IARC as Group 2B "Possibly Carcinogenic to Humans."
- **Information pertaining to particular dangers for man and environment:**
The product has to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.

(Contd. on page 2)



A.P. Green, Harbison-Walker and NARCO

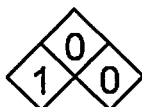
Printing date 05/12/2004

Reviewed on 05/12/2004

Trade name: INSWOOL-HP BLANKET 8#

(Contd. from page 1)

- May cause cancer.
- Irritating to eyes and respiratory system.
- NFPA ratings (scale 0-4)



Health = 1
 Fire = 0
 Reactivity = 0

• HMIS Classification

HEALTH	*1
FIRE	0
REACTIVITY	0

Health: *1
 Flammability: 0
 Reactivity: 0

4 First aid measures

- After inhalation: Move to fresh air; consult doctor if needed.
- After skin contact: Immediately wash with water and soap and rinse thoroughly.
- After eye contact: Flush eyes with water for 15 minutes. If irritation persists, consult a doctor.
- After swallowing:
 This product is intended for industrial applications; in the unlikely event that this product is swallowed, consult a physician if any adverse medical conditions occur.

5 Fire fighting measures

- Suitable extinguishing agents: Use fire fighting measures that suit the environment.
- Protective equipment: No special measures required.

6 Accidental release measures

- Person-related safety precautions: Not required.
- Measures for environmental protection: No special measures required.
- Measures for cleaning/collecting:
 Dispose contaminated material as waste according to item 13.
 Ensure adequate ventilation.

7 Handling and storage

- Handling:
 • Information for safe handling: Prevent formation of dust.
 • Information about protection against explosions and fires: No special measures required.
- Storage:
 • Requirements to be met by storerooms and containers: No special requirements.
 • Information about storage in one common storage facility: Not required.

(Contd. on page 3)



MATERIAL SAFETY DATA SHEET

A.P. Green, Harbison-Walker and NARCO

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Printing date 05/12/2004

Reviewed on 05/12/2004

Trade name: INSWOOL-HP BLANKET 8#

(Contd. from page 2)

Further information about storage conditions: Store product inside, out of extreme weather conditions.

8 Exposure controls and personal protection

Components with limit values that require monitoring at the workplace: The product does not contain any relevant quantities of materials with critical values that have to be monitored at the workplace.

- Personal protective equipment:
General protective and hygienic measures:
Keep away from foodstuffs, beverages and feed.
Wash hands before breaks and at the end of work.
Store protective clothing separately.
Avoid contact with the eyes.
Avoid contact with the eyes and skin.

Breathing equipment:



NIOSH approved respirators should be used if dust is present. A respiratory protection program should be implemented if exposures exceed OSHA PELs.

Protection of hands:



Protective gloves recommended

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation. Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.

Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

Material of gloves

The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer. As the product is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.

Penetration time of glove material

The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

Eye protection: Safety glasses with side shields recommended

9 Physical and chemical properties

General Information

Table with 2 columns: Property (Form, Color, Odor) and Value (Fibers, White, Odorless)

(Contd. on page 4)

USA



MATERIAL SAFETY DATA SHEET

A.P. Green, Harbison-Walker and NARCO

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Printing date 05/12/2004

Reviewed on 05/12/2004

Trade name: **INSWOOL-HP BLANKET 8#**

(Contd. from page 3)

- **Change in condition**
Melting point/Melting range: 1760°C (3200°F)
Boiling point/Boiling range: Undetermined.
- **Flash point:** Not applicable.
- **Auto igniting:** Product is not selfigniting.
- **Danger of explosion:** Product does not present an explosion hazard.
- **Density at 20°C (68°F):** 2.73 g/cm³
- **Solubility in / Miscibility with Water:** Insoluble.

10 Stability and reactivity

- **Thermal decomposition / conditions to be avoided:** No decomposition if used according to specifications.
- **Dangerous reactions** No dangerous reactions known.
- **Dangerous products of decomposition:** No dangerous decomposition products known.

11 Toxicological information

- **Acute toxicity:**
- **Primary acute effects:**
- **Skin contact:** No irritant effect.
- **Eye contact:** Irritating effect.
- **Sensitization:** No sensitizing effects known.
- **Additional toxicological information:**
The product shows the following dangers according to internally approved calculation methods for preparations:
Irritant
Carcinogenic.

12 Ecological information

- **General notes:** At present there are no ecotoxicological assessments.

13 Disposal considerations

- **Recommendation for Disposal of Product:**
As sold, this product is not RCRA hazardous. Final used condition must be evaluated prior to disposal. Dispose of waste product in accordance with Federal, State and Local regulations.
- **Recommendation for Disposal of Uncleaned Packaging:** Reuse, recycle or treat as industrial waste.

USA

(Contd. on page 5)



MATERIAL SAFETY DATA SHEET

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Printing date 05/12/2004

Reviewed on 05/12/2004

Trade name: **INSWOOL-HP BLANKET 8#**

(Contd. from page 4)

14 Transport information

• **Transport/Additional information:** Not dangerous according to available information.

15 Regulations

• **SARA 313 TOXIC CHEMICALS**

No material listed in the components in Section 2 of this MSDS is on the SARA 313 list.

• **SARA 302 EXTREMELY HAZARDOUS SUBSTANCES**

No material listed in the components in Section 2 of this MSDS is on the SARA 302 list.

• **TSCA (Toxic Substances Control Act)**

This substance or all the ingredients of this product are on the Chemical Substances Inventory of the Toxic Substances Control Act (TSCA Inventory). The presence on this list does not require any legal reporting.

• **WHMIS Classification**

Class D - Division 2 - Sub Division A

Untested mixture containing a very toxic material

Class D - Division 2 - Sub Division B

Untested mixture containing a toxic material

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

• **Cancerogenity categories**

• **EPA (Environmental Protection Agency)**

None of the ingredients is listed.

• **IARC (International Agency for Research on Cancer)**

142844-00-6 | refractory ceramic fibers (RCF) | 2B

• **NTP (National Toxicology Program)**

142844-00-6 | refractory ceramic fibers (RCF) | R

• **TLV (Threshold Limit Value established by ACGIH)**

None of the ingredients is listed.

• **MAK (German Maximum Workplace Concentration)**

None of the ingredients is listed.

• **NIOSH-Ca (National Institute for Occupational Safety and Health)**

None of the ingredients is listed.

• **OSHA-Ca (Occupational Safety & Health Administration)**

None of the ingredients is listed.

• **Classification according to EU-guidelines**

• **Hazard symbols:**

Toxic

• **Hazard-determining components of labeling:**

refractory ceramic fibers (RCF)

• **Risk phrases:**

May cause cancer.

(Contd. on page 6)



MATERIAL SAFETY DATA SHEET

A.P. Green, Harbison-Walker and NARCO

Page 6/6

Printing date 05/12/2004

Reviewed on 05/12/2004

Trade name: **INSWOOL-HP BLANKET 8#**

(Contd. from page 5)

Irritating to eyes and respiratory system.

• **Safety phrases:**

Do not breathe dust.

Avoid contact with eyes.

After contact with skin, wash immediately with plenty of soap and water

Wear suitable protective clothing and gloves.

• **Special labeling of certain preparations:**

PRODUCT MAY CONTAIN REFRACTORY CERAMIC FIBERS (RCF) OR INCLUDE A WRAP OR MAT WHICH CONTAINS RCF:

Prolonged or repeated inhalation of RCF dust may cause cancer.

Exposure of the product to high temperature may convert fibers to crystalline silica, an IARC and NTP listed carcinogen which can cause silicosis or cancer.

Use with adequate ventilation, wear safety glasses and dust-type respirator if dust is present.

In case of inhalation, remove victim to fresh air.

In case of eye contact, flush with water for 15 minutes.

• **National regulations:**

• **The following ingredients are known in the state of California to be a cancer risk (Proposition 65):**

All ingredients are listed.

16 Other information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

• **Contact:** Patricia A. Kott 412-375-6712

• **Creation date:** 08/14/2000

USA



MATERIAL SAFETY DATA SHEET

A.P. Green, Harbison-Walker and NARCO

Page 1/6

Printing date 05/12/2004

Reviewed on 05/12/2004

1 Identification of substance

• **Product details**

• **Trade name:** INSWOOL-HP BLANKET 6#

• **Manufacturer/Supplier:**
ANH Refractories Company
400 Fairway Drive
Moon Township, PA 15108

General Phone: (412)375-6600

- **Information department:** MSDS Technical Information: (412)375-6837
- **Emergency information:** CHEMTREC 24 HOUR EMERGENCY PHONE NUMBER: 1-800-424-9300.

2 Composition/Data on components

• **Chemical characterization:**

• **CAS No. Description**

142844-00-6 refractory ceramic fibers (RCF)

• **Chemical characterization**

• **Description:** Mixture of the substances listed below with nonhazardous additions.

• **Components:**

142844-00-6	refractory ceramic fibers (RCF)	60-100%
-------------	---------------------------------	---------

• **Additional information:**

*This product contains Refractory Ceramic Fibers (RCF) or an RCF wrap or mat. IARC has classified RCFs as a possible human carcinogen, Group 2B. This classification was based on sufficient evidence of carcinogenicity in animals and no available data in humans. NTP classified respirable RCFs as reasonably anticipated carcinogens. Recent industry ongoing epidemiology studies show the general health of workers in the RCF industry was similar to that of workers in other dusty work environments. There have been no reports of mesothelioma, and the lung cancer rate appears similar to background rates, but the number of workers with a long latency period are too few for definitive conclusions. There was a small number of employees with an increased risk of developing pleural plaques (shadows along the inside of the chest wall). These plaques, however, are not known to cause symptoms or disability. ANH recommends that safe handling methods are followed, including air monitoring in areas wherever the potential exists for airborne fibers, minimizing airborne exposures through use of NIOSH approved respirators, and wearing protective clothing, gloves and eye protection.

For the wording of the listed risk phrases refer to section 16.

3 Hazards identification

• **Hazard description:**

Toxic

• **Medical conditions aggravated by exposure to the product:** Asthma, chronic lung disease, and skin irritation.

• **Carcinogenicity Information:**

Refractory ceramic fibers are listed by IARC as Group 2B "Possibly Carcinogenic to Humans."

• **Information pertaining to particular dangers for man and environment:**

The product has to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.

(Contd. on page 2)

USA



MATERIAL SAFETY DATA SHEET

A.P. Green, Harbison-Walker and NARCO

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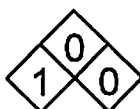
Printing date 05/12/2004

Reviewed on 05/12/2004

Trade name: INSWOOL-HP BLANKET 6#

(Contd. from page 1)

May cause cancer.
Irritating to eyes and respiratory system.
• NFPA ratings (scale 0-4)



Health = 1
Fire = 0
Reactivity = 0

• HMIS Classification

HEALTH	1
FIRE	0
REACTIVITY	0

Health: *1
Flammability: 0
Reactivity: 0

4 First aid measures

- After inhalation: Move to fresh air; consult doctor if needed.
- After skin contact: Immediately wash with water and soap and rinse thoroughly.
- After eye contact: Flush eyes with water for 15 minutes. If irritation persists, consult a doctor.
- After swallowing:
This product is intended for industrial applications; in the unlikely event that this product is swallowed, consult a physician if any adverse medical conditions occur.

5 Fire fighting measures

- Suitable extinguishing agents: Use fire fighting measures that suit the environment.
- Protective equipment: No special measures required.

6 Accidental release measures

- Person-related safety precautions: Not required.
- Measures for environmental protection: No special measures required.
- Measures for cleaning/collecting:
Dispose contaminated material as waste according to item 13.
Ensure adequate ventilation.

7 Handling and storage

- Handling:
• Information for safe handling: Prevent formation of dust.
• Information about protection against explosions and fires: No special measures required.
- Storage:
• Requirements to be met by storerooms and containers: No special requirements.
• Information about storage in one common storage facility: Not required.

(Contd. on page 3)

USA



Trade name: INSWOOL-HP BLANKET 6#

(Contd. from page 2)

Further information about storage conditions: Store product inside, out of extreme weather conditions.

8 Exposure controls and personal protection

Components with limit values that require monitoring at the workplace:
The product does not contain any relevant quantities of materials with critical values that have to be monitored at the workplace.

Personal protective equipment:

General protective and hygienic measures:

- Keep away from foodstuffs, beverages and feed.
- Wash hands before breaks and at the end of work.
- Store protective clothing separately.
- Avoid contact with the eyes.
- Avoid contact with the eyes and skin.

Breathing equipment:



NIOSH approved respirators should be used if dust is present. A respiratory protection program should be implemented if exposures exceed OSHA PELs.

Protection of hands:



Protective gloves recommended

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.

Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

Material of gloves

The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer. As the product is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.

Penetration time of glove material

The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

Eye protection: Safety glasses with side shields recommended

9 Physical and chemical properties

General Information

Form:	Fibers
Color:	White
Odor:	Odorless

(Contd. on page 4)



MATERIAL SAFETY DATA SHEET

A.P. Green, Harbison-Walker and NARCO

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Printing date 05/12/2004

Reviewed on 05/12/2004

Trade name: **INSWOOL-HP BLANKET 6#**

(Contd. from page 3)

- **Change in condition**
Melting point/Melting range: 1760°C (3200°F)
Boiling point/Boiling range: Undetermined.
- **Flash point:** Not applicable.
- **Auto igniting:** Product is not selfigniting.
- **Danger of explosion:** Product does not present an explosion hazard.
- **Density at 20°C (68°F):** 2.73 g/cm³
- **Solubility in / Miscibility with Water:** Insoluble.

10 Stability and reactivity

- **Thermal decomposition / conditions to be avoided:** No decomposition if used according to specifications.
- **Dangerous reactions** No dangerous reactions known.
- **Dangerous products of decomposition:** No dangerous decomposition products known.

11 Toxicological information

- **Acute toxicity:**
- **Primary acute effects:**
- **Skin contact:** No irritant effect.
- **Eye contact:** Irritating effect.
- **Sensitization:** No sensitizing effects known.
- **Additional toxicological information:**
The product shows the following dangers according to internally approved calculation methods for preparations:
Irritant
Carcinogenic.

12 Ecological information

- **General notes:** At present there are no ecotoxicological assessments.

13 Disposal considerations

- **Recommendation for Disposal of Product:**
As sold, this product is not RCRA hazardous. Final used condition must be evaluated prior to disposal. Dispose of waste product in accordance with Federal, State and Local regulations.
- **Recommendation for Disposal of Uncleaned Packaging:** Reuse, recycle or treat as industrial waste.

USA

(Contd. on page 5)



MATERIAL SAFETY DATA SHEET

A.P. Green, Harbison-Walker and NARCO

Page 5/6

Printing date 05/12/2004

Reviewed on 05/12/2004

Trade name: INSWOOL-HP BLANKET 6#

(Contd. from page 4)

14 Transport information

• *Transport/Additional information: Not dangerous according to available information.*

15 Regulations

• **SARA 313 TOXIC CHEMICALS**

No material listed in the components in Section 2 of this MSDS is on the SARA 313 list.

• **SARA 302 EXTREMELY HAZARDOUS SUBSTANCES**

No material listed in the components in Section 2 of this MSDS is on the SARA 302 list.

• **TSCA (Toxic Substances Control Act)**

This substance or all the ingredients of this product are on the Chemical Substances Inventory of the Toxic Substances Control Act (TSCA Inventory). The presence on this list does not require any legal reporting.

• **WHMIS Classification**

Class D - Division 2 - Sub Division A

Untested mixture containing a very toxic material

Class D - Division 2 - Sub Division B

Untested mixture containing a toxic material

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

• **Carcinogenicity categories**

• **EPA (Environmental Protection Agency)**

None of the ingredients is listed.

• **IARC (International Agency for Research on Cancer)**

142844-00-6 refractory ceramic fibers (RCF) | 2B

• **NTP (National Toxicology Program)**

142844-00-6 refractory ceramic fibers (RCF) | R

• **TLV (Threshold Limit Value established by ACGIH)**

None of the ingredients is listed.

• **MAK (German Maximum Workplace Concentration)**

None of the ingredients is listed.

• **NIOSH-Ca (National Institute for Occupational Safety and Health)**

None of the ingredients is listed.

• **OSHA-Ca (Occupational Safety & Health Administration)**

None of the ingredients is listed.

• **Classification according to EU-guidelines**

• **Hazard symbols:**

Toxic

• **Hazard-determining components of labeling:**

refractory ceramic fibers (RCF)

• **Risk phrases:**

May cause cancer.

(Contd. on page 6)



MATERIAL SAFETY DATA SHEET

A.P. Green, Harbison-Walker and NARCO

Page 6/6

Printing date 05/12/2004

Reviewed on 05/12/2004

Trade name: **INSWOOL-HP BLANKET 6#**

(Contd. from page 5)

Irritating to eyes and respiratory system.

• **Safety phrases:**

Do not breathe dust.

Avoid contact with eyes.

After contact with skin, wash immediately with plenty of soap and water

Wear suitable protective clothing and gloves.

• **Special labeling of certain preparations:**

PRODUCT MAY CONTAIN REFRACTORY CERAMIC FIBERS (RCF) OR INCLUDE A WRAP OR MAT WHICH CONTAINS RCF:

Prolonged or repeated inhalation of RCF dust may cause cancer.

Exposure of the product to high temperature may convert fibers to crystalline silica, an IARC and NTP listed carcinogen which can cause silicosis or cancer.

Use with adequate ventilation, wear safety glasses and dust-type respirator if dust is present.

In case of inhalation, remove victim to fresh air.

In case of eye contact, flush with water for 15 minutes.

• **National regulations:**

• **The following ingredients are known in the state of California to be a cancer risk (Proposition 65):**

All ingredients are listed.

16 Other information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

• **Contact:** Patricia A. Kott 412-375-6712

• **Creation date:** 12/05/2000

USA

XVII. MANUFACTURER INFORMATION

1. Allen Bradley
2. American Fan
3. Automation Direct
4. Bettis
5. Coen
6. Dwyer
7. Enardo
8. Fisher
9. Thermal Instrument
10. Thermo Sensors
11. Watlow
12. Worcester
13. Xomox



Installation Instructions

MicroLogix™ Analog Input/Output Module

(Catalog Number 1762-IF20F2)

Inside...

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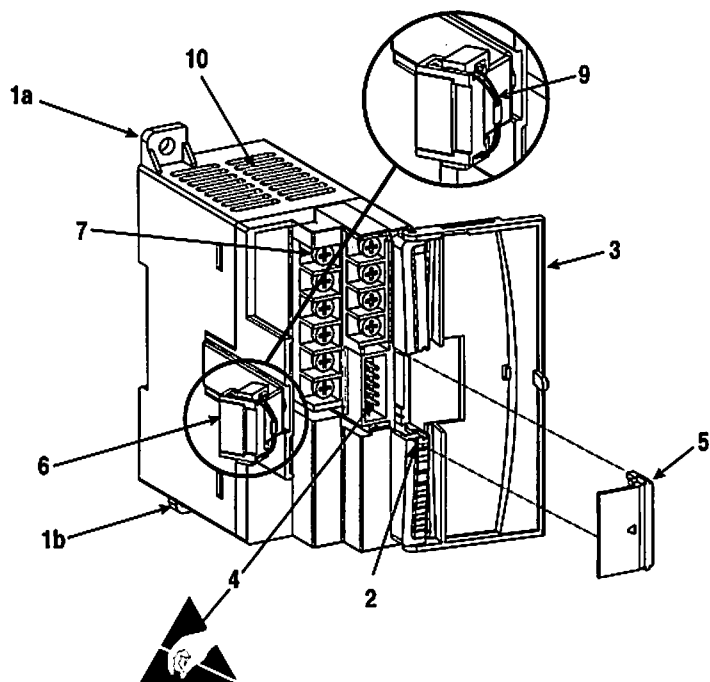
For More Information

For	Refer to this Document	Pub. No.
Information on installing, wiring, and operating a MicroLogix 1200 Programmable Controller	MicroLogix 1200 Programmable Controllers User Manual	1762-UM001A-US-P
Installation guide for the MicroLogix 1200 Programmable Controller.	MicroLogix 1200 Programmable Controllers Installation Instructions	1762-IN006A-ML-P
Installation guide for the MicroLogix 1200 Memory Module and Real Time clock.	MicroLogix 1200 Memory Module and/or Real Time Clock Installation Instructions	1762-IN001A-US-P
Installation guide for the 1762-IA8 Discrete Input Module	1762-IA8 120V ac Input Module Installation Instructions	1762-IN002A-US-P
Installation guide for the 1762-OW8 Discrete Output Module	1762-OW8 Relay Output Module Installation Instructions	1762-IN003A-US-P
Installation guide for the 1762-IQ8 Discrete Input Module	1762-IQ8 DC Input Module Installation Instructions	1762-IN004A-US-P
More information on proper wiring and grounding techniques.	Industrial Automation Wiring and Grounding Guidelines	1770-4.1

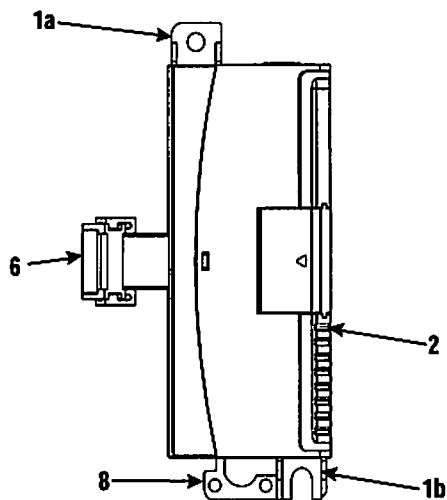
If you would like a manual, you can:

- download a free electronic version from the internet:
www.ab.com/micrologix or www.theautomationbookstore.com
- purchase a printed manual by:
 - contacting your local distributor or Rockwell Automation representative
 - visiting www.theautomationbookstore.com and placing your order
 - calling 1.800.963.9548 (USA/Canada)
 or 001.330.725.1574 (Outside USA/Canada)

Description



Item	Description
1a	upper panel mounting tab
1b	lower panel mounting tab
2	power diagnostic LED
3	module door with terminal identification label
4	bus connector with male pins
5	bus connector cover
6	flat ribbon cable with bus connector (female)
7	terminal block
8	DIN rail latch
9	pull loop
10	input type selector switch



Installation

1762 I/O is suitable for use in an industrial environment when installed in accordance with these instructions. Specifically, this equipment is intended for use in clean, dry environments (Pollution degree 2⁽¹⁾) and to circuits not exceeding Over Voltage Category II⁽²⁾ (IEC 60664-1).⁽³⁾

Prevent Electrostatic Discharge

ATTENTION



Electrostatic discharge can damage integrated circuits or semiconductors if you touch bus connector pins. Follow these guidelines when you handle the module:

- Touch a grounded object to discharge static potential.
 - Wear an approved wrist-strap grounding device.
 - Do not touch the bus connector or connector pins.
 - Do not touch circuit components inside the module.
 - If available, use a static-safe work station.
 - When not in use, keep the module in its static-shield box.
-

Remove Power

ATTENTION



Remove power before removing or installing this module. When you remove or install a module with power applied, an electrical arc may occur. An electrical arc can cause personal injury or property damage by:

- sending an erroneous signal to your system's field devices, causing unintended machine motion
- causing an explosion in a hazardous environment
- causing permanent damage to the module's circuitry

Electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance.

(1) Pollution Degree 2 is an environment where, normally, only non-conductive pollution occurs except that occasionally a temporary conductivity caused by condensation shall be expected.

(2) Over Voltage Category II is the load level section of the electrical distribution system. At this level transient voltages are controlled and do not exceed the impulse voltage capability of the product's insulation.

(3) Pollution Degree 2 and Over Voltage Category II are International Electrotechnical Commission (IEC) designations.

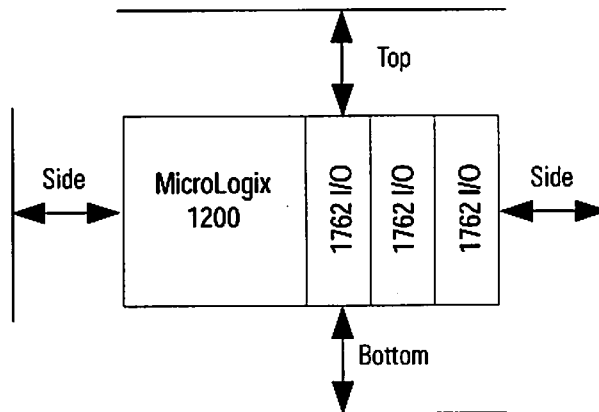
Mounting

ATTENTION

Do not remove protective debris strip until after the module and all other equipment near the module is mounted and wiring is complete. Once wiring is complete and the module is free of debris, carefully remove protective debris strip. Failure to remove strip before operating can cause overheating.

Minimum Spacing

Maintain spacing from enclosure walls, wireways, adjacent equipment, etc. Allow 50.8 mm (2 in.) of space on all sides for adequate ventilation, as shown:

**NOTE**

1762 expansion I/O may be mounted horizontally only.

ATTENTION

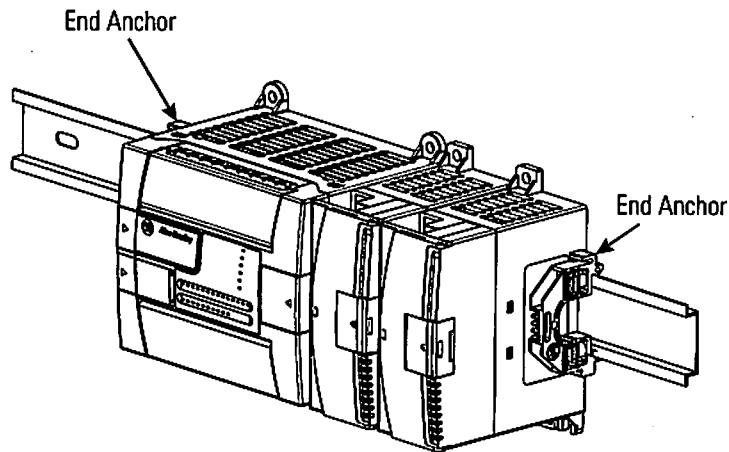
During panel or DIN rail mounting of all devices, be sure that all debris (metal chips, wire strands, etc.) is kept from falling into the module. Debris that falls into the module could cause damage when power is applied to the module.

DIN Rail Mounting

The module can be mounted using the following DIN rails: 35 x 7.5 mm (EN 50 022 - 35 x 7.5) or 35 x 15 mm (EN 50 022 - 35 x 15).

Before mounting the module on a DIN rail, close the DIN rail latch. Press the DIN rail mounting area of the module against the DIN rail. The latch will momentarily open and lock into place.

Use DIN rail end anchors (Allen-Bradley part number 1492-EA35 or 1492-EAH35) for environments with vibration or shock concerns.



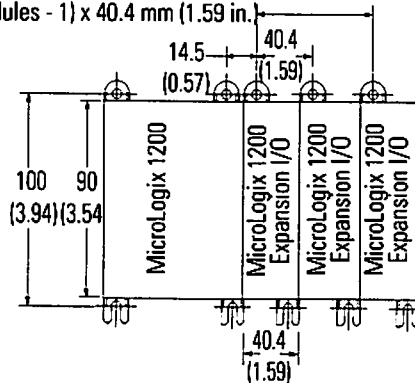
NOTE

For environments with extreme vibration and shock concerns, use the panel mounting method described below, instead of DIN rail mounting.

Panel Mounting

Use the dimensional template shown below to mount the module. The preferred mounting method is to use two M4 or #8 panhead screws per module. M3.5 or #6 panhead screws may also be used, but a washer may be needed to ensure a good ground contact. Mounting screws are required on every module.

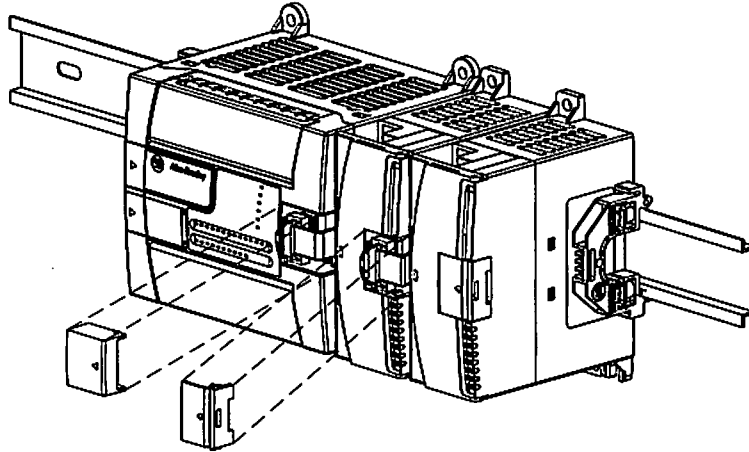
For more than 2 modules: (number of modules - 1) x 40.4 mm (1.59 in.)



NOTE:
Hole spacing tolerance:
±0.4 mm (0.016 in.).

System Assembly

The expansion I/O module is attached to the controller or another I/O module by means of a ribbon cable *after* mounting as shown below.

**NOTE**

Use the pull loop on the connector to disconnect modules. Do not pull on the ribbon cable.

WARNING**EXPLOSION HAZARD**

- In Class I, Division 2 applications, the bus connector must be fully seated and the bus connector cover must be snapped in place.
- In Class I, Division 2 applications, all modules must be mounted in direct contact with each other as shown on page 6. If DIN rail mounting is used, an end stop must be installed ahead of the controller and after the last 1762 I/O module.

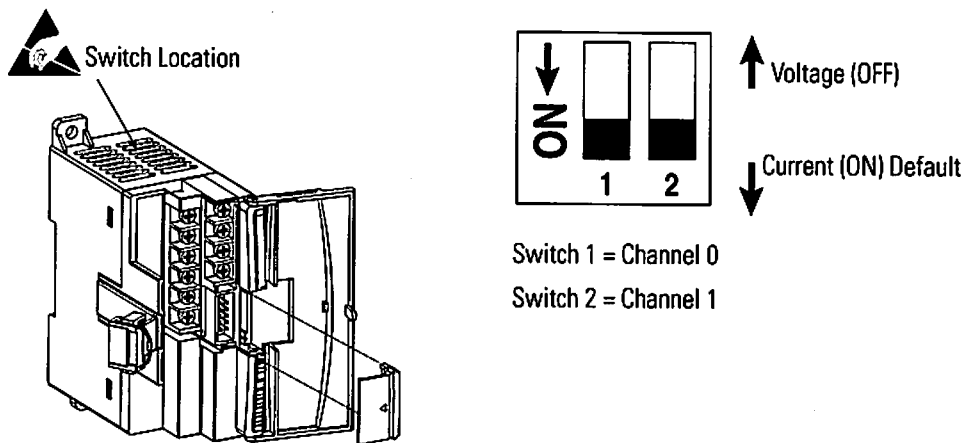
Field Wiring Connections

Grounding the Module

This product is intended to be mounted to a well-grounded mounting surface such as a metal panel. Additional grounding connections from the module's mounting tabs or DIN rail (if used) are not required unless the mounting surface cannot be grounded. Refer to *Industrial Automation Wiring and Grounding Guidelines*, Allen-Bradley publication 1770-4.1, for additional information.

Input Type Selection

Select the input type, current or voltage, using the switch located on the module's circuit board *and* the input type/range selection bits in the Configuration Data File (see page 16). You can access the switch through the ventilation slots on the top of the module. Switch 1 controls channel 0; switch 2 controls channel 1. The factory default setting for both switch 1 and switch 2 is Current. Switch positions are shown below.



Output Type Selection

The output type selection, current or voltage, is made by wiring to the appropriate terminals, Iout or Vout, *and* by the type/range selection bits in the Configuration Data File (see page 16).

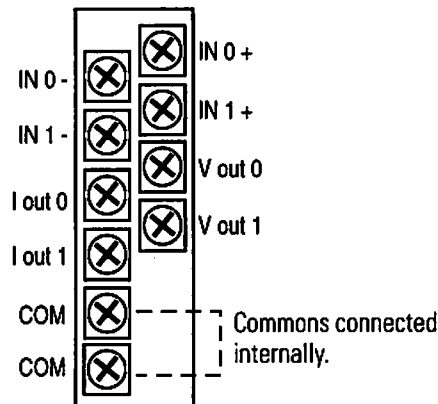
Wiring

System Wiring Guidelines

Consider the following when wiring your system:

- The analog common (COM) is not connected to earth ground inside the module. All terminals are electrically isolated from the system.
- Channels are not isolated from each other.
- Use Belden™ 8761, or equivalent, shielded wire.
- Under normal conditions, the drain wire (shield) should be connected to the metal mounting panel (earth ground). Keep shield connection to earth ground as short as possible.
- To ensure optimum accuracy for voltage type inputs and outputs, limit overall cable impedance by keeping all analog cables as short as possible. Locate the I/O system as close to your voltage type sensors or actuators as possible.
- The 1762-IF2OF2 module does not provide loop power for analog inputs. Use a power supply that matches the input transmitter specifications.

Terminal Block Layout

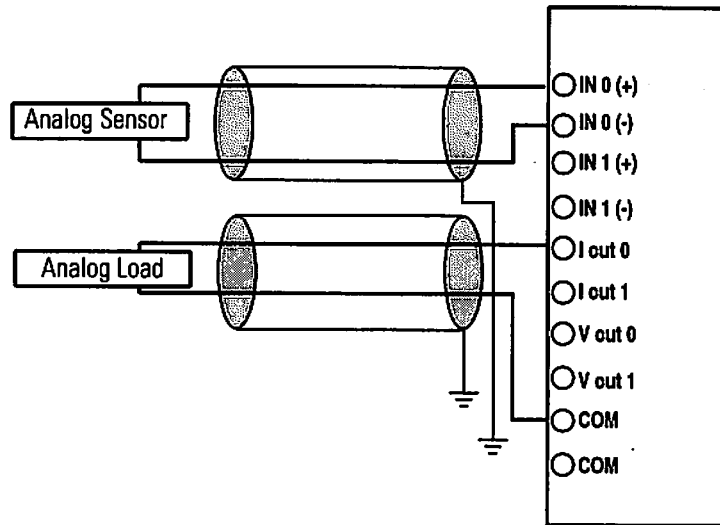


ATTENTION



Analog outputs may fluctuate for less than a second when power is applied or removed. This characteristic is common to most analog outputs. While the majority of loads will not recognize this short signal, it is recommended that preventive measures be taken to ensure that connected equipment is not affected.

Differential Sensor Transmitter Types

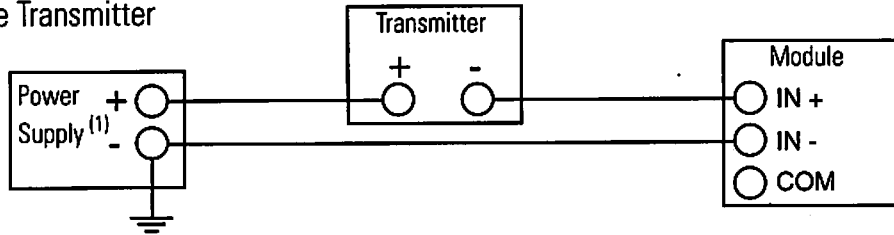


NOTE

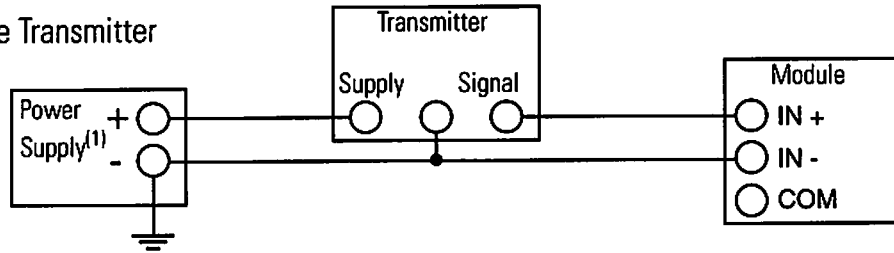
Grounding the cable shield at the module end only usually provides sufficient noise immunity. However, for best cable shield performance, earth ground the shield at both ends, using a 0.01 μ F capacitor at one end to block AC power ground currents, if necessary.

Sensor/Transmitter Types

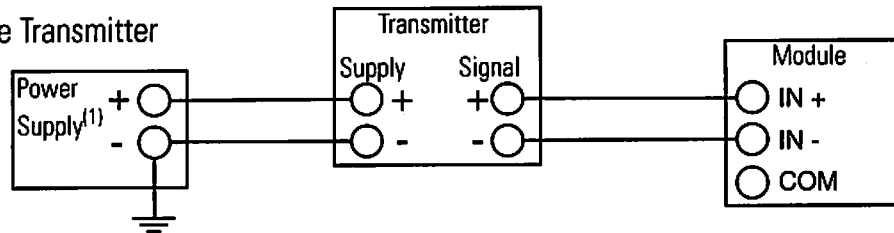
2-Wire Transmitter



3-Wire Transmitter



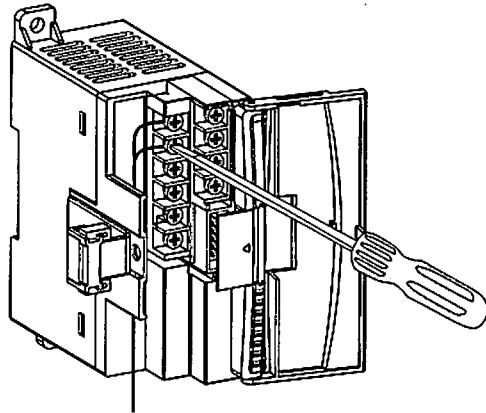
4-Wire Transmitter



(1) All power supplies rated N.E.C. Class 2.

Labeling the Terminals

A write-on label is provided with the module. Mark the identification of each terminal with permanent ink, and slide the label back into the door.



Wiring the Finger-Safe Terminal Block

ATTENTION



Be careful when stripping wires. Wire fragments that fall into a module could cause damage when power is applied. Once wiring is complete, ensure the module is free of all metal fragments.

When wiring the terminal block, keep the finger-safe cover in place.

1. Route the wire under the terminal pressure plate. You can use the stripped end of the wire or a spade lug. The terminals will accept a 6.35 mm (0.25 in.) spade lug.
2. Tighten the terminal screw making sure the pressure plate secures the wire. Recommended torque when tightening terminal screws is 0.904 Nm (8 in-lbs).
3. After wiring is complete, remove the debris shield.

NOTE

If you need to remove the finger-safe cover, insert a screw driver into one of the square wiring holes and gently pry the cover off. If you wire the terminal block with the finger-safe cover removed, you will not be able to put it back on the terminal block because the wires will be in the way.

Wire Size and Terminal Screw Torque

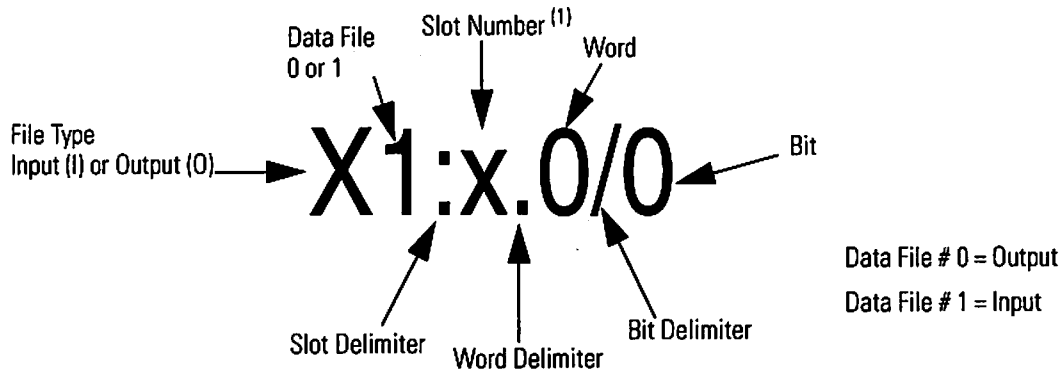
Each terminal accepts up to two wires with the following restrictions:

Wire Type		Wire Size	Terminal Screw Torque
Solid	Cu-90°C (194°F)	#14 to #22 AWG	0.904 Nm (8 in-lbs)
Stranded	Cu-90°C (194°F)	#16 to #22 AWG	0.904 Nm (8 in-lbs)

I/O Memory Mapping

Addressing

The addressing scheme for 1762 Expansion I/O is shown below.



(1) I/O located on the controller (embedded I/O) is slot 0. I/O added to the controller (expansion I/O) begins with slot 1.

Input Data File

For each module, slot x, words 0 and 1 contain the analog values of the inputs. The module can be configured to use either raw/proportional data or scaled-for-PID data. The input data file for each configuration is shown below.

Raw/Proportional Format

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	Channel 0 Data 0 to 32760												0	0	0
1	0	Channel 1 Data 0 to 32760												0	0	0
2	reserved															
3	reserved															
4	reserved										SO 1	SO 0	reserved	SI 1	SI 0	
5	UI 0	OI 0	UI 1	OI 1	reserved				UO 0	OO 0	UO 1	OO 1	reserved			

Scaled-for-PID Format

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	Channel 0 Data 0 to 16,380												0	0
1	0	0	Channel 1 Data 0 to 16,380												0	0
2	reserved															
3	reserved															
4	reserved										SO 1	SO 0	reserved	SI 1	SI 0	
5	UI 0	OI 0	UI 1	OI 1	reserved				UO 0	OO 0	UO 1	OO 1	reserved			

The bits are defined as follows:

- **SIx** = General status bits for input channels 0 and 1.
SOx = General status bits for output channels 0 and 1. This bit is set when an error (over- or under-range) exists for that channel, or there is a general module hardware error.
- **OIx** = Over-range flag bits for input channels 0 and 1.
OOx = Over-range flag bits for output channels 0 and 1. These bits can be used in the control program for error detection.
- **UIx** = Under-range flag bits for input channels 0 and 1.
UOx = Under-range flag bits for output channels 0 and 1. These bits can be used in the control program for error detection.

Output Data File

For each module, slot x, words 0 and 1 contain the channel output data.

Raw/Proportional Format

Word	Bit Position																
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
0	0	Channel 0 Data 0 to 32,760													0	0	0
1	0	Channel 1 Data 0 to 32,760													0	0	0

Scaled-for-PID Format

Word	Bit Position																
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
0	0	0	Channel 0 Data 0 to 16,380													0	0
1	0	0	Channel 1 Data 0 to 16,380													0	0

Configuration Data File

The configuration of the format for analog inputs and outputs is made at going to run (GTR). Changes made to the configuration file while in run mode have no effect.

The configuration table for analog inputs and outputs is shown in the table below.

Configuration Data File

Word	Bit Position																
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
0	reserved	Data Format Input Channel 0				Type/Range Select Input Channel 0				reserved							
1		Data Format Input Channel 1				Type/Range Select Input Channel 1				reserved							
2	reserved																
3	reserved																
4	reserved	Data Format Output Channel 0				Type/Range Select Output Channel 0				reserved							
5		Data Format Output Channel 1				Type/Range Select Output Channel 1				reserved							
6	reserved																
7	reserved																

Bit 15 and Bits 7 through 0 - Reserved

These bits are reserved and are not checked by the module.

Data Format (Bits 14 through 12)

These bits indicate the format of the data as shown in the following table. Other combinations of these bits are not supported and result in an error.

Bit Settings			Data Format
14	13	12	
0	0	0	Raw/Proportional
0	1	0	Scaled for PID
other			Not Supported

Type/Range Select (Bits 11 through 8)

These bits indicate the type and range as in the following table. Other combinations of these bits are not supported and result in an error.

Bit Settings				Data Format
11	10	9	8	
0	0	1	0	Voltage Mode 0 to 10V dc
0	0	1	1	Current Mode 4 to 20 mA
other				Not Supported

Specifications

General Specifications

Specification	Value
Dimensions	90 mm (height) x 87 mm (depth) x 40 mm (width) height including mounting tabs is 110 mm 3.54 in. (height) x 3.43 in. (depth) x 1.58 in. (width) height including mounting tabs is 4.33 in.
Approximate Shipping Weight (with carton)	240g (0.53 lbs.)
Storage Temperature	-40°C to +85°C (-40°F to +185°F)
Operating Temperature	0°C to +55°C (-32°F to +131°F)
Operating Humidity	5% to 95% non-condensing
Operating Altitude	2000 meters (6561 feet)
Vibration	Operating: 10 to 500 Hz, 5G, 0.030 in. max. peak-to-peak
Shock	Operating: 30G
Bus Current Draw (max.)	40 mA at 5V dc 105 mA at 24V dc
Analog Normal Operating Range	Voltage: 0 to 10V dc Current: 4 to 20 mA
Full Scale ⁽¹⁾ Analog Ranges	Voltage: 0 to 10.5V dc Current: 0 to 21 mA
Resolution	12 bits (unipolar)
Repeatability ⁽²⁾	±0.1%
Input and Output Group to System Isolation	30V ac/30V dc rated working voltage ⁽³⁾ (N.E.C. Class 2 required) (IEC Class 2 reinforced insulation) type test: 500V ac or 707V dc for 1 minute
Module Power LED	On: indicates power is applied.
Recommended Cable	Belden™ 8761 (shielded)

Specification	Value
Vendor I.D. Code	1
Product Type Code	10
Product Code	75
Agency Certification	C-UL certified (under CSA C22.2 No. 142) UL 508 listed CE compliant for all applicable directives
Hazardous Environment Class	Class I, Division 2, Hazardous Location, Groups A, B, C, D (UL 1604, C-UL under CSA C22.2 No. 213)
Noise Immunity	NEMA standard ICS 2-230
Radiated and Conducted Emissions	EN50081-2 Class A
<i>Electrical /EMC:</i>	<i>The module has passed testing at the following levels:</i>
ESD Immunity (IEC1000-4-2)	4 kV contact, 8 kV air, 4 kV indirect
Radiated Immunity (IEC1000-4-3)	10 V/m, 80 to 1000 MHz, 80% amplitude modulation, +900 MHz keyed carrier
Fast Transient Burst (IEC1000-4-4)	2 kV, 5 kHz
Surge Immunity (IEC1000-4-5)	1 kV galvanic gun
Conducted Immunity (IEC1000-4-6)	10V, 0.15 to 80 MHz ⁽⁴⁾

- (1) The over- or under-range flag comes on when the normal operating range (over/under) is exceeded. The module continues to convert the analog input up to the maximum full scale range.
- (2) Repeatability is the ability of the input module to register the same reading in successive measurements for the same input signal.
- (3) Rated working voltage is the maximum continuous voltage that can be applied at the terminals with respect to earth ground.
- (4) Conducted Immunity frequency range may be 150 kHz to 30 MHz if the Radiated Immunity frequency range is 30 MHz to 1000 MHz.

Input Specifications

Specification	Value
Number of Inputs	2 differential (unipolar)
A/D Converter Type	Successive approximation
Common Mode Voltage Range ⁽¹⁾	±27 V
Common Mode Rejection ⁽²⁾	> 55 dB at 50 and 60 Hz
Non-linearity (in percent full scale)	±0.1%
Typical Overall Accuracy ⁽³⁾	±0.5% full scale at 0 to 55°C ±0.3% full scale at 25°C
Input Impedance	Voltage Terminal: 200KΩ Current Terminal: 250Ω
Current Input Protection	±32 mA
Voltage Input Protection	±30 V
Channel Diagnostics	Over or under range or open circuit condition by bit reporting for analog inputs.

(1) For proper operation, both the plus and minus input terminals must be within ±27V of analog common.

(2) $V_{cm} = 1 V_{pk-pk}$ AC

(3) $V_{cm} = 0$ (includes offset, gain, non-linearity and repeatability error terms)

Output Specifications

Specification	Value
Number of Outputs	2 single-ended (unipolar)
D/A Converter Type	Resistor string
Resistive Load on Current Output	0 to 500 Ω (includes wire resistance)
Load Range on Voltage Output	> 1K Ω
Reactive Load, Current Output	< 0.1 mH
Reactive Load, Voltage Output	< 1 μ F
Typical Overall Accuracy ⁽¹⁾	\pm 1% full scale at 0 to 55°C \pm 0.5% full scale at 25°C
Output Ripple range 0 to 500 Hz (referred to output range)	< \pm 0.1%
Non-linearity (in percent full scale)	< \pm 0.5%
Open and Short-Circuit Protection	Continuous
Output Protection	\pm 32 mA

(1) Includes offset, gain, non-linearity and repeatability error terms.

Hazardous Location Considerations

This equipment is suitable for use in Class I, Division 2, Groups A, B, C, D or non-hazardous locations only. The following WARNING statement applies to use in hazardous locations.

WARNING**EXPLOSION HAZARD**

- Substitution of components may impair suitability for Class I, Division 2.
 - Do not replace components or disconnect equipment unless power has been switched off.
 - Do not connect or disconnect components unless power has been switched off.
 - This product must be installed in an enclosure.
 - In Class I, Division 2 applications, the bus connector must be fully seated and the bus connector cover must be snapped in place.
 - In Class I, Division 2 applications, all modules must be mounted in direct contact with each other as shown on page 6. If DIN rail mounting is used, an end stop must be installed ahead of the controller and after the last 1762 I/O module.
 - All wiring must comply with N.E.C. article 501-4(b).
-

Environnements dangereux

Cet équipement est conçu pour être utilisé dans des environnements de Classe 1, Division 2, Groupes A, B, C, D ou non dangereux. La mise en garde suivante s'applique à une utilisation dans des environnements dangereux.

MISE EN GARDE DANGER D'EXPLOSION

- La substitution de composants peut rendre cet équipement impropre à une utilisation en environnement de Classe 1, Division 2.
- Ne pas remplacer de composants ou déconnecter l'équipement sans s'être assuré que l'alimentation est coupée.
- Ne pas connecter ou déconnecter des composants sans s'être assuré que l'alimentation est coupée.
- Ce produit doit être installé dans une armoire.
- Pour les applications de Classe I, Division 2, le connecteur de bus doit être correctement installé et son couvercle enclenché.
- Pour les applications de Classe 1, Division 2, tous les modules doivent être installés en contact direct les uns avec les autres, comme indiqué page 6. Si on utilise le montage sur rail DIN, une butée doit être placée à l'avant de l'automate et après la dernière unité d'E/S 1762.

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Publication 1762-IN005A-US-P - March 2000



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PN 40071-073-01(A)

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Installation Instructions

MicroLogix™ 1762-OW8 Relay Output Module

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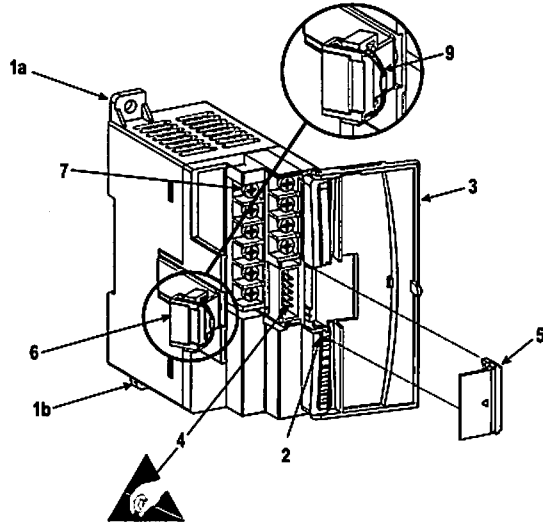
For More Information

For	Refer to this Document	Pub. No.
Information on installing, wiring, and operating a MicroLogix 1200 Programmable Controller	MicroLogix 1200 Programmable Controllers User Manual	1762-UM001A-US-P
Installation guide for the MicroLogix 1200 Programmable Controller.	MicroLogix 1200 Programmable Controllers Installation Instructions	1762-IN006A-ML-P
Installation guide for the MicroLogix 1200 Memory Module and Real Time Clock.	MicroLogix 1200 Memory Module and/or Real Time Clock Installation Instructions	1762-IN001A-US-P
Installation guide for the 1762-IA8 Discrete Input Module	1762-IA8 120V ac Input Module Installation Instructions	1762-IN002A-US-P
Installation guide for the 1762-IQ8 Discrete Input Module	1762-IQ8 DC Input Module Installation Instructions	1762-IN004A-US-P
Installation guide for the 1762-IF2OF2 Analog I/O Module	1762-IF2OF2 Analog Input/Output Module Installation Instructions	1762-IN005A-US-P
More information on proper wiring and grounding techniques.	Industrial Automation Wiring and Grounding Guidelines	1770-4.1

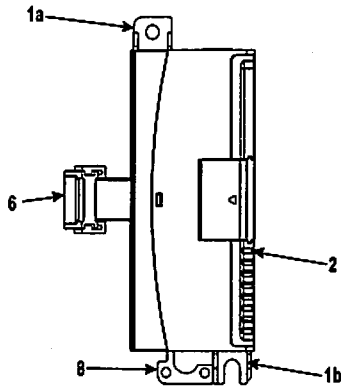
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Description



Item	Description
1a	upper panel mounting tab
1b	lower panel mounting tab
2	I/O diagnostic LEDs
3	module door with terminal identification label
4	bus connector with male pins
5	bus connector cover
6	flat ribbon cable with bus connector (female pins)
7	terminal block
8	DIN rail latch
9	pull loop



Installation

1762 I/O is suitable for use in an industrial environment when installed in accordance with these instructions. Specifically, this equipment is intended for use in clean, dry environments (Pollution degree 2⁽¹⁾) and to circuits not exceeding Over Voltage Category II⁽²⁾ (IEC 60664-1).⁽³⁾

Prevent Electrostatic Discharge



ATTENTION: Electrostatic discharge can damage integrated circuits or semiconductors if you touch bus connector pins.

Follow these guidelines when you handle the module:

- Touch a grounded object to discharge static potential.
 - Wear an approved wrist-strap grounding device.
 - Do not touch the bus connector or connector pins.
 - Do not touch circuit components inside the module.
 - If available, use a static-safe work station.
 - When not in use, keep the module in its static-shield box.
-

Remove Power



ATTENTION: Remove power before removing or installing this module. When you remove or install a module with power applied, an electrical arc may occur. An electrical arc can cause personal injury or property damage by:

- sending an erroneous signal to your system's field devices, causing unintended machine motion
- causing an explosion in a hazardous environment
- causing permanent damage to the module's circuitry

Electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance.

⁽¹⁾ Pollution Degree 2 is an environment where, normally, only non-conductive pollution occurs except that occasionally a temporary conductivity caused by condensation shall be expected.

⁽²⁾ Over Voltage Category II is the load level section of the electrical distribution system. At this level transient voltages are controlled and do not exceed the impulse voltage capability of the product's insulation.

⁽³⁾ Pollution Degree 2 and Over Voltage Category II are International Electrotechnical Commission (IEC) designations.

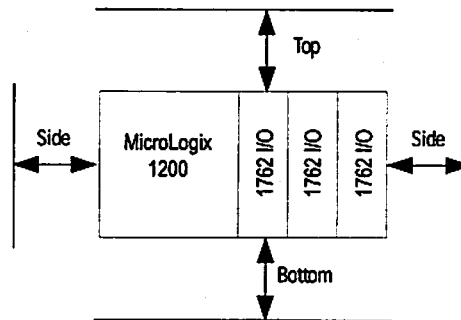
Mounting



ATTENTION: Do not remove protective debris strip until after the module and all other equipment near the module is mounted and wiring is complete. Once wiring is complete and the module is free of debris, carefully remove protective debris strip. Failure to remove strip before operating can cause overheating.

Minimum Spacing

Maintain spacing from enclosure walls, wireways, adjacent equipment, etc. Allow 50.8 mm (2 in.) of space on all sides for adequate ventilation, as shown:



Note: 1762 expansion I/O may be mounted horizontally only.



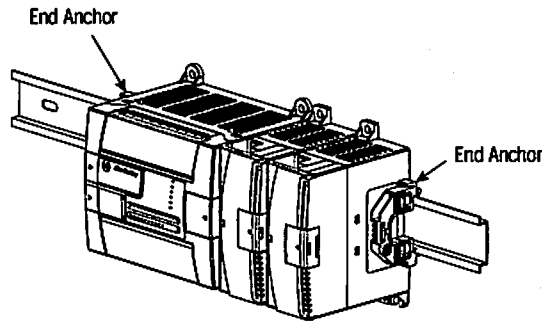
ATTENTION: During panel or DIN rail mounting of all devices, be sure that all debris (metal chips, wire strands, etc.) is kept from falling into the module. Debris that falls into the module could cause damage when power is applied to the module.

DIN Rail Mounting

The module can be mounted using the following DIN rails: 35 x 7.5 mm (EN 50 022 - 35 x 7.5) or 35 x 15 mm (EN 50 022 - 35 x 15).

Before mounting the module on a DIN rail, close the DIN rail latch. Press the DIN rail mounting area of the module against the DIN rail. The latch will momentarily open and lock into place.

Use DIN rail end anchors (Allen-Bradley part number 1492-EA35 or 1492-EAH35) for vibration or shock environments.

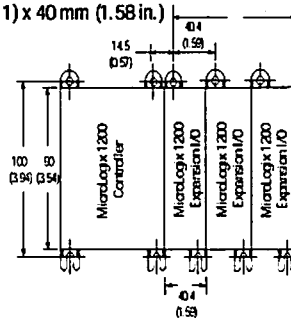


Note: For environments with greater vibration and shock concerns, use the panel mounting method described below, instead of DIN rail mounting.

Panel Mounting

Use the dimensional template shown below to mount the module. The preferred mounting method is to use two M4 or #8 panhead screws per module. M3.5 or #6 panhead screws may also be used, but a washer may be needed to ensure a good ground contact. Mounting screws are required on every module.

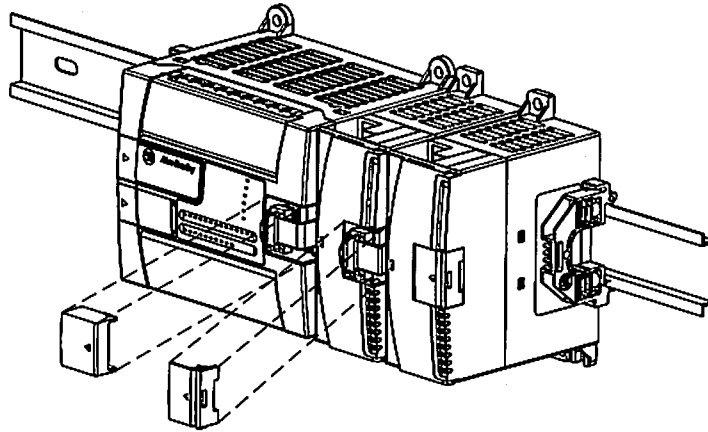
For more than 2 modules: (number of modules - 1) x 40 mm (1.58 in.)



NOTE: All dimensions are in mm (inches). Hole spacing tolerance: ±0.4 mm (0.016 in.)

System Assembly

The expansion I/O module is attached to the controller or another I/O module by means of a flat ribbon cable *after* mounting as shown below.



Note: Use the pull loop on the connector to disconnect modules. Do not pull on the ribbon cable.



ATTENTION: EXPLOSION HAZARD

- In Class I, Division 2 applications, the bus connector must be fully seated and the bus connector cover must be snapped in place.
- In Class I, Division 2 applications, all modules must be mounted in direct contact with each other as shown on page 6. If DIN rail mounting is used, an end stop must be installed ahead of the controller and after the last 1762 I/O module.

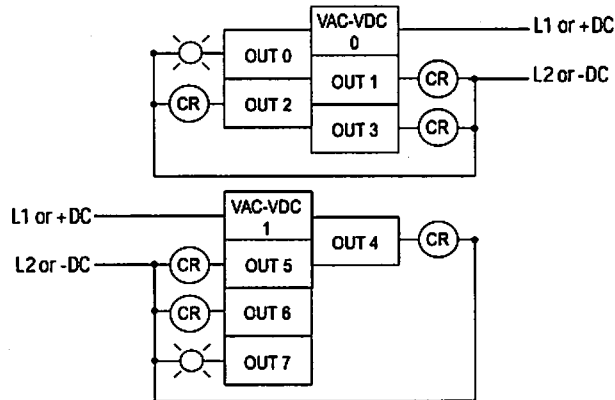
Field Wiring Connections

Grounding the Module

This product is intended to be mounted to a well-grounded mounting surface such as a metal panel. Additional grounding connections from the module's mounting tabs or DIN rail (if used) are not required unless the mounting surface cannot be grounded. Refer to *Industrial Automation Wiring and Grounding Guidelines*, Allen-Bradley publication 1770-4.1, for additional information.

Output Wiring

Basic wiring⁽¹⁾ of the 1762-OW8 is shown below.

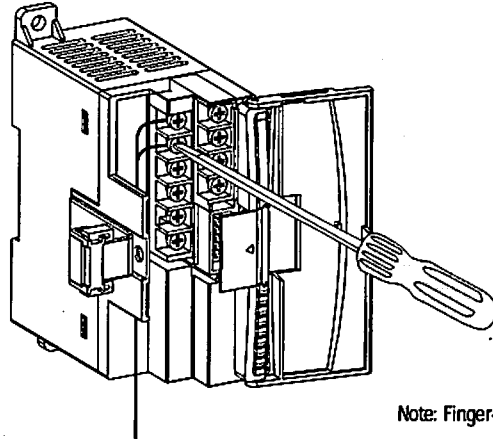


A write-on label is provided with the module. Mark the identification of each terminal with permanent ink, and slide the label back into the door.



ATTENTION: Be careful when stripping wires. Wire fragments that fall into a module could cause damage when power is applied. Once wiring is complete, ensure the module is free of all metal fragments.

⁽¹⁾ **Surge Suppression** – Connecting surge suppressors across your external inductive load will extend the life of the relay contacts. For additional details, refer to *Industrial Automation Wiring and Grounding Guidelines*, Allen-Bradley publication 1770-4.1.



Note: Finger-safe cover not shown.

Wiring the Finger-Safe Terminal Block

When wiring the terminal block, keep the finger-safe cover in place.

1. Route the wire under the terminal pressure plate. You can use the stripped end of the wire or a spade lug. The terminals will accept a 6.35 mm (0.25 in.) spade lug.
2. Tighten the terminal screw making sure the pressure plate secures the wire. Recommended torque when tightening terminal screws is 0.904 Nm (8 in-lbs).

Note: If you need to remove the finger-safe cover, insert a screw driver into one of the square wiring holes and gently pry the cover off. If you wire the terminal block with the finger-safe cover removed, you will not be able to put it back on the terminal block because the wires will be in the way.

Wire Size and Terminal Screw Torque

Each terminal accepts up to two wires with the following restrictions:

Wire Type		Wire Size	Terminal Screw Torque
Solid	Cu-90°C (194°F)	#14 to #22 AWG	0.904 Nm (8 in-lbs)
Stranded	Cu-90°C (194°F)	#16 to #22 AWG	0.904 Nm (8 in-lbs)

I/O Memory Mapping

Output Data File

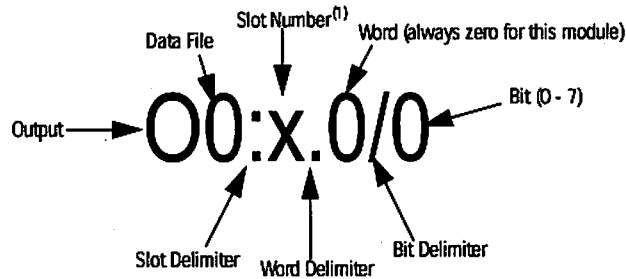
For each output module, the output data file contains the controller-directed state of the discrete output points. Bit positions 0 through 7 correspond to output terminals 0 through 7.

Word	Bit Position															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0	w	w	w	w	w	w	w	w

w = write only, 0 = always at a 0 or OFF state

Addressing

The addressing scheme for 1762 Expansion I/O is shown below.



(1) I/O located on the controller (embedded I/O) is slot 0. I/O added to the controller (expansion I/O) begins with slot 1.

Specifications

General Specifications

Specification	Value
Dimensions	90 mm (height) x 87 mm (depth) x 40 mm (width) height including mounting tabs is 110 mm 3.543 in. (height) x 3.425 in. (depth) x 1.575 in. (width) height including mounting tabs is 4.33 in.
Approximate Shipping Weight (with carton)	228 g (0.50 lbs.)
Storage Temperature	-40° C to +85° C (-40° F to +185° F)
Operating Temperature	0° C to +55° C (-32° F to +131° F)
Operating Humidity	5% to 95% non-condensing
Operating Altitude	2000 meters (6561 feet)
Vibration	Refer to the MicroLogix 1200 Controllers Installation Instructions, publication 1762IN006A-ML-P.
Shock	
Agency Certification	C-UL certified (under CSA C22.2 No. 142) UL 508 listed CE compliant for all applicable directives
Hazardous Environment Class	Class I, Division 2, Hazardous Location, Groups A, B, C, D (UL 1604, C-UL under CSA C22.2 No. 213)
Noise Immunity	NEMA standard ICS 2-230
Radiated and Conducted Emissions	EN50081-2 Class A
<i>Electrical /EMC:</i>	<i>The module has passed testing at the following levels:</i>
ESD Immunity (IEC1000-4-2)	4 kV contact, 8 kV air, 4 kV indirect
Radiated Immunity (IEC1000-4-3)	10 V/m, 80 to 1000 MHz, 80% amplitude modulation, +900 MHz keyed carrier
Fast Transient Burst (IEC1000-4-4)	2 kV, 5 kHz
Surge Immunity (IEC1000-4-5)	2 kV common mode, 1 kV differential mode
Conducted Immunity (IEC1000-4-6)	10V, 0.15 to 80 MHz ⁽¹⁾

⁽¹⁾ Conducted Immunity frequency range may be 150 kHz to 30 MHz if the Radiated Immunity frequency range is 30 MHz to 1000 MHz.

Output Specifications

Specification	1762-0W8
Voltage Category	AC/DC normally open relay
Operating Voltage Range	5 to 265V ac 5 to 125V dc
Number of Outputs	8
Bus Current Draw (max.)	80 mA at 5V dc (0.40W) 90 mA at 24V dc (2.16W)
Heat Dissipation (max.)	2.9 Total Watts
Signal Delay (max.) – resistive load	On Delay: 10 ms Off Delay: 10 ms
Off-State Leakage (max.)	0 mA
On-State Current (min.)	10 mA at 5V dc
Continuous Current per Point (max.)	2.5 A (Also see "Relay Contact Ratings" on page 13.)
Continuous Current per Common (max.)	8 A
Continuous Current per Module (max.)	16 A
Power Supply Distance Rating	6
Isolated Groups	Group 1: Outputs 0 to 3 Group 2: Outputs 4 to 7
Output Group to Backplane Isolation	Verified by one of the following dielectric tests: 1836V ac for 1 sec. or 2596V dc for 1 sec. 265V ac working voltage (IEC Class 2 reinforced insulation)
Output Group to Output Group Isolation	Verified by one of the following dielectric tests: 1836V ac for 1 sec. or 2596V dc for 1 sec. 265V ac working voltage (basic insulation) 150V ac working voltage (IEC Class 2 reinforced insulation)
Vendor I.D. Code	1
Product Type Code	7
Product Code	120

Relay Contact Ratings

Volts (max.)	Continuous Amps per Point (max.)	Amperes ⁽¹⁾		Voltamperes	
		Make	Break	Make	Break
240V ac	2.5 A	7.5 A	0.75 A	1800 VA	180 VA
120V ac		15 A	1.5 A		
125V dc	1.0 A	0.22 A ⁽²⁾		28 VA	
24V dc	2.0 A	1.2 A		28 VA	

⁽¹⁾ **Surge Suppression** – Connecting surge suppressors across your external inductive load will extend the life of the relay contacts. For additional details, refer to *Industrial Automation Wiring and Grounding Guidelines*, Allen-Bradley publication 1770-4.1.

⁽²⁾ For dc voltage applications, the make/break ampere rating for relay contacts can be determined by dividing 28 VA by the applied dc voltage. For example, $28 \text{ VA} / 48 \text{ V dc} = 0.58 \text{ A}$. For dc voltage applications less than 48V, the make/break rating for relay contacts cannot exceed 2A.

Hazardous Location Considerations

This equipment is suitable for use in Class I, Division 2, Groups A, B, C, D or non-hazardous locations only. The following ATTENTION statement applies to use in hazardous locations.



ATTENTION: EXPLOSION HAZARD

- Substitution of components may impair suitability for Class I, Division 2.
 - Do not replace components or disconnect equipment unless power has been switched off.
 - Do not connect or disconnect components unless power has been switched off.
 - This product must be installed in an enclosure.
 - In Class I, Division 2 applications, the bus connector must be fully seated and the bus connector cover must be snapped in place.
 - In Class I, Division 2 applications, all modules must be mounted in direct contact with each other as shown on page 6. If DIN rail mounting is used, an end stop must be installed ahead of the controller and after the last 1762 I/O module.
-

Environnements dangereux

Cet équipement est conçu pour être utilisé dans des environnements de Classe I, Division 2, Groupes A, B, C, D ou non dangereux. La mise en garde suivante s'applique à une utilisation dans des environnements dangereux.



ATTENTION: DANGER D'EXPLOSION

- La substitution de composants peut rendre cet équipement impropre à une utilisation en environnement de Classe I, Division 2.
 - Ne pas remplacer de composants ou déconnecter l'équipement sans s'être assuré que l'alimentation est coupée.
 - Ne pas connecter ou déconnecter des composants sans s'être assuré que l'alimentation est coupée.
 - Ce produit doit être installé dans une armoire.
 - Pour les applications de Classe I, Division 2, le connecteur de bus doit être correctement installé et son couvercle enclenché.
 - Pour les applications de Classe I, Division 2, tous les modules doivent être installés en contact direct les uns avec les autres, comme indiqué page 6. Si on utilise le montage sur rail DIN, une butée doit être placée à l'avant de l'automate et après la dernière unité d'E/S 1762.
-

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Publication 1762-IN003A-US-P - September 1999

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PN 40071-072-01 (A)

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MicroLogix™ 1200 Programmable Controllers

(Cat. No. 1762-L24AWA, 1762-L24BWA, 1762-L24BXB, 1762-L40AWA, 1762-L40BWA, 1762-L40BXB, 1762-L24AWAR, 1762-L24BWAR, 1762-L24BXBR, 1762-L40AWAR, 1762-L40BWAR, 1762-L40BXBR)

http://literature.rockwellautomation.com/idc/groups/literature/documents/in/1762-in006_-mu-p.pdf

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MicroLogix 1200 Programmable Controllers

(Cat. No. 1762-L24AWA, 1762-L24BWA, 1762-L24BXB, 1762-L40AWA,
1762-L40BWA, 1762-L40BXB, 1762-L24AWAR, 1762-L24BWAR,
1762-L24BXBR, 1762-L40AWAR, 1762-L40BWAR, 1762-L40BXBR)

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Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. *Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls* (Publication SGI-1.1 available from your local Rockwell Automation sales office or online at <http://www.ab.com/manuals/gi>) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.





In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Throughout this manual we use notes to make you aware of safety considerations.

<p>WARNING</p> 	<p>Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.</p>
<p>IMPORTANT</p>	<p>Identifies information that is critical for successful application and understanding of the product.</p>
<p>ATTENTION</p> 	<p>Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you:</p> <ul style="list-style-type: none"> • identify a hazard • avoid a hazard • recognize the consequence
<p>SHOCK HAZARD</p> 	<p>Labels may be located on or inside the drive to alert people that dangerous voltage may be present.</p>
<p>BURN HAZARD</p> 	<p>Labels may be located on or inside the drive to alert people that surfaces may be dangerous temperatures.</p>

For More Information

Related Publications

For	Refer to this Document	Pub. No.
A more detailed description of how to install and use your MicroLogix 1200 programmable controller and expansion I/O system.	MicroLogix™ 1200 Programmable Controllers User Manual	1762-UM001
A reference manual that contains data and function files, instruction set, and troubleshooting information for MicroLogix 1200 and MicroLogix 1500.	MicroLogix™ 1200 and MicroLogix™ 1500 Instruction Set Reference Manual	1762-RM001
Information on installing and using 1762 expansion I/O modules.	Installation Instructions are included with each module. Also available via www.theautomationbookstore.com .	1762-INxxx
More information on proper wiring and grounding techniques.	Industrial Automation Wiring and Grounding Guidelines	1770-4.1

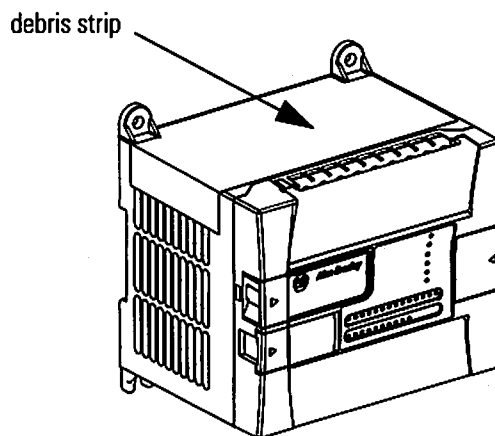
If you would like a manual, you can:

- download a free electronic version from the internet:
<http://literature.rockwellautomation.com>
- purchase a printed manual by contacting your local Allen-Bradley distributor or Rockwell Automation representative

Overview

MicroLogix™ 1200 Controllers are suitable for use in an industrial environment when installed in accordance with these instructions. Specifically, this equipment is intended for use in clean, dry environments (Pollution degree 2⁽¹⁾) and to circuits not exceeding Over Voltage Category II⁽²⁾ (IEC 60664-1).⁽³⁾

Install your controller using these installation instructions.



ATTENTION



Do not remove the protective debris strip until after the controller and all other equipment in the panel near the controller is mounted and wiring is complete. Once wiring is complete, remove protective debris strip. Failure to remove strip before operating can cause overheating.

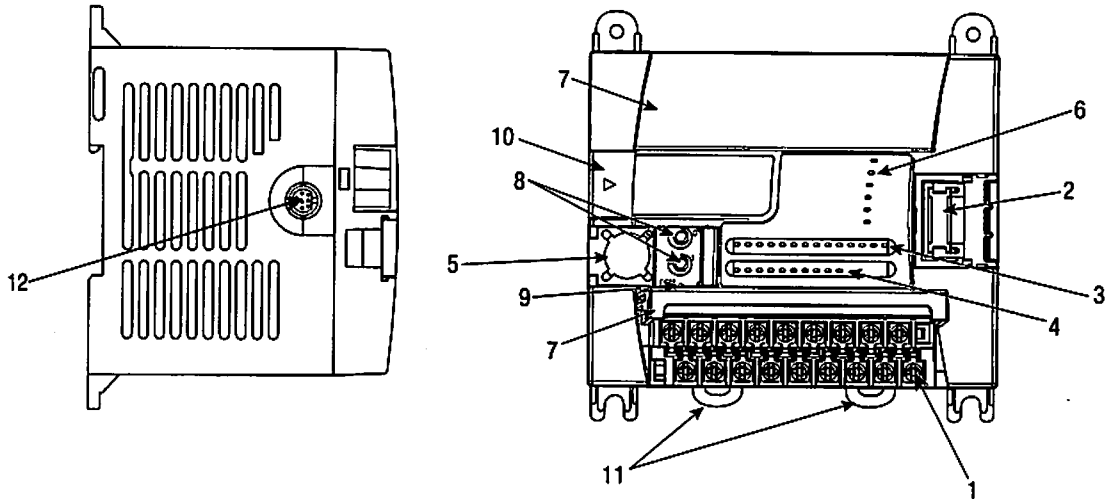
ATTENTION



Electrostatic discharge can damage semiconductor devices inside the controller. Do not touch the connector pins or other sensitive areas.

- (1) Pollution Degree 2 is an environment where, normally, only non-conductive pollution occurs except that occasionally a temporary conductivity caused by condensation shall be expected.
- (2) Over Voltage Category II is the load level section of the electrical distribution system. At this level transient voltages are controlled and do not exceed the impulse voltage capability of the product's insulation.
- (3) Pollution Degree 2 and Over Voltage Category II are International Electrotechnical Commission (IEC) designations.

Controller Description



Item	Description	Item	Description
1	Terminal Blocks (Removable Terminal Blocks on 40-point controllers only)	7	Terminal Doors and Label
2	Bus Connector Interface to Expansion I/O	8	Trim Pots
3	Input LEDs	9	Default Communications Push Button
4	Output LEDs	10	Memory Module Port Cover ⁽¹⁾ -or- Memory Module and/or Real Time Clock ⁽²⁾
5	Communication Port (Channel 0)	11	DIN Rail Latches
6	Status LEDs	12	Programmer/HMI Port (Equipped with 1762-LxxxxR controllers only)

⁽¹⁾ Shipped with controller

⁽²⁾ Optional equipment.

Catalog Number	Description		
	Input Power	Inputs	Outputs
1762-L24AWA, -L24AWAR	120/240V ac	(14) 120V ac	(10) relay
1762-L24BWA, -L24BWAR	120/240V ac	(10) 24V dc (4) fast 24V dc	(10) relay
1762-L24BXB, -L24BXBR	24V dc	(10) 24V dc (4) fast 24V dc	(5) relay, (4) 24V dc FET (1) high-speed 24V dc FET
1762-L40AWA, -L40AWAR	120/240V ac	(24) 120V ac	(16) relay
1762-L40BWA, -L40BWAR	120/240V ac	(20) 24V dc (4) fast 24V dc	(16) relay
1762-L40BXB, -L40BXBR	24V dc	(20) 24V dc (4) fast 24V dc	(8) relay, (7) 24V dc FET (1) high-speed 24V dc FET

Hazardous Location Considerations

This equipment is suitable for use in Class I, Division 2, Groups A, B, C, D or non-hazardous locations only. The following WARNING statement applies to use in hazardous locations.

WARNING



EXPLOSION HAZARD

- Substitution of components may impair suitability for Class I, Division 2.
- Do not replace components or disconnect equipment unless power has been switched off.
- Do not connect or disconnect components unless power has been switched off.
- This product must be installed in an enclosure. All cables connected to the product must remain in the enclosure or be protected by conduit or other means.
- All wiring must comply with N.E.C. article 501-4(b).

Use only the following communication cables in Class I, Division 2 hazardous locations.

Environment Classification	Communication Cables
Class I, Division 2 Hazardous Environment	1761-CBL-PM02 Series C or later
	1761-CBL-HM02 Series C or later
	1761-CBL-AM00 Series C or later
	1761-CBL-AP00 Series C or later
	2707-NC8 Series B or later
	2707-NC10 Series B or later
	2707-NC11 Series B or later

Environnements dangereux

Cet équipement est conçu pour être utilisé dans des environnements de Classe I, Division 2, Groupes A, B, C, D ou non dangereux. La mise en garde suivante s'applique à utilisation en environnements dangereux.

AVERTISSEMENT



DANGER D'EXPLOSION

- La substitution de composants peut rendre cet équipement impropre à une utilisation en environnement de Classe I, Division 2.
- Ne pas remplacer de composants ou déconnecter l'équipement sans s'être assuré que l'alimentation est coupée.
- Ne pas connecter ou déconnecter des composants sans s'être assuré que l'alimentation est coupée.
- Ce produit doit être installé dans une armoire. Tous les câbles connectés à l'appareil doivent rester dans l'armoire ou être protégés par un conduit ou tout autre moyen.
- L'ensemble du câblage doit être conforme à la réglementation en vigueur dans les pays où l'appareil est installé.

Utiliser uniquement les câbles de communication suivants dans les environnements dangereux de Classe I, Division 2.

Classification des environnements	Câbles de communication
Environnement dangereux de Classe I, Division 2	1761-CBL-PM02 série C ou ultérieure
	1761-CBL-HM02 série C ou ultérieure
	1761-CBL-AM00 série C ou ultérieure
	1761-CBL-AP00 série C ou ultérieure
	707-NC8 série B ou ultérieure
	2707-NC10 série B ou ultérieure
	2707-NC11 série B ou ultérieure

Mounting the Controller

General Considerations

Most applications require installation in an industrial enclosure to reduce the effects of electrical interference and environmental exposure. Locate your controller as far as possible from power lines, load lines, and other sources of electrical noise such as hard-contact switches, relays, and AC motor drives. For more information on proper grounding guidelines, see the *Industrial Automation Wiring and Grounding Guidelines* publication 1770-4.1.

ATTENTION



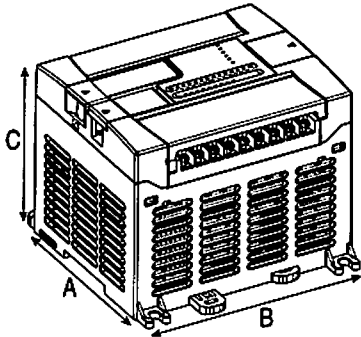
Vertical mounting is not recommended due to thermal considerations.

ATTENTION

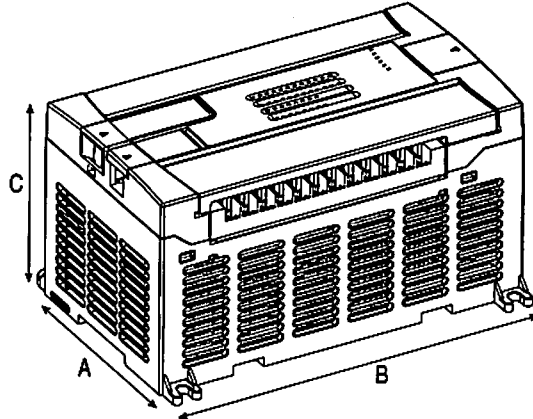


Be careful of metal chips when drilling mounting holes for your controller or other equipment within the enclosure or panel. Drilled fragments that fall into the controller could cause damage. Do not drill holes above a mounted controller if the protective debris strips have been removed.

Mounting Dimensions



1762-L24AWA, 1762-L24BWA, 1762-L24BXB,
1762-L24AWAR, 1762-L24BWAR, 1762-L24BXBR

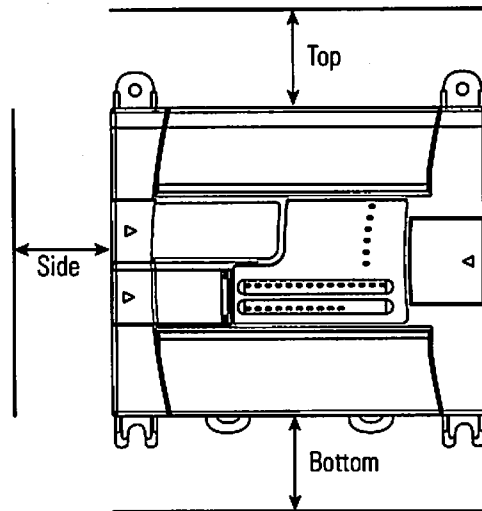


1762-L40AWA, 1762-L40BWA, 1762-L40BXB,
1762-L40AWAR, 1762-L40BWAR, 1762-L40BXBR

Dimension	1762-					
	L24AWA, L24AWAR	L24BWA, L24BWAR	L24BXB, L24BXBR	L40AWA, L40AWAR	L40BWA, L40BWAR	L40BXB, L40BXBR
A	90 mm (3.5 in.)			90 mm (3.5 in.)		
B	110 mm (4.33 in.)			160 mm (6.30 in.)		
C	87 mm (3.43 in.)			87 mm (3.43 in.)		

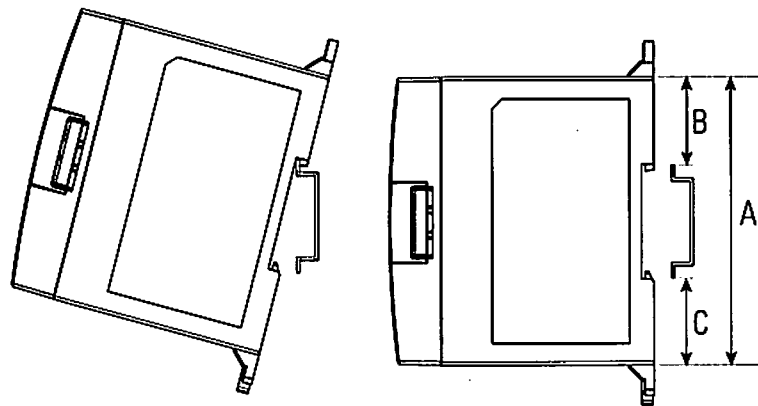
Controller Spacing

The controller mounts horizontally, with the expansion I/O extending to the right of the controller. Allow 50 mm (2 in.) of space on all but the right side for adequate ventilation, as shown below.



DIN Rail Mounting

The maximum extension of the latch is 14 mm (0.55 in.) in the open position. A flat-blade screwdriver is required for removal of the controller. The controller can be mounted to EN50022-35x7.5 or EN50022-35x15 DIN rails. DIN rail mounting dimensions are shown below.



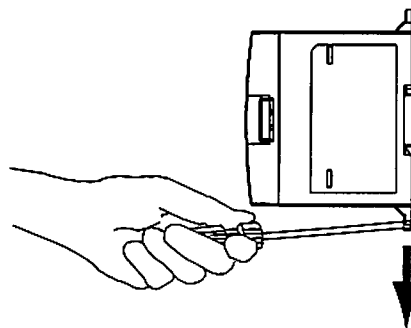
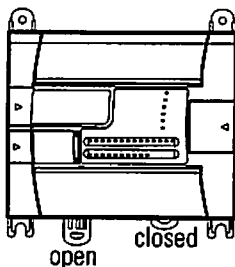
Dimension	Height
A	90 mm (3.5 in.)
B	27.5 mm (1.08 in.)
C	27.5 mm (1.08 in.)

To install your controller on the DIN rail:

1. Mount your DIN rail. (Make sure that the placement of the controller on the DIN rail meets the recommended spacing requirements, see *Controller Spacing* on page 12. Refer to the mounting template inside the back cover of this document.)
2. Close the DIN latch, if it is open.
3. Hook the top slot over the DIN rail.
4. While pressing the controller down against the top of the rail, snap the bottom of the controller into position.
5. Leave the protective debris strip attached until you are finished wiring the controller and any other devices.

To remove your controller from the DIN rail:

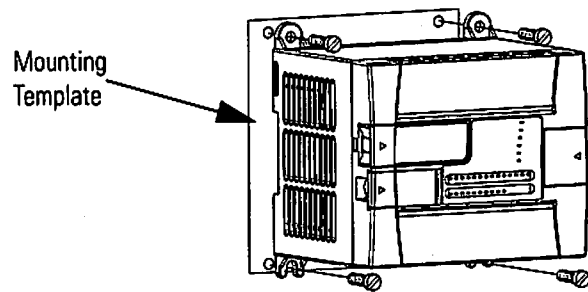
1. Place a flat-blade screwdriver in the DIN rail latch at the bottom of the controller.
2. Holding the controller, pry downward on the latch until the latch locks in the open position.
3. Repeat steps 1 and 2 for the second DIN rail latch.
4. Unhook the top of the DIN rail slot from the rail.



Panel Mounting

Mount to panel using #8 or M4 screws. To install your controller using mounting screws:

1. Remove the mounting template from inside the back cover of this document.
2. Secure the template to the mounting surface. (Make sure your controller is spaced properly. See Controller Spacing on page 12.)
3. Drill holes through the template.
4. Remove the mounting template.
5. Mount the controller.
6. Leave the protective debris strip in place until you are finished wiring the controller and any other devices.



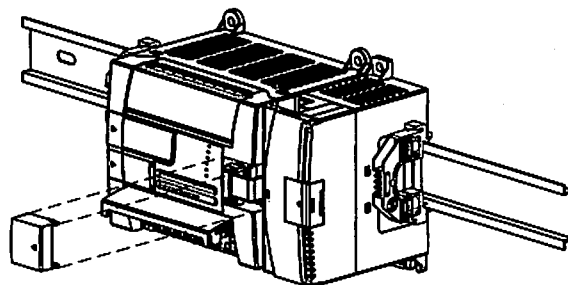
Connecting 1762 I/O Expansion Modules

ATTENTION



Remove power to the system before installing expansion I/O or damage to the controller may result.

Connect 1762 I/O after mounting the controller. Remove the expansion port cover to install expansion I/O modules. Plug the ribbon cable connector into the bus connector. Replace the cover as shown below.



IMPORTANT

Ensure that your system power supply is sufficient to support the number of I/O modules you are installing in the system. A system loading worksheet is provided in the *MicroLogix 1200 Programmable Controllers User Manual*, publication 1762-UM001.

For detailed information on using expansion I/O, refer to the installation instructions for your expansion module.

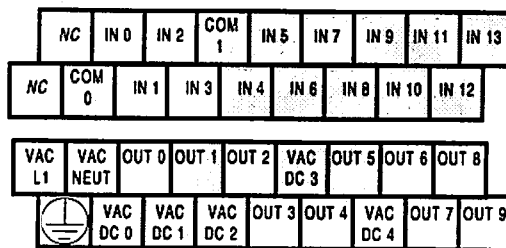
Wiring the Controller

Terminal Block Layouts

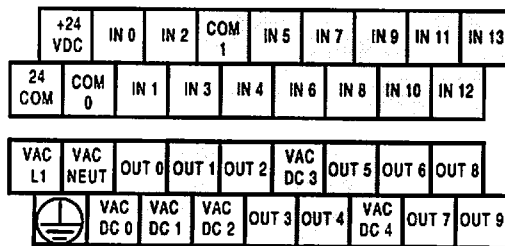
TIP

The shading in the following terminal block illustrations indicates which terminals are tied to which commons.

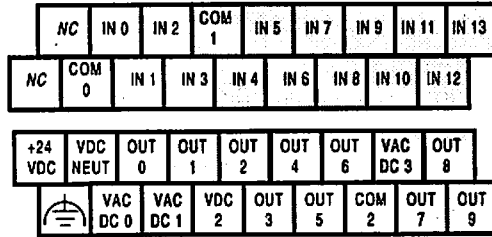
1762-L24AWA,
1762-L24AWAR



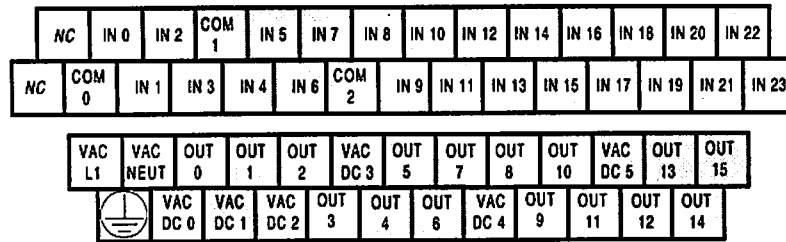
1762-L24BWA,
1762-L24BWAR



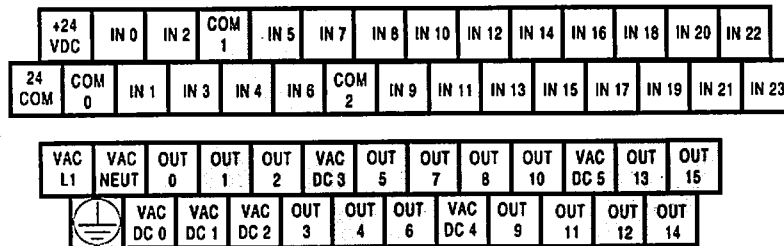
1762-L24BXB,
1762-L24BXBR



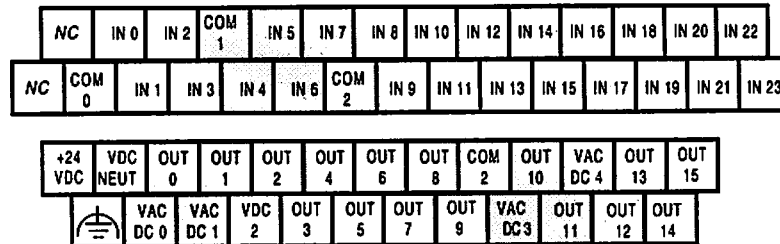
1762-L40AWA,
1762-L40AWAR



1762-L40BWA,
1762-L40BWAR



1762-L40BXB,
1762-L40BXBR



Wire Requirements

Wire Type		Wire Size (2 wire maximum per terminal screw)
Solid	Cu-90°C (194°F)	#14 to #22 AWG
Stranded	Cu-90°C (194°F)	#16 to #22 AWG

Wiring torque = 0.791 Nm (7 in-lb) rated

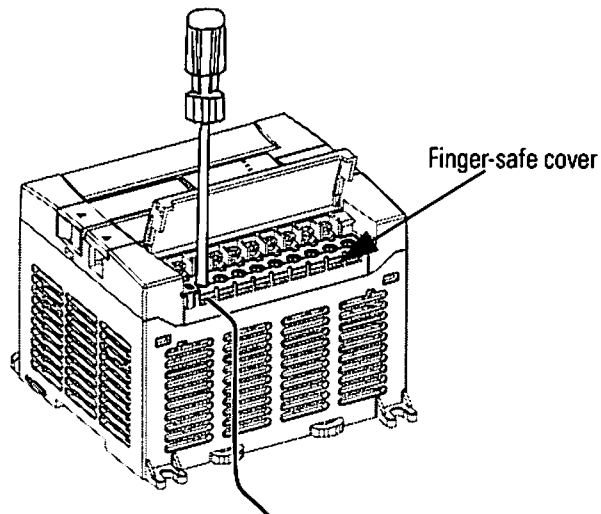
ATTENTION



Be careful when stripping wires. Wire fragments that fall into the controller could cause damage. Once wiring is complete, be sure the controller is free of all metal fragments before removing the protective debris strip. Failure to remove the strip before operating can cause overheating.

Wiring Recommendation

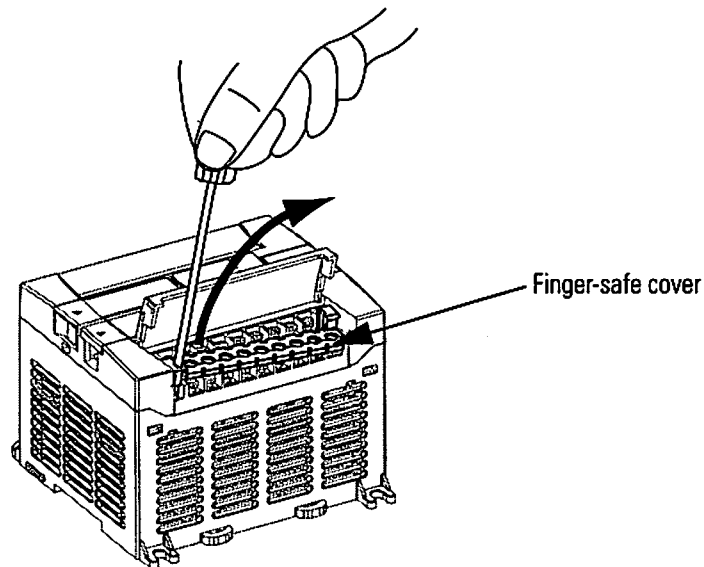
When wiring without spade lugs, keep the finger-safe covers in place. Loosen the terminal screw and route the wires through the opening in the finger-safe cover. Tighten the terminal screw, making sure the pressure plate secures the wire.



Spade Lug Recommendation

The diameter of the terminal screw head is 5.5 mm (0.220 in.). The input and output terminals of the MicroLogix 1200 controller are designed for the following spade lugs. The terminals will accept a 6.35mm (0.25 in.) wide spade (standard for #6 screw for up to 14 AWG) or a 4 mm (metric #4) fork terminal.

When using spade lugs, use a small, flat-blade screwdriver to pry the finger-safe cover from the terminal blocks. Then loosen the terminal screw.



TIP

If you wire the terminal block with the finger-safe cover removed, you may not be able to put it back on the terminal block if the wires are in the way.

Surge Suppression

ATTENTION

Inductive load devices such as motor starters and solenoids require the use of some type of surge suppression to protect the controller output. Switching inductive loads without surge suppression can significantly reduce the life of relay contacts or damage transistor outputs. By using suppression, you also reduce the effects of voltage transients caused by interrupting the current to that inductive device, and prevent electrical noise from radiating into system wiring. Refer to the *MicroLogix 1200 Programmable Controller User Manual*, publication 1762-UM001, for more information on surge suppression.

Grounding the Controller

In solid-state control systems, grounding and wire routing helps limit the effects of noise due to electromagnetic interference (EMI). Run the ground connection from the ground screw of the controller to the ground bus prior to connecting any devices. Use AWG #14 wire. For AC-powered controllers, this connection must be made for safety purposes.

ATTENTION



All devices connected to the RS-232 channel must be referenced to controller ground, or be floating (not referenced to a potential other than ground). Failure to follow this procedure may result in property damage or personal injury.

- For 1762-L24BWA, 1762-L40BWA, 1762-L24BWAR and 1762-L40BWAR controllers:

The COM of the sensor supply is also connected to chassis ground internally. The 24V dc sensor power source should not be used to power output circuits. It should only be used to power input devices.

- For 1762-L24BXB, 1762-L40BXB, 1762-L24BXBR and 1762-L40BXBR controllers:

The VDC NEUT or common terminal of the power supply is also connected to chassis ground internally.

You must also provide an acceptable grounding path for each device in your application. For more information on proper grounding guidelines, refer to the *Industrial Automation Wiring and Grounding Guidelines*, publication 1770-4.1.

Specifications

General Specifications

Description	1762-						
	L24AWA, L24AWAR	L24BWA, L24BWAR	L24BXB, L24BXBR	40AWA, 40AWAR	L40BWA, L40BWAR	L40BXB, L40BXBR	
Dimensions	Height: 90 mm, 104 mm (with DIN latch open) Width: 110 mm, Depth: 87 mm			Height: 90 mm 104 mm (with DIN latch open) Width: 160 mm, Depth: 87 mm			
Shipping Weight	0.9 kg (2.0 lbs)			1.1 kg (2.4 lbs)			
Number of I/O	14 inputs and 10 outputs			24 inputs, 16 outputs			
Power Supply	100 to 240V ac (-15%, +10%) at 47 to 63 Hz		24V dc (-15%, +10%) Class 2 SELV	100 to 240V ac (-15%, +10%) at 47 to 63 Hz		24V dc (-15%, +10%) Class 2 SELV	
Heat Dissipation	Refer to the MicroLogix 1200 Programmable Controllers User Manual.						
Power Supply Inrush	120V ac: 25A for 8 ms 240V ac: 40A for 4 ms		24V dc: 15A for 20 ms	120V ac: 25A for 8 ms 240V ac: 40A for 4 ms		24V dc: 15A for 30 ms	
Power Supply Usage	68 VA	70 VA	27W	80 VA	82 VA	40W	
Power Supply Output	5V dc	400 mA	400 mA ⁽¹⁾	400 mA	600 mA	600 mA ⁽²⁾	600 mA
	24V dc	350 mA	350 mA ⁽¹⁾	350 mA	500 mA	500 mA ⁽²⁾	500 mA
Sensor Power Output	none	24V dc at 250 mA 400 μ F max. ⁽¹⁾	none	none	24V dc at 400 mA 400 μ F max. ⁽²⁾	none	
Input Circuit Type	120V ac	24V dc sink/source	24V dc sink/source	120V ac	24V dc sink/source	24V dc sink/source	
Output Circuit Type	Relay	Relay	Relay/FET	Relay	Relay	Relay/FET	
Operating Temp.	+0°C to +55°C (+32°F to +131°F) ambient						
Storage Temp.	-40°C to +85°C (-40°F to +185°F) ambient						
Operating Humidity	5% to 95% relative humidity (non-condensing)						
Vibration	Operating: 10 to 500 Hz, 5G, 0.030 in. max. peak-to-peak, 2 hours each axis Relay Operation: 1.5G						

Description	1762-					
	L24AWA, L24AWAR	L24BWA, L24BWAR	L24BXB, L24BXBR	40AWA, 40AWAR	L40BWA, L40BWAR	L40BXB, L40BXBR
Shock	Operating: 30G; 3 pulses each direction, each axis Relay Operation: 7G Non-Operating: 50G panel mounted (40G DIN Rail mounted); 3 pulses each direction, each axis					
Agency Certification	<ul style="list-style-type: none"> • UL 508 • C-UL under CSA C22.2 no. 142 • Class I, Div. 2, Groups A, B, C, D (UL 1604, C-UL under CSA C22.2 no. 213) • CE/C-Tick compliant for all applicable directives 					
Electrical/EMC	The controller has passed testing at the following levels: <ul style="list-style-type: none"> • IEC1000-4-2: 4 kV contact, 8 kV air, 4 kV indirect • IEC1000-4-3: 10V/m, 80 to 1000 MHz, 80% amplitude modulation, +900 MHz keyed carrier • IEC1000-4-4: 2 kV, 5 kHz; communications cable: 1 kV, 5 kHz • IEC1000-4-5: communications cable 1 kV galvanic gun I/O: 2 kV CM (common mode), 1 kV DM (differential mode) AC Power Supply: 4 kV CM (common mode), 2 kV DM (differential mode) DC Power Supply: 500V CM (common mode), 500V DM (differential mode) • IEC1000-4-6: 10V, communications cable 3V 					
Terminal Screw Torque	0.791 Nm (7 in-lb) rated					

⁽¹⁾ Do not allow the total load power consumed by the 5V dc, 24V dc, and sensor power outputs to exceed 12W.

⁽²⁾ Do not allow the total load power consumed by the 5V dc, 24V dc, and sensor power outputs to exceed 16W.

Refer to the MicroLogix 1200 User Manual for system validation worksheets.

Input Specifications

Description	1762-L24AWA, -L40AWA 1762-L24AWAR, -L40AWAR	1762-L24BWA, -L24BXB, -L40BWA, -L40BXB 1762-L24BWAR, -L24BXBR, -L40BWAR, -L40BXBR	
		Inputs 0 through 3	Inputs 4 and higher
On-State Voltage Range	79 to 132V ac	14 to 24V dc (+10% at 55°C/131°F) (+25% at 30°C/86°F)	10 to 24V dc (+10% at 55°C/131°F) (+25% at 30°C/86°F)
Off-State Voltage Range	0 to 20V ac	0 to 5V dc	
Operating Frequency	47 Hz to 63 Hz	0 Hz to 20 kHz	0 Hz to 1 kHz (scan time dependent)
On-State Current:			
<ul style="list-style-type: none"> • minimum • nominal • maximum 	<ul style="list-style-type: none"> • 5.0 mA at 79V ac • 12 mA at 120V ac • 16.0 mA at 132V ac 	<ul style="list-style-type: none"> • 2.5 mA at 14V dc • 7.3 mA at 24V dc • 12.0 mA at 30V dc 	<ul style="list-style-type: none"> • 2.0 mA at 10V dc • 8.9 mA at 24V dc • 12.0 mA at 30V dc
Off-State Leakage Current	2.5 mA max.	1.5 mA min.	
Nominal Impedance	12K Ω at 50 Hz 10K Ω at 60 Hz	3.3K Ω	2.7K Ω
Inrush Current (max.) at 120V ac	250 mA	Not Applicable	

Output Specifications

General

Description	1762			
	-L24AWA -L24BWA -L24AWAR -L24BWAR	-L24BXB -L24BXBR	-L40AWA -L40BWA -L40AWAR -L40BWAR	-L40BXB -L40BXBR
Relay and FET Outputs				
Maximum Controlled Load	1440 VA			
Maximum Continuous Current:				
Current per Group Common	8A	7.5A	8A	8A
Current per Controller	at 150V max	30A or total of per-point loads, whichever is less		
	at 240V max	20A or total of per-point loads, whichever is less		
Relay Outputs				
Turn On Time/Turn Off Time	10 msec (minimum) ⁽¹⁾			
Load Current	10 mA (minimum)			

⁽¹⁾ scan time dependent

Relay Contact Ratings

Maximum Volts	Amperes		Amperes Continuous	Volt-Amperes	
	Make	Break		Make	Break
240V ac	7.5A	0.75A	2.5A ⁽²⁾	1800 VA	180 VA
120V ac	15A	1.5A	2.5A ⁽²⁾	1800 VA	180 VA
125V dc	0.22A ⁽¹⁾		1.0A	28 VA	
24V dc	1.2A ⁽¹⁾		2.0A		

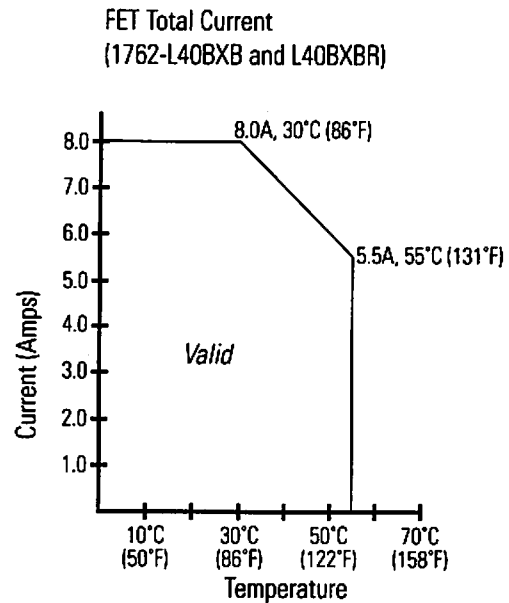
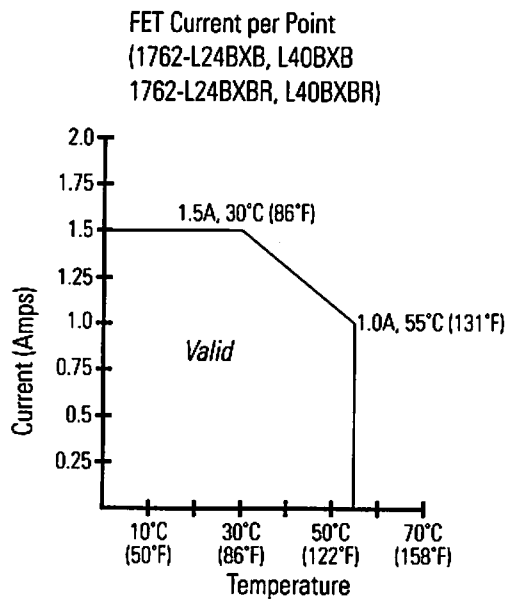
⁽¹⁾ For dc voltage applications, the make/break ampere rating for relay contacts can be determined by dividing 28 VA by the applied dc voltage. For example, 28 VA/48V dc = 0.58A. For dc voltage applications less than 14V, the make/break ratings for relay contacts cannot exceed 2A.

⁽²⁾ 1.5A above 40°C.

BXB FET Output Specifications

Description	General Operation	High Speed Operation ⁽¹⁾ (Output 2 Only)
Power Supply Voltage	24V dc (-15%, +10%)	
On-State Voltage Drop:	<ul style="list-style-type: none"> • 1V dc • 2.5V dc 	<ul style="list-style-type: none"> • Not Applicable • Not Applicable
Current Rating per Point	<ul style="list-style-type: none"> • See graphs below. • 1.0 mA • 1.0 mA 	<ul style="list-style-type: none"> • 100 mA • 10 mA • 1.0 mA

Maximum Output Current (temperature dependent):



Surge Current per Point:		
<ul style="list-style-type: none"> • peak current • maximum surge duration • maximum rate of repetition at 30°C (86°F) • maximum rate of repetition at 55°C (131°F) 	<ul style="list-style-type: none"> • 4.0A • 10 msec • once every second • once every 2 seconds 	<ul style="list-style-type: none"> • Not Applicable • Not Applicable • Not Applicable • Not Applicable

Description	General Operation	High Speed Operation ⁽¹⁾
		(Output 2 Only)
Turn-On Time (maximum)	0.1 msec	6 µsec
Turn-Off Time (maximum)	1.0 msec	18 µsec
Repeatability (maximum)	n/a	2 µsec
Drift (maximum)	n/a	1 µsec per 5°C (9°F)

⁽¹⁾ Output 2 is designed to provide increased functionality over the other FET outputs. Output 2 may be used like the other FET transistor outputs, but in addition, within a limited current range, it may be operated at a higher speed. Output 2 also provides a pulse train output (PTO) or pulse width modulation output (PWM) function.

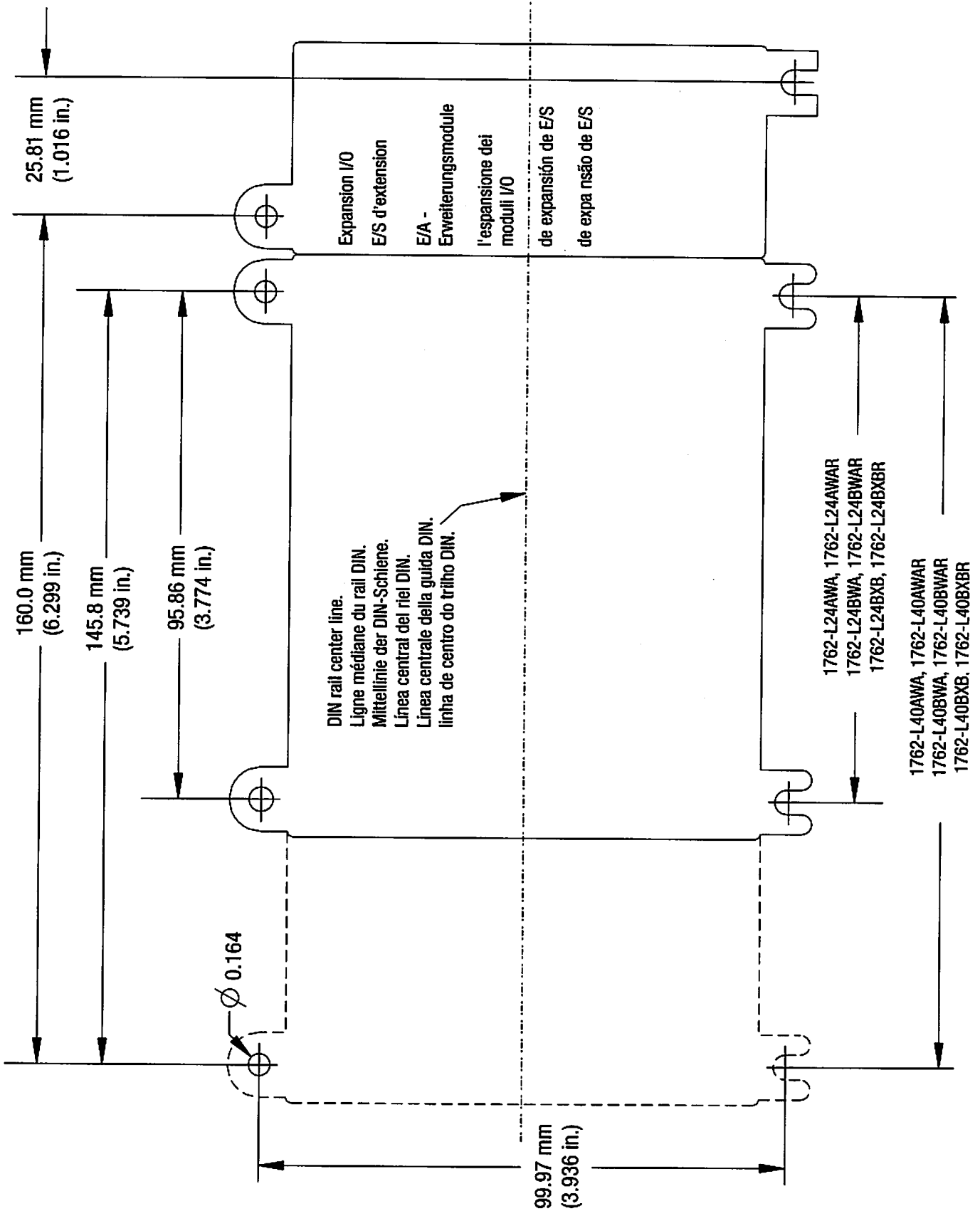
Working Voltage

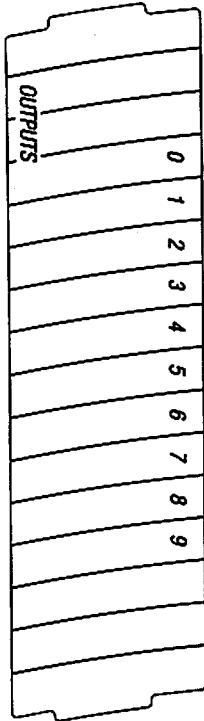
Description	1762-L24AWA, 1762-L40AWA, 1762-L24AWAR, 1762-L40AWAR
Power Supply Input to Backplane Isolation	Verified by one of the following dielectric tests: 1836V ac for 1 second or 2596V dc for 1 second
	265V ac Working Voltage (IEC Class 2 reinforced insulation)
Input Group to Backplane Isolation	Verified by one of the following dielectric tests: 1517V ac for 1 second or 2145V dc for 1 second
	132V ac Working Voltage (IEC Class 2 reinforced insulation)
Input Group to Input Group Isolation	Verified by one of the following dielectric tests: 1517V ac for 1 second or 2145V dc for 1 second
	132V ac Working Voltage (basic insulation)
Output Group to Backplane Isolation	Verified by one of the following dielectric tests: 1836V ac for 1 second or 2596V dc for 1 second
	265V ac Working Voltage (IEC Class 2 reinforced insulation)
Output Group to Output Group Isolation	Verified by one of the following dielectric tests: 1836V ac for 1 second or 2596V dc for 1 second
	265V ac Working Voltage (basic insulation) 150V ac Working Voltage (IEC Class 2 reinforced insulation).

Description	1762-L24BWA, 1762-L40BWA, 1762-L24BWAR, 1762-L40BWAR
Power Supply Input to Backplane Isolation	Verified by one of the following dielectric tests: 1836V ac for 1 second or 2596V dc for 1 second
	265V ac Working Voltage (IEC Class 2 reinforced insulation)
Input Group to Backplane Isolation and Input Group to Input Group Isolation	Verified by one of the following dielectric tests: 1200V ac for 1 second or 1697V dc for 1 second
	75V dc Working Voltage (IEC Class 2 reinforced insulation)
Output Group to Backplane Isolation	Verified by one of the following dielectric tests: 1836V ac for 1 second or 2596V dc for 1 second
	265V ac Working Voltage (IEC Class 2 reinforced insulation).
Output Group to Output Group Isolation	Verified by one of the following dielectric tests: 1836V ac for 1 second or 2596V dc for 1 second
	265V ac Working Voltage (basic insulation) 150V Working Voltage (IEC Class 2 reinforced insulation)

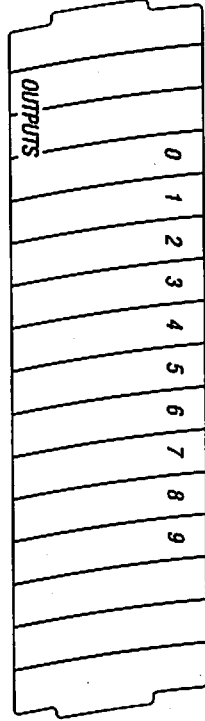
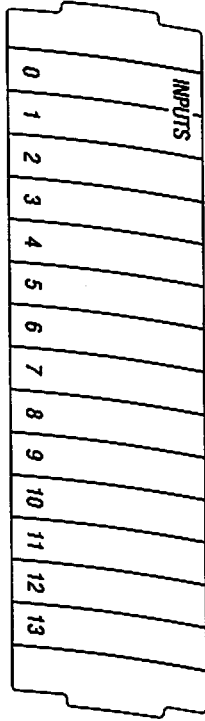
Description	1762-L24BXB, 1762-L40BXB, 1762-L24BXBR, 1762-L40BXBR
Input Group to Backplane Isolation and Input Group to Input Group Isolation	Verified by one of the following dielectric tests: 1200V ac for 1 second or 1697V dc for 1 second
	75V dc Working Voltage (IEC Class 2 reinforced insulation)
FET Output Group to Backplane Isolation	Verified by one of the following dielectric tests: 1200V ac for 1 second or 1697V dc for 1 second
	75V dc Working Voltage (IEC Class 2 reinforced insulation)
Relay Output Group to Backplane Isolation	Verified by one of the following dielectric tests: 1836V ac for 1 second or 2596V dc for 1 second
	265V ac Working Voltage (IEC Class 2 reinforced insulation).
Relay Output Group to Relay Output Group and FET Output Group Isolation	Verified by one of the following dielectric tests: 1836V ac for 1 second or 2596V dc for 1 second
	265V ac Working Voltage (basic insulation) 150V Working Voltage (IEC Class 2 reinforced insulation)

Notes:

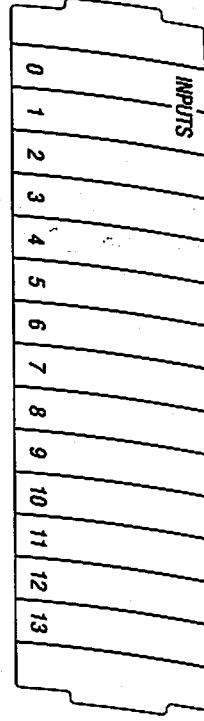


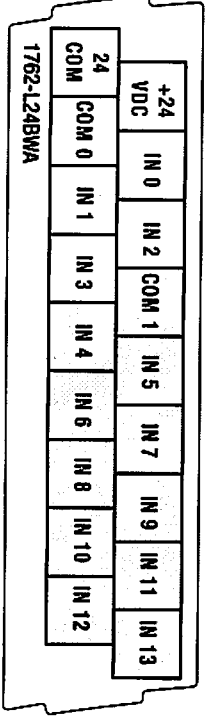
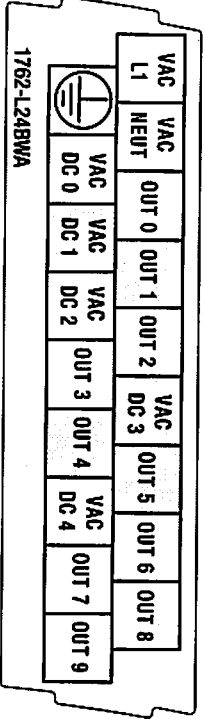
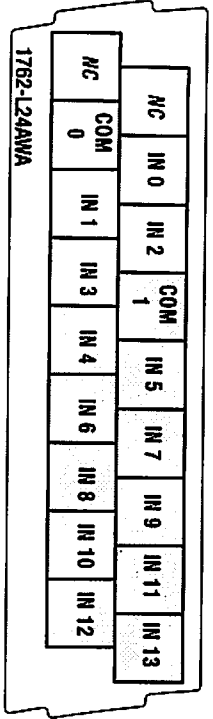
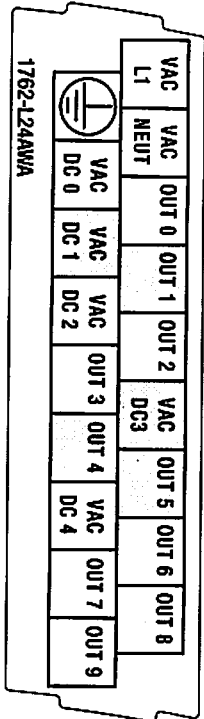


L24AWA L24AWAR



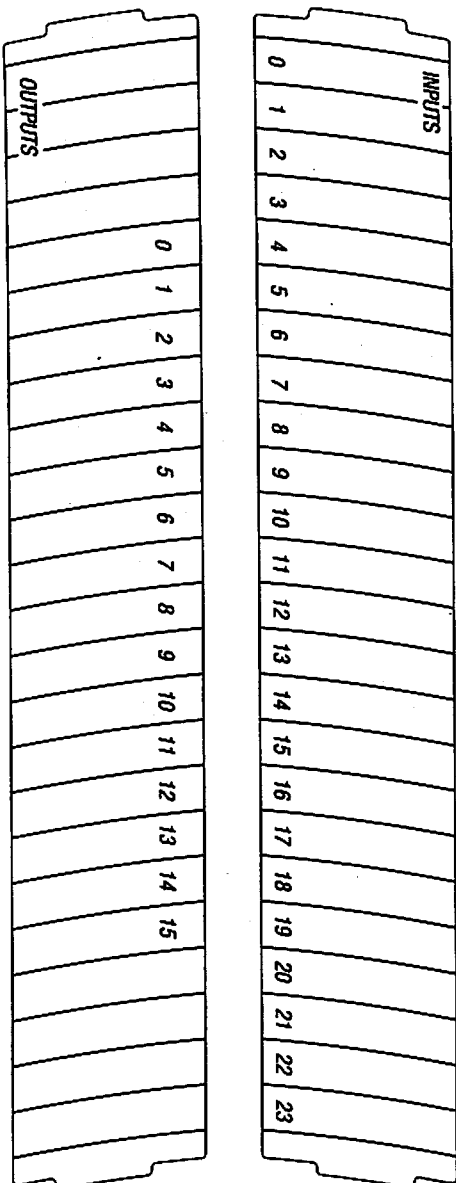
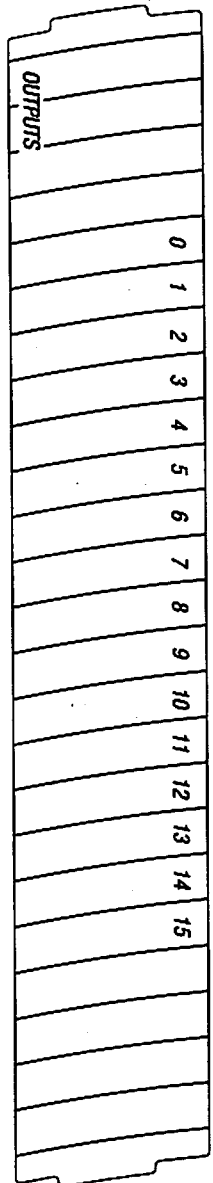
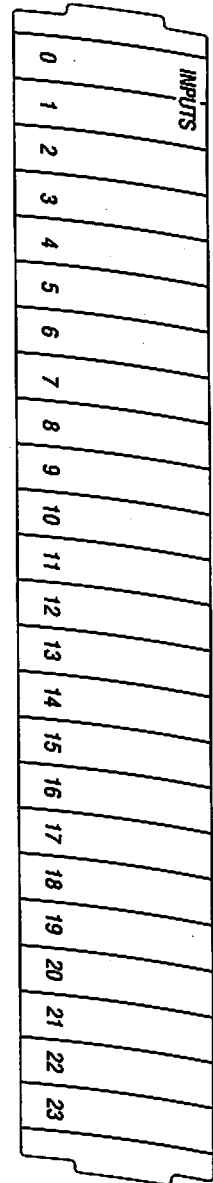
L24BWA L24BWAR





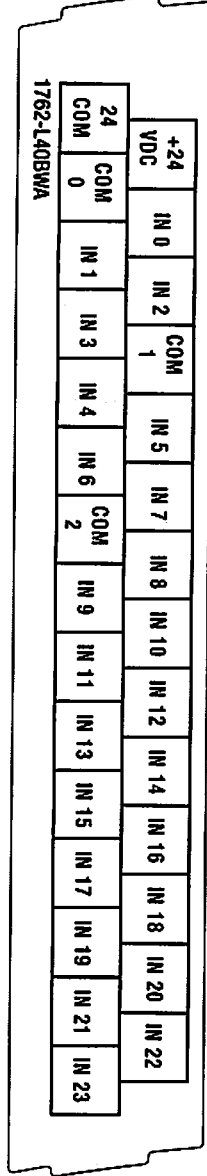
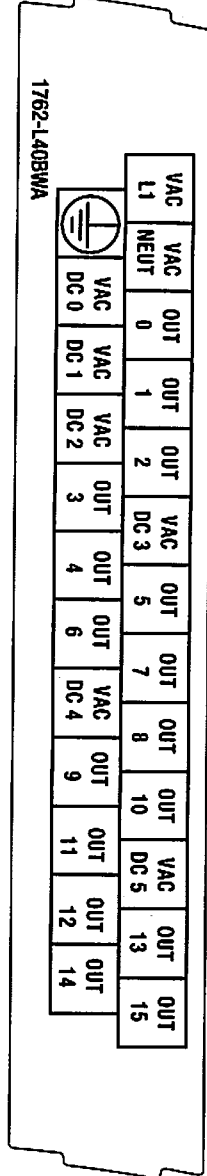
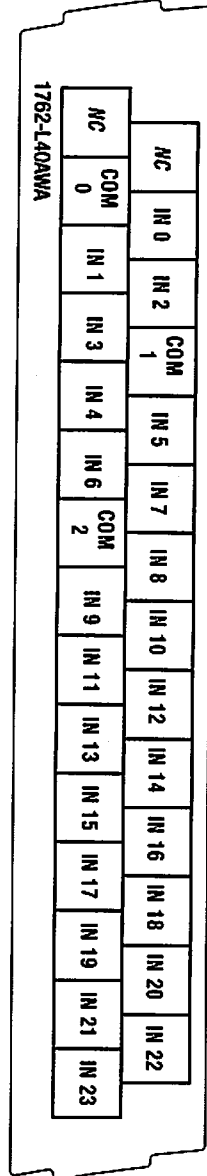
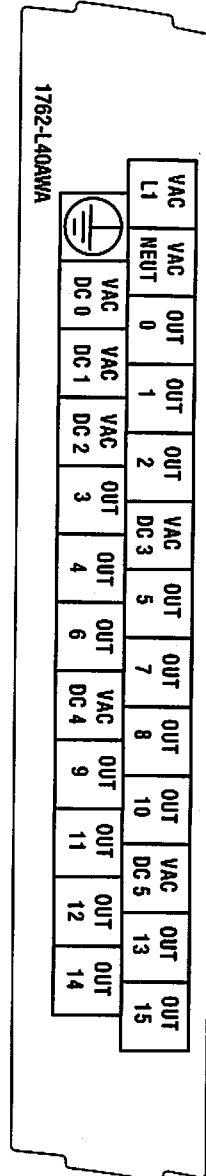
L24BWA L24BWAR

L24AWA L24AWAR



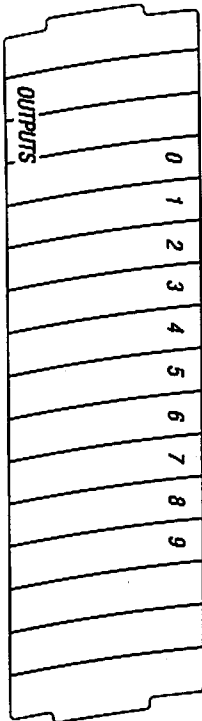
L40AWA L40AWAR

L40BWA L40BWAR

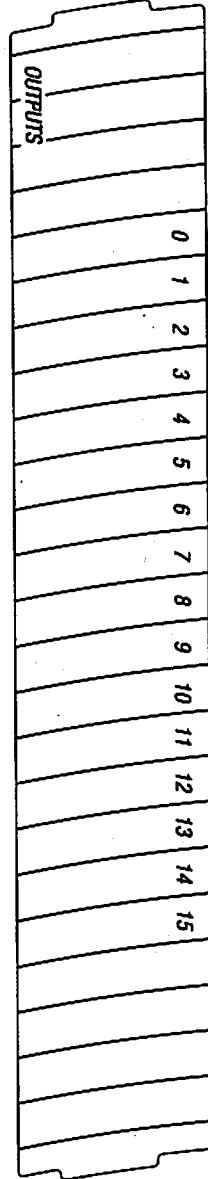
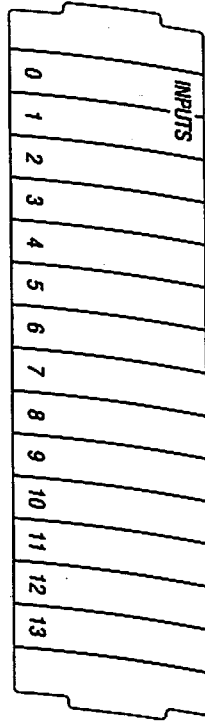


L40BWA L40BWAR

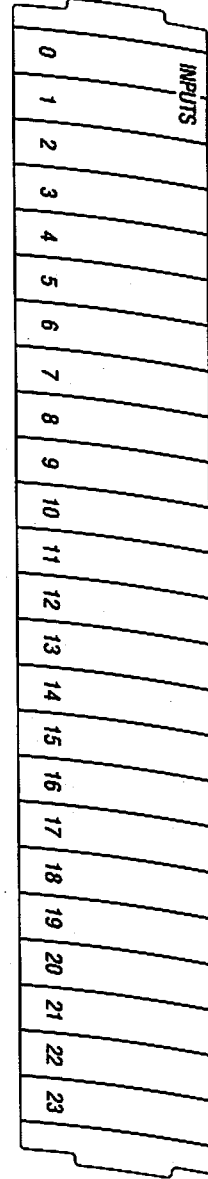
L40AWA L40AWAR

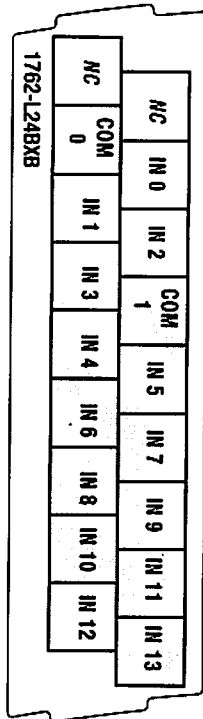
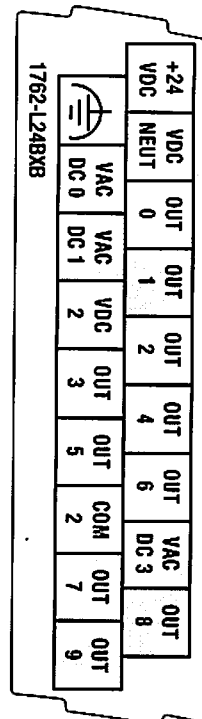


L24BXB L24BXBR

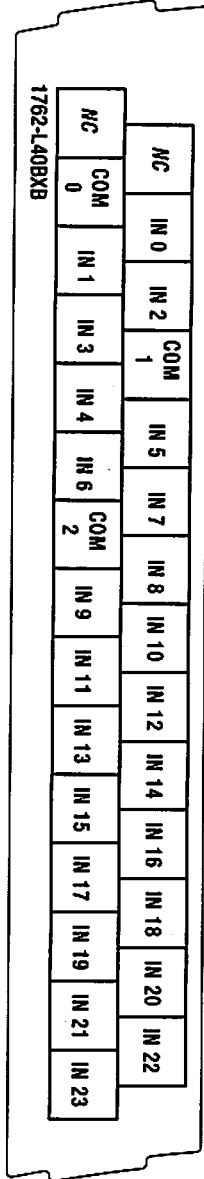
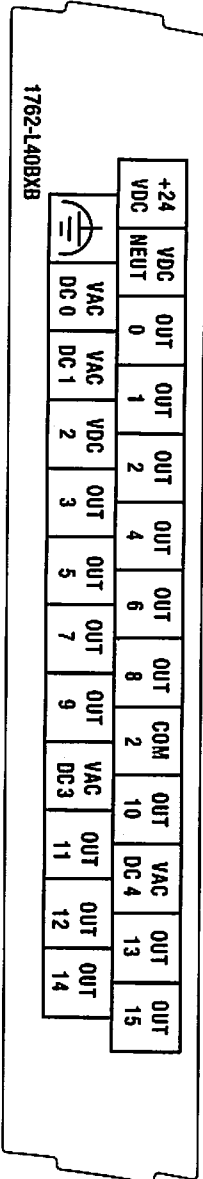


L40BXB L40BXBR





L24BxB L24BxBR



L40BxB L40BxBR

Rockwell Automation Support

Rockwell Automation provides technical information on the Web to assist you in using its products. At <http://support.rockwellautomation.com>, you can find technical manuals, a knowledge base of FAQs, technical and application notes, sample code and links to software service packs, and a MySupport feature that you can customize to make the best use of these tools.

For an additional level of technical phone support for installation, configuration and troubleshooting, we offer TechConnect support programs. For more information, contact your local distributor or Rockwell Automation representative, or visit <http://support.rockwellautomation.com>.

Installation Assistance

If you experience a problem with a hardware module within the first 24 hours of installation, please review the information that's contained in this manual. You can also contact a special Customer Support number for initial help in getting your module up and running:

United States	1.440.646.3434 Monday – Friday, 8am – 5pm EST
Outside United States	Please contact your local Rockwell Automation representative for any technical support issues.

New Product Satisfaction Return

Rockwell Automation tests all of its products to ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned, follow these procedures.

United States	Contact your distributor. You must provide a Customer Support case number (see phone number above to obtain one) to your distributor in order to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for return procedure.

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Publication 1762-IN006C-EN-P - September 2009

Supersedes Publication 1762-IN006B-EN-P - March 2008

PN 40072-073-01(7)

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MicroLogix™ 1200 Thermocouple/mV Input Module

(Catalog Number 1762-IT4)

Inside...

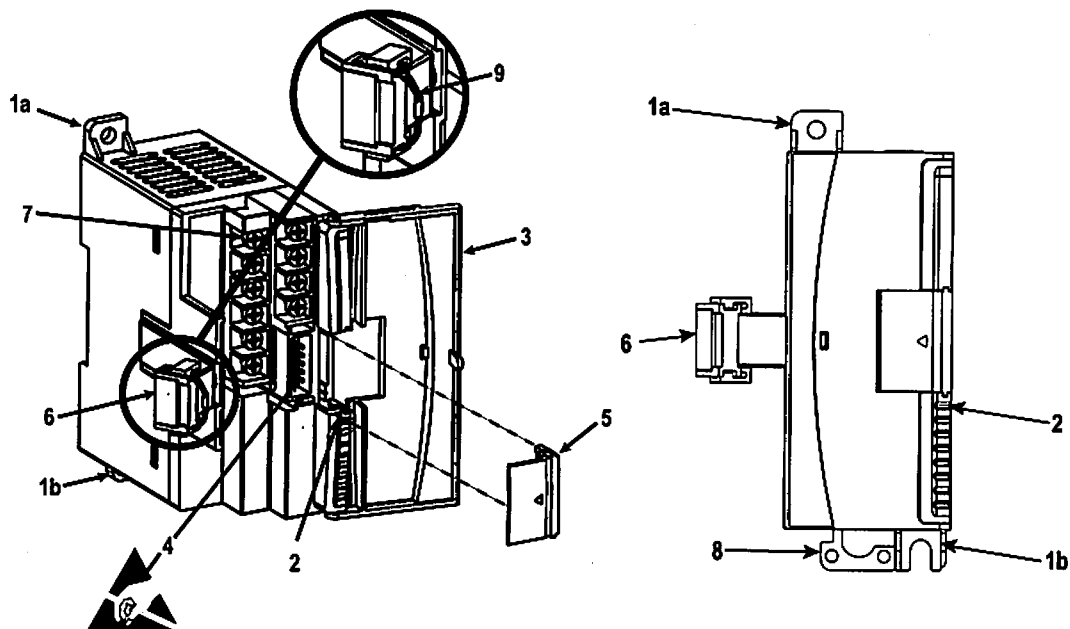
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Module Overview

The thermocouple/mV modules receives and stores digitally converted thermocouple and/or millivolt (mV) analog data from any combination of up to four thermocouple or millivolt analog sensors. Each input channel is individually configurable via software for a specific input device and provides open-circuit, over-range and under-range detection and indication. The module receives all of its +5V dc and +24V dc power from the 1762 expansion I/O bus. The module features a terminal block with a cold-junction compensation (CJC) sensor.

Accepted Inputs	Range
Thermocouple Type J	-210 to +1200°C (-346 to +2192°F)
Thermocouple Type K	-270 to +1370°C (-454 to +2498°F)
Thermocouple Type T	-270 to +400°C (-454 to +752°F)
Thermocouple Type E	-270 to +1000°C (-454 to +1832°F)
Thermocouple Type R	0 to +1768°C (+32 to +3214°F)
Thermocouple Type S	0 to +1768°C (+32 to +3214°F)
Thermocouple Type B	+300 to +1820°C (+572 to +3308°F)
Thermocouple Type N	-210 to +1300°C (-346 to +2372°F)
Thermocouple Type C	0 to +2315°C (+32 to + 4199°F)
millivolt inputs	-50 to +50 mV
	-100 to +100 mV

Description



Item	Description	Item	Description
1a	upper panel mounting tab	5	bus connector cover
1b	lower panel mounting tab	6	flat ribbon cable with bus connector (female)
2	power diagnostic LED	7	terminal block
3	module door with terminal identification label	8	DIN rail latch
4	bus connector with male pins	9	pull loop

Module Installation

1762 I/O is suitable for use in an industrial environment when installed in accordance with these instructions. Specifically, this equipment is intended for use in clean, dry environments (Pollution degree 2⁽¹⁾) and to circuits not exceeding Over Voltage Category II⁽²⁾ (IEC 60664-1).⁽³⁾

- (1) Pollution Degree 2 is an environment where, normally, only non-conductive pollution occurs except that occasionally a temporary conductivity caused by condensation shall be expected.
- (2) Over Voltage Category II is the load level section of the electrical distribution system. At this level transient voltages are controlled and do not exceed the impulse voltage capability of the product's insulation.
- (3) Pollution Degree 2 and Over Voltage Category II are International Electrotechnical Commission (IEC) designations.

Prevent Electrostatic Discharge

ATTENTION



Electrostatic discharge can damage integrated circuits or semiconductors if you touch bus connector pins. Follow these guidelines when you handle the module:

- Touch a grounded object to discharge static potential.
 - Wear an approved wrist-strap grounding device.
 - Do not touch the bus connector or connector pins.
 - Do not touch circuit components inside the module.
 - If available, use a static-safe work station.
 - When not in use, keep the module in its static-shield box.
-

Remove Power

ATTENTION



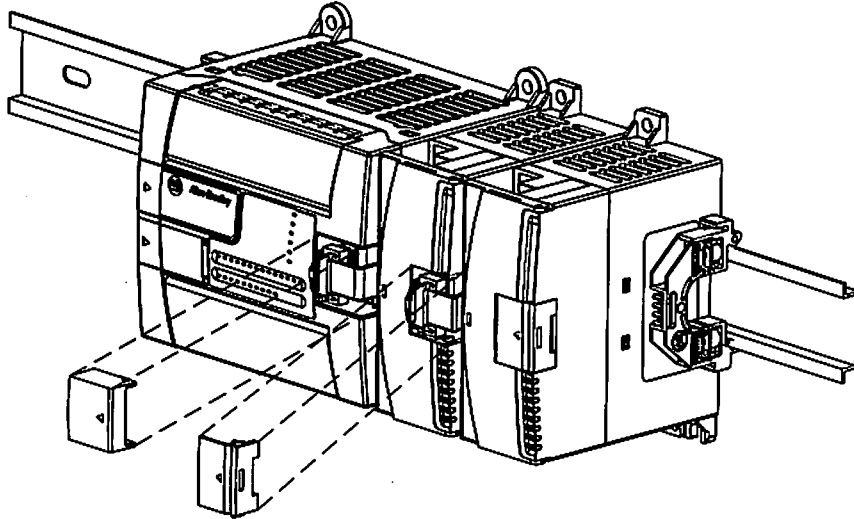
Remove power before removing or installing this module. When you remove or install a module with power applied, an electrical arc may occur. An electrical arc can cause personal injury or property damage by:

- sending an erroneous signal to your system's field devices, causing unintended machine motion
- causing an explosion in a hazardous environment
- causing permanent damage to the module's circuitry

Electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance.

System Assembly

The expansion I/O module is attached to the controller or another I/O module by means of a ribbon cable *after* mounting as shown below.

**TIP**

Use the pull loop on the connector to disconnect modules. Do not pull on the ribbon cable.

**WARNING****EXPLOSION HAZARD**

- In Class I, Division 2 applications, the bus connector must be fully seated and the bus connector cover must be snapped in place.
- In Class I, Division 2 applications, all modules must be mounted in direct contact with each other as shown on page 7. If DIN rail mounting is used, an end stop must be installed ahead of the controller and after the last 1762 I/O module.

Mounting

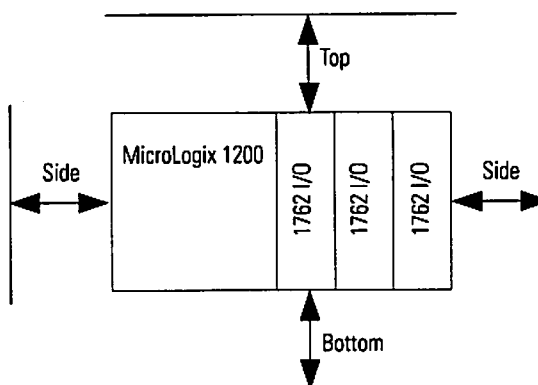
ATTENTION



Do not remove protective debris strip until after the module and all other equipment near the module is mounted and wiring is complete. Once wiring is complete and the module is free of debris, carefully remove protective debris strip. Failure to remove strip before operating can cause overheating.

Minimum Spacing

Maintain spacing from enclosure walls, wireways, adjacent equipment, etc. Allow 50.8 mm (2 in.) of space on all sides for adequate ventilation, as shown:



TIP



1762 expansion I/O may be mounted horizontally only.

ATTENTION



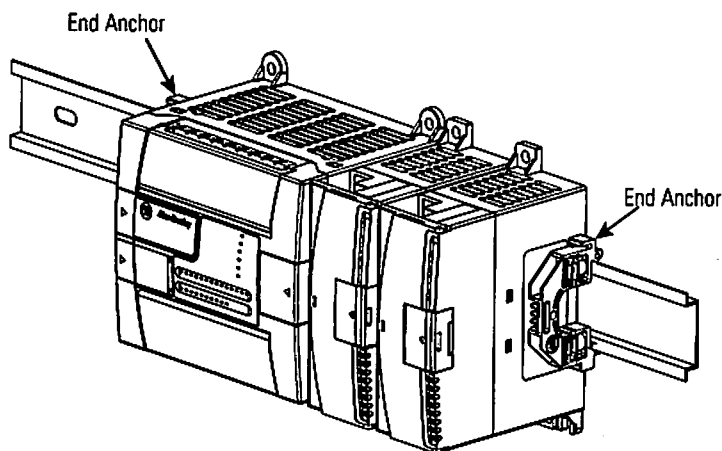
During panel or DIN rail mounting of all devices, be sure that all debris (metal chips, wire strands, etc.) is kept from falling into the module. Debris that falls into the module could cause damage when power is applied to the module.

DIN Rail Mounting

The module can be mounted using the following DIN rails: 35 x 7.5 mm (EN 50 022 - 35 x 7.5) or 35 x 15 mm (EN 50 022 - 35 x 15).

Before mounting the module on a DIN rail, close the DIN rail latch. Press the DIN rail mounting area of the module against the DIN rail. The latch will momentarily open and lock into place.

Use DIN rail end anchors (Allen-Bradley part number 1492-EA35 or 1492-EAH35) for environments with vibration or shock concerns.



TIP

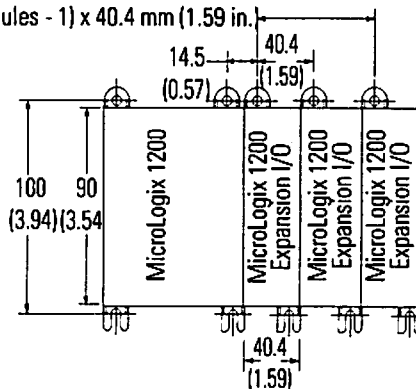


For environments with extreme vibration and shock concerns, use the panel mounting method described below, instead of DIN rail mounting.

Panel Mounting

Use the dimensional template shown below to mount the module. The preferred mounting method is to use two M4 or #8 panhead screws per module. M3.5 or #6 panhead screws may also be used, but a washer may be needed to ensure a good ground contact. Mounting screws are required on every module.

For more than 2 modules: (number of modules - 1) x 40.4 mm (1.59 in.)



NOTE:
Hole spacing tolerance:
±0.4 mm (0.016 in.).

Field Wiring Connections

Grounding the Module

This product is intended to be mounted to a well-grounded mounting surface such as a metal panel. Additional grounding connections from the module's mounting tabs or DIN rail (if used), are not required unless the mounting surface cannot be grounded. Refer to *Industrial Automation Wiring and Grounding Guidelines*, Allen-Bradley publication 1770-4.1, for additional information.

System Wiring Guidelines

ATTENTION



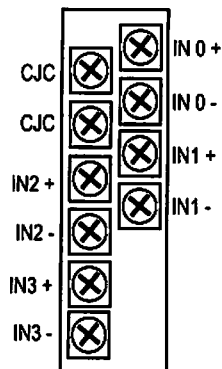
The possibility exists that grounded or exposed thermocouples can become shorted to a potential greater than that of the thermocouple itself. Due to possible shock hazard, care should be taken when wiring these types of thermocouples.

Consider the following when wiring your system:

- Do not tamper with or remove the CJC sensor on the terminal block. Removal of the sensor will reduce accuracy and set the open circuit bit for the CJC sensor.
- For thermocouple inputs, always use shielded, twisted-pair thermocouple extension lead wires specified by the thermocouple manufacturer for the thermocouple type you are using. Using an incorrect thermocouple extension wire type or not following correct polarity convention will cause invalid readings.
- Keep cable shield connection to ground as short as possible.
- To limit noise, keep thermocouple and millivolt signal wires as far away as possible from power and load lines as well as other sources of electrical noise, such as motors, transformers, contactors, and AC devices.
- If the field wiring must cross AC or power cables, ensure that they cross at right angles.

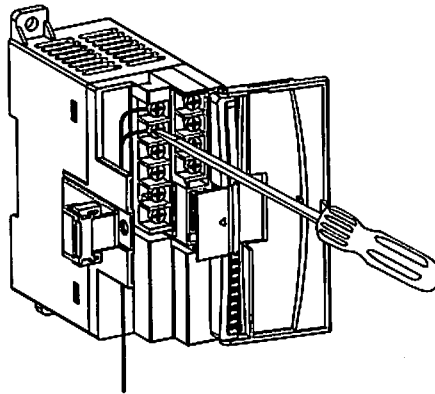
- For millivolt inputs, always use Belden™ 8761 (shielded, twisted-pair) or equivalent wire to ensure proper operation and high immunity to electrical noise.
- If multiple power supplies are used with millivolt analog inputs, the power supply commons must be connected.
- Ground the shield drain wire at one end only. The typical location is the same point as the sensor ground reference.
 - For grounded thermocouples or millivolt sensors, this is at the sensor end.
 - For insulated/ungrounded thermocouples, this is at the module end.
Contact your sensor manufacturer for additional details.
- If it is necessary to connect the shield drain at the module end, connect it to earth ground using a panel or DIN rail mounting screw.
- Routing the field wiring in a grounded conduit can further reduce electrical noise.

Terminal Block Layout



Labeling the Terminals

A write-on label is provided with the module. Mark the identification of each terminal with permanent ink, and slide the label back into the door.



Wiring the Finger-Safe Terminal Block

ATTENTION



Be careful when stripping wires. Wire fragments that fall into a module could cause damage when power is applied. Once wiring is complete, ensure the module is free of all metal fragments.

When wiring the terminal block, keep the finger-safe cover in place.

1. Route the wire under the terminal pressure plate. You can use the stripped end of the wire or a spade lug. The terminals will accept a 6.35 mm (0.25 in.) spade lug.
2. Tighten the terminal screw making sure the pressure plate secures the wire. Recommended torque when tightening terminal screws is 0.904 Nm (8 in-lbs).
3. After wiring is complete, remove the debris shield.

TIP



If you need to remove the finger-safe cover, insert a screw driver into one of the square wiring holes and gently pry the cover off. If you wire the terminal block with the finger-safe cover removed, you will not be able to put it back on the terminal block because the wires will be in the way.

Wire Size and Terminal Screw Torque

Each terminal accepts up to two wires with the following restrictions:

Wire Type		Wire Size	Terminal Screw Torque
Solid	Cu-90°C (194°F)	#14 to #22 AWG	0.904 Nm (8 in-lbs)
Stranded	Cu-90°C (194°F)	#16 to #22 AWG	0.904 Nm (8 in-lbs)

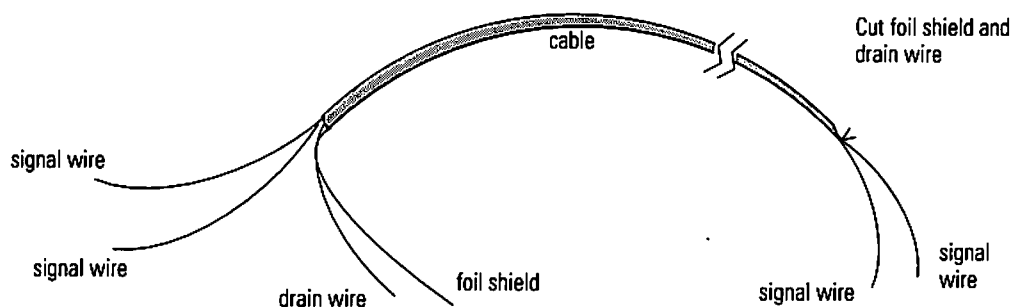
Wiring Input Devices to the 1762-IT4

ATTENTION



Be careful when stripping wires. Wire fragments that fall into a module could cause damage at power up. Once wiring is complete, ensure the module is free of all metal fragments.

After the thermocouple module is properly installed, follow the wiring procedure below, using the shielded thermocouple extension cable recommended for the type of thermocouple you are using, or Belden 8761 for non-thermocouple applications.

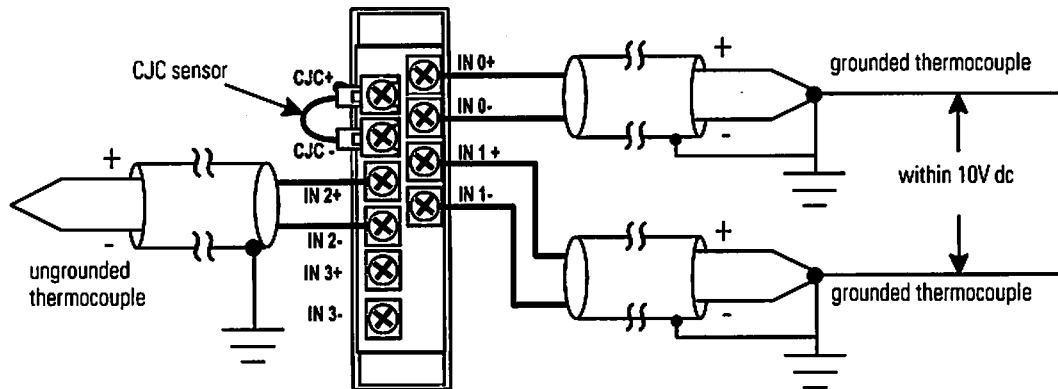


To wire your sensor to the module, follow these steps:

1. At each end of the cable, strip some casing to expose the individual wires.
2. Trim the signal wires to 2-inch lengths. Strip about 3/16 inch (5 mm) of insulation away to expose the end of the wire.
3. At one end of the cable, twist the drain wire and foil shield together, bend them away from the cable, and apply shrink wrap. Then earth ground at the preferred location based on the type of sensor you are using.
4. At the other end of the cable, cut the drain wire and foil shield back to the cable and apply shrink wrap.

5. Connect the signal wires to the module terminal block and input.
6. Repeat steps 1 through 5 for each channel on the module.

Terminal Block with CJC Sensor and Thermocouple Junctions



TIP

When using an ungrounded thermocouple, the shield must be connected to ground at the module end.



IMPORTANT

When using grounded and/or exposed thermocouples that are touching electrically conductive material, the ground potential between any two channels cannot exceed $\pm 10V$ dc, or temperature readings will be inaccurate and the module may be damaged.

Cold-Junction Compensation (CJC)

To obtain accurate readings from each of the channels, the temperature at the terminal junction between the thermocouple wire and the input channel must be compensated for. A cold-junction compensating thermistor has been integrated in the terminal block, as shown on page 12.

ATTENTION

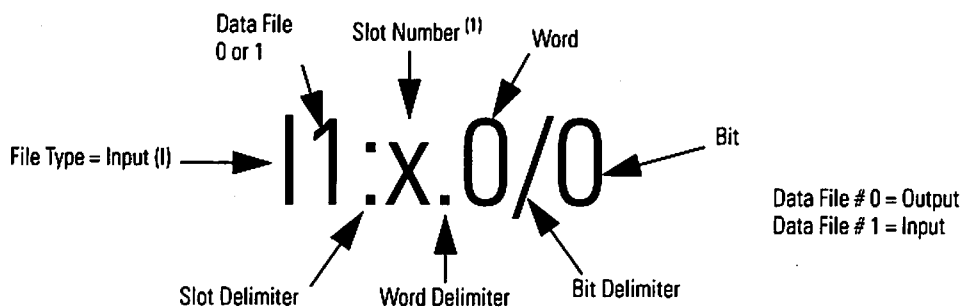


Do not remove or loosen the cold-junction compensating thermistor assembly on the terminal block. The thermistor assembly is critical to ensure accurate thermocouple input readings at each channel. If the CJC sensor is removed, the open-circuit detection bit (OC4) and the general status bit (S4) are set. The module will continue to operate, but with reduced accuracy.

I/O Memory Mapping

Addressing

The addressing scheme for 1762 Expansion I/O is shown below.



(1) I/O located on the controller (embedded I/O) is slot 0. I/O added to the controller (expansion I/O) begins with slot 1.

Input Data File

For each module, slot x, words 0 through 3 contain the analog values of the inputs. The input data file is shown below.

Word/ Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	SGN	Analog Input Data Channel 0														
1	SGN	Analog Input Data Channel 1														
2	SGN	Analog Input Data Channel 2														
3	SGN	Analog Input Data Channel 3														
4	Reserved			OC4	OC3	OC2	OC1	OC0	Reserved			S4	S3	S2	S1	S0
5	U0	O0	U1	O1	U2	O2	U3	O3	U4	O4	Reserved					

The bits are defined as follows:

- S_x = General status bits for channels 0 through 3 (S0 through S3) and the CJC sensor (S4). This bit is set (1) when an error (over-range, under-range, open-circuit, or input data not valid) exists for that channel. An input data not valid condition is determined by the user program. Refer to the *MicroLogix™ 1200 I/O Thermocouple/mV Input Module User Manual*, publication number 1762-UM002 for additional details.
- OC_x = Open-circuit indication for channels 0 through 3 (OC0 through OC3) and the CJC sensor (OC4).
- O_x = Over-range flag bits for channels 0 through 3 (O0 through O3) and the CJC sensor (O4). These bits can be used in the control program for error detection.
- U_x = Under-range flag bits for channels 0 through 3 (U0 through U3) and the CJC sensor (U4). These bits can be used in the control program for error detection.

Configuration Data File

The configuration data file consists of 5 words. Words 0 through 3 of the configuration file allow you to change the parameters of each channel independently. For example, word 0 corresponds to channel 0. The functional arrangement of the bits for a single channel are shown in the table on page 15. Word 4 is the Module Configuration Word and is explained on page 16.

To Select		Make these bit settings															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Filter Frequency	10 Hz														1	1	0
	60 Hz														0	0	0
	50 Hz														0	0	1
	250Hz														0	1	1
	500 Hz														1	0	0
	1 kHz														1	0	1
Open Circuit	Upscale										0	0					
	Downscale										0	1					
	Hold Last State										1	0					
	Zero										1	1					
Temperature Units	Degrees C									0							
	Degrees F									1							
Input Type	Thermocouple J				0	0	0	0									
	Thermocouple K				0	0	0	1									
	Thermocouple T				0	0	1	0									
	Thermocouple E				0	0	1	1									
	Thermocouple R				0	1	0	0									
	Thermocouple S				0	1	0	1									
	Thermocouple B				0	1	1	0									
	Thermocouple N				0	1	1	1									
	Thermocouple C				1	0	0	0									
	-50 to +50 mV				1	0	0	1									
-100 to +100 mV				1	0	1	0										
Data Format	Raw/Proportional		0	0	0												
	Engineering Units		0	0	1												
	Engineering UnitsX10		1	0	0												
	Scaled-for-PID		0	1	0												
	Percent Range		0	1	1												
Enable Channel	Disable	0															
	Enable	1															

Not Used(1)

(1) An attempt to write any non-valid (spare) bit configuration into any selection field results in a module configuration error.

TIP



Program defaults are indicated by zero (0) values. For example, type J thermocouple is the default (no user intervention) thermocouple type.

Module Configuration Word

Word 4 of the configuration data file contains the Enable/Disable Cyclic Calibration bit as shown in the table below.

To Select		Make these bit settings															
		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Cyclic Calibration	Enabled ⁽¹⁾																0
	Disabled																1

(1) When enabled, an autocalibration cycle is performed on all enabled channels every 5 minutes.

Specifications

General Specifications

Specification	Value
Dimensions	90 mm (height) x 87 mm (depth) x 40 mm (width) height including mounting tabs is 110 mm 3.54 in. (height) x 3.43 in. (depth) x 1.58 in. (width) height including mounting tabs is 4.33 in.
Approximate Shipping Weight (with carton)	220g (0.53 lbs.)
Storage Temperature	-40°C to +85°C (-40°F to +185°F)
Operating Temperature	0°C to +55°C (-32°F to +131°F)
Operating Humidity	5% to 95% non-condensing
Operating Altitude	2000 meters (6561 feet)
Vibration	Operating: 10 to 500 Hz, 5G, 0.030 in. max. peak-to-peak
Shock	Operating: 30G
Vendor I.D. Code	1
Product Type Code	10
Product Code	64
Agency Certification	C-UL certified (under CSA C22.2 No. 142) UL 508 listed CE compliant for all applicable directives C-Tick marked for all applicable acts
Hazardous Environment Class	Class I, Division 2, Hazardous Location, Groups A, B, C, D (UL 1604, C-UL under CSA C22.2 No. 213)
Noise Immunity	NEMA standard ICS 2-230
Radiated and Conducted Emissions	EN50081-2 Class A

Specification	Value
<i>Electrical /EMC:</i>	<i>The module has passed testing at the following levels:</i>
ESD Immunity (EN61000-4-2)	4 kV contact, 8 kV air, 4 kV indirect
Radiated Immunity (EN61000-4-3)	10 V/m, 80 to 1000 MHz, 80% amplitude modulation, +900 MHz keyed carrier
Fast Transient Burst (EN61000-4-4)	2 kV, 5 kHz
Surge Immunity (EN61000-4-5)	1 kV galvanic gun
Conducted Immunity (EN61000-4-6)	10V, 0.15 to 80 MHz ⁽¹⁾

(1) Conducted Immunity frequency range may be 150 kHz to 30 MHz if the Radiated Immunity frequency range is 30 MHz to 1000 MHz.

Input Specifications

Specification	1762-IT4
Number of Inputs	4 input channels plus a CJC sensor
Resolution	15 bits plus sign
Bus Current Draw (max.)	40 mA at 5V dc 50 mA at 24V dc
Heat Dissipation	1.5 Total Watts (The Watts per point, plus the minimum Watts, with all points energized.)
Converter Type	Delta Sigma
Input Filtering	Programmable notch filter with 10, 50, 60, 250, 500 and 1k Hz frequencies.
Channel Update Time	Input filter and configuration dependent. See page 18.
Rated Working Voltage ⁽¹⁾	30V ac/30V dc
Common Mode Voltage Range ⁽²⁾	±10V dc maximum per channel
Common Mode Rejection	115 dB (minimum) at 50 Hz (with 10 Hz or 50 Hz filter) 115 dB (minimum) at 60 Hz (with 10 Hz or 60 Hz filter)
Normal Mode Rejection Ratio	85 dB (minimum) at 50 Hz (with 10 Hz or 50 Hz filter) 85 dB (minimum) at 60 Hz (with 10 Hz or 60 Hz filter)
Cable Impedance (max.)	25 Ω
Input Impedance	>10M Ω
Open-circuit Detection Time (max.)	7 ms to 1.515 seconds ⁽³⁾
Calibration	The module performs autocalibration upon power-up and whenever a channel is enabled. You can also program the module to calibrate every five minutes using the Enable/Disable Cyclic Calibration bit.

(1) Rated working voltage is the maximum continuous voltage that can be applied at the input terminal, including the input signal and the value that floats above ground potential (for example, 30V dc input signal and 20V dc potential above ground).

(2) For proper operation, both the plus and minus input terminals must be within ±10V dc of analog common.

(3) Open-circuit detection time is equal to channel update time, which is based on filter frequency, number of channels enabled, and whether cyclic calibration is enabled.

Input Specifications Continued

Specification	1762-IT4
Repeatability ⁽¹⁾	See "Repeatability" on page 20.
Maximum Overload at Input Terminals	±35V dc continuous ⁽²⁾
Module Error over Full Temperature Range (0 to +55°C [+32°F to +131°F])	See "Input Accuracy" on page 19.
CJC Accuracy	±1.3°C (±2.34°F)
Power Supply Distance Rating	6 (The module may not be more than 6 modules away from the system power supply.)
Input Group to Bus Isolation	720V dc for 1 minute (qualification) 30V ac/30V dc working voltage (IEC Class 2 reinforced insulation)
Input Channel Configuration	via configuration software screen or the user program (by writing a unique bit pattern into the module's configuration file).
Module OK LED	On: module has power, has passed internal diagnostics, and is communicating over the bus. Off: Any of the above is not true.
Channel Diagnostics	Over- or under-range and open-circuit by bit reporting

(1) Repeatability is the ability of the input module to register the same reading in successive measurements for the same input signal.

(2) Maximum current input is limited due to input impedance.

Channel Update Time

Filter Frequency Selection	Channel Update Time
10 Hz	303 ms
50 Hz	63 ms
60 Hz	53 ms
250 Hz	15 ms
500 Hz	9 ms
1 kHz	7 ms

Input Accuracy

Input Type ⁽¹⁾	Accuracy for 10 Hz, 50 Hz and 60 Hz Filters ⁽²⁾ (max.) at 25°C [77°F]
Thermocouples J (-210 to 1200°C [-346 to 2192°F])	±0.6°C [± 1.1°F]
Thermocouple N (-200 to +1300°C [-328 to 2372°F])	±1°C [± 1.8°F]
Thermocouple N (-210 to -200°C [-346 to -328°F])	±1.2°C [±2.2°F]
Thermocouple T (-230 to +400°C [-382 to +752°F])	±1°C [± 1.8°F]
Thermocouple T (-270 to -230°C [-454 to -382°F])	±5.4°C [± 9.7°F]
Thermocouple K (-230 to +1370°C [-382 to +2498°F])	±1°C [± 1.8°F]
Thermocouple K (-270 to -230°C [-454 to -382°F])	±7.5°C [± 13.5°F]
Thermocouple E (-210 to +1000°C [-346 to +1832°F])	±0.5°C [± 0.9°F]
Thermocouple E (-270 to -210°C [-454 to -346°F])	±4.2°C [± 7.6°F]
Thermocouples S and R	±1.7°C [± 3.1°F]
Thermocouple C	±1.8°C [±3.2°F]
Thermocouple B	±3.0°C [±5.4°F]
±50 mV	±15 µV
±100 mV	±20 µV

(1) The module uses the National Institute of Standards and Technology (NIST) ITS-90 standard for thermocouple linearization.

(2) Accuracy is dependent upon the analog/digital converter output rate selection, data format, and input noise. Refer to the *MicroLogix 1200 Thermocouple/mV Input Module User's Manual*, publication number 1762-UM002A, for additional information.

Repeatability

Input Type	Repeatability for 10 Hz Filter at 25°C [77°F]
Thermocouple J	±0.1°C [±0.18°F]
Thermocouple N (-110°C to +1300°C [-166°F to +2372°F])	±0.1°C [±0.18°F]
Thermocouple N (-210 to -110°C [-346°F to -166°F])	±0.25°C [±0.45°F]
Thermocouple T (-170°C to +400°C [-274°F to +752°F])	±0.1°C [±0.18°F]
Thermocouple T (-270°C to -170°C [-454°F to -274°F])	±1.5°C [±2.7°F]
Thermocouple K (-270 to +1370°C [-454°F to +2498°F])	±0.1°C [±0.18°F]
Thermocouple K (-270°C to -170°C [-454°F to -274°F])	±2.0°C [±3.6°F]
Thermocouple E (-220 to +1000°C [-364°F to +1832°F])	±0.1°C [±0.18°F]
Thermocouple E (-270 to -220°C [-454°F to -364°F])	±1.0°C [±1.8°F]
Thermocouples S and R	±0.4°C [±0.72°F]
Thermocouple C	±0.2°C [±0.36°F]
Thermocouple B	±0.7°C [±1.26°F]
±50 mV	±6 µV
±100 mV	±6 µV

Hazardous Location Considerations

This equipment is suitable for use in Class I, Division 2, Groups A, B, C, D or non-hazardous locations only. The following WARNING statement applies to use in hazardous locations.

WARNING**EXPLOSION HAZARD**

- Substitution of components may impair suitability for Class I, Division 2.
 - Do not replace components or disconnect equipment unless power has been switched off.
 - Do not connect or disconnect components unless power has been switched off.
 - This product must be installed in an enclosure.
 - In Class I, Division 2 applications, the bus connector must be fully seated and the bus connector cover must be snapped in place.
 - In Class I, Division 2 applications, all modules must be mounted in direct contact with each other as shown on page 7. If DIN rail mounting is used, an end stop must be installed ahead of the controller and after the last 1762 I/O module.
 - All wiring must comply with N.E.C. article 501-4(b).
-

Environnements dangereux

Cet équipement est conçu pour être utilisé dans des environnements de Classe 1, Division 2, Groupes A, B, C, D ou non dangereux. La mise en garde suivante s'applique à une utilisation dans des environnements dangereux.

AVERTISSEMENT



DANGER D'EXPLOSION

- La substitution de composants peut rendre cet équipement impropre à une utilisation en environnement de Classe 1, Division 2.
 - Ne pas remplacer de composants ou déconnecter l'équipement sans s'être assuré que l'alimentation est coupée.
 - Ne pas connecter ou déconnecter des composants sans s'être assuré que l'alimentation est coupée.
 - Ce produit doit être installé dans une armoire.
 - Pour les applications de Classe I, Division 2, le connecteur de bus doit être correctement installé et son couvercle enclenché.
 - Pour les applications de Classe 1, Division 2, tous les modules doivent être installés en contact direct les uns avec les autres, comme indiqué page 7. Si on utilise le montage sur rail DIN, une butée doit être placée à l'avant de l'automate et après la dernière unité d'E/S 1762.
-

For More Information

For	Refer to this Document	Pub. No.
Information on installing, wiring, and operating a MicroLogix 1200 Programmable Controller	MicroLogix 1200 Programmable Controllers User Manual	1762-UM001
Installation guide for the MicroLogix 1200 Programmable Controller	MicroLogix 1200 Programmable Controllers Installation Instructions	1762-IN006
Installation guide for the MicroLogix 1200 Memory Module and Real Time Clock	MicroLogix 1200 Memory Module and/or Real Time Clock Installation Instructions	1762-IN001
Installation guide for the 1762-IA8 Discrete Input Module	1762-IA8 120V ac Input Module Installation Instructions	1762-IN002
Installation guide for the 1762-OW8 Discrete Output Module	1762-OW8 Relay Output Module Installation Instructions	1762-IN003
Installation guide for the 1762-IQ8 Discrete Input Module	1762-IQ8 DC Input Module Installation Instructions	1762-IN004
Installation guide for the 1762-IF20F2 Analog Input/Output Module	1762-IF20F2 Analog Input/Output Module Installation Instructions	1762-IN005
More information on proper wiring and grounding techniques.	Industrial Automation Wiring and Grounding Guidelines	1770-4.1

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Publication 1762-IN013A-EN-P - April 2002

PN 40071-145-01(1)

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A Fläkt Woods Company

Control #
ENG016-0902

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AMERICAN FAN CO. INSTALLATION, OPERATION, AND MAINTENANCE MANUAL 0902

This general manual has been prepared to assist you in installing and maintaining your American Fan equipment. By following the general instructions presented, you will prolong the life of the equipment, while preventing unexpected downtime.

The scope of this manual covers our standard product line and is not intended to cover specially engineered equipment.

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SECTION I

RECEIVING

All shipments are F.O.B. factory, Fairfield, Ohio. It is, therefore, in the interest of the buyer to carefully inspect all shipments before they are accepted from the freight carrier. Upon delivery, be sure that all items listed on the bill of lading and packing list (inserted in the plastic envelope attached to the shipment) have been received. Partial shipments are sometimes made.

Units are usually completely assembled except when specifications call for unit less motor. They are then skidded, boxed or crated to fully comply with rail or trucking requirements for shipment. Accessories are sometimes shipped separately due to handling space requirements.

Although all equipment is carefully inspected and prepared for shipment at the factory, damage to fan and/or drive parts may occur due to rough handling during shipment.

Any shortage, breakage or damage noticed at time of delivery should be indicated to the carrier's representative. Damage noticed after delivery should be reported to the carrier at once. Request their inspection of the shipment and fill out a concealed damage inspection report.

EXTENDED STORAGE

Units that will be held in storage for a period of up to two years, should have special provisions so operation-readiness can be maintained. Motors should be equipped with internal space heaters kept on continuously. Units should be crated and covered with polyethylene film. In addition, impellers should be hand-rotated once a month. For best results, keep units sheltered in a cool, dry location.

HANDLING

Small units should be handled carefully and lifted only by the base, never by the shaft, coupling, motor or housing. Large units should be lifted by the base or by lifting eyes. Precaution should be taken to avoid dropping or jarring equipment as this can cause damage to the shaft or wheel, which is not visibly noticeable, but can cause vibration problems.

INSTALLATION

Fans and motors should be mounted on structurally sound foundations. Concrete is the best, however, other types designed properly are acceptable. Equipment should be leveled on the foundation and shimmed or grouted in place. This will prevent putting the fan structure into a bind by bolting down on an uneven surface.

As a general rule, if vibration isolators are used, the fan should first be bolted to structural steel base and the isolation takes place between the structural steel base and the foundation. This prevents the fan base from floating due to uneven weight distribution and/or drive forces when mounted directly to vibration isolators.

ARRANGEMENT 8 BLOWER MOUNTING PROCEDURE

1. Motor and coupling should be mounted with blower resting on level, flat surface, but not bolted to surface.
2. After blower is situated in its final mounting location, feeler gauges should be used between mounting feet and mounting surface at each bolt hole location to determine thickness of shims required. Since the blower base is a weldment, it will be warped to some degree. If it is not shimmed to the foundation properly when bolted down, a bind in the frame will result. This may cause a bent shaft, coupling, motor and/or bearing misalignment resulting in high vibration levels and premature failure of drive components.
3. After shimming is done, each frame mounting bolt should be finger snugged. Then going from bolt to bolt, progressively tighten each one with a torque wrench until the proper torque value is achieved for the size foundation bolt being used.
4. After the unit is completely tightened down to foundation, coupling alignment should be rechecked. If coupling is now mis-aligned, loosen foundation bolts and recheck coupling alignment. If after loosening foundation bolts, coupling is aligned, then a bind was introduced in the bolt-down procedure. It will then be necessary to re-shim so that the bind is no longer present.
5. Once the unit is tightened down to foundation and coupling alignment is maintained, replace guards and check duck work, etc. Unit is now ready for start-up.
6. Jog motor to make sure unit is rotating in proper direction. If so, bring up to speed and check amperage to motor to make sure enough static pressure is present in system to prevent motor from overloading.
7. Vibration levels should be checked and if they are above values shown in table on page 4, a qualified balancing technician should trim balance the unit to achieve these levels.

SECTION II

BEFORE START-UP

1. Fasteners – all foundation bolts, wheel hub setscrews, wheel locking bolts and bearing locking collars must be tight.
2. Bearings - check bearing alignment and make certain they are properly lubricated.
3. Fan Wheel – turn over rotating assembly by hand to see that it runs free and does not bind or strike fan housing. If wheel strikes housing the wheel may have to be moved on the shaft or the bearing pillow blocks moved and re-shimmed.
4. Motor – check electrical wiring to motor. The current characteristics of the supply line must agree with the motor nameplate rating. Motor should be wired and fused in accordance with the National Electric Code and local codes.
5. V-belt drive must be in alignment with belts at proper tension.
6. Duct connections (if required) from fan to duct work must not be distorted. Ducts should never be supported by the fan. Expansion joints between duct connections should be used where expansion is likely to occur or where fan is mounted on vibration isolators. All duct joints should be sealed to prevent air leaks. All debris should be removed from ductwork and fan.

START UP

1. "Jog" the motor to check for proper wheel rotation. The motor should be started in accordance with the manufacturer's recommendations. Arrows on fan indicate the proper direction of rotation and airflow.
2. Fan may now be brought up to speed. Watch for anything unusual such as vibration, overheating of bearings and motor, etc. Check fan speed on V-belt driven units and adjust motor sheave (on adjustable drives) to give desired RPM.
3. Check motor amperage against nameplate amperage to make sure motor is not overloading.

BALANCE AND VIBRATION

All fan impellers are dynamically balanced prior to installation in the fan assembly. After assembly, fans supplied with motors are test run and fine-tune balanced to reduce vibration levels to acceptable limits as shown in table below (from AMCA Standard 204-96). After field installation, fans will need to be checked prior to commissioning, to assure that the vibration levels do not change significantly from those achieved at the factory. It is recommended that the velocity values in the table below are not exceeded by more than 10% when field installed.

Fan Application Category	Rigid Mounted		Flexible Mounted	
	mm/sec.	(in./sec.)	mm/sec.	(in./sec.)
BV-J	3.8	(0.15)	5.1	(0.20)

The installed vibration level of any fan is not solely dependent on the balance grade. Installation factors such as the mass and stiffness of the supporting system, will influence the "as installed" vibration level (Refer to AMCA Publication 202, *Troubleshooting*). Therefore, the "as installed" fan vibration level is not the responsibility of the fan manufacturer unless specified in the purchase contract.

START-UP OF HIGH TEMPERATURE CONSTRUCTION FANS AND BLOWERS

In addition to normal start-up procedure described above, certain measures must be taken against thermal expansion deformation.

1. Fan or blower should be brought to speed between 40°F and 150°F. It may be necessary to throttle back air entering fan or blower and slowly bleeding in heated air to accomplish this. (Note: If motor horsepower is sized for high temperature operation condition and not cold start-up, throttling inlet air will be mandatory to prevent motor overloading. It is recommended motor amperage be monitored during this procedure.
2. The maximum recommended rate of temperature rise is 15°F per minute.
3. The reverse situation of fan or blower shut-off also applies. That is the temperature must be lowered slowly before turning fan or blower off to prevent damage.

SECTION III

GENERAL MAINTENANCE

1. A definite time schedule for inspecting all rotating parts and accessories should be established. The frequency of inspection depends on the severity of operation and the locality. Inspections might be weekly at first in order to set up the schedule.
2. Alignment – shaft must not be cocked in the bearings. Misalignment can cause overheating, wear to dust seals, bearing failure and vibration.
3. Hardware – check tightness of all bolts and setscrews.
4. Lubrication – check fan and motor bearings and add lubricant if necessary. Be careful not to over grease as this can damage bearing seals.
5. Air flow – make sure there is no debris and no unnecessary obstructions to airflow in outlet or inlet ductwork.
6. Bearings on high-speed fans tend to run hot. Therefore, do not replace a bearing because it feels hot to the touch. Place a pyrometer or contact thermometer against the pillow block and check the temperature. Pillow block and flange mount bearings can have housing surface temperatures of 200°F (93°C) before the cause of overheating be investigated.
7. Wheel- inspect wheel blades for accumulation of dust and dirt. Clean thoroughly with stream of water jet, compressed air or a wire brush. This will help prevent an unbalanced condition. If blades are aluminum, be careful not to damage them. Cover the bearings so water won't enter the pillow block. The wheel should have proper clearances to prevent the blades from striking the housing. Make sure wheel is rotating in proper direction. Never run the fan at a higher speed or temperature than is shown on the fan nameplate. Contact American Fan Company with any questions.

FAN BEARING MAINTENANCE

For most applications, a lithium base grease (such as Mobilith AW2) conforming to a NLGI grade 2 consistency should be used. This type of grease inhibits rust, is water resistant, and has a temperature range of -30°F to 200°F with intermittent highs of 250°F. For extreme duty and higher temperature applications, use Mobilith SHC220, synthetic hydrocarbon grease.

Because oil lubricated bearings are usually used on high-speed or high temperature applications, refer to American Fan Co. factory for the type of oil you should use in your particular application.

When greasing bearings, it is important not to overgrease. This is especially true if the bearings are equipped with extended grease lines and the bearings are not visible. In this case, more bearing failures occur due to overgreasing than undergreasing. It is best to give the bearing just one "shot" of grease periodically if the bearings are not visible. When the bearings are visible, pump in grease until a small bead of grease forms around the bearing seals. It is very important that fan bearing greasing take place while the fan is operating. Caution should be taken while working on and near rotating equipment to avoid personal injury.

When oiling oil-lubricated bearings, oil should be poured into cup at top of bearing until it reached the overflow point at the lower oil cup.

MOTOR MAINTENANCE

Lubricate motor bearings to the manufacturer's recommendations. Lubrication recommendations are included with the packet attached to the fan. Should this packet be missing, the following will apply:

A. Fractional Horsepower Sleeve Bearing Motors:

Under normal operation at ordinary temperatures and clean surroundings, these motors will operate for three years without re-lubrication. Then lubricate annually with electric motor oil or SAE 10 oil. Under continuous operation higher temperatures (but not to exceed 104°F ambient) re-lubricate annually.

B. Fractional Horsepower Ball Bearing Motors:

Under normal conditions, ball bearing motors will operate for five years without re-lubrication. Under continuous operation at higher temperatures, (but not to exceed 104°F ambient) re-lubricate after one year. To re-lubricate where motors are not equipped with pressure fittings, disassemble motor and clean the bearings thoroughly. Repack each bearing one-third full with ball bearing grease.

C. Integral Horsepower Ball Bearings Motors:

Motors having pipe plugs or grease fittings should be re-lubricated while warm and at standstill. Replace one pipe plug on each end shield with grease fitting. Remove other plug for grease relief. On low pressure, grease, run and lubricate until new grease appears at grease relief. Allow motor to run for ten minutes to expel excess grease. Replace pipe plugs. Motors not having pipe plugs or grease fittings can be re-lubricated by removing end shield, cleaning grease cavity and refilling three-fourths or circumference of cavity.

Recommended re-lubrication intervals (General guide only)

H.P Range	Standard Duty 8 Hr./Day	Severe Duty 25 Hr./Day Dirty-Dusty	Extreme Duty Very Dirty High Ambients
1 ½ - 7 ½	5 Yrs.	3Yrs.	9 Mos.
10 - 40	3 Yrs.	1 Yr.	4 Mos.
50 - 150	1 Yr.	9 Mos.	4 Mos.

Recommended Motor Greases
Polyrex EM - Exxon Oil Company
SRI #2 - Chevron Oil Company

V-BELT DRIVE MAINTENANCE

If belts squeal at start-up, they are too loose and should be tightened. Periodically check belt and sheave wear, alignment, and tension. When belts show wear, replace all belts at once with a new matched set of belts. New belts will not work properly in conjunction with used belts due to difference in length. Belts and sheaves should be clean and free from grease. After installing new belts, check tension midway between sheaves. Belts should deflect about 1/64" per inch of

span length with approx. 20-lb. force. Allow unit to run for 4 – 6 hours, then it will be necessary to re-tighten belts again because new belts tend to stretch initially.

VIBRATION LEVEL OF REPLACEMENT IMPELLERS

All replacement impellers are dynamically balanced at our factory prior to shipment. Occasionally, an impeller that has been factory-balanced will yield poor balance/vibration results when installed and operated. This does not mean that the impeller was incorrectly balanced at the factory. It can result from differences between test-stand conditions and operating conditions. A factory test stand has different bearings, bearing spans, structural response, stiffness, mechanical impedance, and by necessity, running speed. The test stand cannot duplicate the actual "fan system" and its response. For these reasons, the "fan system" vibration levels must be checked after installing a replacement impeller. Refer to page 4 for acceptable vibration levels.

SECTION IV.

PROBLEM TROUBLESHOOTING

In the event that trouble is experienced in the field, listed below are the most common fan difficulties. These points should be checked in order to prevent needless delay and expense of factory service.

1. CAPACITY OR PRESSURE RATING
 - A. Total resistance of system higher than anticipated.
 - B. Speed too low.
 - C. Dampers or variable inlet vanes not properly adjusted.
 - D. Poor fan inlet or outlet conditions.
 - E. Air leaks in system.
 - F. Damaged wheel.
 - G. Incorrect direction or rotation.
 - H. Wheel mounted backwards on shaft.
2. VIBRATION & NOISE
 - A. Misalignment of bearings, couplings, wheel, or V-belt drive.
 - B. Unstable foundation, fan bolted to uneven foundation, not shimmed or grouted.
 - C. Foreign material in fan causing unbalance.
 - D. Worn bearings.
 - E. Damaged wheel or motor.
 - F. Broken or loose bolts and setscrews.
 - G. Bent shaft.
 - H. Worn Coupling.
 - I. Fan wheel or driver unbalanced.
 - J. 120 cycle magnetic hum due to electrical input. Check for high or unbalanced voltage.
 - K. Fan delivering more than rated capacity.
 - L. Loose dampers or variable inlet vanes.
 - M. Speed too high or fan rotation in wrong direction.
 - N. Vibration transmitted to fan from some other source.
3. OVERHEATED BEARINGS
 - A. Too much grease.
 - B. Poor alignment.
 - C. Damaged wheel or driver.
 - D. Bent shaft.

- E. Abnormal end thrust.
- F. Dirt in bearings.
- G. Excessive belt tension.

ORDERING SPARE PARTS

American Fan Co. Service and Parts

Phone: (513) 874-2400, Extension 3011

Fax: (513) 874-3932

e-mail: af-serv@amfan-woods.com

Contact the local American Fan Co. sales representative or AFC Service and Parts Department and supply the following information:

1. Fan serial number stamped on nameplate.
2. Fan code and model stamped on nameplate.
3. Fan arrangement.
4. Description of part required.
5. Part number if part is a casting.
6. Special materials, paints or coatings.

WHEEL – Be sure to indicate direction of rotation as viewed from drive side, type of wheel and the operating speed.

SHAFT – Length and diameter.

MOTORS – The name of the motor manufacturer, motor model number, and serial number from the motor nameplate must be supplied to the factory for repairs or replacement.

BEARINGS – The following information should be indicated when ordering various types of bearings:

ANTI-FRICTION BEARINGS

1. State whether ball or roller.
2. Manufacturer.
3. Size and number.
4. Fixed or floating.

RECOMMENDED SPARES:

1. V-belts on V-belt driven fans.
2. Fan bearings
3. Wheel (s)
4. Motor (if blower is critical to your operation).

SECTION V

AMERICAN FAN COMPANY TERMS OF SALE AND WARRANTY

1. **Authority of agents:** No order or contract shall be binding upon us unless signed by an authorized employee of the company. Sales representatives and other agents are not authorized to bind us. Unless a statement representation or guarantee made by an agent is specifically provided for herein, it shall not constitute a warranty or be part of this contract. Typographical errors contained in the quotation or invoice are not binding.
2. **Acceptance, exclusive terms:** Our quotations are subject to acceptance within thirty (30) days from the date of quotation. Acceptance of our quotation includes acceptance of our terms, including those contained herein, which constitute the complete and exclusive contract between the parties. We do not accept any additional or different terms proposed by the buyer's acceptance of this offer. Our failure to specifically object to additional or different terms included in the buyer's acceptance shall not be deemed a waiver of exclusivity of our terms. This agreement may not be modified except by prior written agreement signed by an authorized employee. No course of performance, usage of trade or course of dealing may be used to supplement or explain the terms of this agreement or the obligations and rights of the parties hereunder.
3. **Seller's performance:** We shall not be held responsible for any loss, delay, failure to deliver or damage caused by reasons beyond our control, including but not limited to: our inability to obtain labor, materials, fuel or supplies; fire, accidents, floods or adverse weather conditions; strikes, lockouts or other labor disputes; embargoes, governmental acts or requirements; wars, acts of terrorism, insurrections or riots, or actions of subcontractors.
4. **Payment:** Net payment is due of the invoiced amount (hereinafter "Contract Price") and shall be paid in cash or check only within thirty (30) days F.O.B. our factory unless otherwise specified in our quotation.
 - (a) **Inadequate shipping instructions:** If we are unable to ship the goods when ready due to your (or your representative's) instructions or lack of instructions, invoicing will be submitted and payment in full shall be due within thirty (30) days of notification that we are ready to ship.
 - (b) **Set-off:** No retention, set-offs or counterclaims may be exercised against our invoices without prior written authorization.
 - (c) **Late payment charges:** We shall be entitled to charge interest on overdue accounts (in addition to storage charges referred to below) at the rate of 2% per annum above the prime rate for any amount overdue and unpaid. Overdue accounts will also be charged reasonable costs of collection, including attorney fees to the extent permitted by the laws of the State of Ohio.
5. **Price:** Our quotation only includes such goods, services, accessories, and work as specified therein, unless otherwise specified in our quotation:
 - (a) **Packaging:** Packing in accordance with our current standards is included in our quoted price; otherwise, packing charges will be added to the invoice price.
 - (b) **Samples:** Any samples submitted to you and not returned to our factory within sixty (60) days from date of receipt shall be paid for by you.
 - (c) **Taxes:** All applicable taxes will be added to the invoice price unless we receive your signed Tax Exempt Certificate.
 - (d) **Shipping:** Our quotations do not include shipping. If you request delivery other than F.O.B. our factory, you will be charged extra for any shipping, handling, loading and/or insurance.
 - (e) **Storage:** If we do not receive adequate forwarding instructions within thirty (30) days after notice to you that the goods are ready for collection or that we are ready to ship, we are entitled, but not obligated, to arrange storage at your sole expense (including storage, handling, demurrage and insurance).
 - (f) **Alteration of:** This Quotation/Job does not include alterations to buyer's premises, electrical or other utilities required to install the equipment provided here under.
6. **Price escalation:** We reserve the right to adjust the Contract Price if we incur extra costs due to changes or delays caused by you or your agents including, but not limited to, inadequate or improper instructions, designs or specifications. We reserve the right to adjust the Contract Price if we incur extra costs due to governmental acts, which affect performance of our obligations under contract.
 - (a) **Our equipment:** Prices on equipment of our manufacture are firm for shipments to be made within one hundred twenty (120) days from date of order. [After one hundred twenty (120) days, prices will be adjusted in accordance with increases in the cost of labor, materials and overheads. The increase will be calculated by the FORMULA FOR CONTRACT PRICE ADJUSTMENT specified in our quotation. Or, after one hundred twenty (120) days, prices will be adjusted to our prices in place at the time of shipment.]
 - (b) **Supplier equipment:** Prices on equipment of our manufacture are subject to adjustment by the same percentage of price change as may be made effective by our supplier prior to shipment of the equipment to you.

7. **Shipping:** Unless otherwise agreed, equipment shall be delivered F.O.B. our factory. We are authorized, but not required, to arrange shipping at the buyer's sole cost, by common carrier. For goods to be exported outside the continental United States, we are authorized, but not required, to arrange shipment, at the buyer's sole cost, from our factory alongside a vessel named by you at the port stated on our quotation. This clause does not affect the risk of loss or other incidents of the sale. Our obligations are deemed fulfilled and the risk of loss shifted to the buyers as soon as conforming goods are delivered to a common carrier or to the customer in the event that no common carrier is involved.
8. **Delay in Shipping:** Lead times quoted for shipping are estimated and we are not responsible for any losses resulting from delays. If we specifically agree in writing to a fixed time for shipment, we are not liable for damages caused by delay unless we have also specifically agreed in writing to a liquidated damages clause. In that event, our liability is limited to the amount of the agreed upon liquidated damages or the losses directly caused by our delay, whichever is less. A fixed time period for shipment does not start until we receive a written order with all information necessary to proceed with the job, including, but not limited to, your acceptance and approval of our specifications and drawings, licenses and government approvals, and arrangements for payment which meet our satisfaction. We are not responsible for delays caused by any reason in paragraph (3) above or caused by your instruction or lack thereof. No agreement for a fixed time for shipment is binding on us unless accompanied by an agreed upon liquidated damage clause, signed by an authorized employee.
9. **Cancellation:** Contracts and purchase orders may not be canceled without our prior written consent. You will be subject to cancellation charges. Cancellation charges include the amount necessary to compensate us for all materials ordered and work performed prior to the date of termination, lost profits and reasonable overheads and any other expenses resulting from the cancellation. Payment of all cancellation charges shall be made within thirty (30) days of the date of the invoice itemizing such charges.
10. **Drawings, samples, models and other descriptions:** Descriptive materials do not constitute a warranty that the goods shall conform to the description, and are not part of this contract. All descriptive materials including, but not limited to shipping models, catalogs, price-lists and other advertising materials are for illustrative purposes only. Unless drawings have been approved, we reserve the right at any time to change without notice the design, construction or specification of any equipment, machinery or system provided the revisions do not prejudice the operation of the equipment.
11. **Product Performance:** All performance figures given by us are approximate and are based on our laboratory experience and you agree that we accept no liability in the event of failure to achieve such performance figures. The figures only reflect performance we expect to obtain in our laboratory when tested to the relevant Air Movement and Control Association (AMCA) standards with test and tolerances detailed in our current technical literature. You assume responsibility for your own system design and for the goods being sufficient for your purpose. We will accept neither responsibility nor liability for the performance or suitability of our goods in their final operating environment, whether or not details of the final operating environment have been made available to us. We are not responsible for any performance curves that have been altered. If we specifically agree in writing to guarantee performance, we are only responsible for proven performance deficiencies if, and to the extent, we have agreed in writing to a liquidated damage clause which shall not in any event result in our incurring liability in excess of the Contract Price. No performance guarantees are binding on us unless in writing and signed by an authorized employee.
12. **Inspection and tests:** Our products are subjected to standard quality control inspection procedures before shipping. Standard inspections proceed without notice to you unless you request otherwise. If you require other tests, personal inspection, or that test/inspections be conducted in your presence, you will be charged extra. Any special inspections or tests shall be at our factory and will be made within seven (7) days after we give you notice that the equipment is ready for shipment. Failure to inspect the equipment at this time shall constitute a waiver of your right of inspection. Acceptance of goods occurs when (a) after inspection, you signify to us that the goods are conforming or (b) you fail to timely exercise your inspection right in accordance with this paragraph.
13. **Subcontracting:** We reserve the right to sub-contract the fulfillment of any contract or part thereof.
14. **Governing Law:** The parties acknowledge that the transaction that is the subject matter of this agreement bears a reasonable relation to the State of Ohio and that this agreement shall be governed by the laws of the State of Ohio, including the Uniform Commercial Code as enacted in that State. It is specifically understood and agreed that this agreement is for the sale of "goods" as that term is used in the Uniform Commercial Code.
15. **Severability:** The invalidity or unenforceability of any one or more phrases, sentences, clauses, paragraphs, or sections contained in this agreement shall not affect the validity or enforceability of the remaining portions of this agreement.

16. **Provisions requiring notice:** Any notice provided pursuant to this agreement shall be in writing and shall be deemed given (i) if by hand delivery, telecopy or e-mail upon receipt thereof; (ii) if mailed to the most recent address, three (3) days after deposit in the U.S. mails with prepaid postage or certified mail return receipt requested.
17. **Assignment:** You may not transfer your rights or delegate your performance under this agreement whether by assignment, subcontract, merger, reorganization, operation of law, or otherwise, without the prior written consent of an authorized employee.
18. **No Waiver:** The waiver or failure of American Fan to exercise any right provided herein shall not be deemed a waiver of any further or other right hereunder.
19. **Limited Warranty:** We warrant equipment of our manufacturer to be free from defects in design, materials and workmanship (exclusive of abrasion, corrosion or erosion) for twelve (12) months from the date of receipt of notice that the goods are ready for shipment or from the date of shipment to the original purchaser, whichever comes first. In order to claim the benefit of this warranty you must notify us in writing of the claimed defect within ten (10) days after discovering it and return the equipment or parts to our factory with transportation prepaid. In the event of on-site repair, our service technician will not be dispatched until we receive your written purchase order. This warranty is not applicable if any of the following conditions exist.
- (a) You have operated the equipment outside the scope of the specifications.
 - (b) You have permitted other persons not approved or authorized by us to alter, adjust, replace, or repair the equipment or any part thereof.
 - (c) You have not followed instruction or other directions given in the contract documents or our maintenance manual.
 - (d) When breakage or other loss or damage is the result of any negligence, misuse or fault on the part of any operator or other person not under our supervision or control.
 - (e) When breakage or other loss or damage is the result of fire, lightning, or other casualty, or of factors external to the equipment.
 - (f) The defect is the result of designs or drawings made, furnished or specified by you.
 - (g) The defect is attributable to goods not of our manufacture but supplied by us as part of a contract, in which case our liability shall be the lesser of the supplier's liability to us or any liability we would have for warranty on our own equipment.
 - (h) You have not paid in full any invoices submitted to you, which are due for payment.
 - (i) In the event of fair wear and tear of the equipment.

THIS WARRANTY IS IN LIEU OF ANY OTHER EXPRESS OR IMPLIED WARRANTIES, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. OUR SOLE AND EXCLUSIVE OBLIGATION UNDER THIS WARRANTY IS TO REPAIR OR REPLACE DEFECTIVE EQUIPMENT OR PARTS OR, AT OUR OPTION, TO PAY THE REASONABLE COST OF REPAIR OR REPLACEMENT. YOU AGREE THAT WE SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL, INCIDENTAL OR SPECIAL DAMAGES FOR INJURY OR FOR COMMERCIAL LOSS, PROPERTY DAMAGE OR OTHERWISE. NOTWITHSTANDING THE ABOVE, OUR MAXIMUM LIABILITY SHALL NOT UNDER ANY CIRCUMSTANCES EXCEED THE CONTRACT PRICE.

AC & DC Motor Installation – Maintenance Instructions

These instructions are intended to complement (not replace) the information in MN400 Installation and Operation manual for "Integral Horsepower AC Induction Motors ODP, TEFC, Explosion Proof" and MN605 Installation and Operation manual for "Integral Horsepower DC Motors".

Handling

The weight of the motor and shipping container will vary. Use correct material handling equipment to avoid injury.

Use caution when removing the motor from its packaging. Sharp corners may exist on motor shaft, motor key, sheet metal and other surfaces.

Receiving

Inspect the motor for damage before accepting it. The Motor shaft should rotate freely with no rubs. Report any damage immediately to the commercial carrier that delivered your motor.

Safety Notice

Only qualified personnel trained in the safe installation and operation of this equipment should install this motor. When improperly installed or used, rotating equipment can cause serious or fatal injury. Equipment must be installed in accordance with the National Electrical Code (NEC), local codes and NEMA MG2 Safety Standards for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators. Observe the following guidelines:

1. When eyebolts are provided, they must be fully tightened and are intended to lift the motor and its included accessories only.
2. Ground the motor according to NEC and local codes.
3. Provide a permanent guard to prevent accidental contact of body parts or clothing with rotating or moving parts or burns if motor is hot.
4. Shaft key must be secured before starting motor.
5. Do not apply power to the motor until the motor is securely mounted by its mounting holes.
6. This motor must only be connected to the proper line voltage, line frequency and load size.
7. Motors are not to be used for load holding or restraining unless a properly sized brake is installed. If a motor mounted brake is installed, provide proper safeguards for personnel in case of brake failure.
8. Disconnect all power services, stop the motor and allow it to cool before servicing.
9. For single phase motors, discharge the start and/or run capacitors before servicing.
10. Do not by-pass or render inoperative any safety device.
11. DC series wound motors must be protected from sudden loss of load causing overspeed damage. DC shunt wound motors must be protected from loss of field voltage which can result in damage.
12. When using AC motors with frequency inverters, be certain that the motors Maximum Speed Rating is not exceeded.
13. Mounting bolts should be high tensile steel. Be sure to use a suitable locking device on each bolt (spring washer or thread lock compound).

Guarding

After motor installation is complete, a guard of suitable dimensions must be constructed and installed around the motor/gearmotor.

This guard must prevent personnel from coming in contact with any moving parts of the motor or drive assembly but must allow sufficient cooling air to pass over the motor.

If a motor mounted brake is installed, provide proper safeguards for personnel in case of brake failure.

Brush inspection plates and electrical connection cover plates or lids, must be installed before operating the motor.

When this motor is installed according to these instructions, it complies with the EEC Machinery Directive. Electromagnetic Compatibility (EMC) requirements for CE compliance are met when the incoming power is purely sinusoidal. For other power source types, refer to MN1383 "Recommended Practices for Installation for EC Directive 89/336/EEC Relating to EMC".

BALDOR
MOTORS AND DRIVES

P.O. Box 2400
Fort Smith, AR 72902-2400 U.S.A.
(479) 646-4711

Motor Enclosure

ODP, Open drip proof motors are intended for use in clean, dry locations with adequate supply of cooling air. These motors should not be used in the presence of flammable or combustible materials. Open motors can emit flame and/or molten metal in the event of insulation failure.

TEFC, totally enclosed motors are intended for use where moisture, dirt and/or corrosive materials are present in indoor and outdoor locations.

Explosion proof motors, as indicated by the Underwriters Laboratories, Inc. label are intended for use in hazardous areas as specified by the NEC.

Mounting

Foot mounted machines should be mounted to a rigid foundation to prevent excessive vibration. Shims may be used if location is uneven.

Flange mounted machines should be properly seated and aligned. Note: If improper rotation direction is detrimental to the load, check rotation direction prior to coupling the load to the motor shaft.

For V-belt drive, mount the sheave pulley close to the motor housing. Allow clearance for end to end movement of the motor shaft. Do not overtighten belts as this may cause premature bearing failure or shaft breakage.

Direct coupled machines should be carefully aligned and the shaft should rotate freely without binding.

Wiring

Connect the motor as shown in the connection diagram. If this motor is installed as part of a motor control drive system, connect and protect the motor according to the control manufacturers diagrams. The wiring, fusing and grounding must comply with the National Electrical Code and local codes. When the motor is connected to the load for proper direction of rotation and started, it should start quickly and run smoothly. If not, stop the motor immediately and determine the cause. Possible causes are: low voltage at the motor, motor connections are not correct or the load is too heavy. Check the motor current after a few minutes of operation and compare the measured current with the nameplate rating.

Adjustment

The neutral is adjustable on some DC motors. AC motors have no adjustable parts.

Noise

For specific sound power or pressure level information, contact your local Baldor representative.

Vibration

This motor is balanced to NEMA MG1, Part 7 standard.

Brushes (DC Motors)

Periodically, the brushes should be inspected and all brush dust blown out of the motor. If a brush is worn 1/2" (from length specified in renewal parts data), replace the brushes. If the commutator is worn or rough, the armature should be removed. The commutator should be turned in a lathe, the mica recut and the commutator polished. Reassemble and seat the new brushes using a brush seating stone. Be sure the rocker arm is set on the neutral mark.

Lubrication

This is a ball or roller bearing motor. The bearings have been lubricated at the factory. Motors that do not have regrease capability are factory lubricated for the normal life of the bearings.

Lubricant

Baldor motors are pregreased, normally with Polyrex EM (Exxon Mobil). If other greases are preferred, check with a local Baldor Service Center for recommendations.

Relubrication Intervals (For motors with regrease capability)

New motors that have been stored for a year or more should be relubricated. Lubrication is also recommended at these intervals:

Table 1 Relubrication Interval

NEMA (IEC) Frame Size	Rated Speed (RPM)			
	3600	1800	1200	900
Up to 210 incl. (132)	5500Hrs.	12000Hrs.	18000Hrs.	22000Hrs.
Over 210 to 280 incl. (180)	3600Hrs.	9500Hrs.	15000Hrs.	18000Hrs.
Over 280 to 360 incl. (225)	*2200Hrs.	7400Hrs.	12000Hrs.	15000Hrs.
Over 360 to 5000 incl.(300)	*2200Hrs.	3500Hrs.	7400Hrs.	10500Hrs.

* Lubrication interval for 6313 or 6314 bearings that are used in 360 through 5000 frame, 2 pole motors. If roller bearings are used, bearings must be lubricated more frequently, divide the relubrication interval by 2.

Table 2 Service Conditions

Severity of Service	Ambient Temperature Maximum	Atmospheric Contamination	Type of Bearing
Standard	40° C	Clean, Little Corrosion	Deep Groove Ball Bearing
Severe	50° C	Moderate dirt, Corrosion	Ball Thrust, Roller
Extreme	>50° C* or Class H Insulation	Severe dirt, Abrasive dust, Corrosion	All Bearings
Low Temperature	<-30° C**		

* Special high temperature grease is recommended.

** Special low temperature grease is recommended.

Table 3 Lubrication Interval Multiplier

Severity of Service	Multiplier
Standard	1.0
Severe	0.5
Extreme	0.1
Low Temperature	1.0

Table 4 Amount of Grease to Add

Frame Size NEMA (IEC)	Bearing Description (Largest bearing in each frame size)					
	Bearing	OD D mm	Width B mm	Weight of grease to add ounce (gram)	Volume of grease to add	
					inches ³	teaspoon
Up to 210 incl. (132)	6307	80	21	0.30 (8.4)	0.6	2.0
Over 210 to 280 incl. (180)	6311	120	29	0.61 (17.4)	1.2	3.9
Over 280 to 360 incl. (225)	6313	140	33	0.81 (23.1)	1.5	5.2
Over 360 to 5000 incl.(300)	NU322	240	50	2.12 (60.0)	4.1	13.4

Weight in grams = 0.005 DB

Procedure

Clean the grease fitting (or area around grease hole, if equipped with slotted grease screws). If motor has a purge plug, remove it. Motors can be regreased while stopped (at less than 80° C) or running.

Apply grease gun to fitting (or grease hole). Too much grease or injecting grease too quickly can cause premature bearing failure. Slowly apply the recommended amount of grease, taking 1 minute or so to apply. Operate motor for 20 minutes, reinstall purge plug if previously removed. Caution: Keep grease clean. Mixing dissimilar grease is not recommended.

Sample Relubrication Determination

This sample determination is based on a NEMA 286T (IEC 180) motor operating at 1750 RPM driving an exhaust fan in an ambient of 43° C atmosphere that is moderately corrosive.

1. Table 1 list 9500 hours for standard conditions.
2. Table 2 classifies severity of service as "Severe".
3. Table 3 lists a multiplier value of 0.5 for Severe conditions.
4. Table 4 shows that 1.2 in³ or 3.9 teaspoon of grease is to be added.

Note: Smaller bearings in size category may require reduced amounts of grease.



Recommended SAFETY PRACTICES

For Users and Installers
of Industrial and Commercial Fans
AMCA Publication 410-96

FOREWORD

i. This publication has been prepared by the Air Movement Division of the Air Movement and Control Association International, Inc. (AMCA). The information contained in this publication has been derived from many sources. The suggestions made necessarily should be general in their meaning and cannot be applied literally to all specific situations or conditions.

ii. **The safe installation and operation of fans is the responsibility of the system designer, installer, maintainer, and user.** From the initial system design through the life of the equipment, safety should be a foremost consideration. Some areas which require some special attention include system design, layout and construction, fan performance specifications, foundation and installation details, storage procedures, start-up and commissioning procedures, operation, maintenance, and repair. Specific safety requirements are mandated by federal, state, and local codes. *Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans* is published by AMCA for assistance. System designers, installers, maintainers, and users should consult and properly comply with all applicable codes and guidelines.

iii. The safety recommendations contained herein are intended to assist designers, installers, maintainers, or other users of air moving devices in the safe operation and use of the devices mentioned. These recommendations do not represent the only methods, procedures, or devices appropriate for the situations discussed. Caution should be used at all times when working in or around moving parts.

iv. AMCA disclaims any and all warranties, expressed or implied, regarding the products sold by the manufacturer with which this booklet has been provided. Further, AMCA recommends that competent personnel be consulted in deciding what is the preferred or recommended safety procedure in a particular instance where the guidelines contained in this booklet are unclear or in any way incomplete.

v. AMCA has offered the information within this booklet to assist in the safe operation, maintenance, and use of the products sold by members of AMCA. In so doing, AMCA does not assume any legal duties of the designer or manufacturer to instruct or warn about their product. AMCA expressly disclaims liability for any injury or damage arising out of the operation or use of the product or the guidelines contained herein.

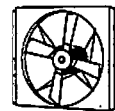
vi. These recommended safety practices were adopted by the AMCA membership on April 28, 1996.



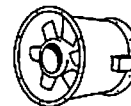
Power Roof
Ventilator



Wall
Exhauster



Propeller
Fan



Axial
Fan

1. INTRODUCTION

1.1 Fans and other air moving devices are made in a wide variety of types, sizes, and arrangements. This publication addresses the proper use and installation of industrial and commercial fans. It is not intended to address residential and consumer fans.

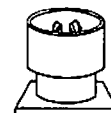
1.2 Various "size" factors are important when assessing potential for injury; some factors are: diameter of impeller (wheel, rotor, propeller), rotational inertia, voltage, and current.

1.3 This guide is intended to assist in the safe installation of air moving equipment and to warn operating and maintenance personnel of the commonly recognized hazards associated with this equipment.

1.4 **Handling and installation should always be performed only by experienced and trained personnel who are aware of the hazards associated with rotating equipment. Failure to comply with these practices may result in death or serious bodily injury.** In addition to following the manufacturer's installation instructions, care should be taken to ensure compliance with specific safety requirements mandated by federal, state, and local codes. Industry safety standards and practices published by AMCA and by other recognized agencies and associations should be consulted and followed where applicable.



Centrifugal
Fan



Upblast Roof
Exhauster

2. PERSONNEL SAFETY ACCESSORIES

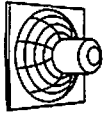
2.1 GENERAL

2.1.1 Protective devices are incorporated as standard construction on some types of fans but on many fans, these devices are offered as optional accessories. This is done because the need for the devices and the design required will frequently depend upon the type of system, fan location, and operating procedures being employed. Proper protective safety devices; company safety standards; specific safety requirements mandated by federal, state, and local codes; and industry safety standards and practices published by AMCA and by other recognized agencies and associations should be determined by the user, who should specify and obtain the appropriate devices from the fan manufacturer or others, and should not allow operation of the equipment without them. Examples of available devices include the following:

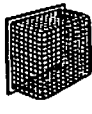
2.2 FAN GUARDS

2.2.1 All fans have moving parts which require guarding in the same way as other moving machinery. Fans located less than seven (7) feet above the floor require special consideration. Specific safety requirements should comply with mandated federal, state, and local codes; and industry safety standards and practices published by AMCA and by other recognized agencies and associations should be followed.

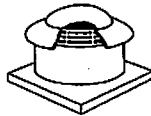
2.2.2 Roof-mounted fans and other fans which are not generally accessible may not require safety guards which might otherwise be appropriate. Where accessibility to these fans is occasional or infrequent, the expense of permanent guarding may be reduced through the use of lockout switches and suitable warnings. In such cases, maintenance personnel should engage the lockout switch before undertaking any maintenance or repairs. As is the case with other machinery involving moving parts, common sense and caution will preserve personal safety.



Industrial Type Guard For Propeller Fan



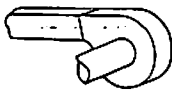
Maximum Safety Guard for Propeller Fan



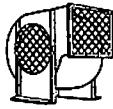
Screen on Roof Ventilator

2.3 INLET AND OUTLET GUARDS

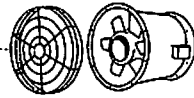
2.3.1 Axial and centrifugal fans are often connected directly to ductwork which will prevent contact with the internal moving parts; when an exposed inlet or outlet represents a hazard, a suitable guard should be installed.



Centrifugal Fan Protected by Ductwork



Inlet or Outlet Guard on Centrifugal Fan



Guard for Axial Fan With Non-Ducted Inlet or Outlet

2.4 DRIVE GUARDS

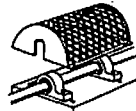
2.4.1 Fans may be driven directly from the motor shaft or through a belt drive. Where the bearing assembly, rotating shaft, sheaves, or belts are exposed, a suitable guard may need to be provided. Some example guards are shown below.



Drive Coupling Guard



Heat Slinger Guard (Shaft and bearing guard omitted for clarity)



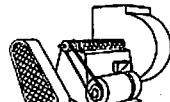
Shaft and Bearing Guard

2.4.2 Drive guards may be required for tubular centrifugal or axial fans to cover the exposed drive sheave and belts outside the fan housing.



Drive Guard - Axial Fan

2.4.3 A typical centrifugal fan drive guard may vary with the arrangement. Safety guards should be used when drive systems are accessible to personnel. In restricted areas, omission of the back cover may be acceptable.



Drive Guard - Centrifugal Fan

2.4.4 Dampers and their linkage may operate suddenly without warning at high speeds. Dampers and their linkage contain pinch points which should be identified and guarded.

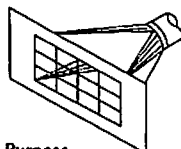
3. HIDDEN DANGERS

3.1 GENERAL

3.1.1 In addition to the obvious hazards associated with the moving parts of rotating machinery, fans present additional potential hazards that are not so obvious and should be considered by the system designer and user for safe operation.

3.2 SUCTION AND AIR PRESSURE

3.2.1 Fans operate by creating suction and air pressure which can be hazardous. Solid objects can be drawn into a fan's inlet and then become dangerous projectiles when they are ex-



Special Purpose Intake Screen

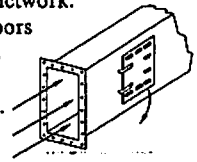
hausted through the fan's outlet. **Solid objects can also cause fan failure or impeller failure due to imbalance or damage to the impeller blades.** Personnel in close proximity to a fan inlet can be overcome by the suction, and drawn into the fan.

3.2.2 Whenever there is a possibility that solid objects can be drawn into a remote intake, the intake should be guarded at all times. Before a guard is removed, the fan should be disconnected and the power supply locked out.

3.2.3 Where fans are installed over an occupied area, safety guards should be provided to prevent dropped objects from entering this area during installation and maintenance.

3.2.4 Access doors to a fan or duct system should never be opened while the fan is operating or coasting to a stop. On the downstream (or pressure) side of the system, releasing the door with the system in operation may result in an explosive opening. On the upstream (or suction) side, the inflow may be sufficient to draw in tools, clothing, and other materials. The power supply should always be locked out prior to accessing a fan or ductwork.

3.2.5 Fan design sometimes requires access doors to be supplied with internal components such as a plug to fill a hole in the fan casing. These doors can often be heavy and difficult to handle. Care should be exercised when opening, removing, and installing these components.



Bolted Access Door in Duct

3.3 WINDMILLING

3.3.1 Even when the power supply is locked out, fans may cause injury or damage if the impeller is subject to "windmilling" which is the turning of the impeller and drive components due to a draft in the system. To guard against this hazard, the impeller should be secured to physically restrict rotational movement.

3.4 TEMPERATURE

3.4.1 Many fans, fan motors, and fan components run at temperatures that could burn someone who comes in contact with the hot areas, including discharged or leaking gases. If this potential hazard is present, steps should be taken so that personnel working near the fan are aware of the danger and can exercise caution.

3.5 FAN NOISE AND ENVIRONMENT

3.5.1 Some fans can generate sound that could be hazardous to exposed personnel. Sound pressure can be measured in the field, but obtaining accurate data is difficult. The environment in which the fan operates can impact the ability to obtain accurate fan sound readings. Consult the manufacturer for fan sound data. It is the responsibility of the system designer, installer, user, and maintainer to comply with specific safety requirements mandated by federal, state, and local codes; and to follow industry safety standards and practices published by AMCA and by other recognized agencies and associations, regarding personnel safety from exposure to fan noise associated with use and exposure to the equipment.



Hearing Protection

3.6 STROBOSCOPIC EFFECT

3.6.1 The stroboscopic effect of certain lights in combination with certain fan speeds may cause a rotating assembly to appear stopped. In these cases, irregular markings can be placed on the moving parts to prevent this type of effect. Personnel should be warned that the fan may be in motion even if it appears not to be.

3.7 SPECIAL PURPOSE FANS AND SYSTEMS

3.7.1 The hidden dangers associated with Special Purpose Fans used in special systems are covered in Section 6.

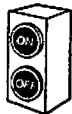
4. POWER ISOLATION

4.1 Every fan should be installed with a suitable device allowing it to be completely disconnected or isolated from the power supply.

4.2 Many fans are started by remote switches or push-buttons,

by interlocks with other equipment, or by automatic controls. Before performing any maintenance, inspection, or other activity which will require removal of guards, ductwork, access doors, etc., or exposure of moving parts, the fan power supply should be locked out and the fan tagged out of service.

4.3 In some installations other equipment, such as gas burners, may be interlocked with the fan so that disconnecting the fan will automatically shut off the burner or other device. Maintenance on systems of this type should be performed only under the supervision of competent engineering personnel and in accordance with applicable codes and standards.



Remote Switch



Disconnect Switch



Lock Carried by Maintenance Personnel

4.4 In cases where the fan is power driven by a source other than an electric motor, appropriate provisions should be made for the isolation or disengagement of the power supply.

5. START-UP CHECK LIST

5.1 GENERAL

5.1.1 Before putting any fan into initial operation, the manufacturer's instructions should be followed. Transportation, handling, and installation can cause fasteners to loosen, and cause misalignment of fan components. Carefully follow this check list when commissioning equipment.

5.1.2 Lock out the primary and all secondary power sources.

5.1.3 A complete inspection should be made of all of the ductwork and the interior of the fan. Make certain there is no foreign material which can be drawn into or blown through the fan or ductwork. Appropriate protective measures and safety practices should be observed when entering or working within these areas. These measures might include the use of goggles, respirators, or other personal protective devices.

5.1.4 Make sure the foundation or mounting arrangement and the duct connections are adequately designed and installed per drawings and in accordance with recognized acceptable engineering practices and with the fan manufacturer's recommendations.

5.1.5 Check and tighten all bolts, fasteners, and set screws as necessary.

5.1.6 Check the fan assembly and bearings for proper grounding to prevent static electricity discharge.

5.1.7 Ensure power and drive components such as motor starter, variable frequency drive, or hydraulic power unit are properly sized, matched, and connected to the fan.

5.1.8 Check bearings for recommended lubricant and lubrication amount.

5.1.9 Spin the rotating assembly to determine whether it rotates freely, without hitting anything, and is not grossly out of balance.

5.1.10 Inspect impeller for proper rotation for the fan design.

5.1.11 Check alignment of drives and all other components.

5.1.12 Check the belt drive for proper sheave selection and installation and make sure the sheaves are not reversed (excessive speeds could develop).

5.1.13 Check for recommended belt tension.

5.1.14 Properly secure all safety guards.

5.1.15 Assure that all appropriate warnings have been put in place.

5.1.16 Secure all access doors to the fan and ductwork.

5.1.17 Momentarily energize the fan to check the direction of rotation. Listen as the fan coasts to a stop for any unusual noise, identify the source, and take corrective action as necessary.

5.1.18 Switch on the electrical supply and allow the fan to reach full speed. Check carefully for:

- (1) Excessive vibration
- (2) Unusual noise

(3) Proper belt alignment

(4) Proper lubrication

(5) Proper amperage, voltage, or power values.

(6) If any problem is indicated, SWITCH OFF IMMEDIATELY.

(7) Lock out the power supply. Secure the fan impeller if there is a potential for windmilling. Check carefully for the cause of the trouble, correct as necessary, and repeat check list procedure.

5.2 Even if the fan appears to be operating satisfactorily, shut down after a brief period, lock out the power supply, and recheck items 5.1.5 through 5.1.17 as the initial start-up may have loosened the bolts, fasteners, and set screws.

5.3 The fan may now be put into operation, but during the first eight hours of running, it should be closely observed and checked for excessive vibration and noise. At this time checks should also be made of motor input current and motor and bearing temperatures to ensure that they do not exceed manufacturer's recommendations.

5.4 After eight hours of operation, the fan should be shut down and the power locked out. Check list items 5.1.5 through 5.1.17 should be inspected and adjusted, if necessary.

5.5 After twenty-four (24) hours of satisfactory operation, the fan should be shut down (locked out) and the drive belt tension should be readjusted to recommended tension.

5.6 After commissioning and start-up, the fan should be operated and maintained in accordance with the manufacturer's and component manufacturer's recommendations. Some basic guidelines for WARNING SIGNS and ROUTINE MAINTENANCE are included in Sections 7 and 8 of this publication. These sections are meant as a supplement to other publications and are not intended to replace the manufacturer's instructions.

6. SPECIAL PURPOSE FANS

6.1 Most fans are designed to handle clean air at standard temperatures between 32°F and 120°F. These fans should not be placed in systems or used for other than their design intended use. *Special Purpose Fans* are designed for use in systems that may include extreme temperatures, explosive, toxic, or special gases, material handling, corrosive environments, or other special hazards which should be carefully considered. Specific safety requirements should comply with mandated federal, state, and local codes; and industry safety standards and practices published by AMCA and by other recognized agencies and associations should be followed.

6.2 Where the system will handle explosive or flammable materials (i.e., dust, fumes, vapors or gases), fans of spark-resistant construction should be used.

6.3 Fans connected by ductwork or other piping may contain gases other than air which are hazardous. In these cases, procedures should be established to prevent exposure of personnel working on or near the fan, and by maintenance personnel who may need to enter the fan. Appropriate personal protective equipment as determined by the material safety data sheet, and system operators should be utilized. Appropriate environmental protective measures should also be taken.

6.4 Fan inlet boxes, housings, ductwork, and other system components which are large enough to permit entry should be considered confined spaces. System areas may also serve as low points where heavy gases, liquids, or other substances may accumulate and present explosive, fire, health, or suffocation hazards. Appropriate protective measures and safety practices should be observed when entering or working within these areas.

6.5 Material-handling fans are specially designed to allow the fan to handle a specific type of material without excessive accumulation of material on the fan impeller. Fans handling corrosive gases or erosive materials should be checked periodically. If loss of material is evident, the fan should be shut down, power supply locked out, and tagged out of service. The manufacturer or other qualified personnel should be consulted to determine if the fan is

within safety limits for operation. To ensure satisfactory operation it is essential to observe the manufacturer's limitations concerning the type of material to be handled by the fan.

6.6 Fan ratings and maximum speed limits are typically based on the use of air at 70°F. At temperatures above the normal range (specified by the manufacturer), a reduction should be made in the maximum speed limit. Information on this reduction and on other precautions to be taken for high temperature applications should be obtained from the fan manufacturer. Personnel working near high temperature fans should be aware that coming in contact with the fan's housing, ductwork, or handled gases could result in serious burns. Where the danger of burns is not apparent, appropriate warnings should be posted. Appropriate protective apparel should be worn whenever working in close contact with heated housings or ductwork.

6.7 Corrosive contaminants can be formed when moisture combines with an active airborne chemical. Fans subjected to corrosive contaminants will corrode; however, suitable protective coatings or material, if used in the fan construction, can delay corrosion. Protected fans should be regularly inspected to ensure that the protection remains effective. Personnel working in environments with airborne chemicals may require personal protective apparel equipment.

6.8 Where liquid can accumulate within the fan, provide for the installation of adequately sized drains.

6.9 In those applications where there is a potential for chemical build-up (such as grease, creosote, etc.), periodic cleaning and proper drainage are necessary to avoid a fire hazard.

7. WARNING SIGNS

7.1 GENERAL

7.1.1 A change in the operating characteristics of a fan may indicate the need for maintenance. Sudden changes may indicate severe problems or dangerous conditions developing. Investigate any changes in the operational characteristics or unusual symptoms of the fan. Refer to AMCA Publication 202, *Troubleshooting*, for a more detailed explanation of investigating procedures. Consult your manufacturer or other qualified consultant with questions concerning changes observed.

7.2 EXCESSIVE VIBRATION

7.2.1 Operational vibration levels are one of the best indicators of the condition of the blower. Careful observation and monitoring of vibration levels can detect a minor problem in the early stages of development when correction is less costly and easier. Recommended maximum vibration levels should be obtained from the equipment manufacturer.

7.2.2 If excessive vibration is observed, stop the fan and lock it out until the cause is corrected. Check for material build-up on the impeller. Generally this will show up as material flaking off the fan impeller and causing an imbalance which may lead to catastrophic failure of the fan or its components. Excessive vibration can also be caused by looseness in the drive train, loose fasteners, misalignment or impeller damage. Contact the fan manufacturer or other qualified consultant to determine the maximum vibration level if it is not included in maintenance instructions.

7.3 NOISE

7.3.1 Changes to the sound level may indicate maintenance is needed. Some unusual noises often heard include: bearing noise indicating the bearings need lubricant or replacement; scraping or ticking noise indicating the rotating parts are hitting the stationary parts; squealing indicating the belt drive needs tensioning; repeated changing pitch of the blower indicating operation of the blower at too low a flow. If any of these noises or any other unusual noises are detected, their cause should be determined and corrective action taken as necessary.

7.4 HIGH MOTOR TEMPERATURES

7.4.1 Check that cooling air to the motor has not been diverted or blocked by dirty guards or similar obstacles. Check the input amperage. An increase in amperage may indicate that some major change has occurred in the system.

7.5 HIGH BEARING TEMPERATURES

7.5.1 This condition is usually caused by improper lubrication; this can be either "over," "under," or "unsuitable" lubrication. In every case, if the cause of the trouble is not easily seen, experienced personnel should examine the equipment before it is put back in operation.

7.6 POOR PERFORMANCE

7.6.1 Too much flow or pressure or too little flow or pressure is often a symptom of a change in the operating system. A fan will typically operate at the same performance in a static system. Some typical causes include: operating of the fan backwards after maintenance procedures; filters dirty or not in place; change or blockage in the ductwork; change in speed of the fan (switching the sheaves); loss or failure of the impeller. All of these causes and many others will affect the flow and pressure produced by the fan.

8. ROUTINE MAINTENANCE

8.1 A preventive maintenance program is an important aspect of an effective safety program. Consult your manufacturer or other qualified consultant with questions concerning changes observed during periodic inspections and routine maintenance.

8.2 The fan manufacturer's operating and maintenance recommendations, as well as the components manufacturer's instructions (such as motor, bearing, drives, etc.) should be strictly followed.

8.3 *Maintenance should always be performed by experienced and trained personnel who are aware of the hazards associated with rotating equipment.* Do not attempt any maintenance on a fan unless the fan power supply has been locked out and tagged out and the impeller has been secured.

8.4 When performing maintenance functions which include disassembly of the fan, careful consideration should be given to the size, weight, center of gravity, and lifting means of the fan components. It should also be noted that the outboard bearing on some fans such as arrangements 1, 8, 9, and 10 is often cap-loaded. Removal of the securing means may result in a sudden change in impeller position.

8.5 Historical data is often the best indicator for determining the operational condition of the fan. Maintenance logs which include relubrication, vibration levels, temperature levels, power requirements, inspections, and other pertinent records should be maintained and consulted as necessary when assessing the condition of the fan.

8.6 Under normal circumstances, handling clean air, the system should require cleaning only once a year. However, the fan and system should be checked at regular intervals to detect any unusual accumulation.

8.7 The fan impeller should be specially checked for build-up of material or dirt which may cause an imbalance with resulting undue wear on bearings and belt drives. A regular maintenance program should be established as needed to prevent material build-up.

8.8 Periodic inspection of the rotating assembly should be made to detect any indication of weakening of the rotor because of corrosion, erosion, or metal fatigue. Where signs of deterioration are found, lock out and tag out the impeller until the unit has been inspected and approved by a qualified consultant.



Hardware User Manual

EA-USER-M

WARNING

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HARDWARE USER MANUAL

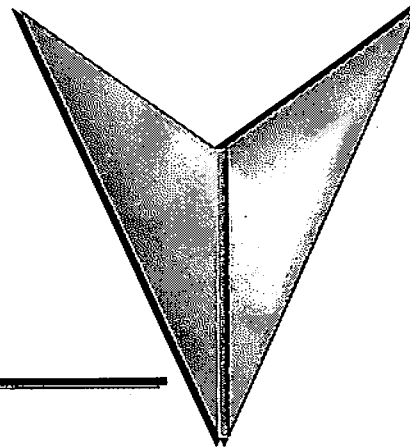


Please include the Manual Number and the Manual Issue, both shown below, when communicating with Technical Support regarding this publication.

Manual Number: EA-USER-M
Issue: 2nd Edition Rev. A
Issue Date: 07/08

Publication History		
Issue	Date	Description of Changes
First Edition	11/05	Original
Rev. A	01/06	Added chapters and content.
Rev. B	04/06	Added chapters 7-9 and appendix B.
Rev. C	08/07	Added AB EtherNet/IP, minor corrections, and content added.
Second Edition	02/08	Added Recipe backup/restore, Omron Ethernet & Siemens
Rev. A	07/08	Added Mitsubishi drivers, minor corrections.

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 EA7-T10CC-7

 EA7-T12CC-9

 EA7-T15CC-11

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GETTING STARTED



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Introduction

The Purpose of this Manual

Thank you for purchasing our *C-more*® Touch Panel family of products. This manual describes AutomationDirect.com's *C-more* Touch Panels, their specifications, included components, available accessories and provides you with important information for installation, connectivity and setup. The manual shows you how install, wire and use the products. It also helps you understand how to interface the panels to other devices in a control system.

This user manual contains important information for personnel who will install the touch panels and accessories, and for the personnel who will be programming the panel. If you understand control systems that make use of operating interfaces such as the *C-more* touch panels, our user manuals will provide all the information you need to get, and keep your system up and running.

Supplemental Manuals

If you are familiar with industrial control type devices, you may be able to get up and running with just the aide of the Quick Start Guide that is included with each touch panel. You can also refer to the On-line help that is available in the *C-more* programming software for more information about programming the panel. The accessories include data sheets that will help with installing the accessories.

Technical Support

We strive to make our manuals the best in the industry. We rely on your feedback to let us know if we are reaching our goal. If you cannot find the solution to your particular application, or, if for any reason you need technical assistance, please call us at:

770-844-4200

Our technical support group will work with you to answer your questions. They are available Monday through Friday from 9:00 A.M. to 6:00 P.M. Eastern Time. We also encourage you to visit our web site where you can find technical and non-technical information about our products and our company.

<http://www.automationdirect.com>

If you have a comment, question or suggestion about any of our products, services, or manuals, please fill out and return the 'Suggestions' card that was included with this manual.

Conventions Used




When you see the “notepad” icon in the left-hand margin, the paragraph to its immediate right will be a special note. The word **NOTE:** in boldface will mark the beginning of the text.



When you see the “exclamation mark” icon in the left-hand margin, the paragraph to its immediate right will be a warning. This information could prevent injury, loss of property, or even death (in extreme cases). The word **WARNING:** in boldface will mark the beginning of the text.

Key Topics for Each Chapter

The beginning of each chapter will list the key topics that can be found in that chapter.

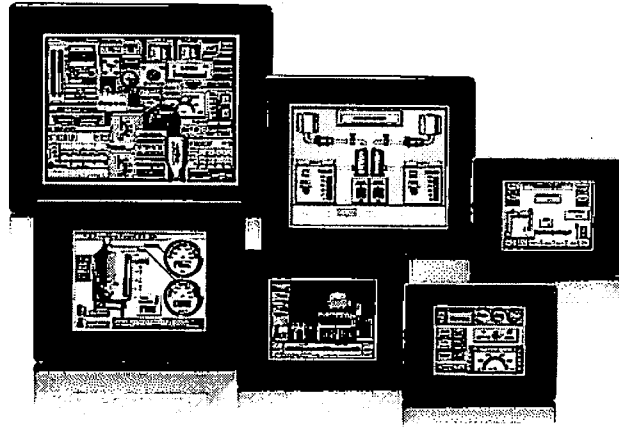
Getting Started		CHAPTER 1
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Mounting Clips – New Style



NOTE: *C-more* touch panels shipped prior to approximately April 2006 had a slightly different mounting clip design. All of the drawings and illustrations in this issue of the Hardware User Manual are shown with the newer design. **Appendix C: Mounting Clips Prior April 2006** contains drawings and illustrations of the original designed mounting clips for your reference.

Product Overview

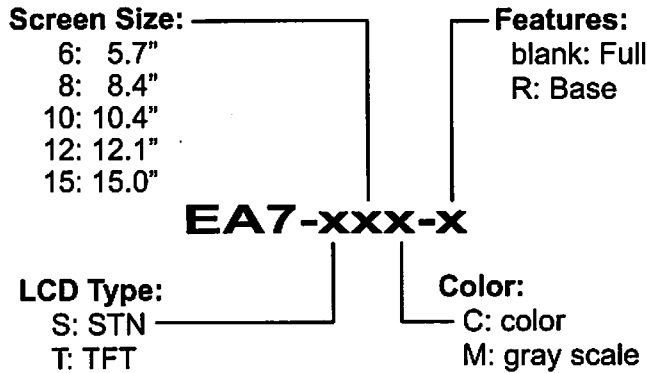


Some of the features designed into the product to provide excellent hardware and software are listed below.

- Analog touch screen (no touch cell boundaries)
- Plenty of memory and methods to get data in/out of the panel
- Overlapping active devices on the touch screen
- 65,536 colors for enhanced graphics on 6" (TFT), 8", 10", 12" and 15" panels (256 colors on 6" STN panels)
- Screen resolutions up to 1024 X 768 pixels
- Built-in project simulation; test on PC while developing
- Serial RS232, RS422/485 and Ethernet 10/100Base-T communications (Ethernet available on full feature units only.)
- Programming via USB or Ethernet (Ethernet available on full feature units only.)
- Optional AC/DC power adapter (EA-AC)
- User replaceable bulbs on 8", 10", 12" and 15" panels
- Animation of bitmaps and objects
- 4,000 built-in symbols, classic fonts: 6x8, 8x16, 8x32, 8x64, 16x16, 16x32, 16x64, 32x16, 32x32, 32x64, and Windows fonts
- PID face plate, trending, alarming and a recipe database
- Event Manager to trigger actions based on assigned state changes, schedules, PLC tag names, etc. setup in a database environment. The event can also trigger a sound byte, initiate a screen capture, send a data file (FTP), send an E-mail, etc.
- Select unique background screens for each created screen
- Trend Data logging
- Built-in FTP client/server, E-mail client, and Web server
- Audio output port - stereo, requires amplifier and speaker(s)

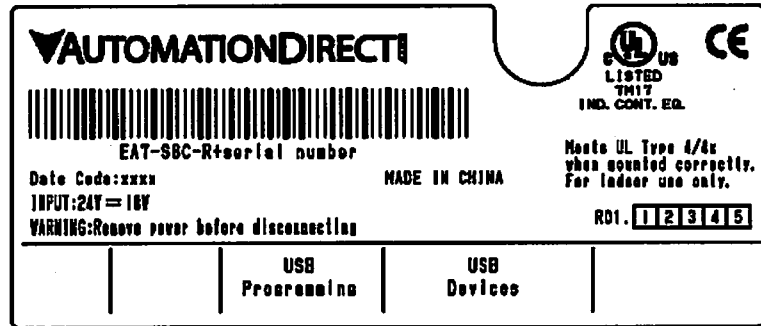
Part Number Key – Touch Panels

The *C-more* touch panel part numbers consist of the following key:

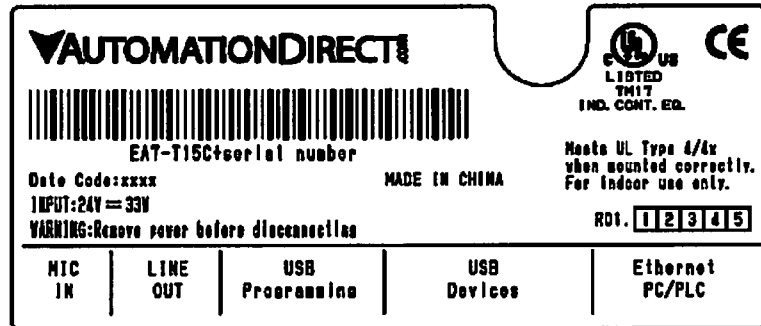


Product label examples:

EA7-S6C-R



EA7-T15C



Serial Number and Date Code formats:

Serial Number = [Part Number]+[YYMDDFNNN]

Date Code = **YYMF**

- YY:** Year (05–99 --- e.g. 05 = 2005)
- M:** Month (1–9, X, Y, Z --- e.g. X = Oct.)
- DD:** Day (1–31)
- F:** Manufacturing Site (0–9, A–Z)
- NNN:** Sequence number for the date listed (000–999)

EZTouch Conversion and Mounting

C-more panels are a drop-in replacement for EZTouch panels from *AutomationDirect*. They fit the same panel cutout*. The *C-more* software will convert your legacy EZTouch project (created with EZTouch Edit ver. 3.1a) automatically with no changes to the project required.** Just open your old EZTouch project in the new *C-more* Programming Software, connect the USB cable, and click "Send to Panel". The conversion is automatic and you will benefit immediately from:

- A better looking display
- A brighter screen
- Longer backlight bulb life
- Wider temperature tolerance
- A two year warranty



Note: EZTouch projects most have been created with EZTouch Edit software version 3.1a to assure proper project conversion.

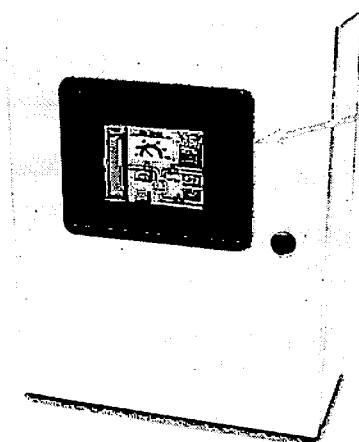
Now, there are hundreds of new features you may want to take advantage of, but it's nice to know that you can be up and running your existing EZTouch project in just a few minutes.

C-more accepts the same PLC communications and networking cables that you are using with EZTouch. The 24 VDC power connections accept the same DC wiring that you used for EZTouch, and now there is a removable terminal block connector. Only the programming cable is different - you no longer have to buy a proprietary serial cable to program your touch panel. *C-more* uses a standard USB cable or an Ethernet (CAT5) connection for programming.

* If you have an old 6" non-slim bezel EZTouch panel you will need our 6" Adapter Plate, part number EA-6-ADPTR, see the chapter on accessories.



** Some things to keep in mind when switching to *C-more*:




- 1.) The project conversion utility is a great feature. However the user must take full responsibility in ensuring the conversion works to their satisfaction.
- 2.) *C-more* does not support: FDA approval, DH+, ModBus+, Profibus, DeviceNet, Siemens MPI




Example of a C-more 6" touch panel mounted into an existing EZTouch non-slim bezel cutout using the C-more 6" adapter plate.

EZTouch Touch Panel Cross Reference to C-more

EZTouch		C-more*	
EZTouch 6", grayscale STN (0-45 °C)		C-more 6" Adapter	
		C-more 6", grayscale STN (0-50 °C)	
EZ-S6M-R	Requires: EA-6-ADPTR		EA7-S6M-R
EZ-S6M-RS			
EZ-S6M-F	Requires: EA-6-ADPTR		EA7-S6M (includes Ethernet)
EZ-S6M-FS			

EZTouch		C-more*	
EZTouch 6", 128 Color STN (0-45 °C)		C-more 6" Adapter	
		C-more 6", 256 Color STN or 65,536 Color TFT (0-50 °C)	
EZ-S6C-K	Requires: EA-6-ADPTR		EA7-S6C-R
EZ-S6C-KS			
EZ-S6C-F	Requires: EA-6-ADPTR		EA7-S6C (256 Color STN; includes Ethernet)
EZ-S6C-FS			
EZ-S6C-FST			EA7-T6C (65,536 Color TFT; includes Ethernet)

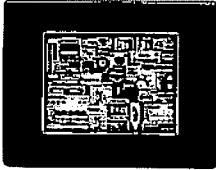
EZTouch		C-more*	
EZTouch 8", 128 Color STN (0-40 °C)		C-more 8" Adapter	
		C-more 8", 65,536 Color TFT (0-50 °C)	
EZ-S8C-F			EA7-T8C (includes Ethernet)
EZ-S8C-FS			
EZ-S8C-FST			

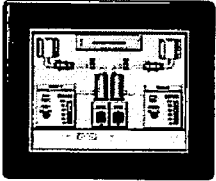


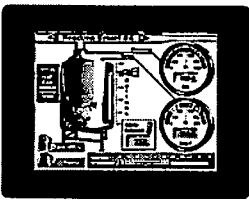
*Note: All C-more touch panels are NEMA 4/4X, IP-65 (When mounted correctly, for indoor use only), non-FDA.

1

EZTouch Touch Panel Cross Reference to C-more (cont'd)

EZTouch	C-more*
EZTouch 10", 128 Color TFT (0-50 °C)	C-more 10", 65,536 Color TFT (0-50 °C)
EZ-S10C-F	 <p>EA7-T10C (includes Ethernet)</p>
EZ-S10C-FS	
EZ-S10C-FST	
EZ-S10T-FSE	

EZTouch	C-more*
No 12" EZTouch available	C-more 12", 65,536 Color TFT (0-50 °C)
	 <p>EA7-T12C (includes Ethernet)</p>

EZTouch	C-more*
EZTouch 15", 128 Color TFT (0-45 °C)	C-more 15", 65,536 Color TFT (0-50 °C)
EZ-S15C-FS	 <p>EA7-T15C (includes Ethernet)</p>
EZ-S15C-FST	
EZ-S15C-FSE	



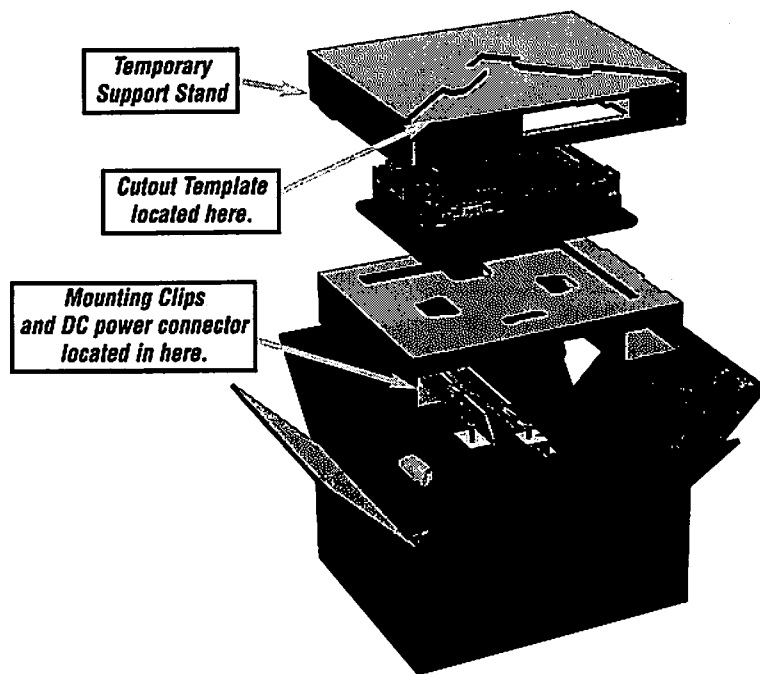
*Note: All C-more touch panels are NEMA 4/4X, IP-65 (When mounted correctly, for indoor use only), non-FDA.

Quick Start Steps

Step 1 – Unpack and Inspect

a.) Unpack the *C-more* Touch Panel from its shipping carton. Included in the carton are the following:

- *C-more* Touch Panel
- cutout template
- mounting clips
- temporary support stand
- DC power connector
- gasket
- Quick Start Guide, p/n EA-QSG



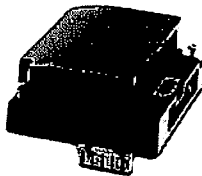
b.) Unpack any accessories that have been ordered, such as: AC/DC Power Adapter, Expansion Assembly, CompactFlash memory, programming cable, communications cable, etc.

c.) Inspect all equipment for completeness. If anything is missing or damaged, immediately call the *AutomationDirect*® returns department @ 1-800-633-0405.

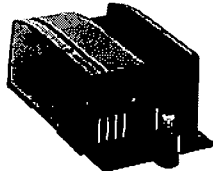
Shipping Carton Contents

Optional Accessories

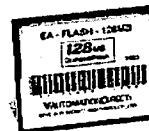
AC Power Adapter
EA-AC



Expansion Assembly
EA-EXP-OPT



128 MB Compact Flash
EA-FLASH-128MB



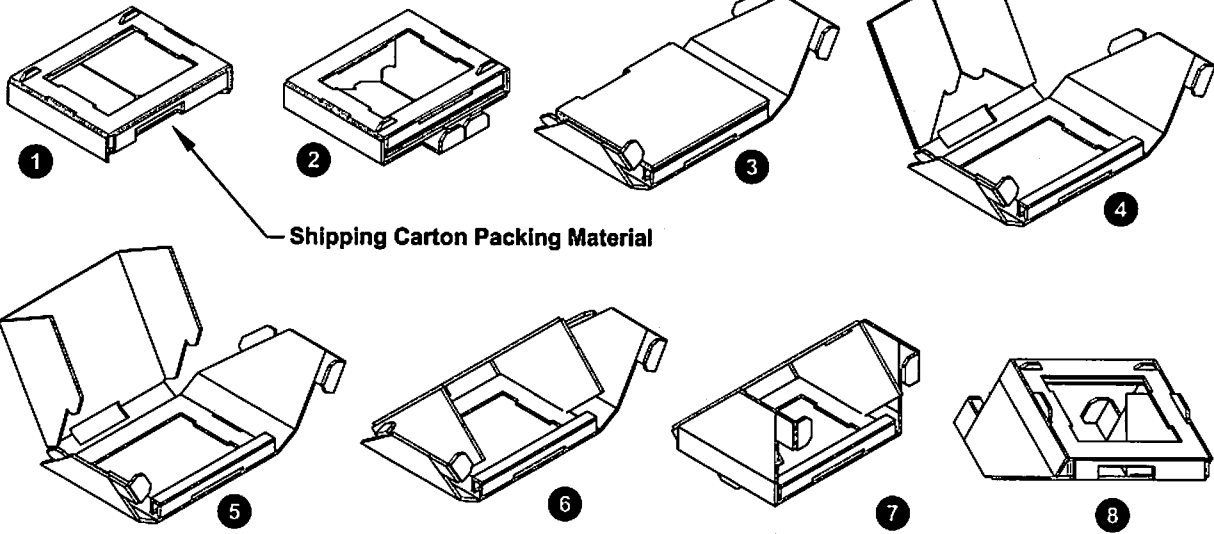
2GB USB Pen Drive
SDCZ4-2048-A10



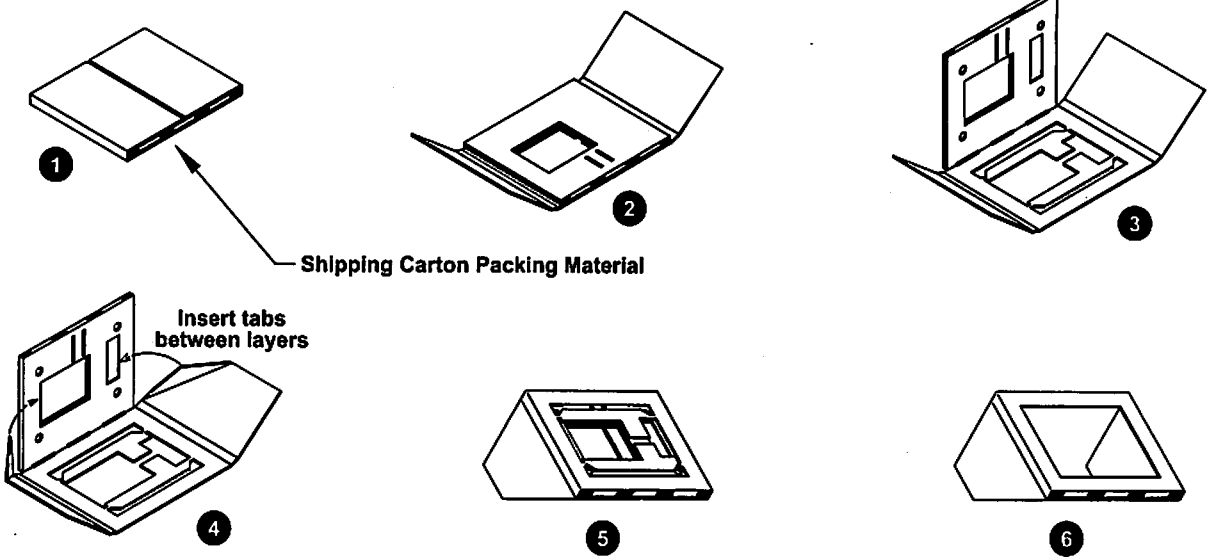
Step 2 – Assemble Temporary Support Stand

1

6" & 8" Touch Panel – Temporary Stand



10", 12" & 15" Touch Panel – Temporary Stand



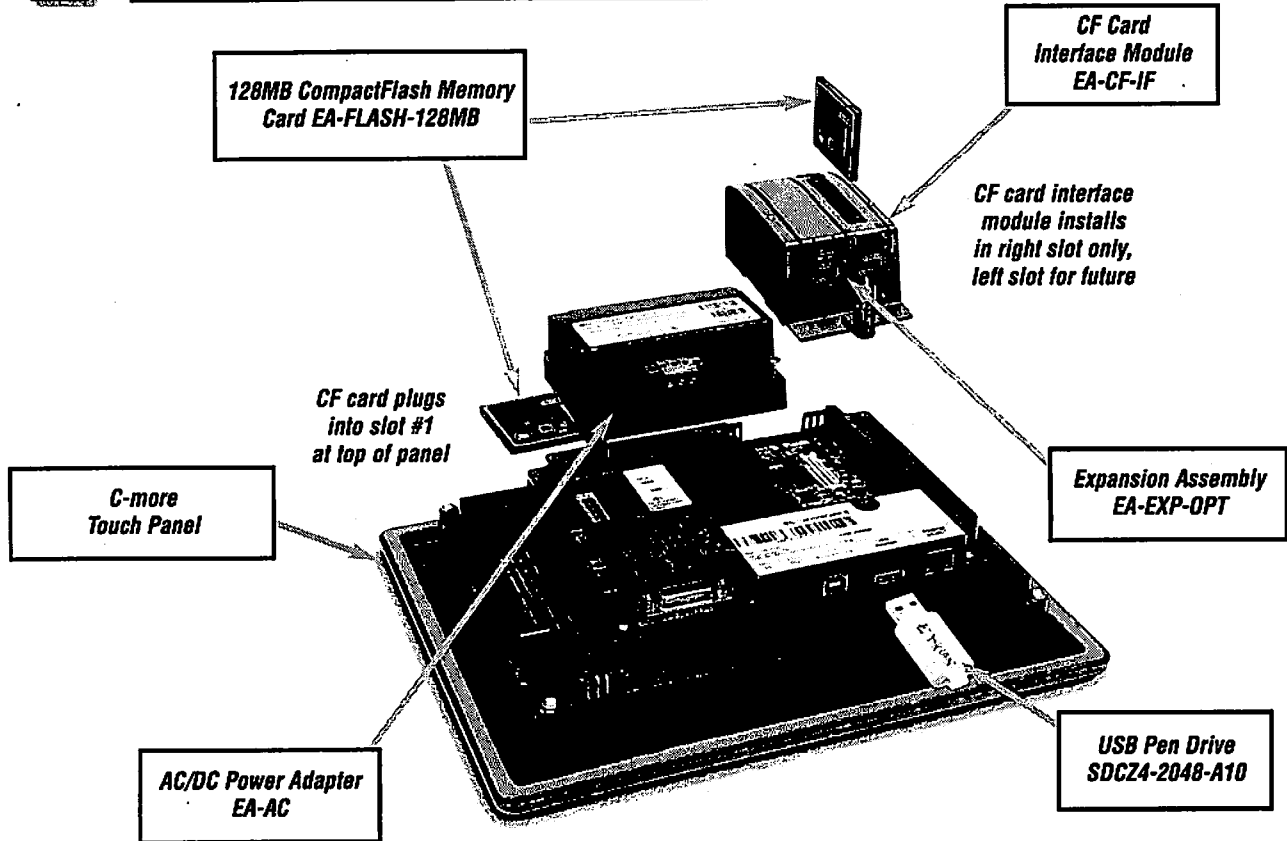
NOTE: See Chapter 4: Installation and Wiring for C-more touch panel installation information including cutout dimensions and mounting clearances.

Step 3 – Install Optional Hardware Accessories

1



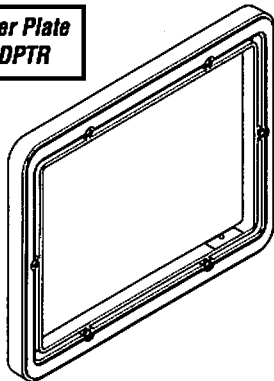
NOTE: CompactFlash memory card designations – *CF Slot #1* is at the top of the panel and *CF Slot #2* is the CF Card Interface Module, p/n EA-CF-IF.



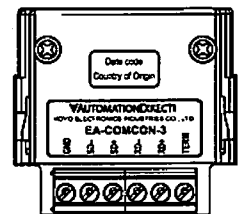
NOTE: The C-more 6" touch panels will fit into the existing cutout of any EZTouch 6" slim bezel panel. Use the C-more 6" Adapter Plate, p/n EA-6-ADPTR, to install C-more 6" panels into existing cutouts of EZTouch 6" non-slim (rounded bezel) panels.

Optional Accessories

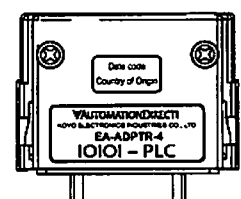
6" Adapter Plate EA-6-ADPTR



15-pin Terminal Block Adapter EA-COMCON-3

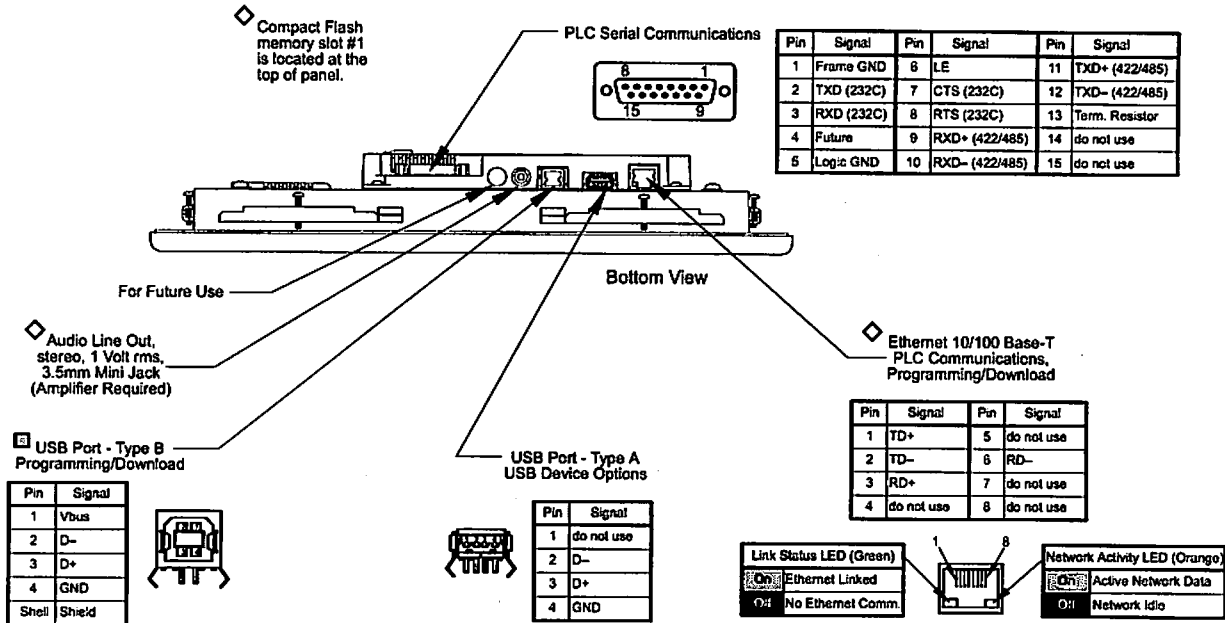


15-pin 90 Degree Comm. Port Adapter EA-ADPTR-4



Step 4 – Become Familiar with Available Communication Ports

1



◆ Note: Device is not available on Base Feature touch panels, part numbers EA7-S6M-R and EA7-S6C-R.

■ Note: Use USB Programming Cable, p/n USB-CBL-AB15.

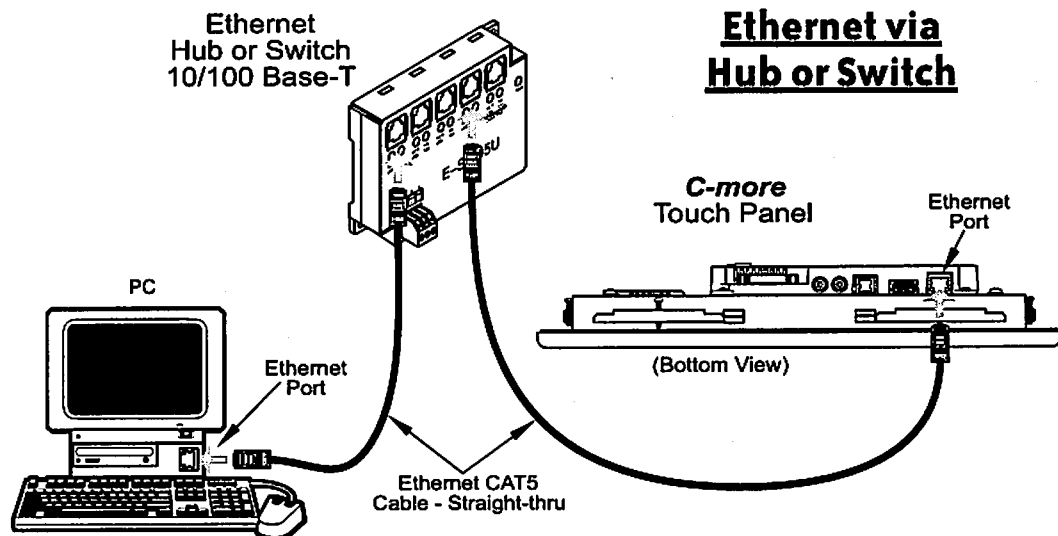
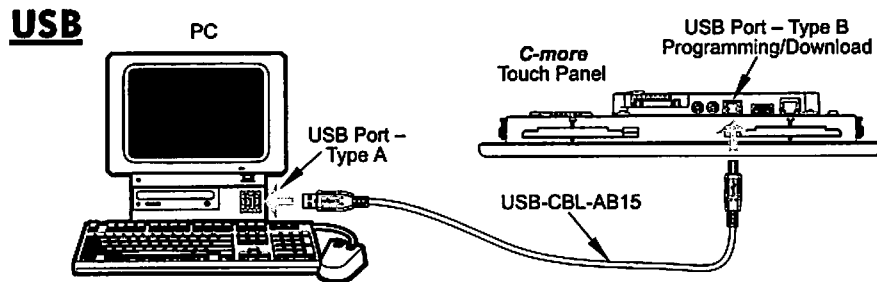


Note: See Chapter 2: Specifications and Chapter 6: PLC Communications for additional details on the available communication ports, protocols and cables.

Step 5 – Connect Touch Panel to Computer

- Connect a USB Programming Cable, p/n USB-CBL-AB15, from an USB type A port on the PC to the USB type B programming port on the *C-more* touch panel
- or connect the *C-more* touch panel and PC together via an Ethernet hub or switch, and CAT5 Ethernet cables (full feature panels only)
- or use an Ethernet crossover cable directly between the *C-more* touch panel Ethernet port and the PC Ethernet port (full feature panels only)

1

**Ethernet via Crossover Cable**

PC

Ethernet Port

Ethernet CAT5 Cable - Crossover

C-more Touch Panel

Ethernet Port

(Bottom View)

1

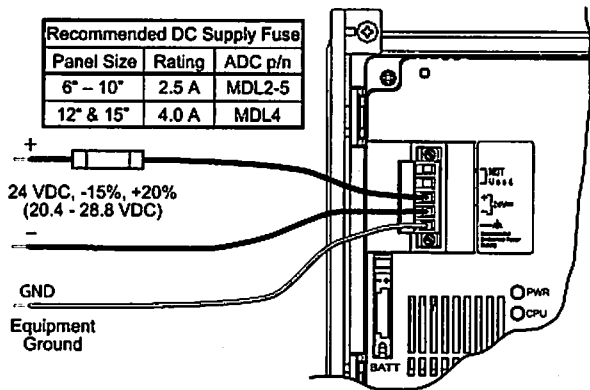
Step 6 – Provide Power to the Touch Panel

- Connect a dedicated 24 VDC (20.4 - 28.8 VDC) switching power supply rated at a minimum of 1.5 A to the DC connector on the rear of the *C-more* touch panel, include wiring the ground terminal to a proper equipment ground
- or install a *C-more* AC/DC Power Adapter, EA-AC, to the rear of the touch panel and connect an AC voltage source of 100-240 VAC, 50/60Hertz, to its AC connector (see note below)
- then turn on the power source and check the LED status indicators on the rear of the *C-more* touch panel for proper indication



NOTE: The AC/DC Power Adapter, EA-AC, is for *C-more* touch panels only. The adapter is powered from a 100-240 VAC, 50/60 Hertz power source. The adapter provides 24 VDC @ 1.5 A. Power Fault features help protect data being logged to CompactFlash during power failures. The *C-more* panel must have firmware version 1.21 Build 6.18E or higher for proper operation.

DC Wiring

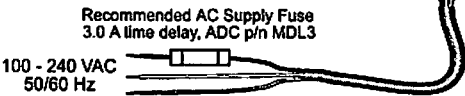
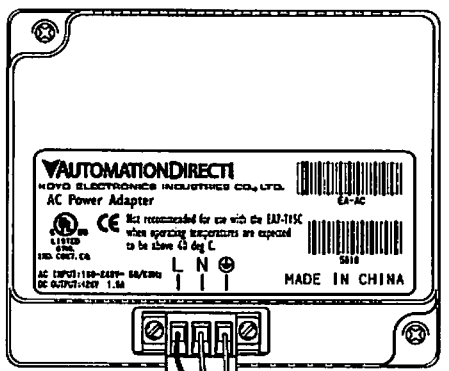


Panel Size	Rating	ADC p/n
6" - 10"	2.5 A	MDL2-5
12" & 15"	4.0 A	MDL4



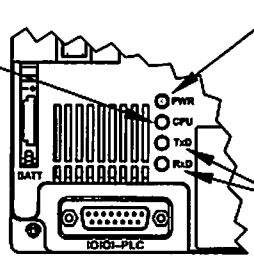
WARNING: The AC/DC Power Adapter is not recommended for use with the EA7-T15C touch panel when operating temperatures are expected to exceed 40 °C [104 °F].

AC Wiring



C-more LED Status Indicators

CPU Status LED (Green, Orange & Red)	
Off	Power Off
Green	Normal – CPU Run State
Blinking Red	Memory Error
Blinking Orange	Operating System not found
Blinking	LCD Backlight Failure
Blinking	Power Loss Detection



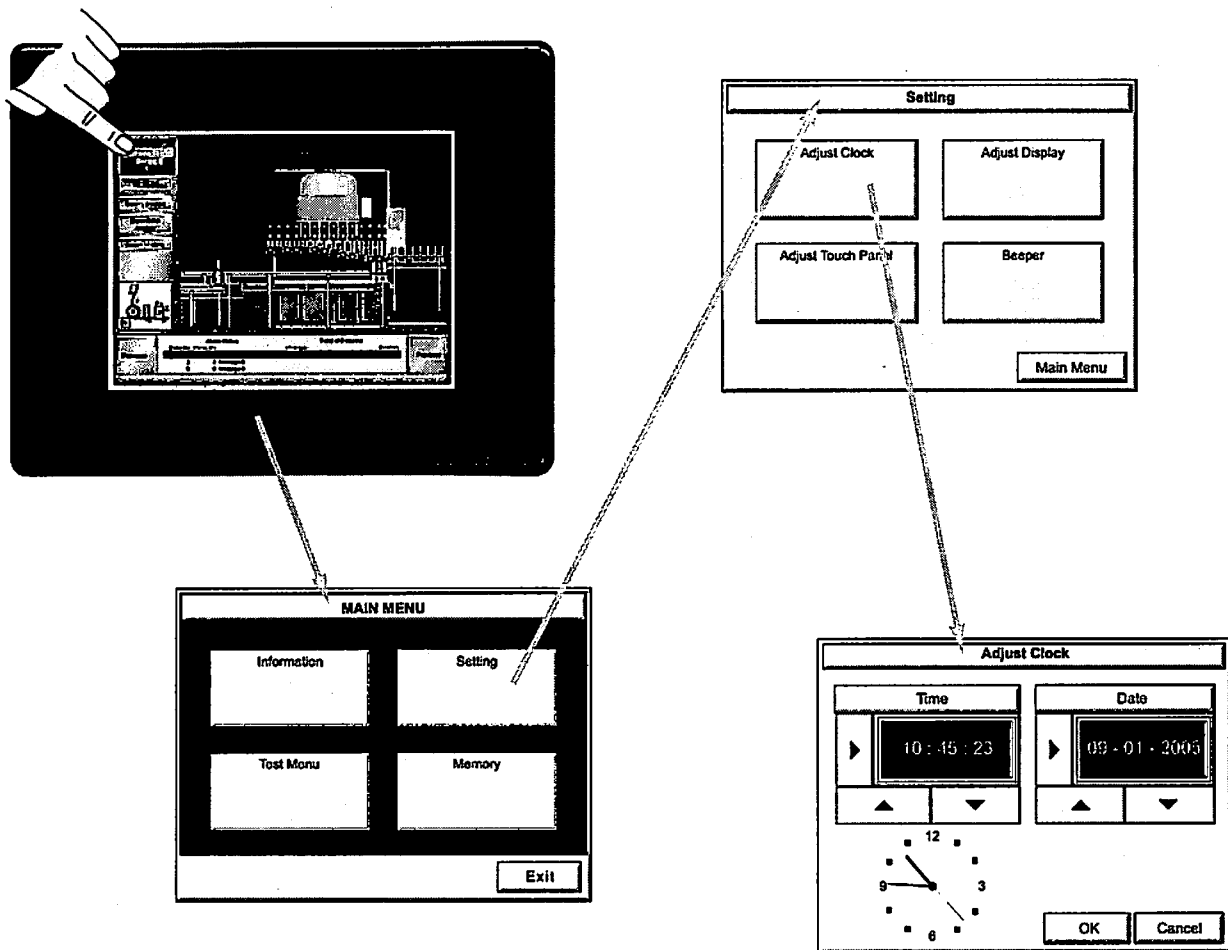
Rear View

Power LED (Green)	
On	Power On
Off	Power Off

Serial Tx/D/RxD LED (Green)	
On	Comm. is active
Off	No communication

Step 7 – Access the Touch Panel Setup Screens

- Access the Main Menu of the touch panel System Setup Screens by pressing the extreme upper left corner of the panel display area for three (3) seconds as shown below.
- Adjust the time and date for the panel by pressing the Setting button on the Main Menu, then press the Adjust Clock button on the Setting screen.
- Use the right pointing arrows for the time or date display to select the unit to change. Use the up and down arrows to increment or decrement the value for the selected unit.
- Press OK when done to accept the changes to the time and date that is retained in the touch panel's battery backed memory, or press Cancel to exit the Adjust Clock setup screen without making any changes.
- Press the Main Menu button on the Setting screen and then the Exit button on the Main Menu screen to return to the application screen.



Note: When using an Ethernet connection, by default the panel is set for DHCP IP addressing. If it can not find a DHCP server, the panel will automatically assign an IP address. The IP address can be changed by the user from the programming software or by accessing the IP address setting screen as shown on page 5-19 and detailed on page 5-25. See Chapter 5 - System Setup Screens for details on other setup screen settings and functions.

Step 8 – Choose Touch Panel to PLC Protocol & Cables

1

PLC Compatibility Table			
PLC Family	Model	Protocols	
DirectLOGIC	DL05/DL06	all	K-Sequence
			<i>Direct</i> NET
		Modbus (Koyo addressing)	
		H0-ECOM/H0-ECOM100	<i>Direct</i> LOGIC Ethernet
	DL105	all	K-Sequence
	DL205	D2-230	K-Sequence
		D2-240	K-Sequence
			<i>Direct</i> NET
		D2-250/D2-250-1/D2-260	K-Sequence
			<i>Direct</i> NET
			Modbus (Koyo addressing)
		D2-240/D2-250-1/D2-260 Using DCM	<i>Direct</i> NET
			Modbus (Koyo addressing)
		H2-ECOM/H2-ECOM100	<i>Direct</i> LOGIC Ethernet
	DL305	D3-330/330P (Requires the use of a Data Communications Unit)	<i>Direct</i> NET
		D3-340	<i>Direct</i> NET
		D3-350	K-Sequence
			<i>Direct</i> NET
			Modbus (Koyo addressing)
	D3-350 DCM	<i>Direct</i> NET	
		Modbus (Koyo addressing)	
	DL405	D4-430	K-Sequence
			<i>Direct</i> NET
		D4-440	K-Sequence
			<i>Direct</i> NET
		D4-450	K-Sequence
			<i>Direct</i> NET
			Modbus (Koyo addressing)
	All with DCM	<i>Direct</i> NET	
		Modbus (Koyo addressing)	
	H4-ECOM/H4-ECOM100	<i>Direct</i> LOGIC Ethernet	
	H2-WinPLC (Think & Do) Live V5.2 or later and Studio any version	Think & Do Modbus RTU (serial port)	
	H2-WinPLC (Think & Do) Live V5.5.1 or later and Studio V7.2.1 or later	Think & Do Modbus TCP/IP (Ethernet port)	

PLC Compatibility Table continued on the next page.

Step 8 – Choose Touch Panel to PLC Protocol & Cables (cont'd)

PLC Compatibility Table (cont'd)		
PLC Family	Model	Protocols
Allen-Bradley	MicroLogix 1000, 1100, 1200, 1500, SLC 5-01/02/03, PLC5	DH485/AIC/AIC+
	MicroLogix 1000, 1100, 1200 and 1500	DF1 Half Duplex; DF1 Full Duplex
	SLC 5-03/04/05	
	ControlLogix™, CompactLogix™, FlexLogix™	
	PLC-5	DF1 Full Duplex
	ControlLogix, CompactLogix, FlexLogix - Tag Based	DF1 Half Duplex; DF1 Full Duplex
	ControlLogix, CompactLogix, FlexLogix - Generic I/O Messaging	EtherNet/IP Server
	ControlLogix, CompactLogix, FlexLogix - Tag Based	EtherNet/IP Client
	MicroLogix 1100 & SLC 5/05, both via native Ethernet port	
	MicroLogix 1000, 1100, 1200, 1500, SLC 5-03/04/05, all via ENI adapter	
Modbus TCP/IP	Modbus TCP/IP devices	Modbus TCP/IP
GE	90/30, 90/70, Micro 90, VersaMax Micro	SNPX
Mitsubishi	FX Series	FX Direct
	Q02, Q02H, Q06H, Q12H, Q25H	Q CPU
	Q, QnA Serial	QnA Serial
	Q, QnA Ethernet	QnA Ethernet
Omron	C200 Adapter, C500	Host Link
	CJ1/CS1 Serial	FINS
	CJ1/CS1 Ethernet	
Modicon	984 CPU, Quantum 113 CPU, AEG Modicon Micro Series 110 CPU: 311-xx, 411-xx, 512-xx, 612-xx	Modbus RTU
Siemens	S7-200 CPU, RS-485 Serial	PPI
	S7-300, Ethernet	Ethernet ISO over TCP

Step 8 – Choose Cables continued on next page.

Step 8 – Choose Touch Panel to PLC Protocol & Cables (cont'd)

1

Purchased Cable Description	Cable Part Number
DirectLOGIC PLC RJ-12 port, DL05, DL06, DL105, DL205, D3-350, D4-450 & H2-WINPLC (RS-232C)	EA-2CBL
DirectLOGIC (VGA Style) 15-pin port, DL06, D2-250 (250-1), D2-260 (RS-232C)	EA-2CBL-1
DirectLOGIC PLC RJ-11 port, D3-340 (RS-232C)	EA-3CBL
DirectLOGIC DL405 PLC 15-pin D-sub port, DL405 (RS-232C)	EA-4CBL-1
DirectLOGIC PLC 25-pin D-sub port, DL405, D3-350, DL305 DCU and all DCM's (RS-232C)	EA-4CBL-2
Allen-Bradley MicroLogix 1000, 1100, 1200 & 1500 (RS-232C)	EA-MLOGIX-CBL
Allen-Bradley SLC 5-03/04/05, ControlLogix, CompactLogix, FlexLogix DF1 port (RS-232C)	EA-SLC-232-CBL
Allen-Bradley PLC-5 DF1 port (RS-232C)	EA-PLC5-232-CBL
Allen-Bradley MicroLogix, SLC 5-01/02/03, PLC5 DH485 port (RS-232C)	EA-DH485-CBL
GE 90/30, 90/70, Micro 90, VersaMax Micro 15-pin D-sub port (RS-422A)	EA-90-30-CBL
MITSUBISHI FX Series 25-pin port (RS-422A)	EA-MITSU-CBL
MITSUBISHI FX Series 8-pin mini-DIN (RS-422A)	EA-MITSU-CBL-1
OMRON Host Link (C200 Adapter, C500) (RS-232C)	EA-OMRON-CBL

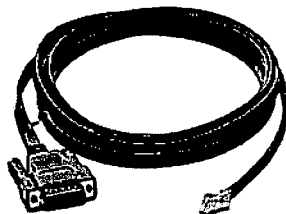


NOTE 1: The above list of pre-made communications cables may be purchased. See **Chapter 6: PLC Communications** for wiring diagrams of additional user constructed cables. Chapter 6 also includes wiring diagrams for the pre-made cables.

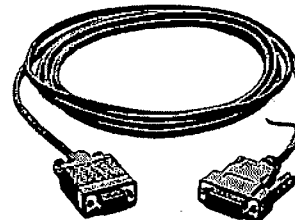
NOTE 2: EZTouch serial PLC communication cables are compatible with C-more touch panels.

Pre-made cable examples

EA-2CBL



EA-2CBL-1

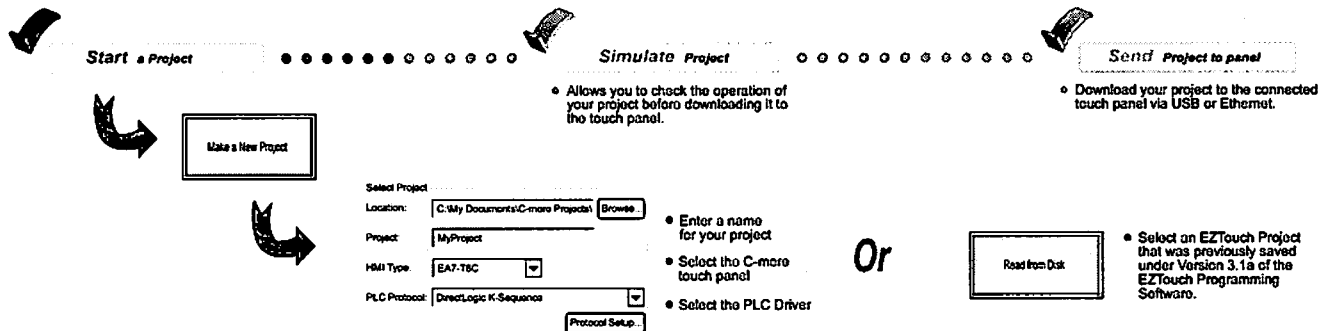
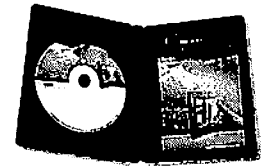


Step 9 – Install the Programming Software and Develop a Project

Following are the minimum system requirements for running *C-more* Programming Software, p/n EA-PGMSW, on a PC:

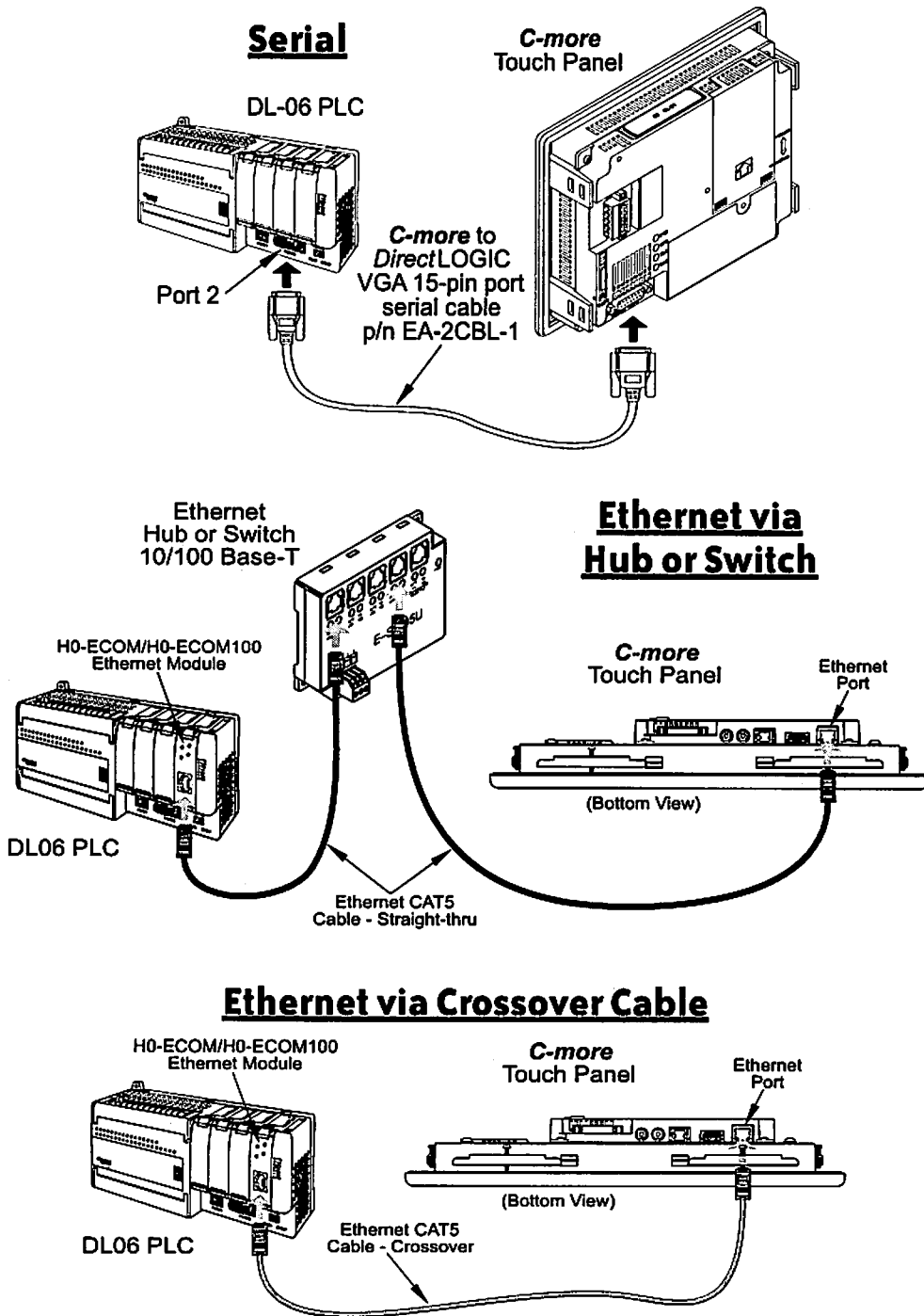
- Personal Computer with a 333 MHz or higher processor (CPU) clock speed recommended; Intel® Pentium/Celeron family, or AMD® K6/Athlon/Duron family, or compatible processor recommended
- Keyboard and Mouse or compatible pointing device
- Super VGA color video adapter and monitor with at least 800 x 600 pixels resolution (1024 x 768 pixels recommended), 64K color minimum
- 300 MB free hard-disk space
- 128 MB free RAM (512 MB recommended)
- CD-ROM or DVD drive for installing software from the CD
- USB type A port or Ethernet 10/100 Mbps port for project transfer from software to touch panel (Ethernet port not available on -R models)
- Operating System - Windows® XP Home / Professional Edition or Windows® 2000 with Service Pack 4. (To check your computer system information, go to the Start Menu – All Programs and select Accessories, then System Tools, and finally System Information.)

Insert the supplied CD-ROM into the PC's CD-ROM drive and follow the instructions. If you need assistance during the software installation, please refer to the supplied Software Installation Guide or call the AutomationDirect Technical Support team @ 770-844-4200.



Step 10 – Connect Touch Panel to PLC

- Connect the serial communications cable between the *C-more* touch panel and the PLC
- or connect the *C-more* touch panel and PLC together via an Ethernet hub or switch, and CAT5 Ethernet cables (full feature panels only)
- or use an Ethernet crossover cable directly between the *C-more* Ethernet port and the PLC Ethernet port (full feature panels only)



SPECIFICATIONS



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Available Models

The *C-more*[®] Operator Interface is the next generation of touch panel brought to you by *AutomationDirect*. It has been designed to display and interchange graphical data from a PLC by merely viewing or touching the screen.

The *C-more* Touch Panel is available in a variety of models to suit your application. Refer to the following tables for a list of part numbers, descriptions and options available.

Part Number	Description	User Memory	CF Card Option	USB Device	Ethernet
EA7-S6M-R	6-inch <i>C-more</i> grayscale STN touch panel (5.7 inch viewable screen), 15 shades of gray, 320 x 240 pixel QVGA screen resolution, 333 MHz CPU, 24 VDC (20.4-28.8 VDC operating range), NEMA 4/4X, IP-65 (when mounted correctly; for indoor use only), non-replaceable backlight, 50,000 hour half-life. *Base Model: Built-in USB only, no Ethernet or CompactFlash support.	10 MB	No	Yes	No
EA7-S6C-R	6-inch <i>C-more</i> color STN touch panel (5.7 inch viewable screen), 256 colors, 320 x 240 pixel QVGA screen resolution, 333 MHz CPU, 24 VDC (20.4-28.8 VDC operating range), NEMA 4/4X, IP-65 (when mounted correctly; for indoor use only), non-replaceable backlight, 50,000 hour half-life. *Base Model: Built-in USB only, no Ethernet or CompactFlash support.	10 MB	No	Yes	No
EA7-S6M	6-inch <i>C-more</i> grayscale STN touch panel (5.7 inch viewable screen), 15 shades of gray, 320 x 240 pixel QVGA screen resolution, 333 MHz CPU, 24 VDC (20.4-28.8 VDC operating range), NEMA 4/4X, IP-65 (when mounted correctly; for indoor use only), non-replaceable backlight, 50,000 hour half-life. Built-in Ethernet and USB; supports CompactFlash.	10MB	Yes	Yes	Yes
EA7-S6C	6-inch <i>C-more</i> color STN touch panel (5.7 inch viewable screen), 256 colors, 320 x 240 pixel QVGA screen resolution, 333 MHz CPU, 24 VDC (20.4-28.8 VDC operating range), NEMA 4/4X, IP-65 (when mounted correctly; for indoor use only), non-replaceable backlight, 50,000 hour half-life. Built-in Ethernet and USB; supports CompactFlash.	10 MB	Yes	Yes	Yes
EA7-T6C	6-inch <i>C-more</i> color TFT touch panel (5.7 inch viewable screen), 64K colors, 320 x 240 pixel QVGA screen resolution, 333 MHz CPU, 24 VDC (20.4-28.8 VDC operating range), NEMA 4/4X, IP-65 (when mounted correctly; for indoor use only), non-replaceable backlight, 50,000 hour half-life. Built-in Ethernet and USB; supports CompactFlash.	10 MB	Yes	Yes	Yes

Table continued on the next page.

Available Models (cont'd)

Part Number	Description	User Memory	CF Card Option	USB Device	Ethernet
EA7-T8C	8-inch <i>C-more</i> color TFT touch panel (8.4 inch viewable screen), 64K colors, 640 x 480 pixel VGA screen resolution, 400 MHz CPU, 24 VDC (20.4-28.8 VDC operating range), NEMA 4/4X, IP-65 (when mounted correctly; for indoor use only), user replaceable backlight, 50,000 hour half-life. Built-in Ethernet and USB; supports CompactFlash.	10 MB	Yes	Yes	Yes
EA7-T10C	10-inch <i>C-more</i> color TFT touch panel (10.4 inch viewable screen), 64K colors, 640 x 480 pixel VGA screen resolution, 400 MHz CPU, 24 VDC (20.4-28.8 VDC operating range), NEMA 4/4X, IP-65 (when mounted correctly; for indoor use only), user replaceable backlight, 50,000 hour half-life. Built-in Ethernet and USB; supports CompactFlash.	10 MB	Yes	Yes	Yes
EA7-T12C	12-inch <i>C-more</i> color TFT touch panel (12.1 inch viewable screen), 64K colors, 800 x 600 pixel SVGA screen resolution, 400 MHz CPU, 24 VDC (20.4-28.8 VDC operating range), NEMA 4/4X, IP-65 (when mounted correctly; for indoor use only), user replaceable backlight, 50,000 hour half-life. Built-in Ethernet and USB; supports CompactFlash.	40 MB	Yes	Yes	Yes
EA7-T15C	15-inch <i>C-more</i> color TFT touch panel (15.0 inch viewable screen), 64K colors, 1024 x 768 XGA screen resolution, 400 MHz CPU, 24V DC (20.4-28.8 VDC operating range), NEMA 4/4X, IP-65 (when mounted correctly; for indoor use only), user replaceable backlight, 50,000 hour half-life. Built-in Ethernet and USB; supports CompactFlash.	40 MB	Yes	Yes	Yes

2

Model Specifications

The following tables on the next four pages provide details to the Specifications of each available model. The specification tables are separated into the following groups:

- 6" Base Feature Models, EA7-S6M-R and EA7-S6C-R
- 6" Full Feature Models, EA7-S6M, EA7-S6C and EA7-T6C
- 8" & 10" Full Feature Models, EA7-T8C and EA7-T10C
- 12" & 15" Full Feature Models, EA7-T12C & EA7-T15C

The following note applies to the Backlight Average Lifetime of 50,000 hours shown in the following four tables:



Note: The backlight average lifetime is defined as the average usage time it takes before the brightness becomes 50% of the initial brightness. The lifetime of the backlight depends on the ambient temperature. The lifetime will decrease under low or high temperature usage.

6" Base Feature Models

2

Specification	Model	6" STN grayscale w/ base features	6" STN color w/ base features
Part Number		EA7-S6M-R	EA7-S6C-R
Display Actual Size and Type		5.7" STN grayscale	5.7" STN color
Color Scale		15 shades of gray	256 colors
Display Viewing Area		4.54" x 3.4" [115.2 mm x 86.4 mm]	
Screen Pixels		320 x 240 (QVGA)	
Display Brightness		150 cd/m ² (NITS)	200 cd/m ² (NITS)
LCD Panel Dot Pitch		0.36 mm x 0.36 mm	
Backlight Average Lifetime		Approximately 50,000 hours (See note at bottom of page 2-3.)	
Backlight User Replaceable		No	
Touch Panel Type		Analog resistive (10-bit resolution, 1024 x 1024 touch area)	
CPU Type		32-Bit RISC CPU (333 MHz)	
Battery		Replaceable battery – ADC Part # D2-BAT-1 (Manufacturer Part # CR2354)	
System Memory		SDRAM 32 MBytes	
System Flash Memory		FLASH 32 MBytes	
Backup Memory (SRAM)		Control data backup memory (SRAM) 256 KBytes	
Logging Data Memory		USB Pen Drive p/n SDCZ4-2048-A10 (Optional)	
Number of Screens		Up to 999 – limited by project memory (10 MBytes)	
Realtime Clock		Built into panel (PLC clock is still accessible if available)	
Calendar – Month/Day/Year		Yes - battery backup	
Screen Saver		Yes, backlight turns off after a 30–1500 minute adjustable time, or can be disabled	
Serial PLC Interface		Serial PLC Port: RS-232C/422/485 15-Pin D-sub (female)	
USB Port – Type B		Download/Program – USB Port – type B	
USB Port – Type A		Port for USB device options – type A	
Ethernet Port		not available	
Audio Line Out		not available	
CF Card – Slot #1		not available	
Expansion Assembly (p/n EA-EXP-OPT)		not available	
Supply Power		24 VDC, -15%, +20% (20.4–28.8 VDC operating range, minimum of 1.5 A) (Use the AC/DC Power Adapter, EA-AC, to power the touch panel from a 100-240 VAC, 50/60 Hz. power source.)	
Power Consumption		9 W @ 24 VDC	10 W @ 24 VDC
Recommended DC Supply Fuse		2.5 A time delay, ADC p/n MDL2-5	
Operating Temperature		0 to 50 °C (32 to 122 °F)	
Storage Temperature		-20 to +60 °C (-4 to +140 °F)	
Humidity		10–85% RH (non-condensing)	
Noise Immunity		Noise voltage: 1000 Vp-p, Pulse width: 1 μs, Rise time: 1 ns	
Withstand Voltage		1000 VDC for 1 minute, between DC power supply input terminal and safety ground	
Insulation Resistance		Over 20 MΩ between DC power supply input terminal and safety ground	
Vibration		IEC61131-2 compliant, 10–57 Hz: 0.075 mm amplitude, 57–150 Hz 1.0 G: 10 sweep cycles per axis on each of 3 mutually perpendicular axes	
Shock		15 G peak, 11 ms duration, 2 shocks per axis, on 3 mutually perpendicular axes	
Enclosure		NEMA 4/4X, IP-65 (When mounted correctly. For indoor use only.)	
Agency Approvals		UL, cUL, CE	
Dimensions		6.140" x 8.047" x 1.697" [156.0 mm x 204.4 mm x 43.1 mm]	
Weight		1.46 lb. [660 g]	1.39 lb. [630 g]

6" Full Feature Models

2

Specification	Model	6" STN grayscale w/full features	6" STN color w/full features	6" TFT color w/full features
Part Number		EA7-S6M	EA7-S6C	EA7-T6C
Display Actual Size and Type		5.7" STN grayscale	5.7" STN color	5.7" TFT color
Color Scale		15 shades of gray	256 colors	65,536 colors
Display Viewing Area		4.54" x 3.4" [115.2 mm x 86.4 mm]		
Screen Pixels		320 x 240 (QVGA)		
Display Brightness		150 cd/m ² (NITS)	200 cd/m ² (NITS)	270 cd/m ² (NITS)
LCD Panel Dot Pitch		0.36 mm x 0.36 mm		
Backlight Average Lifetime		Approximately 50,000 hours (See note at bottom of page 2-3.)		
Backlight User Replaceable		No		
Touch Panel Type		Analog resistive (10-bit resolution, 1024 x 1024 touch area)		
CPU Type		32-Bit RISC CPU (333 MHz)		
Battery		Replaceable battery – ADC Part # D2-BAT-1 (Manufacturer Part # CR2354)		
System Memory		SDRAM 32 MBytes		
System Flash Memory		FLASH 32 MBytes		
Backup Memory (SRAM)		Control data backup memory (SRAM) 256 KBytes		
Logging Data Memory		CompactFlash Memory Card p/n EA-FLASH-128MB, industrial grade, high speed (Optional) or USB Pen Drive p/n SDCZ4-2048-A10 (Optional)		
Number of Screens		Up to 999 – limited by project memory (10 MBytes)		
Realtime Clock		Built into panel (PLC clock is still accessible if available)		
Calendar – Month/Day/Year		Yes - battery backup		
Screen Saver		Yes, backlight turns off after a 30–1500 minute adjustable time, or can be disabled		
Serial PLC Interface		Serial PLC Port: RS-232C/422/485 15-Pin D-sub (female)		
USB Port – Type B		Download/Program – USB Port – type B		
USB Port – Type A		Port for USB device options – type A		
Ethernet Port		Ethernet 10/100 Base-T		
Audio Line Out		Audio Line Out, 1 volt rms, stereo – requires amplifier and speaker(s)		
CF Card – Slot #1		Optional: CompactFlash Card p/n EA-FLASH-32MB, slot #1 located on top side of touch panel.		
Expansion Assembly (p/n EA-EXP-OPT)		Optional: Use the CF Card Adapter p/n EA-CF-IF in the right slot of the expansion assembly for installing CF card - Slot #2. The left slot of the expansion assembly is for future options.		
Supply Power		24 VDC, -15%, +20% (20.4–28.8 VDC operating range, minimum of 1.5 A) (Use the AC/DC Power Adapter, EA-AC, to power the touch panel from a 100-240 VAC, 50/60 Hz. power source.)		
Power Consumption		10 W @ 24 VDC	11 W @ 24 VDC	13 W @ 24 VDC
Recommended DC Supply Fuse		2.5 A time delay, ADC p/n MDL2-5		
Operating Temperature		0 to 50 °C (32 to 122 °F)		
Storage Temperature		–20 to +60 °C (–4 to +140 °F)		
Humidity		10–85% RH (non-condensing)		
Noise Immunity		Noise voltage: 1000 Vp-p, Pulse width: 1 µs, Rise time: 1 ns		
Withstand Voltage		1000 VDC for 1 minute, between DC power supply input terminal and safety ground		
Insulation Resistance		Over 20 MΩ between DC power supply input terminal and safety ground		
Vibration		IEC61131-2 compliant, 10–57 Hz: 0.075 mm amplitude, 57–150 Hz 1.0 G: 10 sweep cycles per axis on each of 3 mutually perpendicular axes		
Shock		15 G peak, 11 ms duration, 2 shocks per axis, on 3 mutually perpendicular axes		
Enclosure		NEMA 4/4X, IP-65 (When mounted correctly. For indoor use only.)		
Agency Approvals		UL, cUL, CE		
Dimensions		6.140" x 8.047" x 1.697" [156.0 mm x 204.4 mm x 43.1 mm]		
Weight		1.50 lb. [680 g]	1.43 lb. [650 g]	1.52 lb. [690 g]

8" and 10" Full Feature Models

2

Specifications	Model	8" TFT color w/ full features	10" TFT color w/ full features
Part Number		EA7-T8C	EA7-T10C
Display Actual Size and Type		8.4" TFT color	10.4" TFT color
Color Scale		65,536 colors	
Display Viewing Area		6.73" x 5.05" [170.9 mm x 128.2 mm]	8.31" x 6.24" [211.2 mm x 158.4 mm]
Screen Pixels		640 x 480 (VGA)	
Display Brightness		300 cd/m ² (NITS)	270 cd/m ² (NITS)
LCD Panel Dot Pitch		0.267 mm x 0.267 mm	0.33 mm x 0.33 mm
Backlight Average Lifetime		Approximately 50,000 hours (See note at bottom of page 2-3.)	
Backlight User Replaceable		Yes - Part No. EA-xx-BULB, xx = panel size	
Touch Panel Type		Analog resistive (10-bit resolution, 1024 x 1024 touch area)	
CPU Type		32-Bit RISC CPU (400 MHz)	
Battery		Replaceable battery – ADC Part # D2-BAT-1 (Manufacturer Part # CR2354)	
System Memory		SDRAM 32 MBytes	
System Flash Memory		FLASH 32 MBytes	
Backup Memory (SRAM)		Control data backup memory (SRAM) 256 KBytes	
Logging Data Memory		CompactFlash Memory Card p/n EA-FLASH-128MB, industrial grade, high speed (Optional) or USB Pen Drive p/n SDCZ4-2048-A10 (Optional)	
Number of Screens		Up to 999 – limited by project memory (10 MBytes)	
Realtime Clock		Built into panel (PLC clock is still accessible if available)	
Calendar – Month/Day/Year		Yes - battery backup	
Screen Saver		Yes, backlight turns off after a 30–1500 minute adjustable time, or can be disabled	
Serial PLC Interface		Serial PLC Port: RS-232C/422/485 15-Pin D-sub (female)	
USB Port – Type B		Download/Program – USB Port – type B	
USB Port – Type A		Port for USB device options – type A	
Ethernet Port		Ethernet 10/100 Base-T	
Audio Line Out		Audio Line Out, 1 volt rms, stereo – requires amplifier and speaker(s)	
CF Card – Slot #1		Optional: CompactFlash Card p/n EA-FLASH-32MB, slot #1 located on top side of touch panel.	
Expansion Assembly (p/n EA-EXP-OPT)		Optional: Use the CF Card Adapter p/n EA-CF-IF in the right slot of the expansion assembly for installing CF card - Slot #2. The left slot of the expansion assembly is for future options.	
Supply Power		24 VDC, -15%, +20% (20.4–28.8 VDC operating range, minimum of 1.5 A) (Use the AC/DC Power Adapter, EA-AC, to power the touch panel from a 100-240 VAC, 50/60 Hz. power source.)	
Power Consumption		15 W @ 24 VDC	17 W @ 24 VDC
Recommended DC Supply Fuse		2.5 A time delay, ADC p/n MDL2-5	
Operating Temperature		0 to 50 °C (32 to 122 °F)	
Storage Temperature		–20 to +60 °C (–4 to +140 °F)	
Humidity		10–85% RH (non-condensing)	
Noise Immunity		Noise voltage: 1000 Vp-p, Pulse width: 1 μs, Rise time: 1 ns	
Withstand Voltage		1000 VDC for 1 minute, between DC power supply input terminal and safety ground	
Insulation Resistance		Over 20 MΩ between DC power supply input terminal and safety ground	
Vibration		IEC61131-2 compliant, 10–57 Hz: 0.075 mm amplitude, 57–150 Hz 1.0 G: 10 sweep cycles per axis on each of 3 mutually perpendicular axes	
Shock		15 G peak, 11 ms duration, 2 shocks per axis, on 3 mutually perpendicular axes	
Enclosure		NEMA 4/4X, IP-65 (When mounted correctly. For indoor use only.)	
Agency Approvals		UL, cUL, CE	
Dimensions		8.748" x 10.894" x 2.053" [222.2 mm x 276.7 mm x 52.1 mm]	10.669" x 13.661" x 2.079" [271.0 x 347.0 x 52.8 mm]
Weight		2.60 lb. [1,180 g]	3.55 lb. [1,610 g]

12" and 15" Full Feature Models

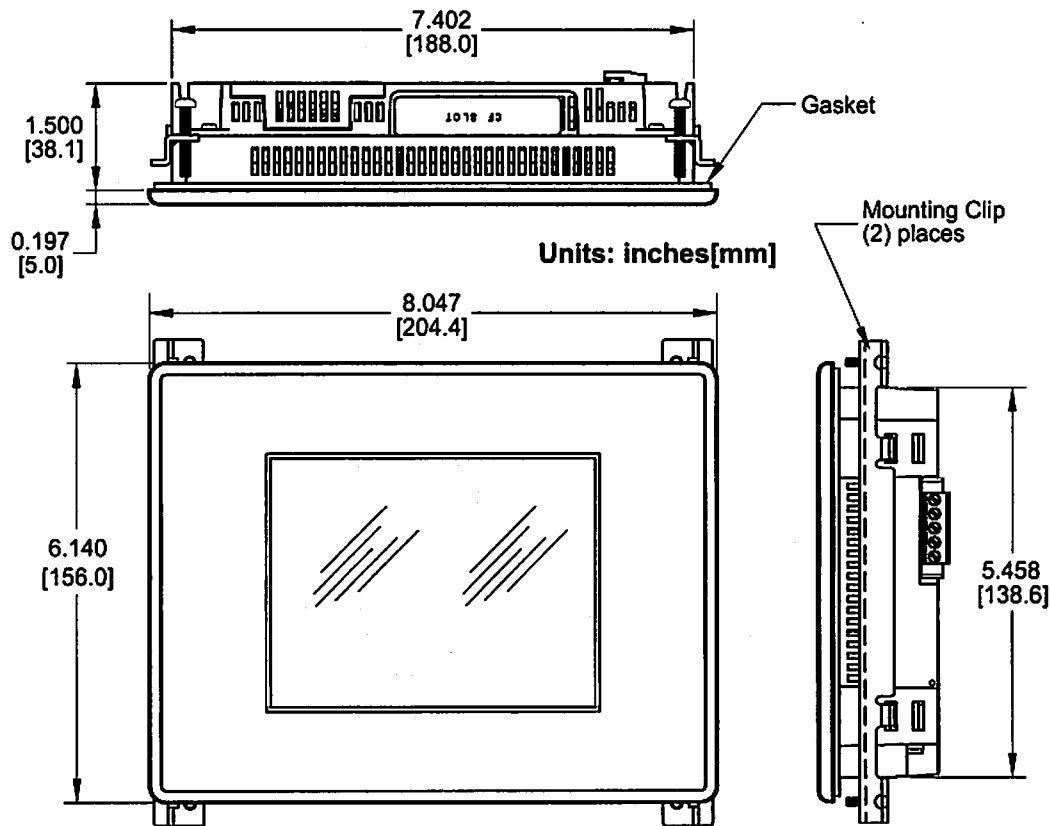
2

Specifications	Model	12" TFT color w/full features	15" TFT color w/full features
Part Number	EA7-T12C		EA7-T15C
Display Actual Size and Type	12.1" TFT color		15.0" TFT color
Color Scale	65,536 Colors		
Display Viewing Area	9.47" x 7.62" [240.6 mm x 184.5 mm]		11.97" x 8.98" [304.1 mm x 228.1 mm]
Screen Pixels	800 x 600 (SVGA)		1024 x 768 (XGA)
Display Brightness	260 cd/m ² (NITS)		220 cd/m ² (NITS)
LCD Panel Dot Pitch	0.267 mm x 0.267 mm		0.297 mm x 0.297 mm
Backlight Average Lifetime	Approximately 50,000 hours (See note at bottom of page 2-3.)		
Backlight User Replaceable	Yes - Part No. EA-xx-BULB, xx = panel size		
Touch Panel Type	Analog resistive (12-bit resolution, 4096 x 4096 touch area)		
CPU Type	32-Bit RISC CPU (400 MHz) Plus Graphic Accelerator Chip		
Battery	Replaceable battery – ADC Part # D2-BAT-1 (Manufacturer Part # CR2354)		
System Memory	SDRAM 64 MBytes		
System Flash Memory	FLASH 64 MBytes		
Backup Memory (SRAM)	Control data backup memory (SRAM) 256 KBytes		
Logging Data Memory	CompactFlash Memory Card p/n EA-FLASH-128MB, industrial grade, high speed (Optional) or USB Pen Drive p/n SDCZ4-2048-A10 (Optional)		
Number of Screens	Up to 999 – limited by project memory (40 MBytes)		
Realtime Clock	Built into panel (PLC clock is still accessible if available)		
Calendar – Month/Day/Year	Yes - battery backup		
Screen Saver	Yes, backlight turns off after a 30–1500 minute adjustable time, or can be disabled		
Serial PLC Interface	Serial PLC Port: RS-232C/422/485 15-Pin D-sub (female)		
USB Port – Type B	Download/Program – USB Port – type B		
USB Port – Type A	Port for USB device options – type A		
Ethernet Port	Ethernet 10/100 Base-T		
Audio Line Out	Audio Line Out, 1 volt rms, stereo – requires amplifier and speaker(s)		
CF Card – Slot #1	Optional: CompactFlash Card p/n EA-FLASH-32MB, slot #1 located on top side of touch panel.		
Expansion Assembly (p/n EA-EXP-OPT)	Optional: Use the CF Card Adapter p/n EA-CF-IF in the right slot of the expansion assembly for installing CF card - Slot #2. The left slot of the expansion assembly is for future options.		
Supply Power	24 VDC, -15%, +20% (20.4–28.8 VDC operating range, minimum of 1.5 A) (Use the AC/DC Power Adapter, EA-AC, to power the touch panel from a 100-240 VAC, 50/60 Hz. power source.)		
Power Consumption	20 W @ 24 VDC		33 W @ 24 VDC
Recommended DC Supply Fuse	4.0 A time delay, ADC MDL4		
Operating Temperature	0 to 50 °C (32 to 122 °F)		
Storage Temperature	–20 to +60 °C (–4 to +140 °F)		
Humidity	10–85% RH (non-condensing)		
Noise Immunity	Noise voltage: 1000 Vp-p, Pulse width: 1 µs, Rise time: 1 ns		
Withstand Voltage	1000 VDC for 1 minute, between DC power supply input terminal and safety ground		
Insulation Resistance	Over 20 MΩ between DC power supply input terminal and safety ground		
Vibration	IEC61131-2 compliant, 10–57 Hz: 0.075 mm amplitude, 57–150 Hz 1.0 G: 10 sweep cycles per axis on each of 3 mutually perpendicular axes		
Shock	15 G peak, 11 ms duration, 2 shocks per axis, on 3 mutually perpendicular axes		
Enclosure	NEMA 4/4X, IP-65 (When mounted correctly. For indoor use only.)		
Agency Approvals	UL, cUL, CE		
Dimensions	11.024" x 13.336" x 2.075" [280.0 x 339.5 x 52.7 mm]		13.000" x 16.748" x 1.0481" [330.2 x 425.4 x 54.0 mm]
Weight	4.59 lb. [2,080 g]		7.01 lb. [3,180 g]

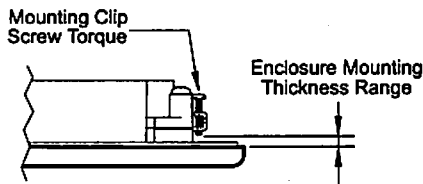
EA7-S6M-R, S6C-R, S6M, S6C and T6C

Dimensions:

All the necessary mounting hardware is provided with the touch panel. Use the two (2) mounting clips and screws to secure the touch panel to the cabinet or enclosure surface. A template is provided for marking the cutout dimensions on the mounting surface.



Enclosure Mounting Thickness Ranges and Mounting Clip Screw Torque



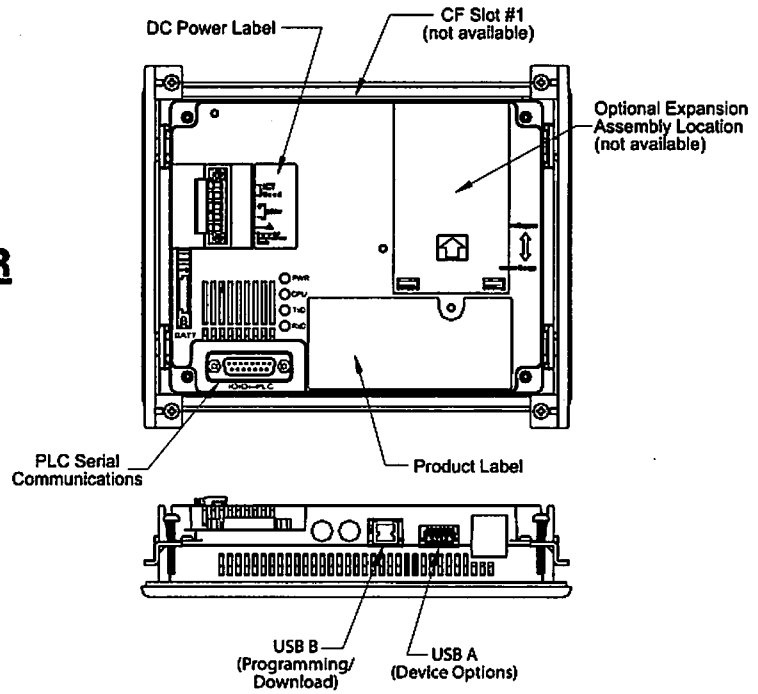
Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
6" – lower mounting clip position	0.039 - 0.24 inch [1 - 6 mm]	35 ~ 50 oz-in [0.25 ~ 0.35 Nm]
6" – upper mounting clip position	0.20 - 0.63 inch [5 - 16 mm]	35 ~ 50 oz-in [0.25 ~ 0.35 Nm]

EA7-S6M-R, S6C-R, S6M, S6C and T6C

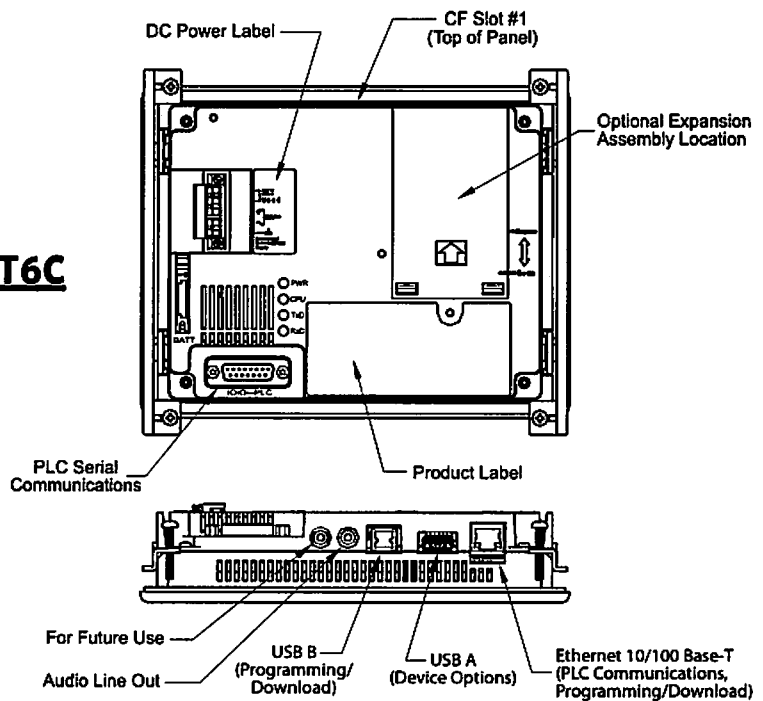
Ports & Memory Expansion:

2

Base Feature Model EA7-S6M-R & EA7-S6C-R



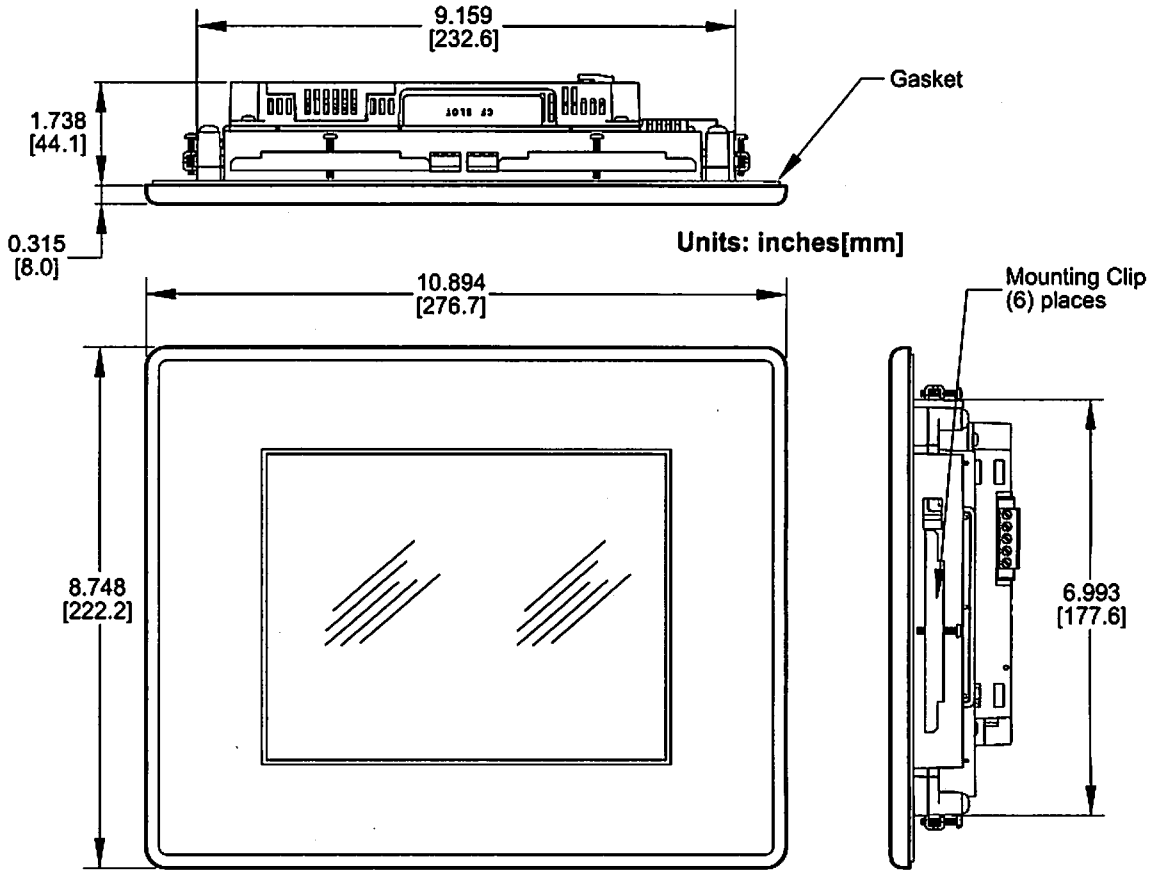
Full Feature Model EA7-S6M, EA7-S6C & EA7-T6C



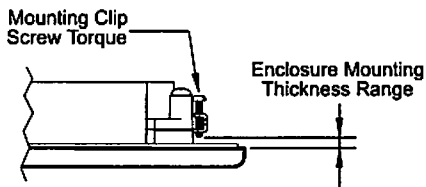
EA7-T8C

Dimensions:

All the necessary mounting hardware is provided with the touch panel. Use the six (6) mounting clips and screws to secure the touch panel to the cabinet or enclosure surface. A template is provided for marking the cutout dimensions on the mounting surface.



Enclosure Mounting Thickness Ranges and Mounting Clip Screw Torque



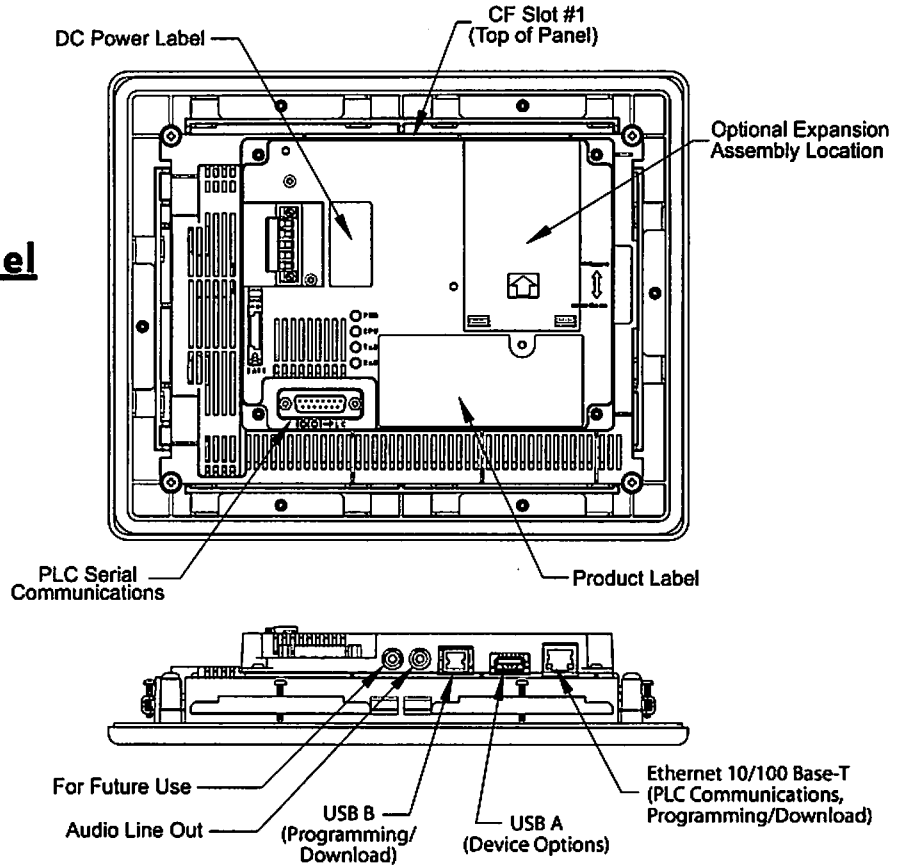
Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
8", 10", 12" & 15"	0.039 - 0.20 inch [1 - 5 mm]	42 ~ 57 oz-in [0.3 ~ 0.4 Nm]

EA7-T8C

Ports & Memory Expansion:

2

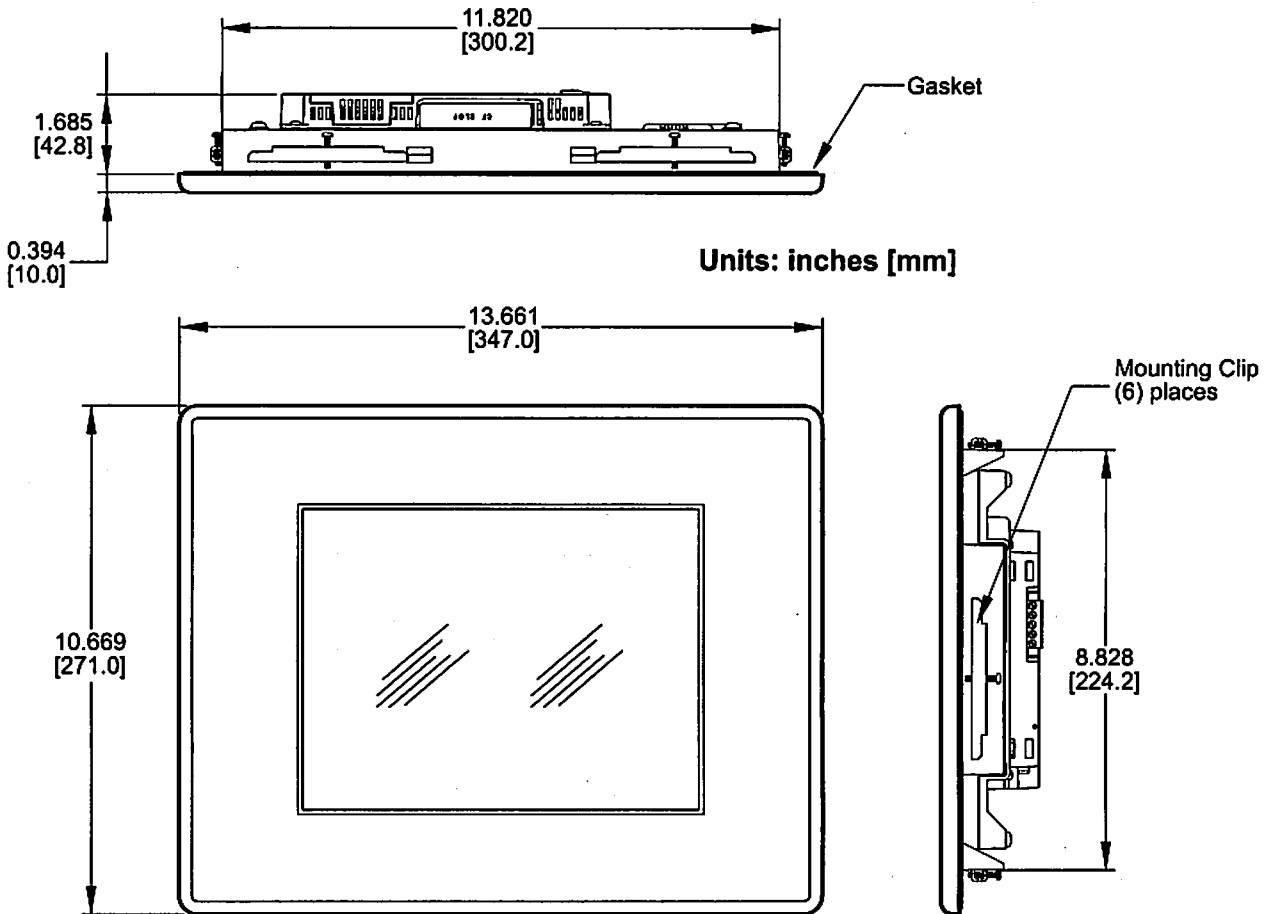
Full Feature Model EA7-T8C



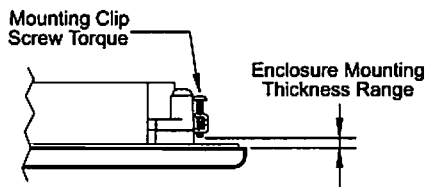
EA7-T10C

Dimensions:

All the necessary mounting hardware is provided with the touch panel. Use the six (6) mounting clips and screws to secure the touch panel to the cabinet or enclosure surface. A template is provided for marking the cutout dimensions on the mounting surface.



Enclosure Mounting Thickness Ranges and Mounting Clip Screw Torque



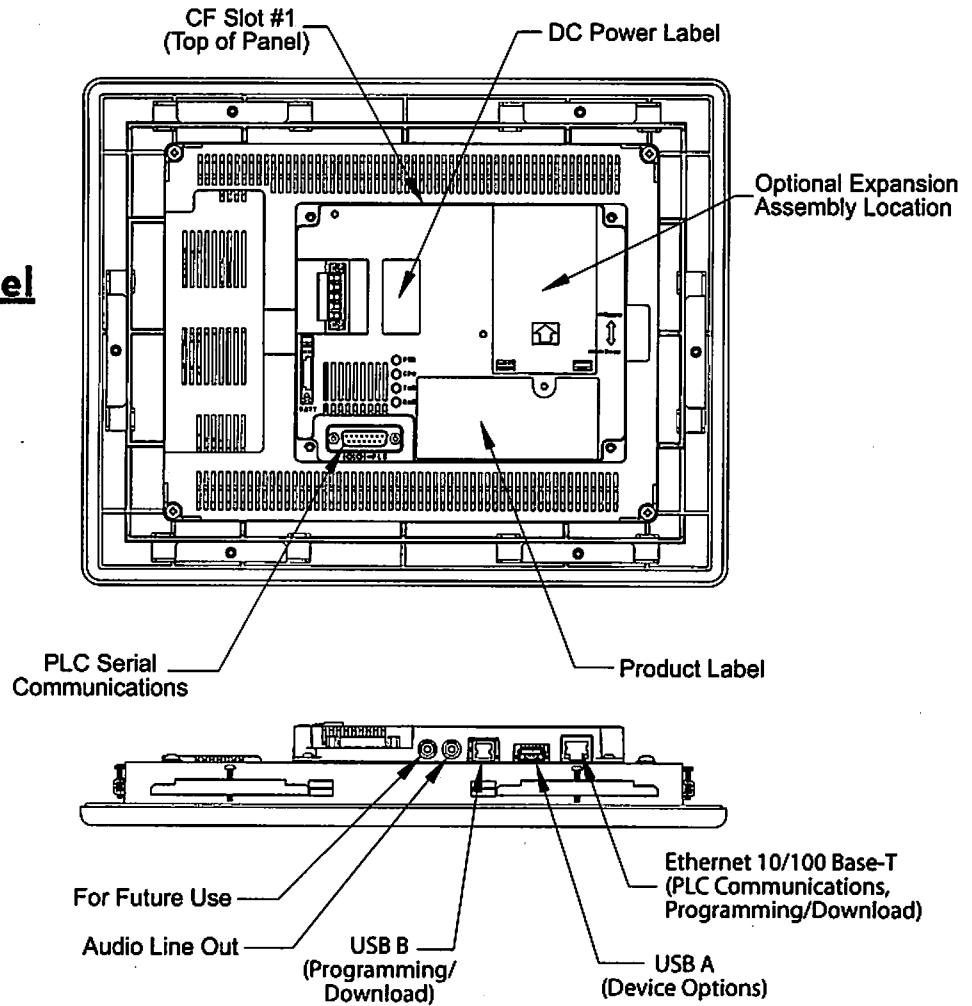
Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
8", 10", 12" & 15"	0.039 - 0.20 inch [1 - 5 mm]	42 ~ 57 oz-in [0.3 ~ 0.4 Nm]

EA7-T10C

Ports & Memory Expansion:

2

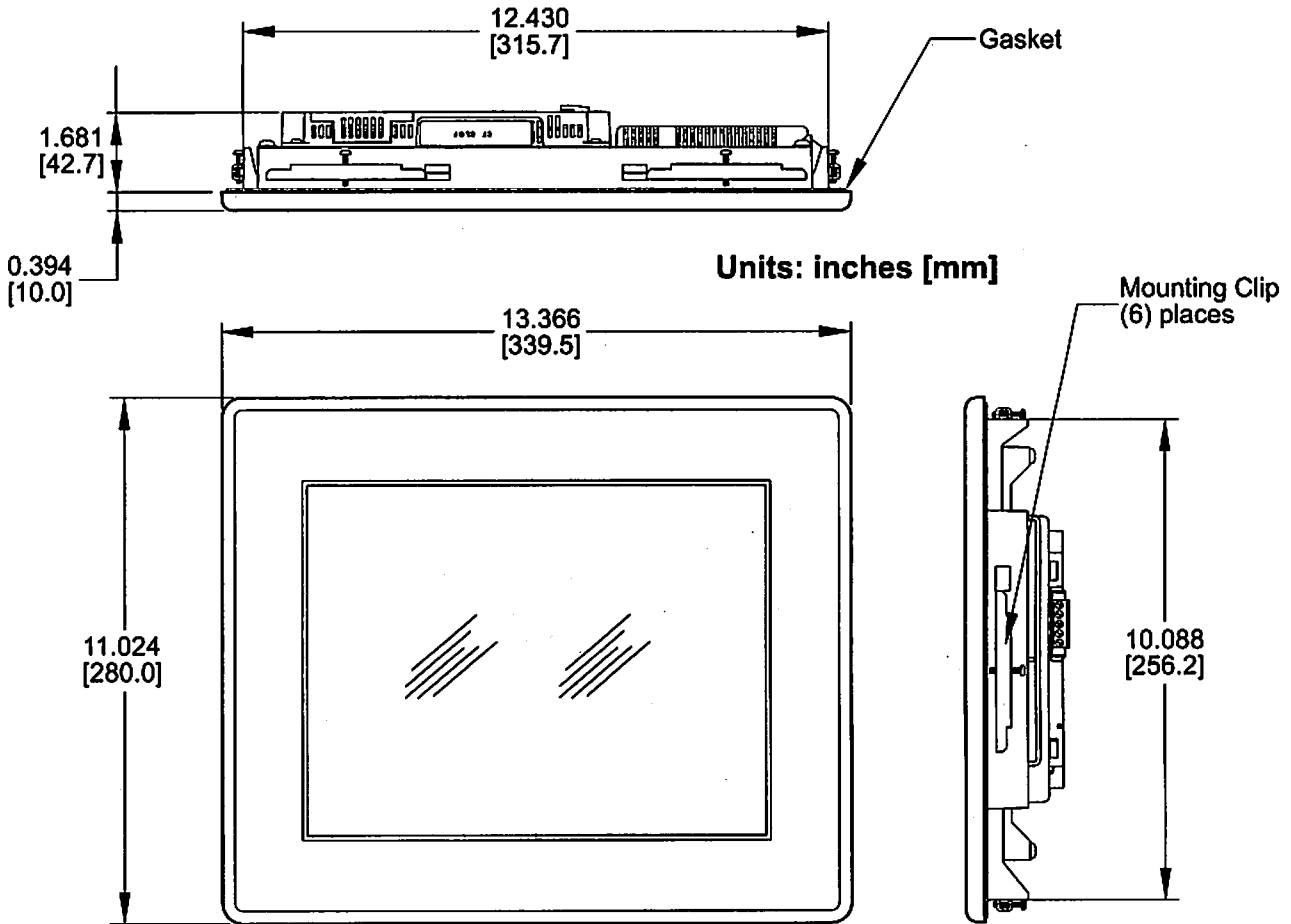
Full Feature Model
EA7-T10C



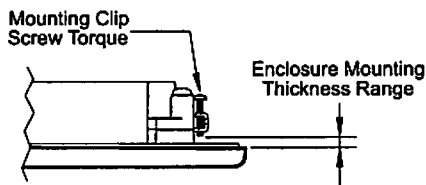
EA7-T12C

Dimensions:

All the necessary mounting hardware is provided with the touch panel. Use the six (6) mounting clips and screws to secure the touch panel to the cabinet or enclosure surface. A template is provided for marking the cutout dimensions on the mounting surface.



Enclosure Mounting Thickness Ranges and Mounting Clip Screw Torque



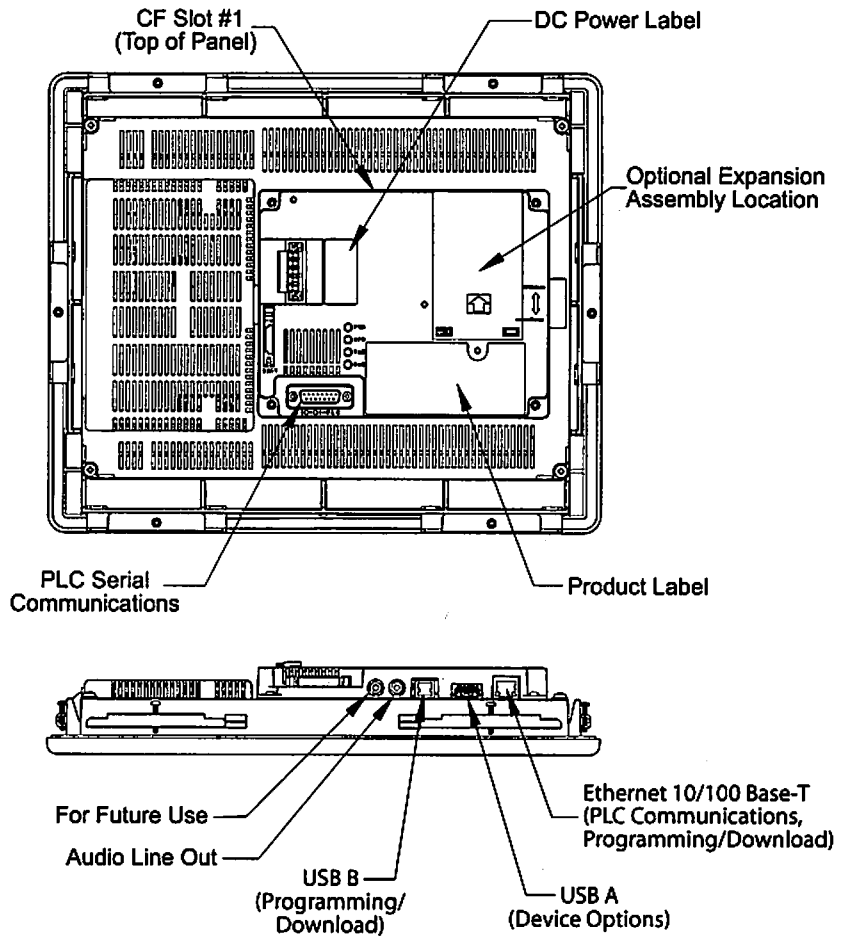
Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
8", 10", 12" & 15"	0.039 - 0.20 inch [1 - 5 mm]	42 ~ 57 oz-in [0.3 ~ 0.4 Nm]

EA7-T12C

Ports & Memory Expansion:

2

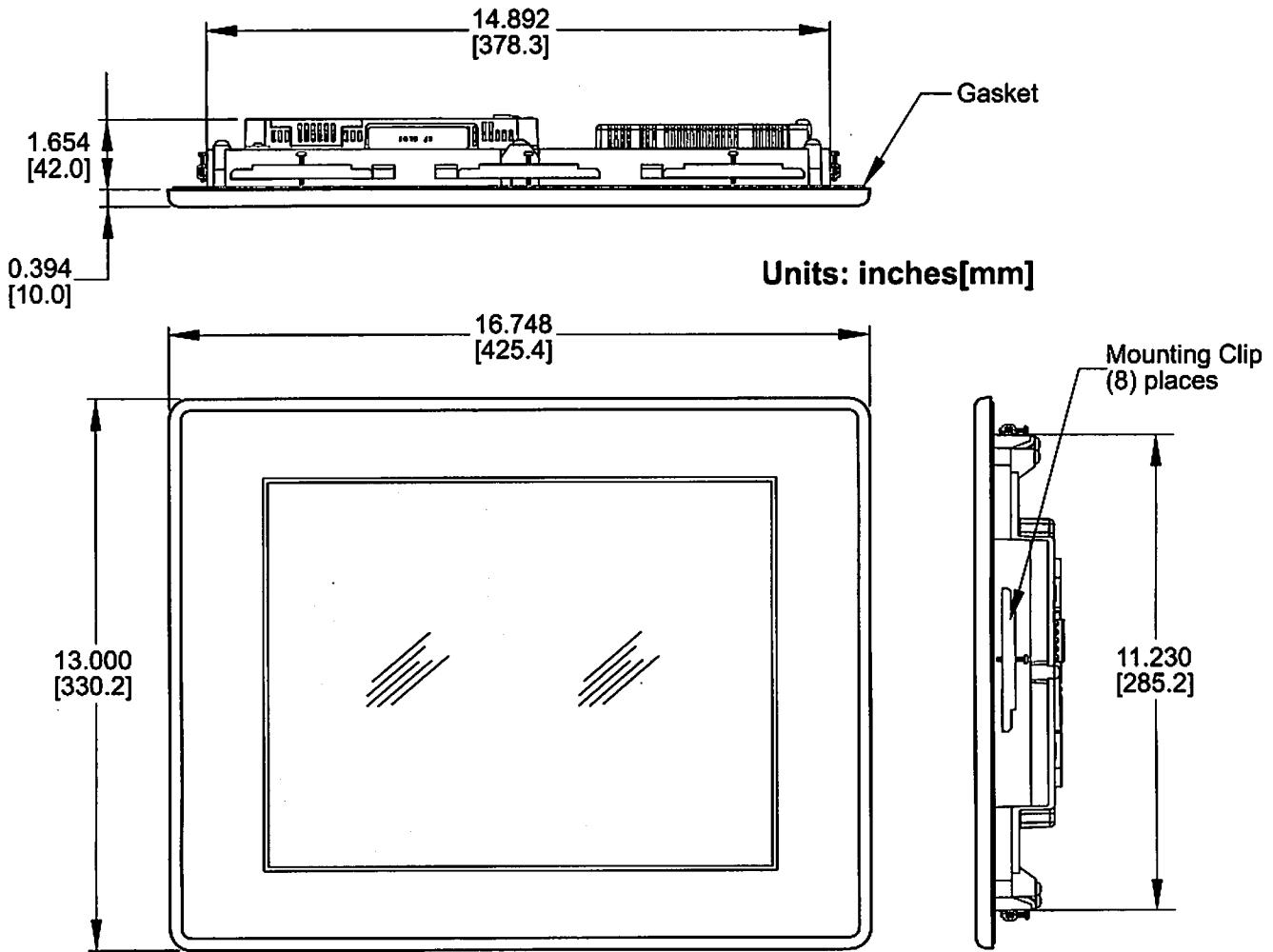
Full Feature Model
EA7-T12C



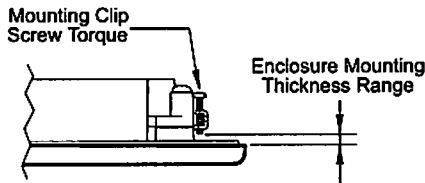
EA7-T15C

Dimensions:

All the necessary mounting hardware is provided with the touch panel. Use the eight (8) mounting clips and screws to secure the touch panel to the cabinet or enclosure surface. A template is provided for marking the cutout dimensions on the mounting surface.



Enclosure Mounting Thickness Ranges and Mounting Clip Screw Torque



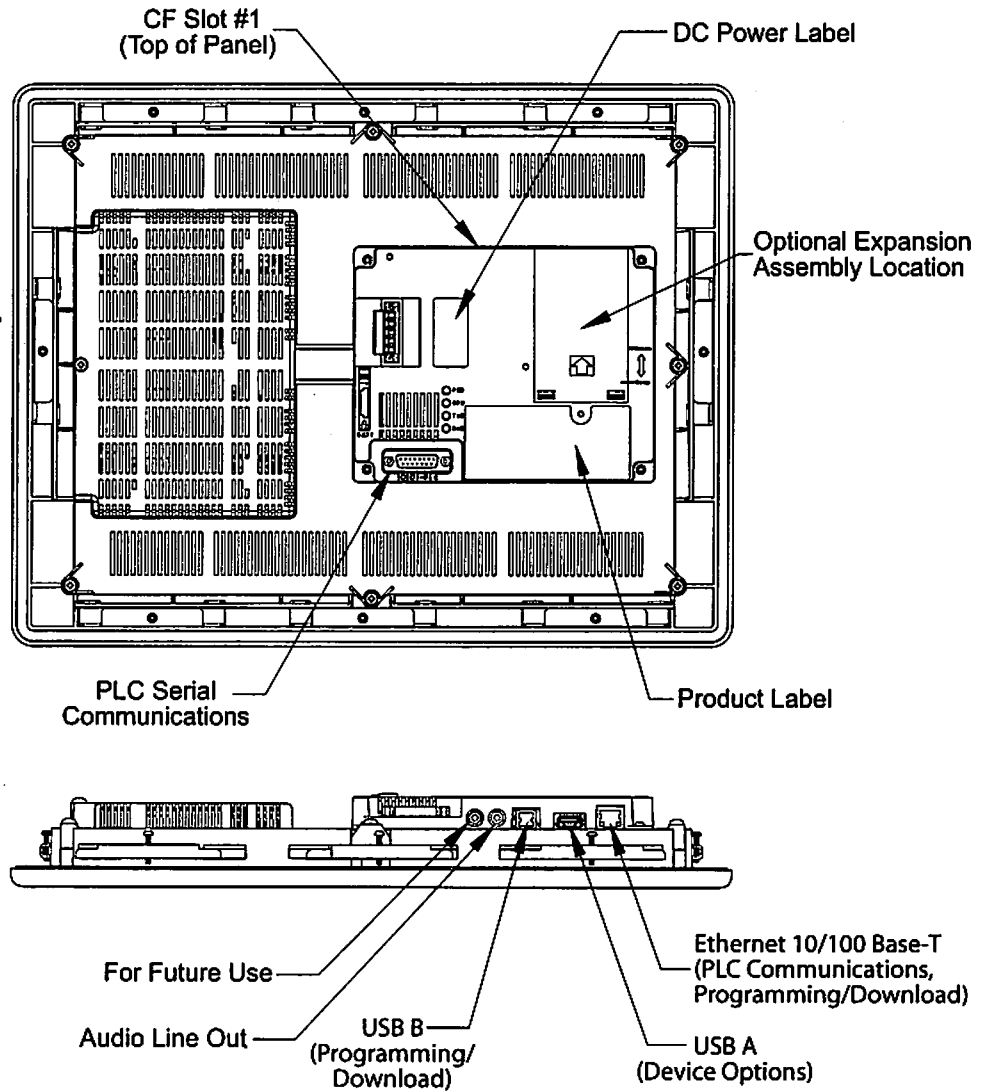
Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
8", 10", 12" & 15"	0.039 - 0.20 inch [1 - 5 mm]	42 ~ 57 oz-in [0.3 ~ 0.4 Nm]

EA7-T15C

Ports & Memory Expansion:

2

Full Feature Model
EA7-T15C



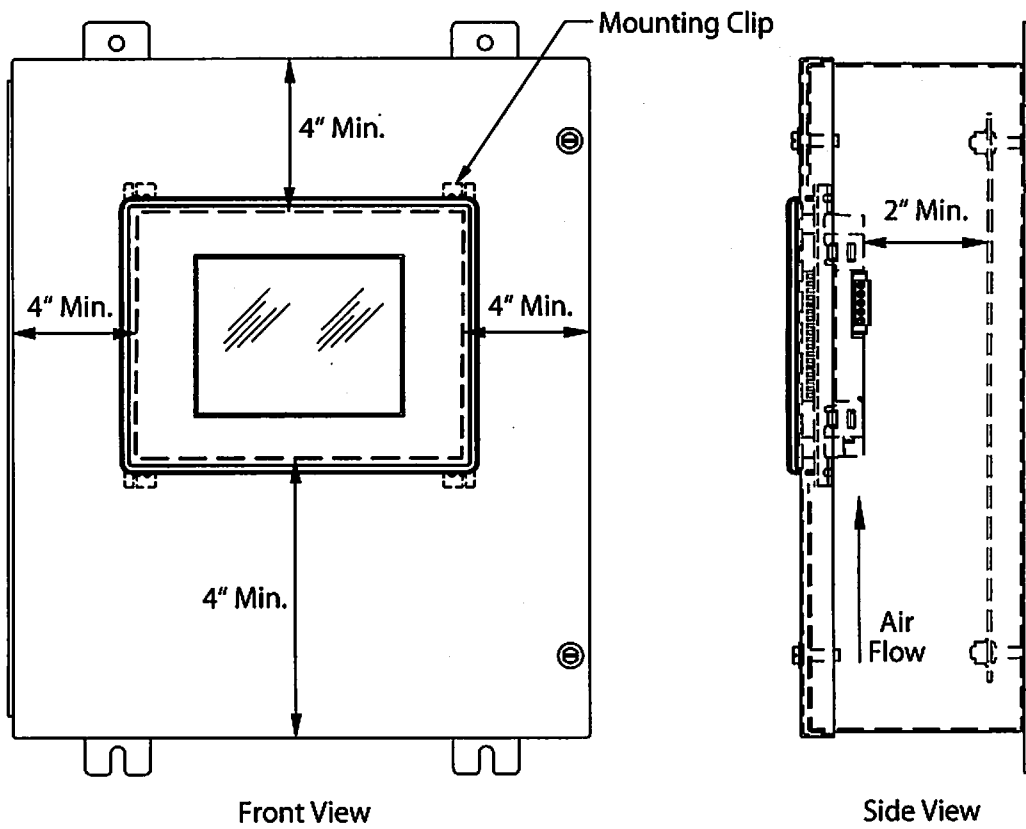
Mounting Clearances

The following drawing shows the mounting clearances for the *C-more* touch panel. There should be a minimum of 4 inches of space between all sides of the panel and the nearest object or obstruction and at least 2 inches between the rear of the panel and the nearest object or obstruction.

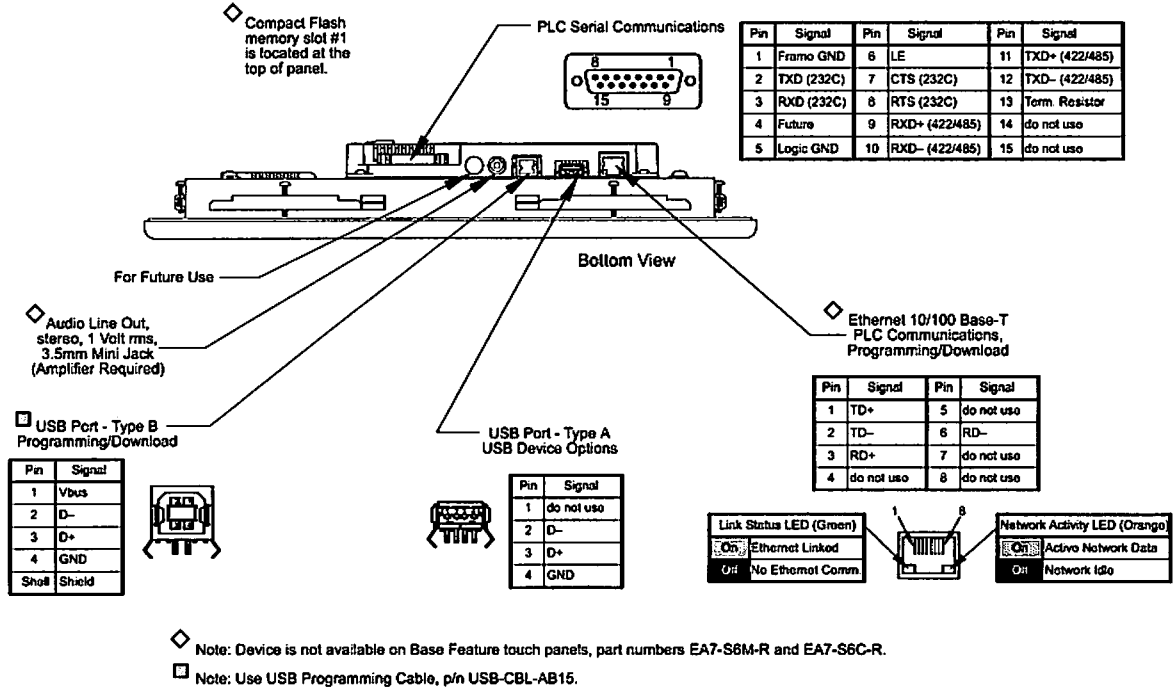
2



Note: Make sure the touch panel is mounted on a vertical surface to allow convection air flow for proper cooling.



Communications Ports



Ethernet Port

The Ethernet port can be used several ways: for programming the panel (downloading a project), for PLC communication, and for the advanced features, such as sending e-mail, FTP access, and allowing the panel to act as a web-server.

The Ethernet connector is an RJ-45 Module jack type. It has a green and an orange LED.

- The orange LED indicates the Ethernet communication status. It illuminates when there is data activity on the network.
- The green LED indicates link status and illuminates when a link is established.

Ethernet connections to PLCs:

- Direct LOGIC Ethernet
- Modbus TCP/IP
- Allen-Bradley EtherNet/IP™ Server - Generic I/O Messaging (ControlLogix™, CompactLogix™, and FlexLogix™)
- Allen-Bradley EtherNet/IP Client - Tag Based (ControlLogix, CompactLogix, and FlexLogix)
- Allen-Bradley EtherNet/IP Client - MicroLogix 1100 & SLC 5/05, both via native Ethernet port
- Allen-Bradley EtherNet/IP Client - MicroLogix 1000, 1100, 1200, 1500, SLC 5-03/04/05, all via ENI Adapter
- Entivity Modbus TCP/IP
- Omron Ethernet FINS
- Siemens Ethernet ISO over TCP

Note: The base panels (-R part numbers) do not include an Ethernet port, and do not have these capabilities.

Communications Ports (cont'd)

USB Port B

Program *C-more* via the USB programming port. It's fast and easy, with no baud rate settings, parity, or stop bits to worry about. We stock standard USB cables for your convenience, such as part no. USB-CBL-AB15. USB Port B can be used to upload or download projects to and from a PC (personnel computer).

USB Port A

The Universal Serial Bus (USB) type A port is a standard feature for all models and can be used to connect various USB HID (Human Input Device) devices to the panel, such as:

- USB pen drives, (such as ADC p/n SDCZ4-2048-A10)
- USB keyboards
- USB barcode scanners
- USB card scanners

C-more can log data to the USB pen drive as well as load projects to the panel from the pen drive. You can also back up project files and panel firmware.

Sound Interface (Audio Line Out)

When attached to an amplifier and speaker(s), *C-more* can play warning sounds, or pre-recorded messages such as: "conveyor is jammed". *C-more* supports WAV type files. The output is stereo. See the next page for the WAV file specifications. Various "Objects" in the *C-more* programming software support sounds. Sound files are stored in the sound library. See the *C-more* programming software help support for additional details.

PLC Port

The PLC port is an RS-232C, RS-422A or RS-485A female 15-pin D-sub connector. Use this port for serial connections to PLCs. The port supports the following PLC protocols:

- All *AutomationDirect.com* *Direct*LOGIC PLCs:
 - Direct*LOGIC K-sequence
 - Direct*NET
 - Modbus (Koyo Addressing)
- Allen Bradley:
 - DF1 Full & Half Duplex
 - DF1 Full & Half Duplex - Tag Based
 - PLC5 DF1
 - DH485
- Modbus RTU
- Entivity Modbus RTU
- GE SNPX (90/30, 90/70, Micro 90, VersaMax Micro)
- Omron:
 - Host Link (C200 Adapter, C500)
 - FINS (CJ1, CS1)
- Mitsubishi Melsec FX
- Siemens PPI (S7-200 CPU)

Audio WAV File Specifications

The *C-more* Audio Line Out port supports the following WAV file specifications:

Bit Rate: 44 Kbps

Audio Sample Size: 8 bit or 16 bit

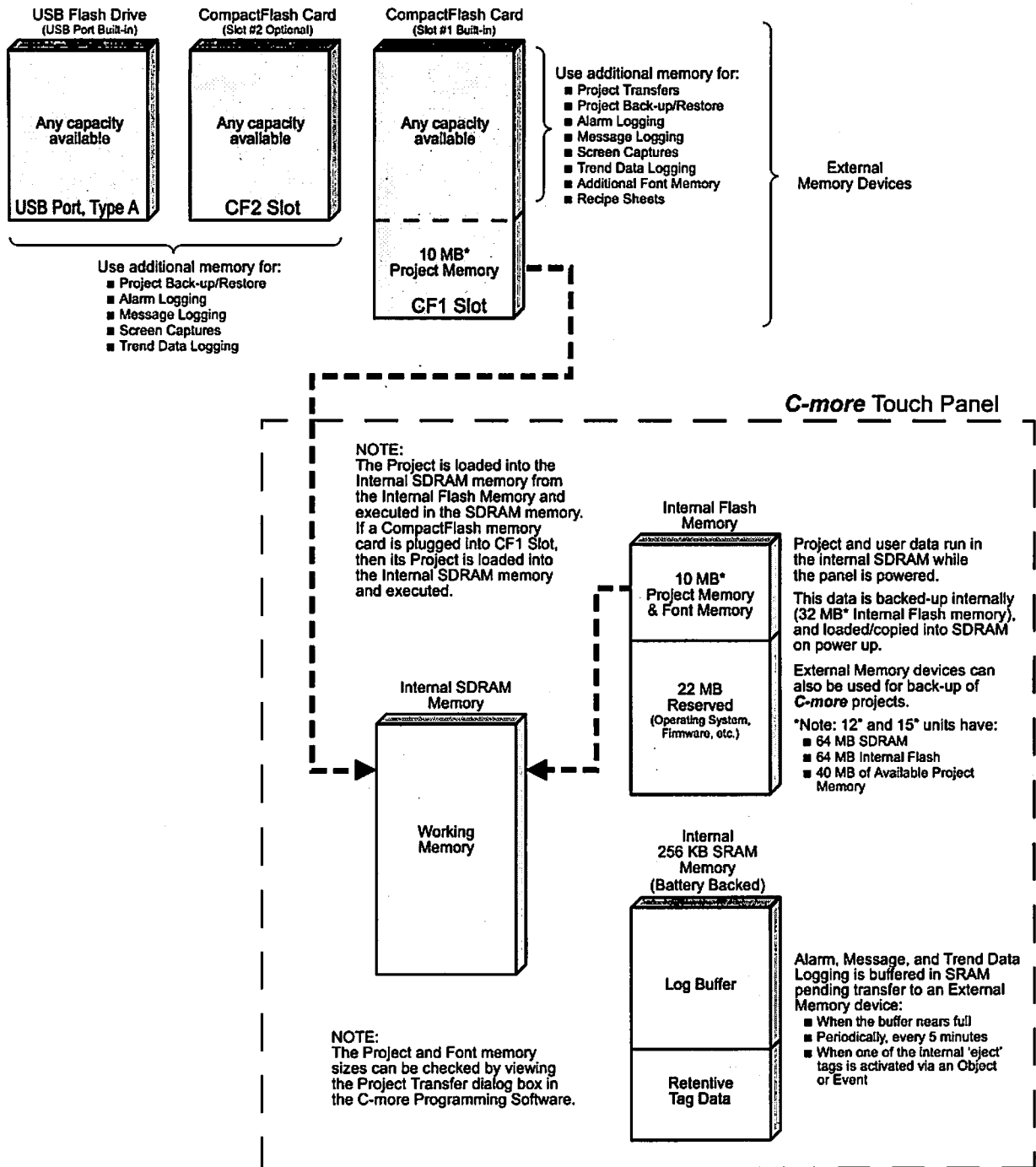
Number of Channels: 2 channel, 3.5 mm mini jack stereo output (amplifier required)

Audio Format: WAVE_FORMAT_1M08 11.025 kHz, mono, 8-bit
WAVE_FORMAT_1M16 11.025 kHz, mono, 16-bit
WAVE_FORMAT_1S08 11.025 kHz, stereo, 8-bit
WAVE_FORMAT_1S16 11.025 kHz, stereo, 16-bit
WAVE_FORMAT_2M08 22.05 kHz, mono, 8-bit
WAVE_FORMAT_2M16 22.05 kHz, mono, 16-bit
WAVE_FORMAT_2S08 22.05 kHz, stereo, 8-bit
WAVE_FORMAT_2S16 22.05 kHz, stereo, 16-bit
WAVE_FORMAT_4M08 44.1 kHz, mono, 8-bit
WAVE_FORMAT_4M16 44.1 kHz, mono, 16-bit
WAVE_FORMAT_4S08 44.1 kHz, stereo, 8-bit
WAVE_FORMAT_4S16 44.1 kHz, stereo, 16-bit

Memory Organization

The following diagram outlines the relationships between the internal memory of the panel and any external memory device. It also shows how the various memory areas can be used for different functions. The 6", 8" and 10" panels have a project area of 10 MB, while the 12" and 15" panels have a 40 MB project area.

2



Handling External Memory Devices

Consider the following to prevent data error risk when utilizing data logging.

- Do not turn off power to the *C-more* touch panel at any time the external memory device is being accessed.
- Do not remove any external memory device when the device is being accessed by the touch panel.



Note: A system tag, such as **SYS %device% WriteStatus** can be used to detect when the external memory device is being accessed. See the *C-more* programming software on-line help for additional information on **System Tag Names**.

- If a CompactFlash memory card is plugged into the CF1 slot while the panel is running, the project will continue to run from the project that is currently in the internal SDRAM. If power is cycled and there is a good project stored on the CompactFlash, then that project will be loaded into the internal SDRAM and ran.
- Be sure to backup the memory device at regular intervals.
- A CompactFlash memory card plugged into the CF1 slot that includes a project that is being run cannot be used for backup.
- If you suspect the memory device is bad, you may want to use a PC to re-format the device, or use a known good memory device.



Note: The *C-more* touch panel requires that all external memory devices be formatted with a **FAT32** file system.

- The number of times the memory device can be written to is limited, approximately 300,000 times. Consequently, frequent writing at short intervals may shorten the service life of the memory device. Try to use as long as possible sampling times for logging data to reduce the amount of times the memory device is accessed.

Power Loss Detection and Power Retention Period

It is important to have an understanding of how the touch panel handles power loss as it applies to data logging and retentive name tag data. The C-more touch panel system CPU will receive a power loss interrupt signal when the incoming DC voltage level drops below 19.2 VDC. If using the optional AC/DC Power Adapter, EA-AC, then an interrupt signal will occur when the incoming AC voltage level drops below 58 VAC (+/- 5%). When power loss is detected, the backlight will turn off immediately to allow extending the power retention period. Any logging to either CompactFlash memory or an USB pen drive will also stop. This will allow time to complete writing any data to the internal 256 KB SRAM. The 256 KB SRAM along with CPU Date/Time registers are battery backed.

Because the 24 VDC power retention time period is very short, only data backup to the internal 256 KB SRAM memory buffer can occur. When power is restored, the contents of the SRAM will be written to the selected memory storage device.

Data Logging Function and Logging Media

Considering the power retention period and the CF card write performance, the EA-FLASH-128MB memory card is recommended to minimize data loss. It is also recommended to further reduce the risk of losing data, a uninterruptible power supply (UPS) should be used to provide power to the touch panel.

Data Logging - Memory Device Full

The following explains what occurs when logging data from an object, such as Line Trending, and the memory device becomes full. The memory device can be a USB pen drive plugged into the USB port, or a CompactFlash memory card plugged into location CF1 or CF2.

The answer is when the memory device that is being used for logging is full, the panel will stop writing to the log and a RTE-001 Runtime Error will be displayed on the screen. The displayed error message will read "Log Failed. Not enough Memory Space in %Device%". (%Device% can be USB, CF1, or CF2.) The data logging object will continue to execute.

The user can monitor the System Tag "SYS %DEVICE% FreeMemory" with the Event Manager, and display a message to the operator to warn when the memory device is close to full.

The user can also use a Pushbutton object with the tag "SYS Copy Log to %Device%" to copy ALL logs on ALL other devices to %Device% and therefore save the current data.

For example, if the application is logging to CF1 and CF2, the user can monitor "SYS CF1 FreeMemory" and "SYS CF2 FreeMemory" in the Event Manager. When the value of either gets below a set value in the Event Manager, then the Event Manger can issue an Alarm, send an email, etc. The operator can then insert a USB pen drive into the panel's USB port, and press a pushbutton that is configured with System Tag "SYS Copy Log to USB". This action will copy all of the logged data to the USB pen drive from both CF1 and CF2. The operator can then use the System Setup Screen's Memory selection to clear both CompactFlash CF1 and CF2.

This example can work with different combinations of the memory devices, but the preferred method is using a USB pen drive because it is the easiest device to insert and remove.

Chemical Compatibility

The *C-more* touch panels are comprised of three different materials that may be exposed to outside elements. The panel's screen has a polyester (PET) surface. The bezel uses ABS plastic materials and the panel's gasket is a silicone rubber material. The following tables are provided to make you aware of the general compatibility between chemicals that may be present in your work environment and the various materials used in the manufacture of the panel. Use the table to determine those chemicals that are safe to use around your *C-more* touch panel and those that may harm it. The tables are made up of specifications provided by the manufacturer of the listed material. The tables rate these chemicals as either Excellent, Good, Not Recommended, or Not Usable. Because the ratings are for ideal conditions at room temperature, consider all factors when evaluating your application. Areas left blank have not been tested by the manufacturer and therefore information of compatibility is not available.

The values in [brackets] represent the chemical's density at room temperature, 20 °C.

Chemicals	Screen Sheet – PET [Density %, Temperature °C]	6" Bezel – ABS [Density %, Temperature °C]	8"-15" Bezel – ABS [Density %, Temperature °C]	Gasket – Silicone [Density %, Temperature °C]
Acetaldehyde		Not Recommended	Not Usable	
Acetic Acid		[10, 20 °C] Excellent		
		[10, 20 °C] Excellent		
	[Glacial] Excellent	[50, 20 °C] Not Usable		
		[50-70, 20 °C] Not Usable		
		[100, 20 °C] Not Usable		
Acetic anhydride		Not Recommended		
Acetone	Excellent	Not Usable	Not Usable	
Acetophenone		Not Usable	Not Usable	
Acetylene		Excellent		
Acrylonitrile		Not Recommended	Not Usable	
Alcohol - Butyl Ether				Excellent
Alcohol - Ethanol				Excellent
Alcohol - Isopropyl				Excellent
Alums NH3, Cr, K		Excellent		
Aluminum acetate		Excellent		
Aluminum bromide		Good		
Aluminum chloride		Good		
Aluminum nitrate		Excellent		
Aluminum sulfate		Excellent		
Ammonia [anhydrous] (10%)		Good		Good

Table continued at top of next page.

Chemical Compatibility (cont'd)

2

Chemicals	Screen Sheet – PET [Density %, Temperature °C]	6" Bezel – ABS [Density %, Temperature °C]	8"–15" Bezel – ABS [Density %, Temperature °C]	Gasket – Silicone [Density %, Temperature °C]
Ammonia gas [cold]		Good		
Ammonia liquid		Good		
Ammonia water		[12%] Not Usable		
		[28%] Not Usable		
Ammonium carbonate		Excellent		
Ammonium chloride		Excellent		
Ammonium hydroxide [ammonia water]		Excellent		
Ammonium nitrate		Excellent		
Ammonium persulfate		Excellent		
Ammonium phosphate		Excellent		
Ammonium sulfate		Excellent		
Amyl acetate		Not Usable		
Amyl alcohol		Good		
Aniline dyes		Not Recommended		
Animal oil [lard]		Good		
Aqua regia		Not Usable		
Arsenic acid		Not Recommended		
Asphalt		Excellent		
Barium chloride		Excellent		
Barium hydroxide		Excellent		
Barium sulfate		Excellent		
Barium sulfide		Excellent		
Beer		Excellent	Good	
Beet sugar liquors		Excellent		
Benzaldehyde		Not Recommended	Not Usable	
Benzene [Benzol]		Not Recommended	Not Usable	
Benzene	Excellent		Not Usable	
Benzine		Not Usable		Not Usable
Benzyl alcohol		Not Recommended	Not Usable	
Benzyl benzoate		Not Usable	Not Usable	
Benzyl chloride		Not Usable	Not Usable	
Borax		Excellent		
Boric acid		Good		

Table continued at top of next page.

Chemical Compatibility (cont'd)

Chemicals	Screen Sheet – PET [Density %, Temperature °C]	6" Bezel – ABS [Density %, Temperature °C]	8"-15" Bezel – ABS [Density %, Temperature °C]	Gasket – Silicone [Density %, Temperature °C]
Bromine		Not Usable		
Butane		Excellent		
Butter		Good		
Butyl acetate		Not Usable		
Butyl acrylate		Not Usable		
Butyl alcohol [Butanol]		Good	Good	
Calcium acetate		Excellent		
Calcium bisulfite		Good		
Calcium chloride		Excellent		
Calcium hydroxide		Excellent		
Calcium hypochlorite		[20,RT] Excellent		
Calcium nitrate		Excellent		
Calcium sulfide		Excellent		
Cane sugar liquors		Excellent	Good	
Carbon dioxide		Excellent		
Carbon disulfide		Not Usable		
Carbonic acid		Good		
Carbon tetrachloride	Excellent	Not Usable	Not Usable	
Castor oil		Not Recommended	Not Usable	
China wood [tung] oil		Excellent	Not Usable	
Chlorine gas [dry]		Not Usable		
Chlorine gas [wet]		Not Usable		
Chlorine liquid		Not Usable		
Chlorinated solvents		Not Usable	Not Usable	
Chloroacetic acid		Not Usable	Not Usable	
Chloroacetone		Not Usable	Not Usable	
Chloroform	Excellent	Not Usable	Not Usable	
Chlorophenol	Not Usable		Not Usable	
Chlorosulfonic acid		Not Usable	Not Usable	
Chlorotoluene		Not Usable	Not Usable	

Table continued at top of next page.

Chemical Compatibility (cont'd)

Chemicals	Screen Sheet – PET [Density %, Temperature °C]	6" Bezel – ABS [Density %, Temperature °C]	8"-15" Bezel – ABS [Density %, Temperature °C]	Gasket – Silicone [Density %, Temperature °C]
Chromic acid		[2, 70 °C] Not Usable	[2, 70 °C] Not Usable	
		[5, 70 °C] Not Usable	[5, 70 °C] Not Usable	
		[10, 70 °C] Not Usable	[10, 70 °C] Not Usable	
		[25, 70 °C] Not Usable	[25, 70 °C] Not Usable	
Citric acid		Good		
Cocoonut oil		Good	Not Usable	
Copper chloride		Excellent		
Copper cyanide		Excellent		
Copper sulfate		Excellent		
Corn oil		Good	Not Usable	
Cottonseed oil		Good	Not Usable	
Creosol		Not Usable	Not Usable	
Cyclohexane		Good	Not Usable	
Cyclohexanol		Good	Not Usable	
Cyclohexanone		Not Usable	Not Usable	
Developing solutions [Hypos]		Excellent		
Dibutyl phthalate [DBP]		Not Usable	Not Usable	
Dichlorobenzene		Not Usable	Not Usable	
Diethylene glycol		Good	Not Usable	
Diethyl ether		Not Usable	Not Usable	
Disopropyl ketone		Not Usable	Not Usable	
Dimethyl aniline		Not Usable	Not Usable	
Dimethyl formamide		Not Usable	Not Usable	
Dioxane		Not Usable	Not Usable	
Dipentene		Not Usable	Not Usable	
Epichlorohydrine		Not Usable	Not Usable	
Ethyl acetate	Excellent	Not Usable	Not Usable	
Ethyl acetoacetate		Not Usable	Not Usable	
Ethyl acrylate		Not Usable	Not Usable	
Ethyl alcohol		Not Recommended	Good	
Ethyl benzene		Not Usable	Not Usable	
Ethyl chloride		Not Usable	Not Usable	
Ethylene chlorohydrin		Not Usable	Not Usable	

Table continued at top of next page.

Chemical Compatibility (cont'd)

Chemicals	Screen Sheet – PET [Density %, Temperature °C]	6" Bezel – ABS [Density %, Temperature °C]	8"-15" Bezel – ABS [Density %, Temperature °C]	Gasket – Silicone [Density %, Temperature °C]
Ethylene diamine		Not Usable	Not Usable	
Ethylene dichloride		Not Usable	Not Usable	
Ethylene glycol		Excellent	Good	
Ethylene oxide		Not Usable	Not Usable	
Fatty acid		Good	Not Usable	
Ferric chloride		Excellent		
Ferric nitrate		Excellent		
Ferric sulfate		Excellent		
Fluorboric acid		Not Recommended		
Fluorobenzene		Not Usable	Not Usable	
Fluosilicic acid		Not Recommended		
Formaldehyde		[40, 20 °C] Good	[40, 20 °C] Not Usable	
		[25, 20 °C] Excellent		
		[50, 20 °C] Good		
		[90, 20 °C] Not Recommended		
Freon	[45°C] Excellent			
Freon 11		Not Recommended		
Freon 12		Good		
Freon 113		Not Usable		
Freon 114		Not Recommended		
Fuel oil		Good		
Gasoline		Not Recommended	Not Usable	
Gelatin		Excellent	Good	
Glauber's salt		Excellent		
Glue		Excellent		
Glycerin		Excellent	Good	
Grease		Excellent	Good	
Hexane		Not Recommended	Not Usable	
Hexyl alcohol		Good	Not Usable	
Hydrobromic acid		[20, 20 °C] Not Usable		
		[20-70, 20 °C] Not Usable		
		[37, 20 °C] Not Usable		

Table continued at top of next page.

Chemical Compatibility (cont'd)

2

Chemicals	Screen Sheet – PET [Density %, Temperature °C]	6" Bezel – ABS [Density %, Temperature °C]	8"-15" Bezel – ABS [Density %, Temperature °C]	Gasket – Silicone [Density %, Temperature °C]
Hydrochloric acid	[18%] Excellent	[10, 20 °C] Excellent	[10, 20 °C] Good	Good
	[35%] Good	[20, 20 °C] Good		
		[20-80, 20 °C] Not Recommended		
		[38, 20 °C] Not Recommended		
Hydrocyanic acid		Excellent		
Hydrofluoric acid		[10, 20 °C] Excellent		
		[20, 20 °C] Excellent		
		[40, 20 °C] Good		
Hydrofluoric acid anhydrous		Not Usable		
Hydrogen		Excellent		
Hydrogen peroxide		[5, 20 °C] Not Recommended		
		[5-50, 20 °C] Not Recommended		
		[30, 20 °C] Not Usable		
Hydrogen sulfide		Excellent		
Hydroquinone		Not Recommended		
Hypochlorous acid		Not Recommended		
Isobutyl alcohol		Good	Good	
Isopropyl acetate		Not Usable	Not Usable	
Isopropyl alcohol		Good	Good	
JP fuels (1-6)		Good	Not Usable	
Kerosene		Good	Not Usable	
Lacquer		Not Usable		
Lactic acid		Excellent		
Lard		Excellent		
Lead acetate		Excellent		
Lead nitrate		Good		
Lead sulfamate		Good		
Linoleic acid		Excellent		
Linseed oil		Excellent	Not Usable	
Liquified petroleum gas [LPG]		Excellent		
Lubricating oil		Excellent		
Lye solution		Excellent		

Table continued at top of next page.

Chemical Compatibility (cont'd)

Chemicals	Screen Sheet – PET [Density %, Temperature °C]	6" Bezel – ABS [Density %, Temperature °C]	8"-15" Bezel – ABS [Density %, Temperature °C]	Gasket – Silicone [Density %, Temperature °C]
Magnesium chloride		Excellent		
Magnesium hydroxide		Excellent		
Magnesium sulfate		Excellent		
Maleic acid		Excellent		
Mercuric chloride		Excellent		
MEK	Good			
Mercury		Excellent		
Metacresol	Not Usable			
Methyl acetate		Not Usable	Not Usable	
Methyl alcohol	Excellent	Not Recommended	Not Usable	
Methyl Benzoate	Not Usable			
Methyl chloride		Not Usable	Not Usable	
Methyl ethyl ketone [MEK]		Not Usable	Not Usable	
Methyl isobutyl ketone [MIBK]		Not Usable	Not Usable	
Methyl methacrylate		Not Usable	Not Usable	
Methyl dichloride		Not Usable	Not Usable	
Methyl Salicylate	Not Usable			
Milk		Excellent		
Mineral oil		Not Usable		Excellent
Monochlorobenzene	Not Usable	Not Usable	Not Usable	
Naptha		Good		
Napthalene		Excellent		
Napthenic acid		Good		
Natural gas		Excellent		
Natural oil				Excellent
Nickel acetate		Excellent		
Nickel chloride		Excellent		
Nickel sulfate		Excellent		
Nitric acid	[20%] Good	[10, 20 °C] Good	[10, 20 °C] Good	
		[10-70, 20 °C] Not Usable	[10-70, 20 °C] Not Usable	
		[30, 20 °C] Not Usable	[30, 20 °C] Not Usable	
	[30%] Not Usable	[30-70, 20 °C] Not Usable	[30-70, 20 °C] Not Usable	
		[61.3, 20 °C] Not Usable	[61.3, 20 °C] Not Usable	
		[Vapor, 20 °C] Not Usable	[Vapor, 20 °C] Not Usable	

Table continued at top of next page.

Chemical Compatibility (cont'd)

Chemicals	Screen Sheet – PET [Density %, Temperature °C]	6" Bezel – ABS [Density %, Temperature °C]	8"-15" Bezel – ABS [Density %, Temperature °C]	Gasket – Silicone [Density %, Temperature °C]
Nitrobenzene	Not Usable	Not Usable	Not Usable	
Nitroethane		Not Usable	Not Usable	
Nitromethane		Not Usable	Not Usable	
Nitropropane		Not Usable	Not Usable	
Nitrogen		Excellent	Good	
Octyl alcohol		Good		
Oleic acid		Excellent	Not Usable	
Olive oil		Excellent	Not Usable	
Oxalic acid		Excellent		
Oxygen		Excellent		
Ozone		Not Recommended		
Palmitic acid		Excellent		
Perchloroethylene		Not Usable	Not Usable	
Petroleum		Excellent	Not Usable	
Phenol	Not Usable	Not Usable	Not Usable	
Phosphoric acid		[50, 20 °C] Good		
		[50-70, 20 °C] Not Usable		
		[75, 20 °C] Not Usable		
Pickling solution		[Sulfuric acid 20% + nitric acid 4%] Good		
		[Sulfuric acid 40% + nitric acid 15%] Not Recommended		
Pine oil		Good		
Potassium chloride		Excellent		
Potassium cyanide		Excellent		
Potassium dichromate		[10, 20 °C] Excellent		
Potassium hydroxide	[10%] Not Usable	Excellent		
Potassium nitrate		Excellent		
Potassium permangante		[5, 20 °C] Excellent		
Potassium sulfate		Excellent		
Propane		Excellent		
Propyl acetate		Not Usable	Not Usable	
Propyl alcohol		Good	Good	

Table continued at top of next page.

Chemical Compatibility (cont'd)

Chemicals	Screen Sheet – PET [Density %, Temperature °C]	6" Bezel – ABS [Density %, Temperature °C]	8"-15" Bezel – ABS [Density %, Temperature °C]	Gasket – Silicone [Density %, Temperature °C]
Salt water		Excellent	Good	
Silicone oils		Good	Good	
Silver nitrate		Excellent		
Skydrol 500		Not Usable		
Skydrol 7000		Not Usable		Not Usable
Soap solutions		Excellent		
Soda ash		Excellent		
Sodium bicarbonate		Excellent		
Sodium bisulfate		Good		
Sodium borate		Excellent		
Sodium carbonate	[10%] Excellent			
Sodium chloride		Excellent	Good	
Sodium cyanide		Excellent		
Sodium hydroxide	[10%] Not Usable	[10, 20 °C] Excellent		
		[30, 20 °C] Excellent		
		[30-70, 20 °C] Not Usable		
Sodium hydrochlorite		[5, 20 °C] Excellent		
		[5-70, 20 °C] Not Usable		
Sodium metaphosphate		Excellent		
Sodium nitrate		Excellent		
Sodium perborate		Excellent		
Sodium peroxide		Not Usable		
Sodium phosphate		Excellent		
Sodium thiosulfate		Excellent		
Sodium sulfate [Glauber's salt]		Good		
Sodium sulfite		Excellent		
Soybean oil		Excellent		
Stannic chloride		Good		
Steam		[below 150 degrees] Not Usable		
Steam		[above 150 degrees] Not Usable		
Stearic acid		Excellent		
Styrene		Not Recommended		
Sucrose solutions		Excellent		

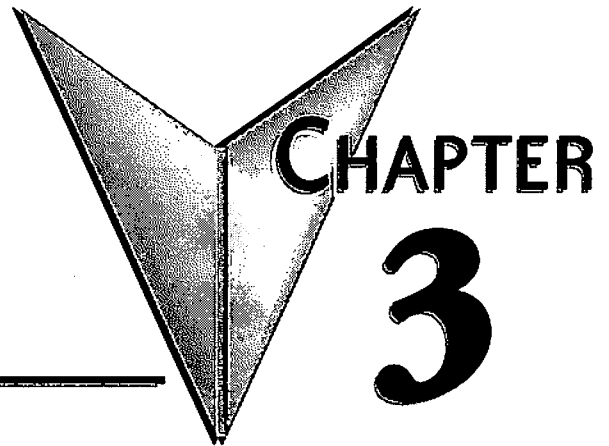
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Chemical Compatibility (cont'd)

2

Chemicals	Screen Sheet – PET [Density %, Temperature °C]	6" Bezel – ABS [Density %, Temperature °C]	8"-15" Bezel – ABS [Density %, Temperature °C]	Gasket – Silicone [Density %, Temperature °C]
Sulfur		Excellent		
Sulfur dioxide		Good		
Sulfuric acid	[40%] Excellent	[10, 20 °C] Excellent	[10, 20 °C] Good	Not Usable
		[10-70, 20 °C] Not Usable		
	[60%] Excellent	[30, 20 °C] Excellent		
		[30-70, 20 °C] Not Recommended		
[70%] Not Usable	[98, 20 °C] Not Usable			
	[Vapor, 20 °C] Not Usable			
Sulphurous acid		[10, 20 °C] Good		
Tannic acid		Good		
Tar		Not Recommended		
Tartaric acid		Excellent		
Terpineol		Not Recommended		
Tetrachloroethane	Good	Not Usable		
Tetraethyl lead		Good	Not Usable	
Tetralin	Not Usable			
Tetrahydrofuran		Not Usable	Not Usable	Not Usable
Thionyl chloride		Not Usable	Not Usable	
Toluene	Excellent	Not Usable	Not Usable	Not Usable
Trichloroethylene [Trichlene]		Not Usable	Not Usable	
Triethanol amine		Good	Not Usable	
Turpentine oil		Good	Not Usable	
Vegetable oil		Good	Not Usable	
Vinegar		Excellent	Good	
Water		Excellent	Good	
Whiskey		Excellent		
Xylene	Excellent	Not Usable	Not Usable	
Zeolites		Excellent		
Zinc acetate		Excellent		
Zinc chloride		Excellent		
Zinc sulfate		Excellent		

ACCESSORIES



In This Chapter...

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Accessories at a Glance	3-4
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6" Adapter Plate – EA-6-ADPTR	3-17
D-SUB 15-pin 90 degree Comm Port Adapter – EA-ADPTR-4	3-19
D-SUB 15-pin to Terminal Block Adapter – EA-COMCON-3	3-20
Non-glare Screen Covers – EA-xx-COV2, xx = 6, 8, 10, 12 or 15	3-22
USB Pen Drive – SDCZ4-2048-A10	3-23

Accessories

3

Part Number	Description	Part Number	Description
EA-AC	The AC/DC Power Adapter, EA-AC, is for <i>C-more</i> touch panels only, and is powered from a 100-240 VAC, 50/60 Hertz power source. The adapter provides 24 VDC @ 1.5 A. Power Fault features help protect data being logged to CompactFlash during power failures. The <i>C-more</i> panel must have firmware version 1.21 Build 6.18E or higher for proper operation.	EA-6-COV2	Non Glare 6 Inch Screen Cover, protective overlay used to protect the touch screen while helping to reduce the glare from external light sources. (pk of 3)
EA-EXP-OPT	Expansion Assembly, is used to allow installation of the optional CF Card Interface Module for CF card use and also provides a slot for future option modules.	EA-8-COV2	Non Glare 8 Inch Screen Cover, protective overlay used to protect the touch screen while helping to reduce the glare from external light sources. (pk of 3)
EA-CF-IF	CF Card Interface Module, is used with the Expansion Assembly to allow use of CF cards, such as the CompactFlash Memory, p/n EA-FLASH-128MB.	EA-10-COV2	Non Glare 10-Inch Screen Cover, protective overlay used to protect the touch screen while helping to reduce the glare from external light sources. (pk of 3)
EA-FLASH-128MB	128 MB CompactFlash Memory Card Option, industrial grade, high speed memory for non-volatile storage.	EA-12-COV2	Non Glare 12-Inch Screen Cover, protective overlay used to protect the touch screen while helping to reduce the glare from external light sources. (pk of 3)
EA-6-ADPTR	6 Inch Adapter Plate, allows C-more 6" touch panels to be mounted into EZTouch 6" non-slim bezel cutouts without having to make alterations. NEMA 4/4X.	EA-15-COV2	Non Glare 15-Inch Screen Cover, protective overlay used to protect the touch screen while helping to reduce the glare from external light sources. (pk of 3)
EA-ADPTR-4	D-SUB 15-pin 90 degree PLC serial communication port adapter to allow a PLC communication cable to be plugged in at a 90 degree angle to reduce panel depth requirements.	SDCZ4-2048-A10	USB Pen Drive, 2GB, SanDisk Cruzer micro Pen Drive. Compatible with Windows 98SE, ME, 2000, XP and Mac OS 9.1.x+, OS X 10.1.2+ Certified Windows XP and Mac OS X. Contains Unit, sleeve and protective cap, lanyard and keychain loop. Recommended for use with the <i>C-more</i> Operator Touch Panels.
EA-COMCON-3	D-SUB 15-pin to 6-terminal PLC serial communication port adapter to allow wire terminal connections for RS-422/485 PLC communication cable.		



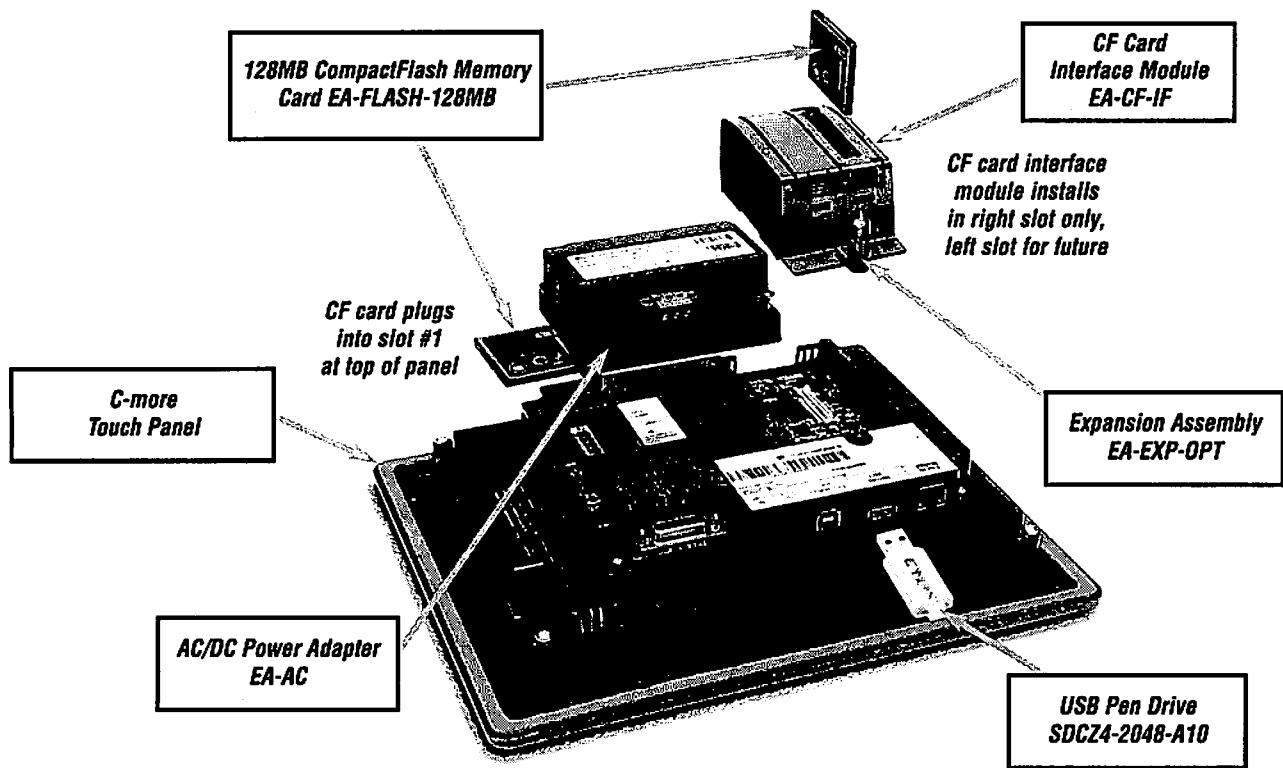
WARNING: Do NOT use EZTouch RAM or Flash memory cards with the *C-more* touch panels.



Accessories Overview

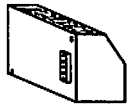


NOTE: CompactFlash memory card designations – CF Slot #1 is at the top of the panel and CF Slot #2 is the CF Card Interface Module, EA-CF-IF.

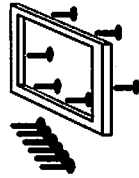


NOTE: Refer to the individual product data sheets that are included with the accessories for additional information.

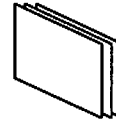
Accessories at a glance:



AC/DC Power Adapter:
EA-AC



6 inch Adapter Plate:
EA-6-ADPTR
(Used to retrofit new
C-more 6" touch panel
into existing EZTouch
non-slim panel cutout.)



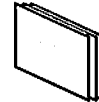
Non glare 15 inch screen cover:
EA-15-COV2
(pk of 3)



Expansion Assembly:
EA-EXP-OPT



D-SUB 15 pin 90 degree
Comm Port Adapter:
EA-ADPTR-4



Non glare 12 inch screen cover:
EA-12-COV2
(pk of 3)



CF Card Interface Module:
EA-CF-IF



D-SUB 15 pin to
Terminal Block Adapter:
EA-COMCON-3



Non glare 10 inch screen cover:
EA-10-COV2
(pk of 3)



128 MB CompactFlash
Memory Card:
EA-FLASH-128MB



USB Pen Drive,
2 GB:
SDCZ4-2048-A10



Non glare 8 inch screen cover:
EA-8-COV2
(pk of 3)



Non glare 6 inch screen cover:
EA-6-COV2
(pk of 3)



WARNING

To minimize the risk of potential safety problems, you should follow all applicable local and national codes that regulate the installation and operation of your equipment. These codes vary from area to area and it is your responsibility to determine which codes should be followed, and to verify that the equipment, installation, and operation are in compliance with the latest revision of these codes.

Equipment damage or serious injury to personnel can result from the failure to follow all applicable codes and standards. We do not guarantee the products described in this publication are suitable for your particular application, nor do we assume any responsibility for your product design, installation, or operation.

If you have any questions concerning the installation or operation of this equipment, or if you need additional information, please call us at 770-844-4200.

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AC/DC Power Adapter

The optional *C-more* AC/DC Power Adapter can be used to power the *C-more* touch panels from a 100-240 VAC, 50/60 Hertz, voltage source. The adapter provides 24 VDC @ 1.5 A to the touch panel's DC power connector and can be conveniently secured to the touch panel with two captive screws. The adapter provides a power loss signal to the touch panel that can be used to track power outages. This signal also allows the touch panel by way of a timed sequence to stop writing data to CompactFlash memory devices providing a controlled shutdown for increased data logging reliability.

3

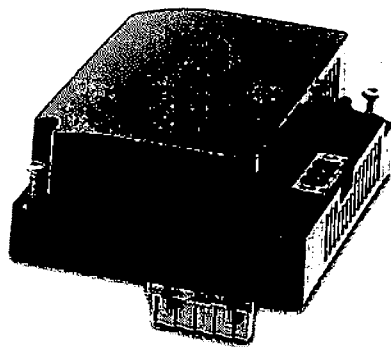


WARNING: The AC/DC Power Adapter is not recommended for use with the EA7-T15C touch panel when operating temperatures are expected to exceed 40 °C [104 °F].

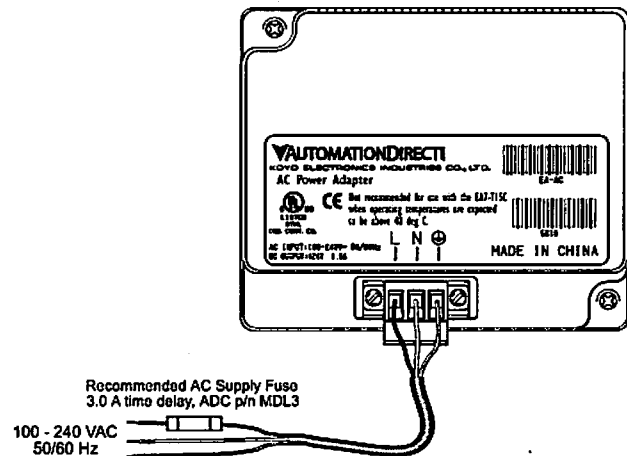


NOTE: 1.) The AC/DC Power Adapter, EA-AC, is for *C-more* touch panels only, and is powered from a 100-240 VAC, 50/60 Hertz power source. The adapter provides 24 VDC @ 1.5 A.
2.) Power Fault features help protect data being logged to CompactFlash during power failures. The *C-more* panel must have firmware version 1.21 Build 6.18E or higher for proper operation.

Part No. EA-AC



AC/DC Power Adapter Wiring



AC/DC Power Adapter Specifications

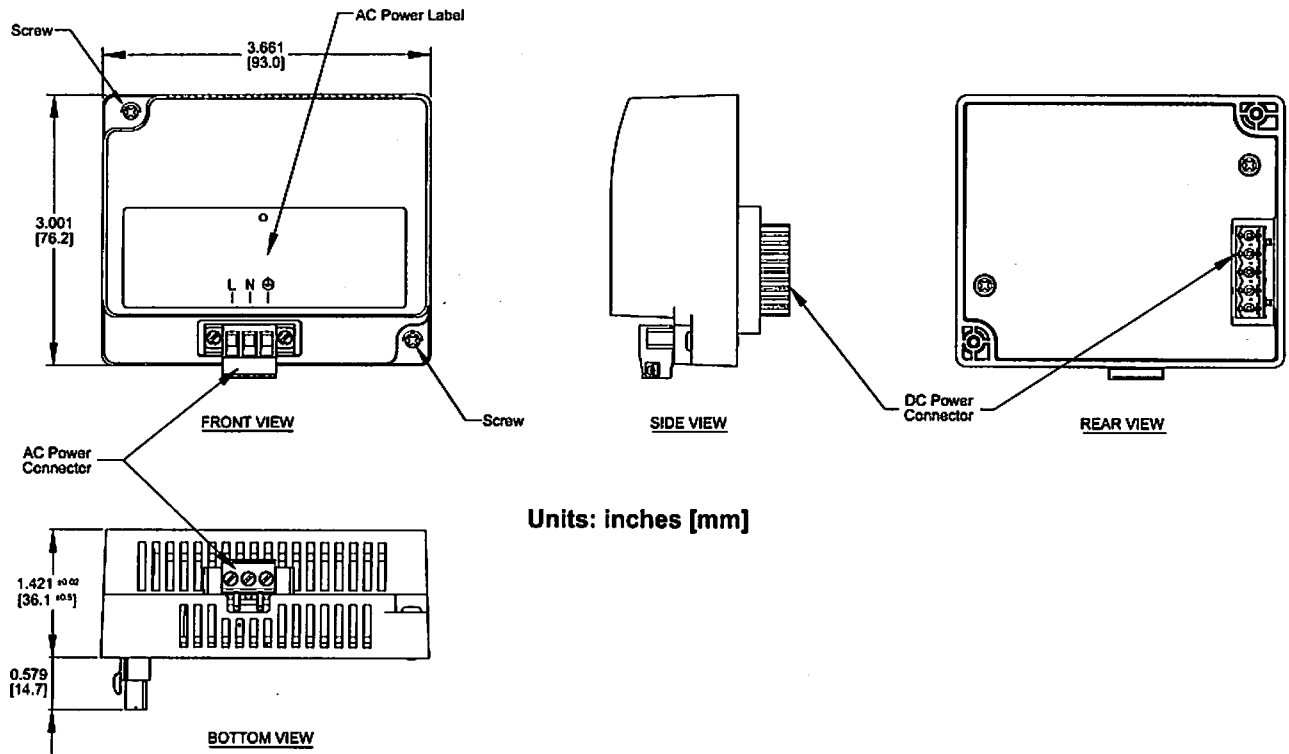
AC/DC Power Adapter Specifications	
Part Number	EA-AC
Input Voltage & frequency	100-240 VAC; 50/60 Hertz
Voltage Range	85-264 VAC w/ Under Voltage and Over Voltage Shutdown
Permissible Momentary Power Failure	Within 40 ms, see explanation in the Note below.
Input Power	68 VA or less
Operating Temperature Range	0 °C to 50 °C [32 to 122 °F] (For the EA7-T15C touch panel, maximum temperature is 40° C, [104 °F] when using the AC/DC Power Adapter.)
Storage Temperature Range	-20 to 60 °C [-4 to 140 °F]
Operating & Storage Humidity	10-85% RH (non-condensing)
Noise Immunity	1000 VAC p-p (Pulse width 1 µs, rise time: 1 ns) With proper ground connection on AC terminal block.
Hi-pot	1000 VAC, 1 minute With proper ground connection on AC terminal block.
Insulation Resistance	500 VDC, 10 M ohm or above With proper ground connection on AC terminal block.
Vibration	Compliant with IEC61131-2
Shock	Pulse shape: Sine half wave, Peak acceleration: 147 m/s ² (15 G), X, Y, Z: 3 directions, 2 times each
Thermal Protection	140 °C [284 °F], with autorecovery
Short Circuit Protection	85 VAC: 2.6 A, 100 VAC: 2.8 A, 264 VAC: 3.9 A
Static Electricity Discharge Resistance	Compliant with IEC61000-4-2, Contact: 4 kV, Air: 8 kV
Agency Approvals	UL508, cUL, CE, EMC EN61132-2
Environment	No corrosive gas or conductive dust
Grounding	Ground resistance: less than 100 ohm
Dimensions - inches [mm]	3.00" (H) x 3.66" (W) x 1.42" (D) [76.2 mm x 93.0 mm x 36.1 mm] (Excluding DC Power Connector.)
Weight	6.13 oz. [175 g]
Cooling Method	Natural convection when installed on vertically mounted touch panel.
Included Parts	AC Power Connector, Data Sheet Insert
Removable AC Power Connector	EA-AC-CON or DECA Switchlab MC101-508-03G Secure with (2) captive M2.5 screws, torque to 70 oz-in [0.5 Nm]
Output Voltage and Ripple	21.6 - 26.4 VDC, Ripple < 100 mV p-p
Output Current	Maximum 1.5 A
Inrush Current	For 100 VAC: 15 A, 3 ms or less For 240 VAC: 20 A, 3 ms or less
Power Fail Detection Voltage	58 VAC ±5%
Recommended AC Supply Fuse	3.0 A time delay, ADC p/n MDL3
Mounting to Touch Panel	Secure with (2) spring loaded captive M3-20 screws, torque to 50 oz-in [0.35 Nm]



NOTE: Permissible momentary power failure: The **C-more** touch panel will turn off the LCD backlight instantly when the power failure is detected (less than 58 VAC +/- 5%) for extending the Power Retention Period that enables the CPU to run longer. The backlight turns on automatically when the power returns to the **C-more** operating voltage.

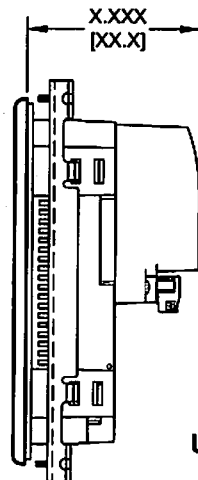
AC/DC Power Adapter Dimensions

Dimensions



3

Panel Depth with AC/DC Power Adapter Installed



- EA7-S6M-R = 2.921 [74.2]
- EA7-S6C-R = 2.921 [74.2]
- EA7-S6M = 2.921 [74.2]
- EA7-S6C = 2.921 [74.2]
- EA7-T6C = 2.921 [74.2]
- EA7-T8C = 3.157 [80.2]
- EA7-T10C = 3.106 [78.9]
- EA7-T12C = 3.102 [78.8]
- EA7-T15C = 3.075 [78.1]

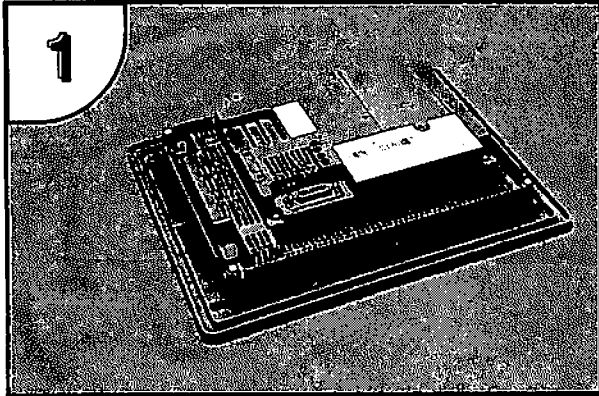
Units: inches[mm]

AC/DC Power Adapter Installation

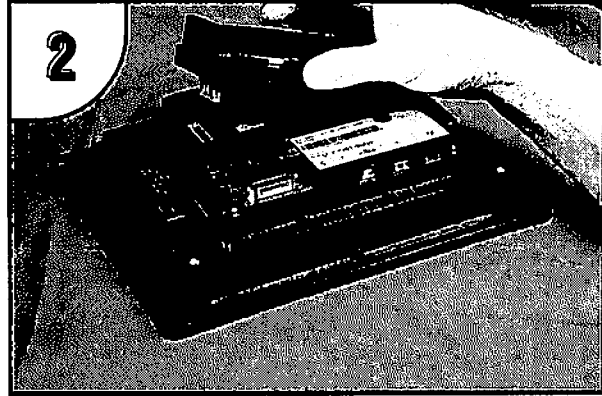


WARNING: This procedure should only be performed by qualified personnel who are experienced in working with electronic equipment. Take the necessary steps to prevent damage that may be caused by static electricity discharge. Disconnect input power to the touch panel before proceeding.

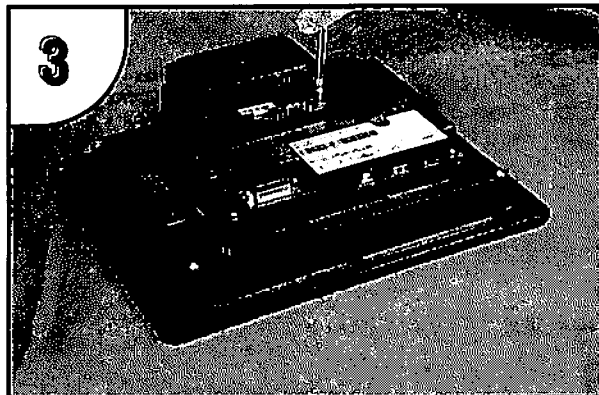
3



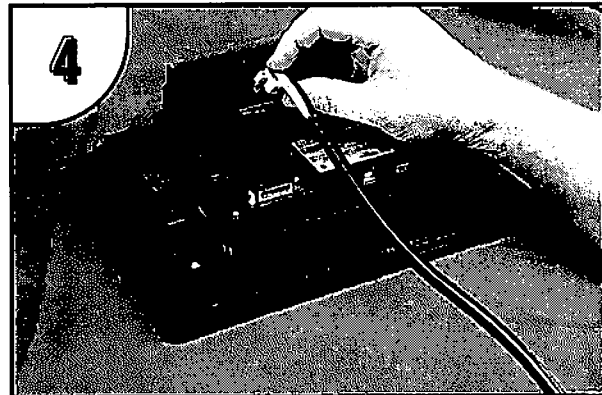
1
Preparation: Place the touch panel face down on a lint-free soft surface to prevent scratching the display screen if not already installed in a control cabinet. Remove the DC power connector if it is installed.



2
Insert the AC/DC Power Adapter into the touch panel's 5-position DC power connector.



3
Secure the AC/DC Power Adapter to the touch panel by tightening the two (2) spring loaded captive M3-20 screws to a torque of 50 oz-in [0.35 Nm].

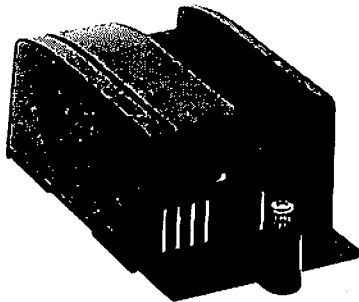


4
Plug the wired 3-pin AC Power Connector into its mating connector on the adapter and secure in place by tightening the two (2) captive M2.5 screws to a torque of 70 oz-in [0.5 Nm]. (Wiring details shown on page 3-5.)

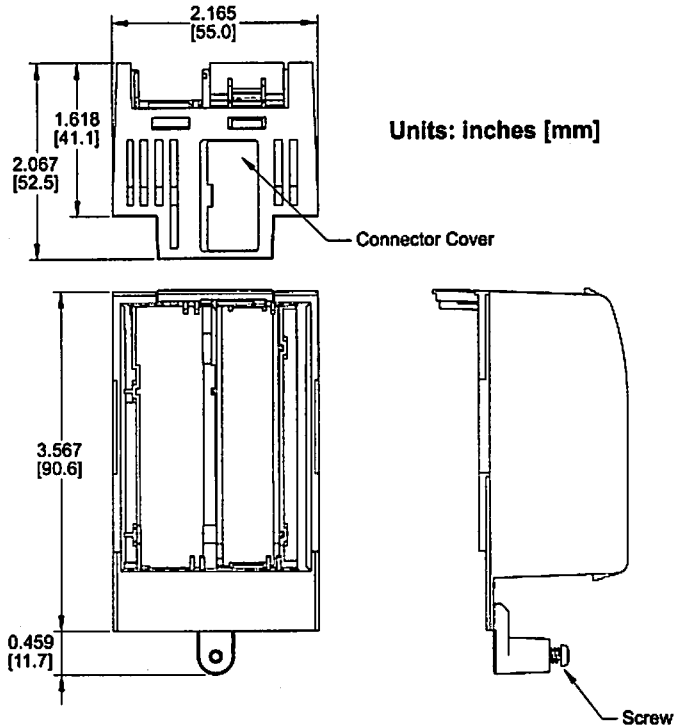
Expansion Assembly

The *C-more* Expansion Assembly is used to allow installation of the optional CF Card Interface Module for CF card use and also provides a slot for future option modules.

Part No. EA-EXP-OPT

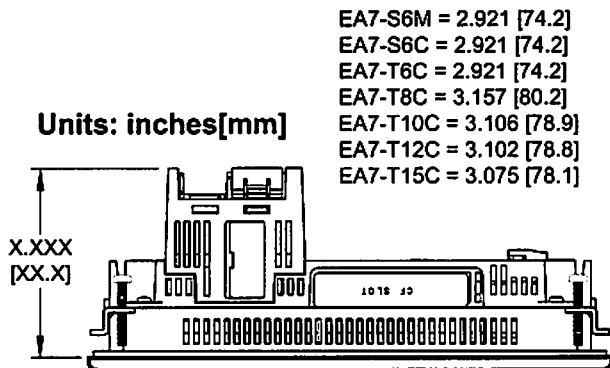


Expansion Assembly Dimensions

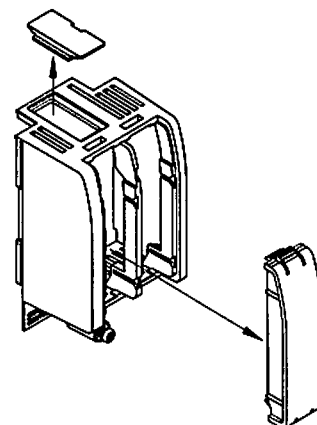


3

Panel Depth with Expansion Assembly Installed



Expansion Assembly Details

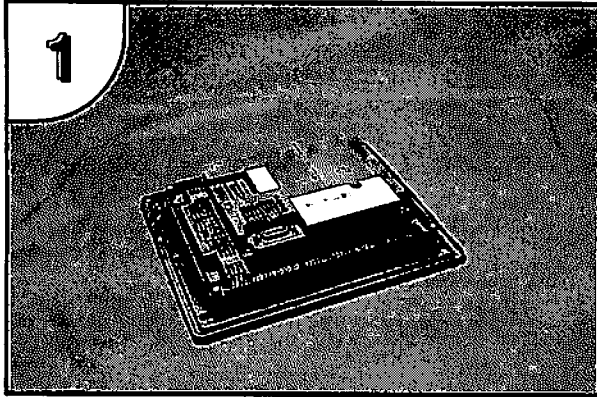


Expansion Assembly Installation

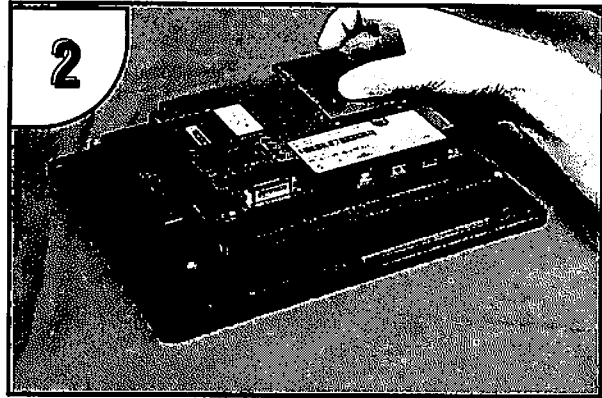


WARNING: This procedure should only be performed by qualified personnel who are experienced in working with electronic equipment. Disconnect input power to the touch panel before proceeding.

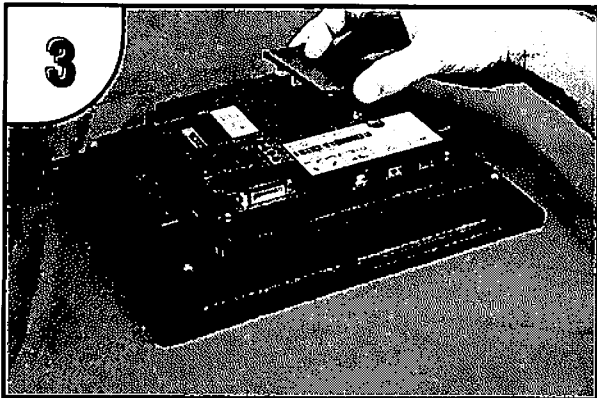
3



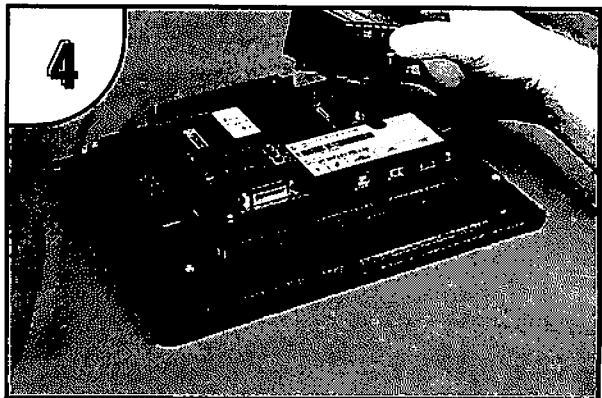
1
Preparation: Place the touch panel face down on a lint-free soft surface to prevent scratching the display screen if not already installed in a control cabinet.



2
Remove expansion area cover by pressing down on the left and right line markings and at the same time, slide the cover in the direction of the embossed arrow.

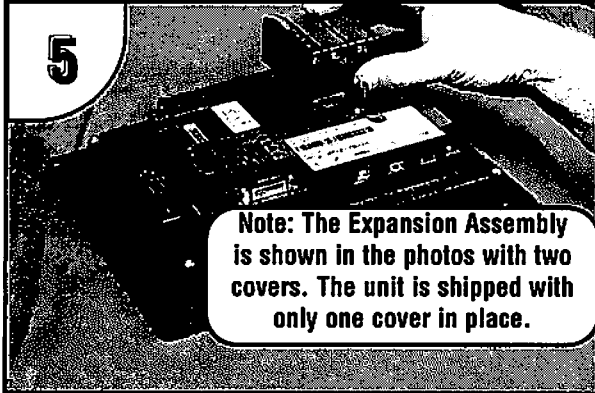


3
The cover will stop at the "Remove" position indicated by a tic mark on the cover lining up with the "Remove" tic mark on the panel. At this position, lift the cover up.

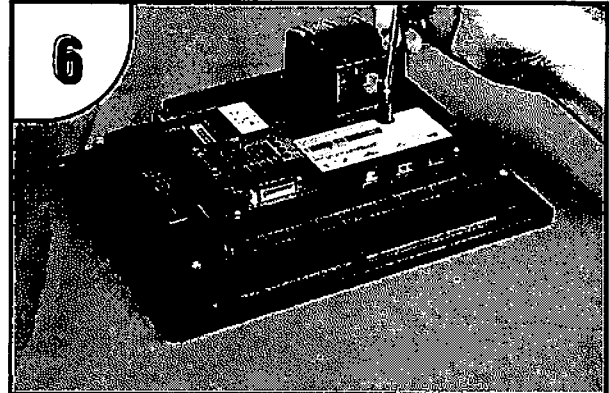


4
Position the expansion assembly over the opening so that the tic mark to the right of the fastening screw lines up with the "Remove" tic mark.

Expansion Assembly Installation (cont'd)



Slide the expansion assembly in a downward direction until the tic marks at the home position line up.



Secure the Expansion Assembly to the touch panel by tightening the spring loaded captive M3-20 screw to a torque of 50 oz-in [0.35 Nm].

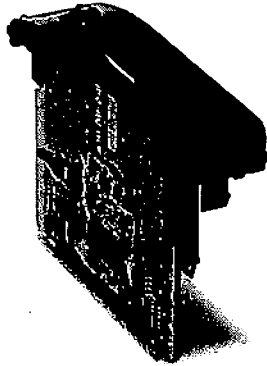
3

CF Card Interface Module

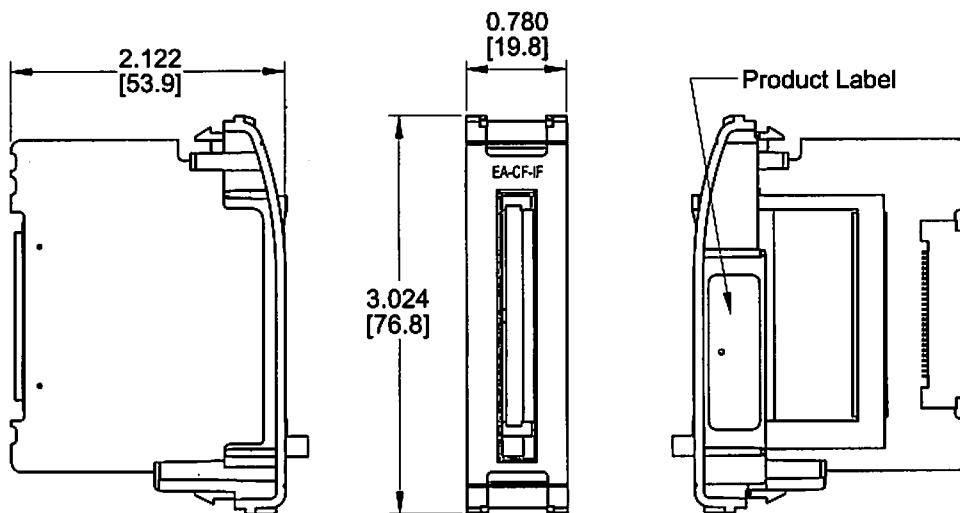
The *C-more* CF Card Interface Module is used with the Expansion Assembly to allow use of CompactFlash™ cards, such as the CompactFlash Memory, EA-FLASH-128MB.

Part No. EA-CF-IF

3



CF Card Interface Module Dimensions



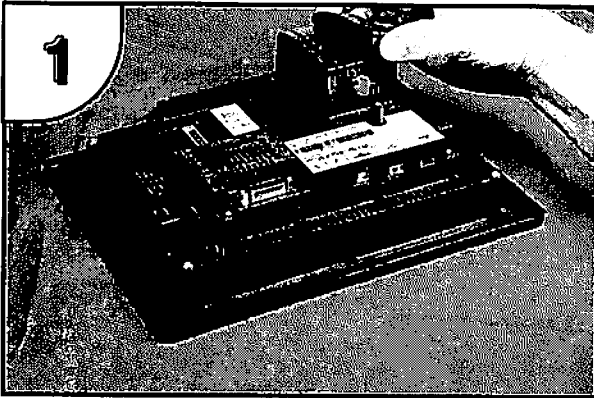
Units: inches [mm]

CF Card Interface Module Installation

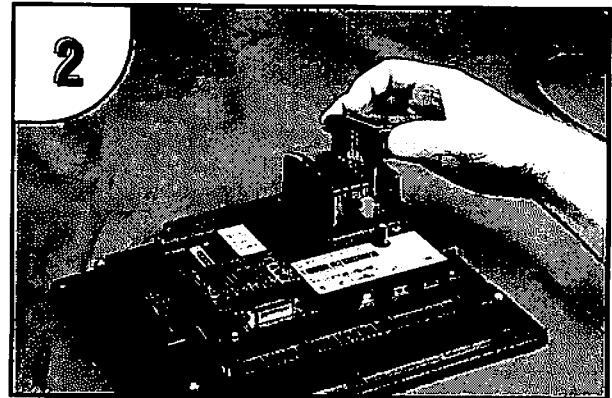


WARNING: The CF Card Interface Module is designed to be installed in the right hand side slot of the Expansion Assembly only. This procedure should only be performed by qualified personnel who are experienced in working with electronic equipment. Take the necessary steps to prevent damage that may be caused by static electricity discharge. Disconnect input power to the touch panel before proceeding.

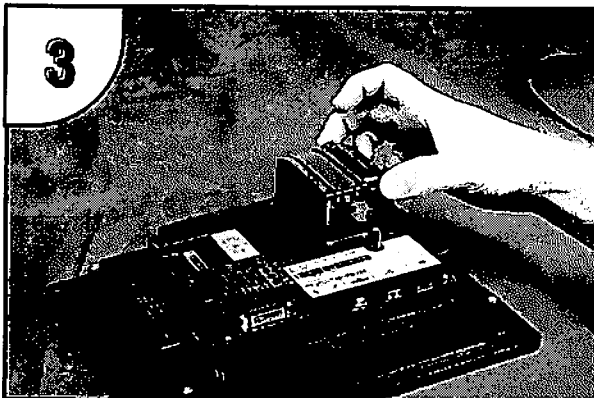
3



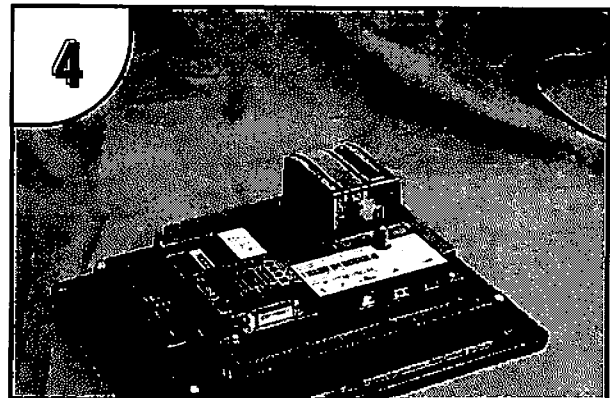
Preparation: Place the touch panel face down on a lint-free soft surface to prevent scratching the display screen if not already installed in a control cabinet. Again, make sure the input power is disconnected. Remove the right hand side protective slot cover, if it is installed, by squeezing the pinch tabs and lifting the cover off.



Install the CF Card Interface Module, p/n EA-CF-IF, into the right hand side slot by carefully aligning the female connector of the interface module with the male connector on the touch panel. There are PCB guides at the top and bottom of the slot to accept the edge of the Interface Module's printed circuit board. It is also helpful to preset the locking tabs of the Interface Module so they are swung inward, top and bottom.



Continue to slide the interface module into the slot until the front of the module is flush with the front of the Expansion Assembly. Press on the front of the Interface Module until the locking tabs snap into place.



The above photo shows the CF Card Interface Module fully installed. To remove the Interface Module in the future, pry out on the top and bottom locking tabs at the same time and the module will release from the connector. Lift the module from the slot. The Interface Module should only be removed from the slot with input power disconnected.

128 MB CompactFlash Memory

EA-FLASH-128MB is a 128MB high speed industrial grade CompactFlash™ memory card for non-volatile storage. Its 85 °C operating temperature makes it perfect for data logging in industrial applications (recommended for *C-more* touch panels).

3

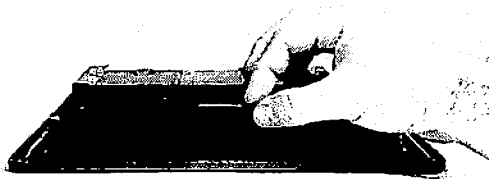
Part No. EA-FLASH-128MB



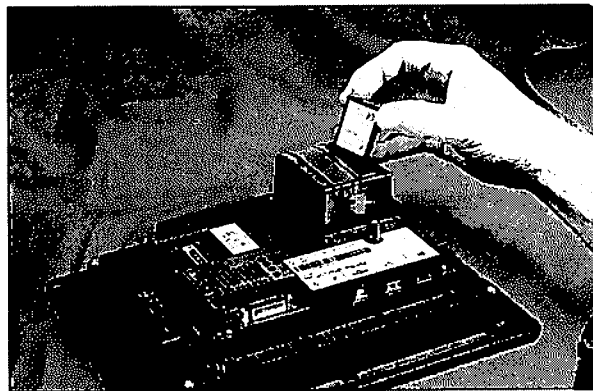
Specifications/Features:

- CompactFlash™ Compatibility
- Interface transfer speed: 16.6 MB/second
- W/E Endurance: 100,000 cycles ($T_a = 40^{\circ}\text{C}$ to 85°C); 300,000 cycles ($T_a = 0^{\circ}\text{C}$ to 70°C)

CF Slot #1 Location



CF Slot #2 Location



CompactFlash Memory Card Installation

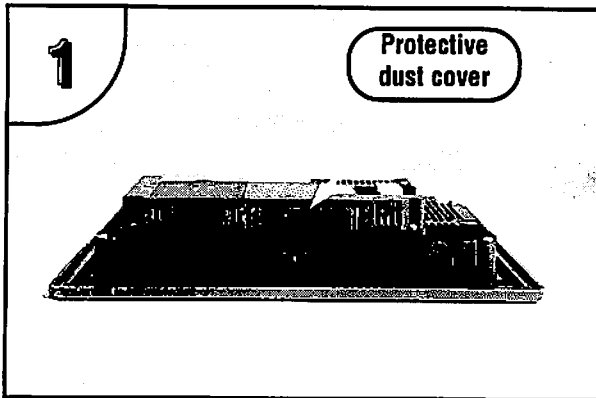


WARNING: Take the necessary steps to prevent damage that may be caused by static electricity discharge. Disconnect input power to the touch panel before proceeding.

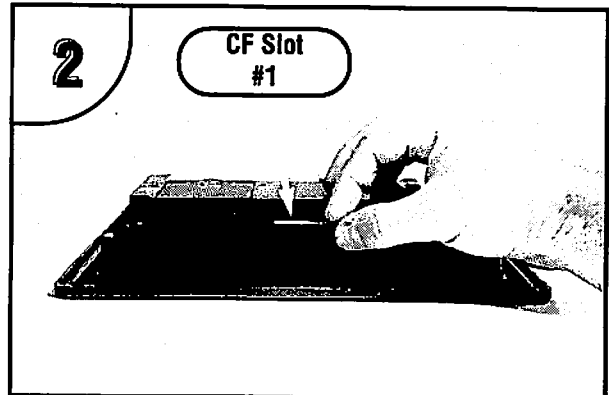
Preparation: If the touch panel is not already installed into a control cabinet, then in a clean environment, place the panel face down on a lint-free soft surface to prevent scratching the front of the panel.

CF Card Installed in CF Slot #1:

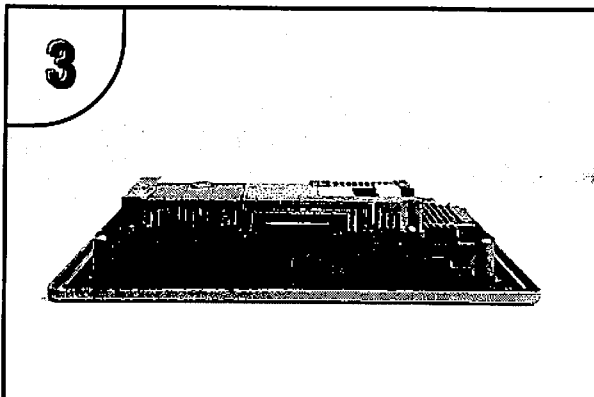
3



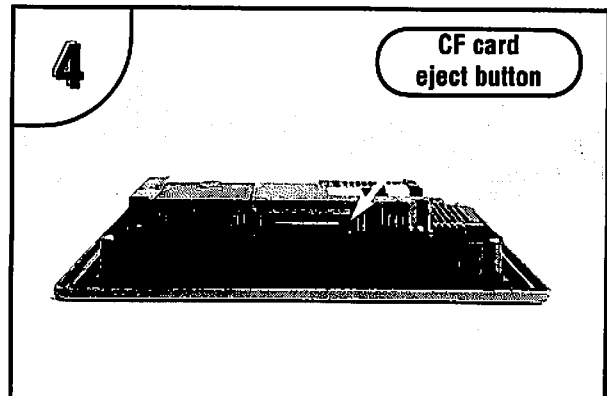
Remove the protective dust cover from the CF Slot #1 at the top of the touch panel by prying up on one edge. Discard the dust cover or store it for future use when a CF card is not being used.



Orientate the CompactFlash memory card so that the front label is facing the back of the panel and the CF card connector faces into the slot. There are guides on each side of the slot that will match the guides on the CF card. The CF card can only be inserted one way.



Gently press the CF card into the slot until it stops. You should feel a slight resistance as the CF card connector mates with the slot's connector. The CF card should be flush with the slot's opening. The dust cover can then be re-installed.



To remove the CF card from the CF Slot #1, press in on the eject button to the right of the CF card. This will cause the CF card to be partially ejected from the slot allowing removal.



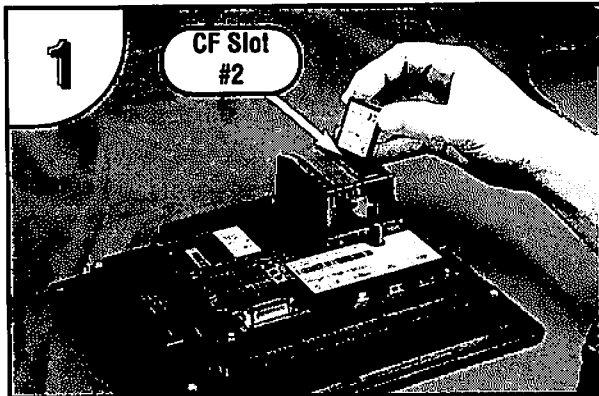
WARNING: Do NOT use EZTouch RAM or Flash memory cards with the *C-more* touch panels.



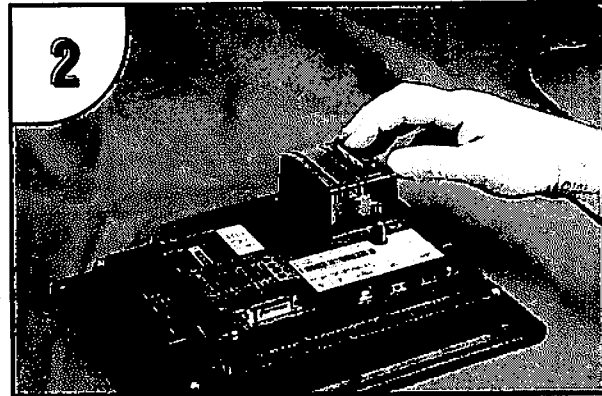
CompactFlash Memory Card Installation (cont'd)

3 CF Card Installed in CF Slot #2:

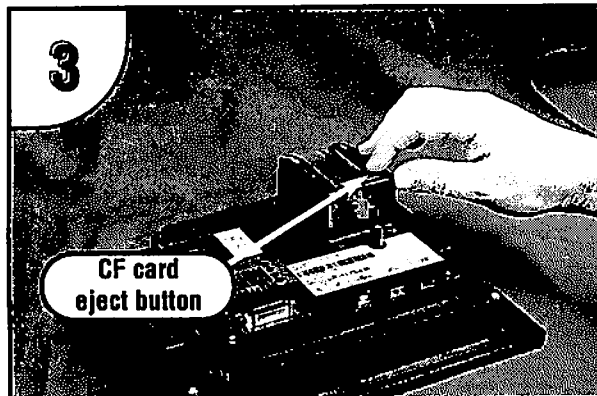
Preparation: Disconnect input power and all other connections, then remove the touch panel from the control cabinet. In a clean environment, place the panel face down on a lint-free soft surface to prevent scratching the front of the panel.



Orientate the CompactFlash memory card so that the front label is facing the power supply connector and the CF card connector faces into the slot. There are guides on each side of the slot that will match the guides on the CF card. The CF card can only be inserted one way.



Gently press the CF card into the slot until it stops. You should feel a slight resistance as the CF card connector mates with the slot's connector. The CF card should be flush with the slot's opening.



To remove the CF card from the CF Slot #2, press in on the eject button at the bottom of the CF card. This will cause the CF card to be partially ejected from the slot allowing removal.



WARNING: Do NOT use EZTouch RAM or Flash memory cards with the *C-more* touch panels.

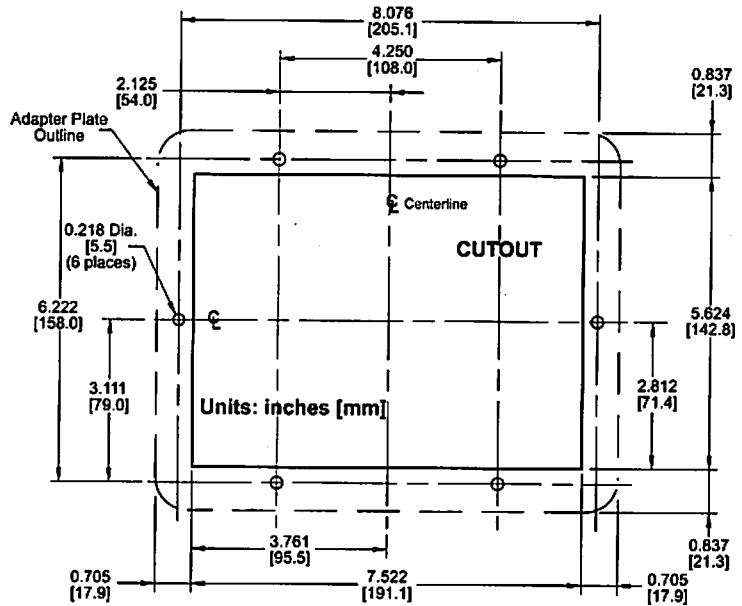
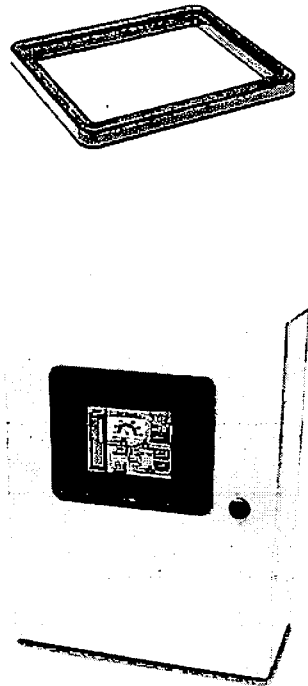


6" Adapter Plate

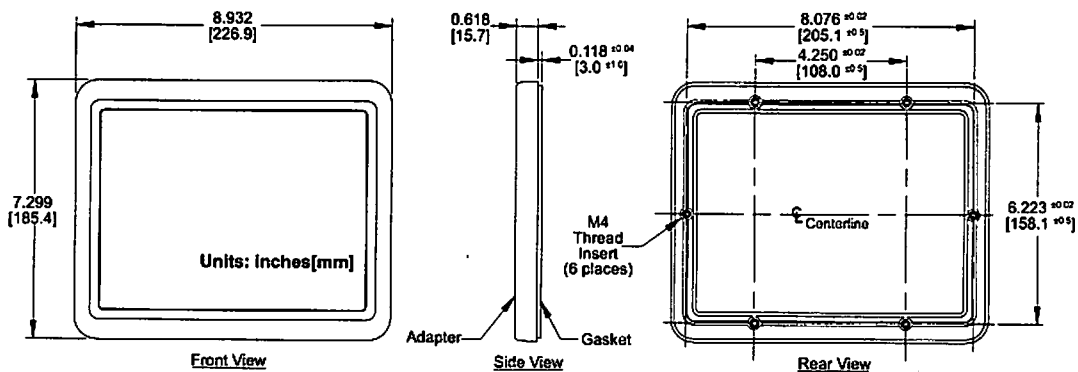
The adapter plate has been designed to simplify the retrofit of a new *C-more* 6" touch panel into an existing cabinet cutout for an EZTouch 6" non-slim touch panel, such as *AutomationDirect* part number EZ-S6C-K, EZ-S6C-F, EZ-S6M-R or EZ-S6M-F. The new *C-more* 6" touch panel will directly mount into the existing cutout opening for any EZTouch 6" slim touch panel.

Part No. EA-6-ADPTR

6" Adapter Plate Cutout Dimensions



6" Adapter Plate Dimensions



6" Adapter Plate Installation

The adapter plate has been designed to simplify the retrofit of a new *C-more* 6" touch panel into an existing cabinet cutout for an EZTouch 6" non-slim touch panel, such as our part number EZ-S6C-K, EZ-S6C-F, EZ-S6M-R or EZ-S6M-F. The new *C-more* 6" touch panel will directly mount into the existing cutout opening for any EZTouch 6" slim touch panel.

Two sets of mounting screws are provided with the adapter plate. Set A contains six M4 metric screws by 8mm in length for a control cabinet thickness range of 0.02-0.118" [0.5-3mm]. Set B contains six M4 metric screws by 10mm in length for a control cabinet thickness range of 0.118-0.197" [3-5mm]. Mounting screw torque: 100 oz-in [0.7 Nm].

The two DIN mounting clips that secure the *C-more* 6" touch panel to the adapter plate are provided with the touch panel. The adapter plate has an integral sealing gasket and the touch panel includes a gasket to seal the panel to the adapter.

Use of the adapter plate will maintain the NEMA 4/4X (indoor) rating of the *C-more* touch panel.

Dimensions for the cutout with mounting hole locations and an assembly diagram are shown in this chapter.

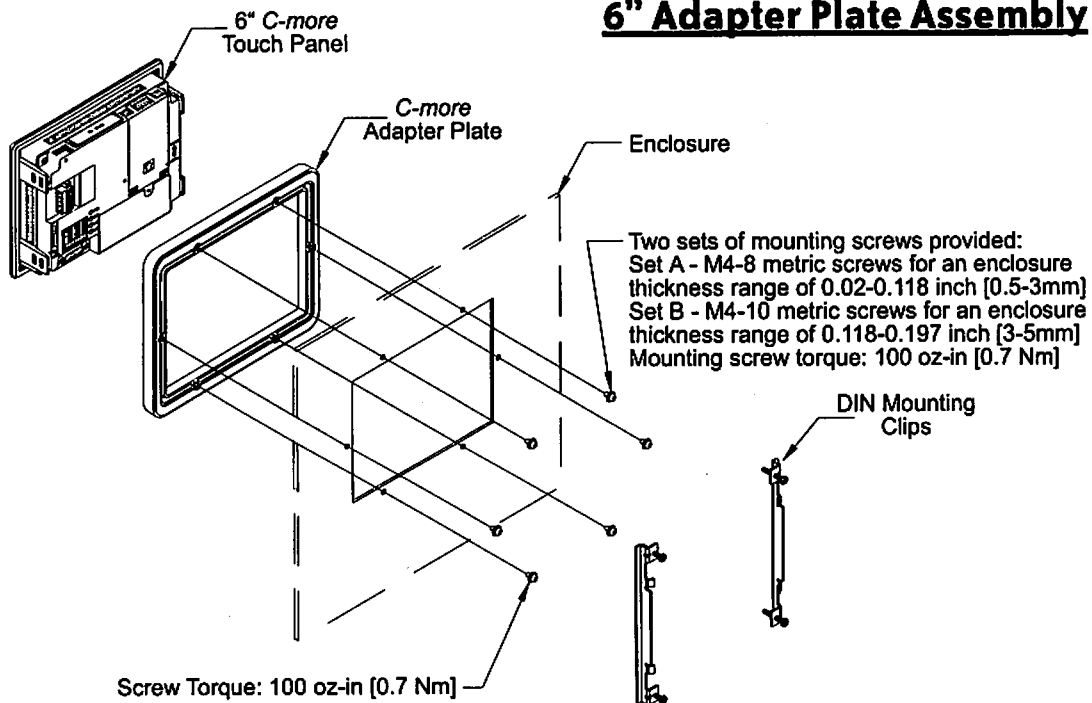
Preparation: Confirm the existing cutout with the dimensions shown on the previous page when using the adapter plate to replace an existing EZTouch 6" non-slim touch panel with a new *C-more* 6" touch panel.

3



WARNING: Mount the adapter plate and touch panel on a vertical surface to allow proper cooling.

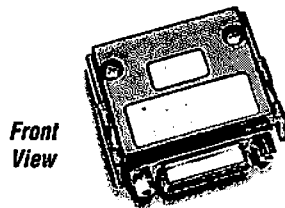
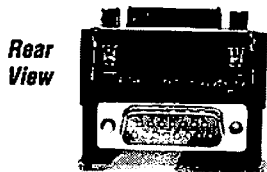
6" Adapter Plate Assembly



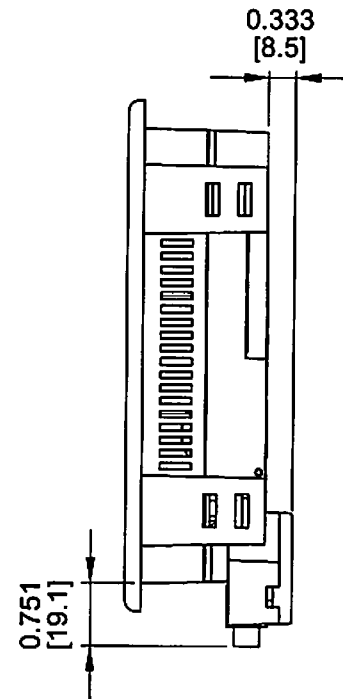
D-SUB 15-pin 90 degree Comm Port Adapter

The EA-ADPTR-4 adapter is plugged into the 15-pin serial port on the rear of the panel to allow a PLC communication cable to be plugged in at a 90 degree angle to reduce panel depth requirements. UL Recognized.

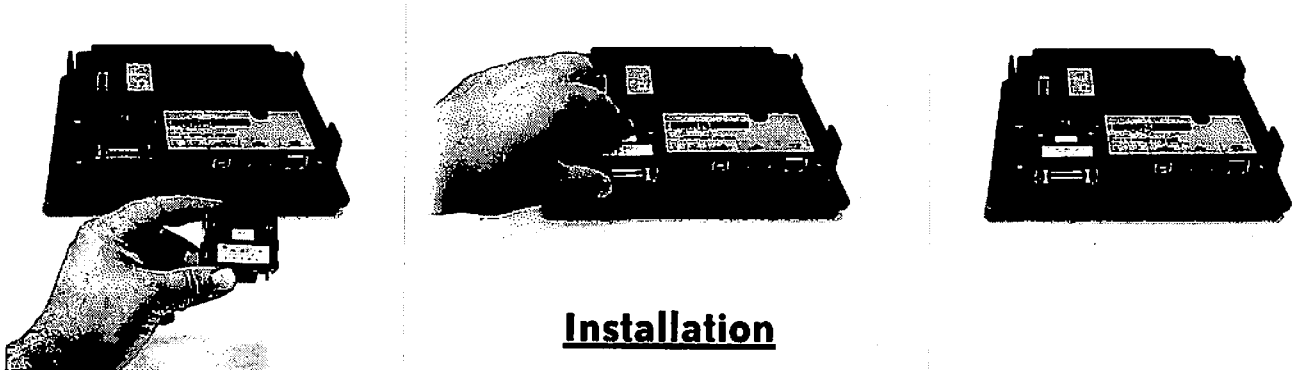
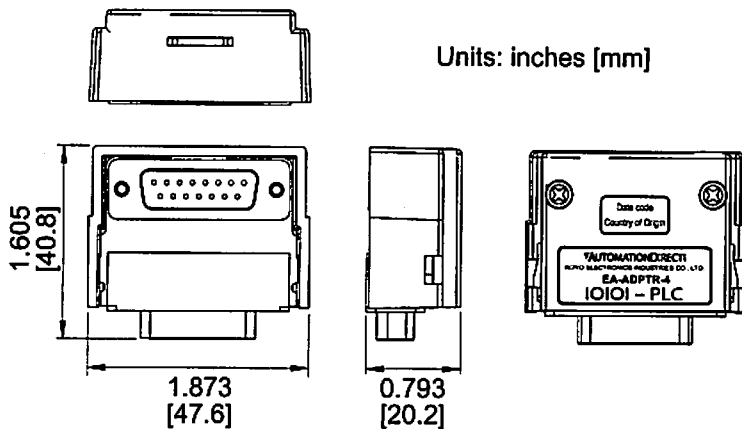
Part No. EA-ADPTR-4



Panel Dimensions with Connector Installed



Comm Port Adapter Dimensions



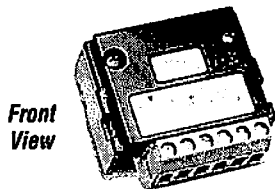
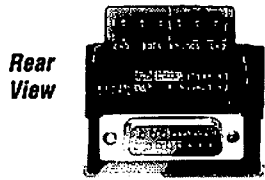
Installation

D-SUB 15-pin to Terminal Block Adapter

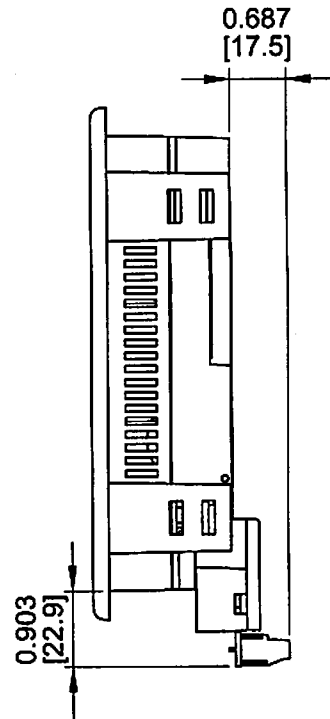
The EA-COMCON-3 adapter is plugged into the 15-pin serial port on the rear of the panel to allow wire terminal connections for RS-422/485 PLC communication cable. UL Recognized.

Part No. EA-COMCON-3

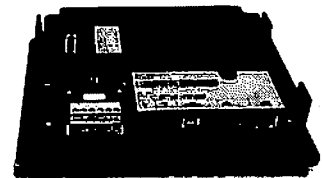
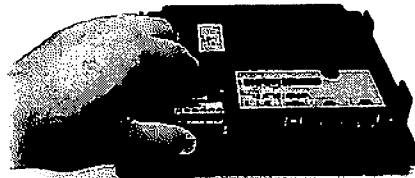
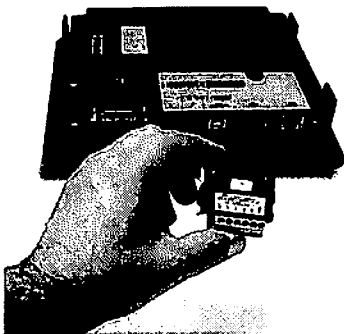
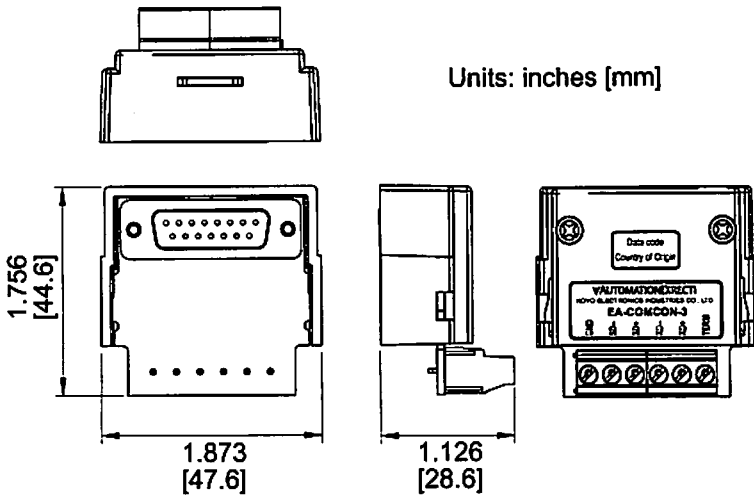
3



Panel Dimensions with Connector Installed



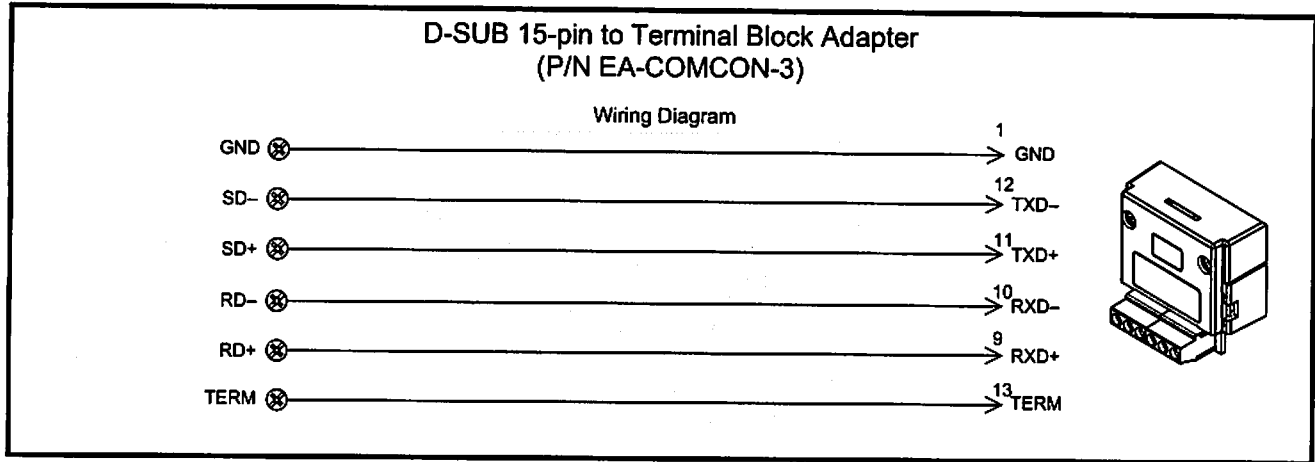
Terminal Block Adapter Dimensions



Installation

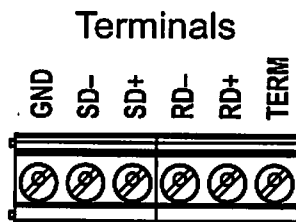
D-SUB 15-pin to Terminal Block Adapter (cont'd)

Terminal Block Adapter Wiring Diagram



3

Terminal Block Adapter Terminal Designations



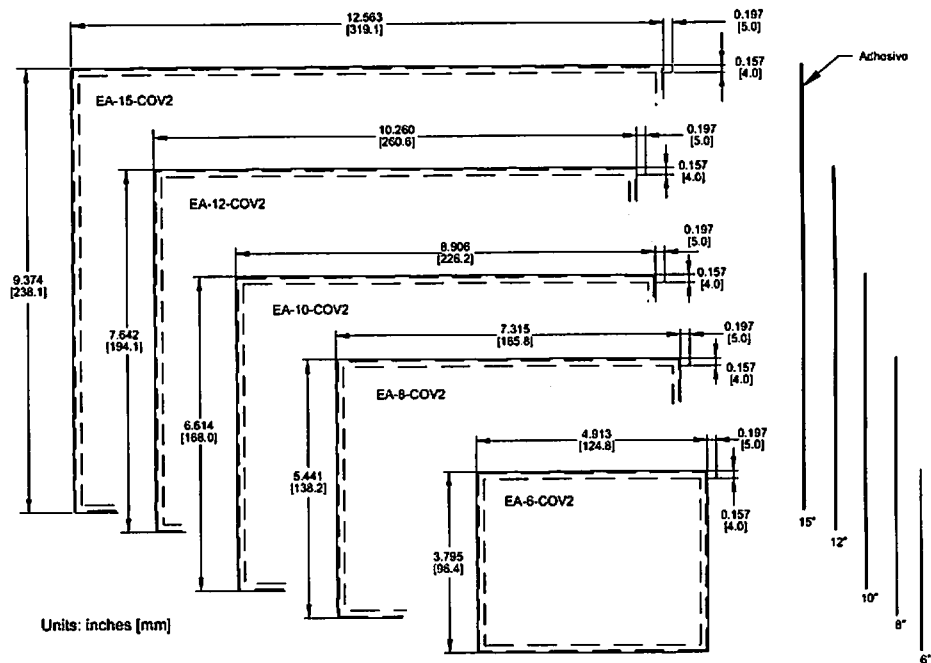
Non-glare Screen Covers

Non Glare 6 Inch Screen Cover, protective overlay used to protect the touch screen while helping to reduce the glare from external light sources. (pk of 3)

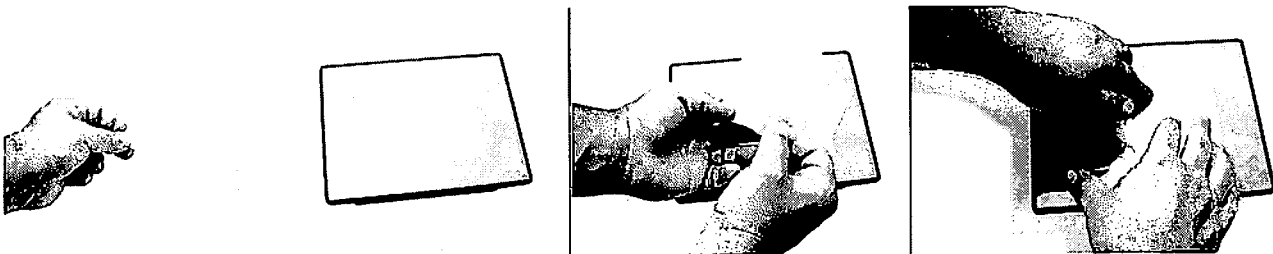
Part No. EA-6-COV2, EA-8-COV2, EA-10-COV2, EA-12-COV2 & EA-15-COV2

3

Screen Cover Dimensions



Installation



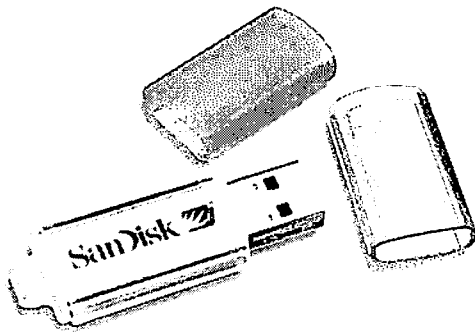
NOTE: The protective cover ships with a thin protective sheet on the face of the cover that needs to be carefully removed. If your panel is not clear, the protective sheet may not have been removed.

USB Pen Drive

The SanDisk Cruzer Micro is an extremely small 2 GB USB Flash Drive (UFD) that connects to a USB port. Users can easily store their logging data, project data, key documents and images on a Cruzer Micro and transfer them to another computer with a USB port.

Includes software for data encryption (CruzerLock 2)*, and trial version for back-up (PocketCache)*, and Outlook synchronization (CruzerSync)*.

Part No. SDCZ4-2048-A10



Specifications/Features:

- Dimensions: 7.9mm x 18.95mm x 52.2mm (H x W x L)
- Stylish, metal casing with changeable colored skins and caps **
- Includes CruzerLock 2 for data security*, and trial versions of PocketCache (back-up)* and CruzerSync (Outlook & My Documents folder synchronization) software*
- Hi-Speed USB 2.0 certified (backwards compatible with all USB 1.1 ports)
- Compatible with Windows 98SE, ME, 2000, XP and Mac OS 9.1.x+, OS X v10.1.2+
- Certified Windows XP and Mac OS X

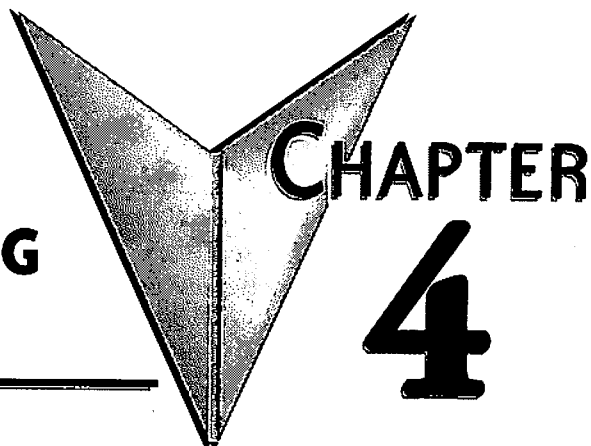
Cruzer Micro Package Contents:

- Cruzer Micro Skins (with clear skin and cap)
- 2 additional colored skins w/matching caps **
- Lanyard
- Quick Start Guide

* For Windows only

** Available for new version of Cruzer Micro with Skins only

INSTALLATION & WIRING



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Safety Guidelines



NOTE: Products with CE marks perform their required functions safely and adhere to relevant standards as specified by CE directives provided they are used according to their intended purpose and that the instructions in this manual are adhered to. The protection provided by the equipment may be impaired if this equipment is used in a manner not specified in this manual. A listing of our international affiliates is available on our Web site: <http://www.automationdirect.com>

4



WARNING: Providing a safe operating environment for personnel and equipment is your responsibility and should be your primary goal during system planning and installation. Automation systems can fail and may result in situations that can cause serious injury to personnel or damage to equipment. Do not rely on the automation system alone to provide a safe operating environment. You should use external electromechanical devices, such as relays or limit switches, that are independent of the PLC application to provide protection for any part of the system that may cause personal injury or damage. Every automation application is different, so there may be special requirements for your particular application. Make sure you follow all national, state, and local government requirements for the proper installation and use of your equipment.

Plan for Safety

The best way to provide a safe operating environment is to make personnel and equipment safety part of the planning process. You should examine *every* aspect of the system to determine which areas are critical to operator or machine safety. If you are not familiar with control system installation practices, or your company does not have established installation guidelines, you should obtain additional information from the following sources.

- NEMA — The National Electrical Manufacturers Association, located in Washington, D.C. publishes many different documents that discuss standards for industrial control systems. You can order these publications directly from NEMA. Some of these include:
 - ICS 1, General Standards for Industrial Control and Systems*
 - ICS 3, Industrial Systems*
 - ICS 6, Enclosures for Industrial Control Systems*
- NEC — The National Electrical Code provides regulations concerning the installation and use of various types of electrical equipment. Copies of the NEC Handbook can often be obtained from your local electrical equipment distributor or your local library.
- Local and State Agencies — many local governments and state governments have additional requirements above and beyond those described in the NEC Handbook. Check with your local Electrical Inspector or Fire Marshall office for information.

Introduction

The installation and wiring of the *C-more*[®] touch panels requires selecting an appropriate location for the touch panel, laying out the cutout dimensions on the surface of the control cabinet that the panel will be mounted through, securing the touch panel with the provided mounting clips, tightening the screws to the appropriate torque rating to assure the gasket is sealing correctly, and finally connecting the appropriate power source to the touch panel.



WARNING: *C-more* touch panels need to be mounted on a vertical surface to ensure proper cooling of the panel and its components.



Note: Each *C-more* touch panel is provided with a cutout template to make marking the proper cutout size on the surface of the control cabinet that the panel will be mounted through a simple task.

The *C-more* 6" touch panels include two mounting clips. The clips can be viewed as a long metal bracket with two screws in each clip. The 6" panel clips can be fitted to the touch panel at two different depth locations that allow the 6" panel to be mounted through a wide range of enclosure thicknesses. The 8" through 12" touch panels include six mounting clips while the 15" touch panel includes eight. The 8" through 15" panel mounting clips are all the same. They are fitted to the touch panel by inserting two tabs into mating wide slots around the panel and then sliding the clip into a narrower slot to secure it in place. There is one screw on each clip that needs tightening to secure the panel in place.

Any *C-more* touch panel can be mounted directly through the existing cutout of a same size EZTouch slim touch panel. There is a simple solution for the need to replace an EZTouch 6" non-slim (rounded bezel) touch panel as explained in the following note.

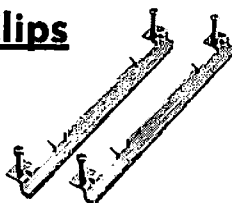


NOTE: The *C-more* 6" touch panels will fit into the existing cutout of any EZTouch 6" slim bezel panel. Use the *C-more* 6" Adapter Plate, EA-6-ADPTR, to install *C-more* 6" panels into existing cutouts of EZTouch 6" non-slim (rounded bezel) panels. The adapter plate gasket is included.

This chapter only covers the proper mounting of the touch panel and connecting power. Once power is applied to the touch panel, the user will want to read Chapter 5 on the System Setup Screens in order to set the internal time and date for the panel, check the information menu to make sure the panel is the correct unit for the application and is the latest version, set communication port parameters that may be required, become familiar with the touch panel test features, and check memory options.

The next step will be to select the appropriate PLC protocol and communications cable as described in Chapter 6.

6" Mounting Clips



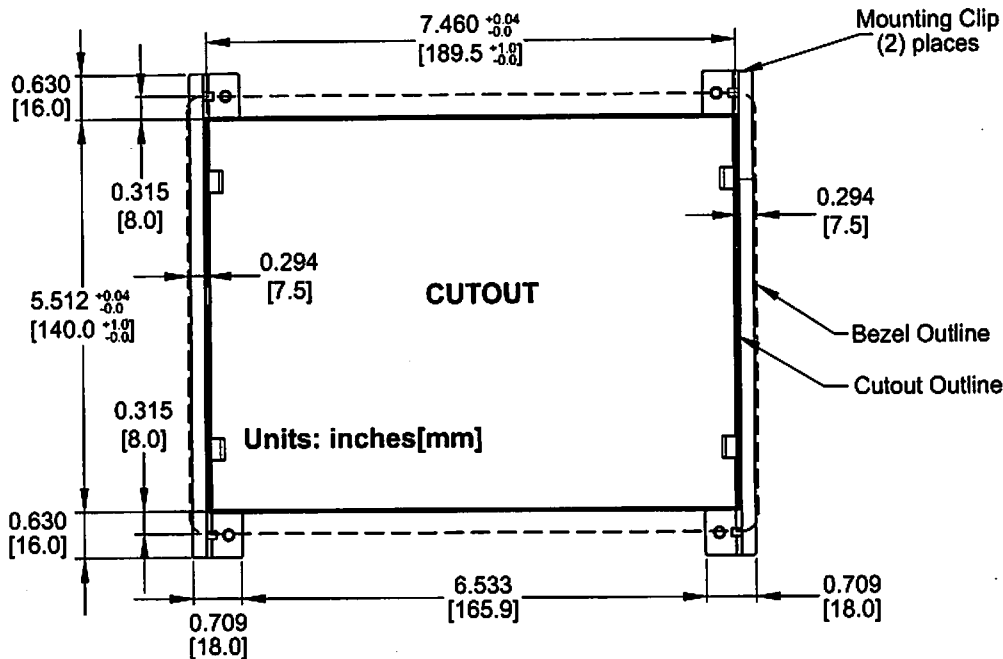
8-15" Mounting Clip



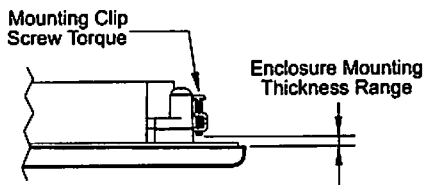
EA7-S6M-R, S6C-R, S6M, S6C and T6C – Cutout Dimensions

The *C-more* 6" touch panels are mounted into a cutout through the control cabinet and secured with two (2) mounting clips. The mounting clips are provided with the touch panel. There is a set of four (4) rectangular holes (slots) on each side of the touch panel's short dimension that the two tabs on each mounting clip will match. You will need to select either the upper or lower set of holes depending on your control cabinet's material thickness. The table below shows the different thickness ranges. The mounting clips are held in place, and pull the front bezel of the panel tight to the mounting surface, by tightening the screws into the rear of the control cabinet. The screws need to be tightened to the torque rating shown in the table below so that the gasket is compressed to form the proper seal between the panel and cabinet surface.

Note: Mount the touch panel on a vertical surface to allow convection air flow for proper cooling.



Enclosure Mounting Thickness Ranges and Mounting Clip Screw Torque



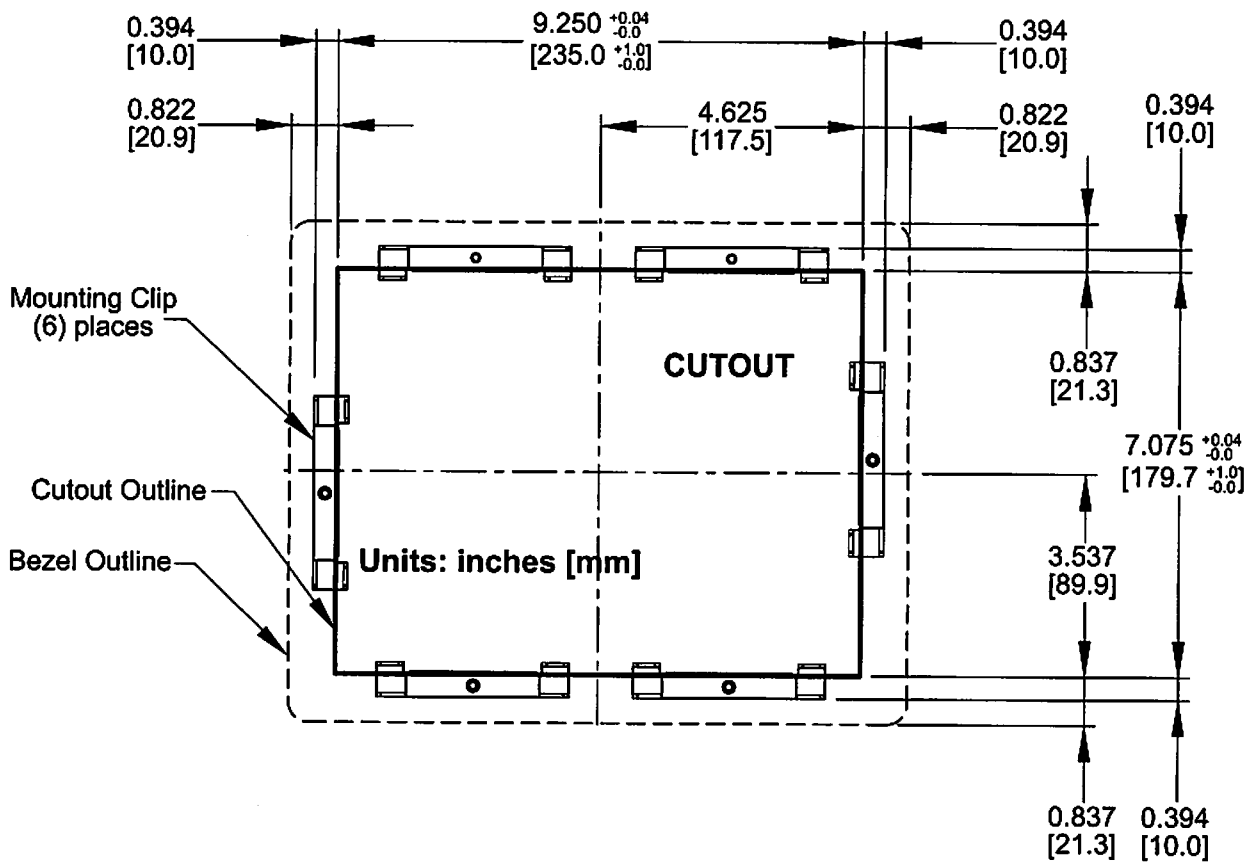
Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
6" – lower mounting clip position	0.039 - 0.24 inch [1 - 6 mm]	35 ~ 50 oz-in [0.25 ~ 0.35 Nm]
6" – upper mounting clip position	0.20 - 0.63 inch [5 - 16 mm]	35 ~ 50 oz-in [0.25 ~ 0.35 Nm]

EA7-T8C – Cutout Dimensions

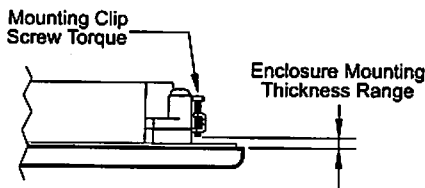
The *C-more* 8" touch panels are mounted into a cutout through the control cabinet and secured with six (6) mounting clips. The mounting clips are provided with the touch panel. The mounting clips will insert into a series of slots around the rear perimeter of the touch panel. Each clip has two tabs that will mate to two slots, using the larger rectangular holes. The mounting clips are held in place by sliding the clip toward the smaller rectangular holes. The screw of each mounting clip needs to be tightened to the torque rating shown in the table below so that the gasket is compressed to form the proper seal between the panel and cabinet surface.



Note: Mount the touch panel on a vertical surface to allow convection air flow for proper cooling.



Enclosure Mounting Thickness Ranges and Mounting Clip Screw Torque

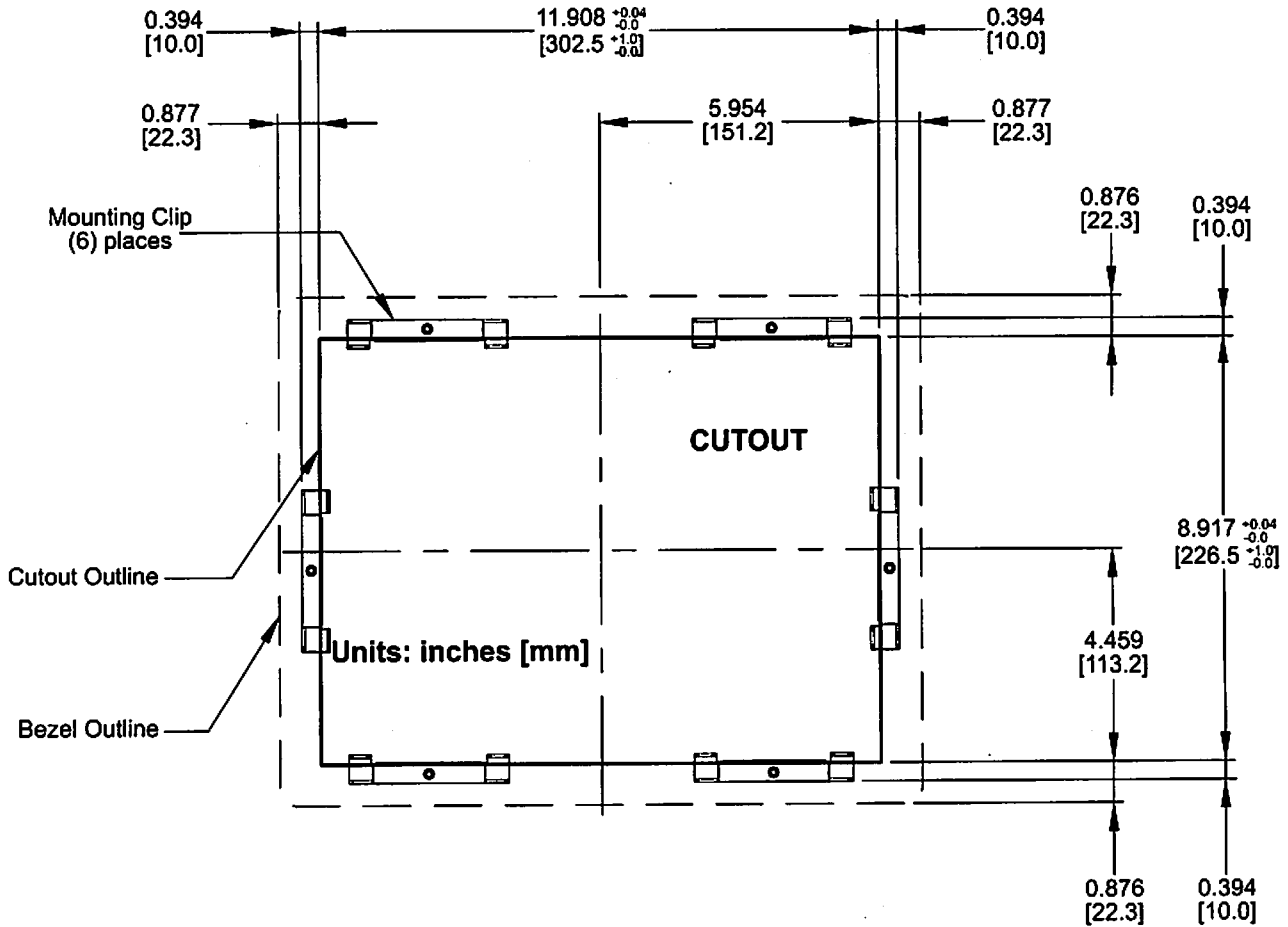


Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
8", 10", 12" & 15"	0.039 - 0.20 inch [1 - 5 mm]	42 ~ 57 oz-in [0.3 ~ 0.4 Nm]

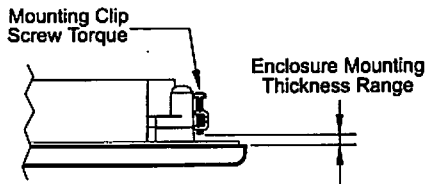
EA7-T10C – Cutout Dimensions

The *C-more* 10" touch panels are mounted into a cutout through the control cabinet and secured with six (6) mounting clips. The mounting clips are provided with the touch panel. The mounting clips will insert into a series of slots around the rear perimeter of the touch panel. Each clip has two tabs that will mate to two slots, using the larger rectangular holes. The mounting clips are held in place by sliding the clip toward the smaller rectangular holes. The screw of each mounting clip needs to be tightened to the torque rating shown in the table below so that the gasket is compressed to form the proper seal between the panel and cabinet surface.

Note: Mount the touch panel on a vertical surface to allow convection air flow for proper cooling.



Enclosure Mounting Thickness Ranges and Mounting Clip Screw Torque



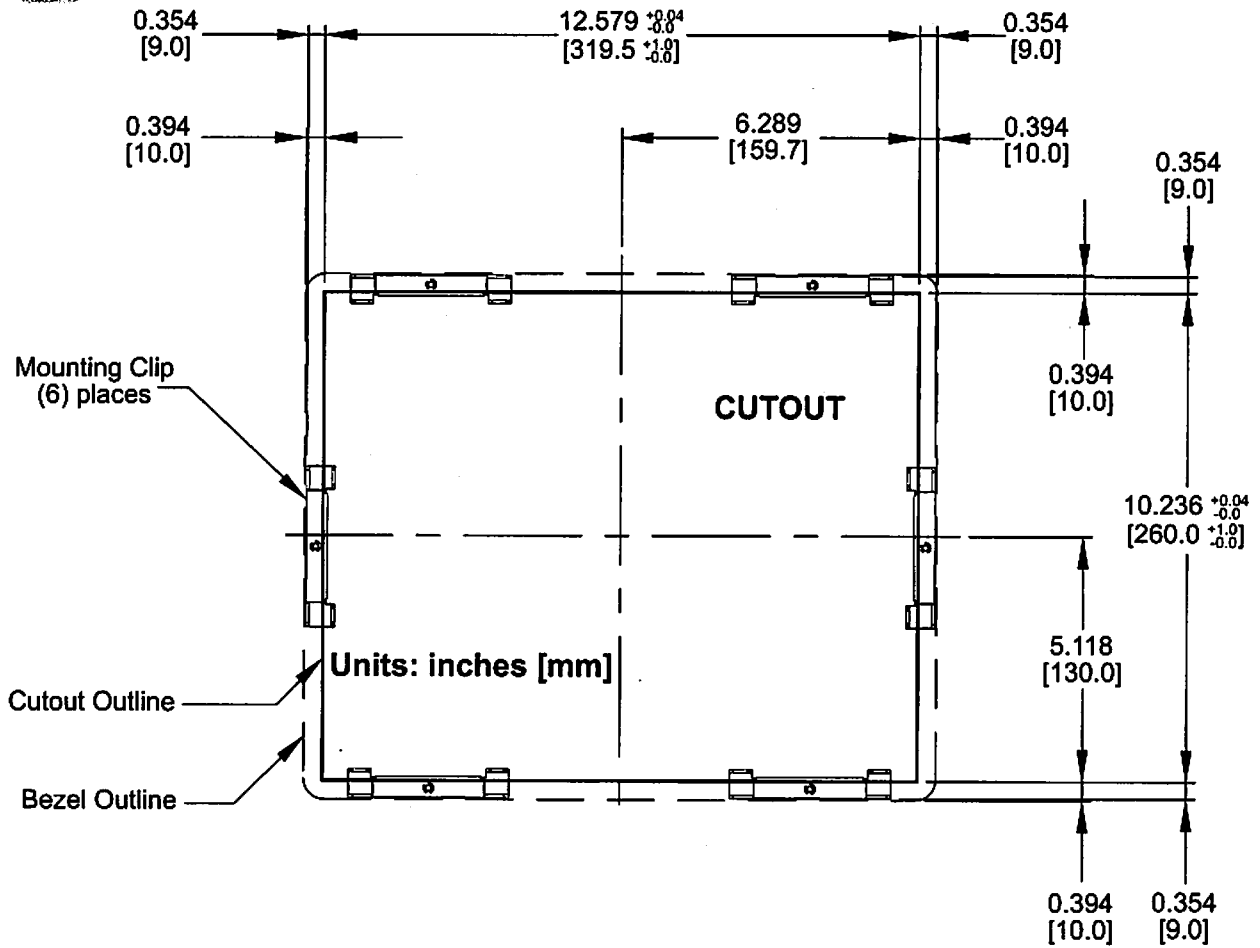
Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
8", 10", 12" & 15"	0.039 - 0.20 inch [1 - 5 mm]	42 ~ 57 oz-in [0.3 ~ 0.4 Nm]

EA7-T12C – Cutout Dimensions

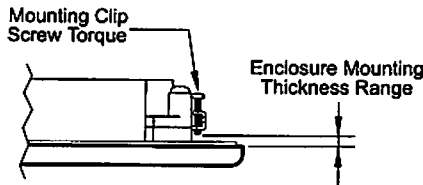
The *C-more* 12" touch panels are mounted into a cutout through the control cabinet and secured with six (6) mounting clips. The mounting clips are provided with the touch panel. The mounting clips will insert into a series of slots around the rear perimeter of the touch panel. Each clip has two tabs that will mate to two slots, using the larger rectangular holes. The mounting clips are held in place by sliding the clip toward the smaller rectangular holes. The screw of each mounting clip needs to be tightened to the torque rating shown in the table below so that the gasket is compressed to form the proper seal between the panel and cabinet surface.



Note: Mount the touch panel on a vertical surface to allow convection air flow for proper cooling.



Enclosure Mounting Thickness Ranges and Mounting Clip Screw Torque

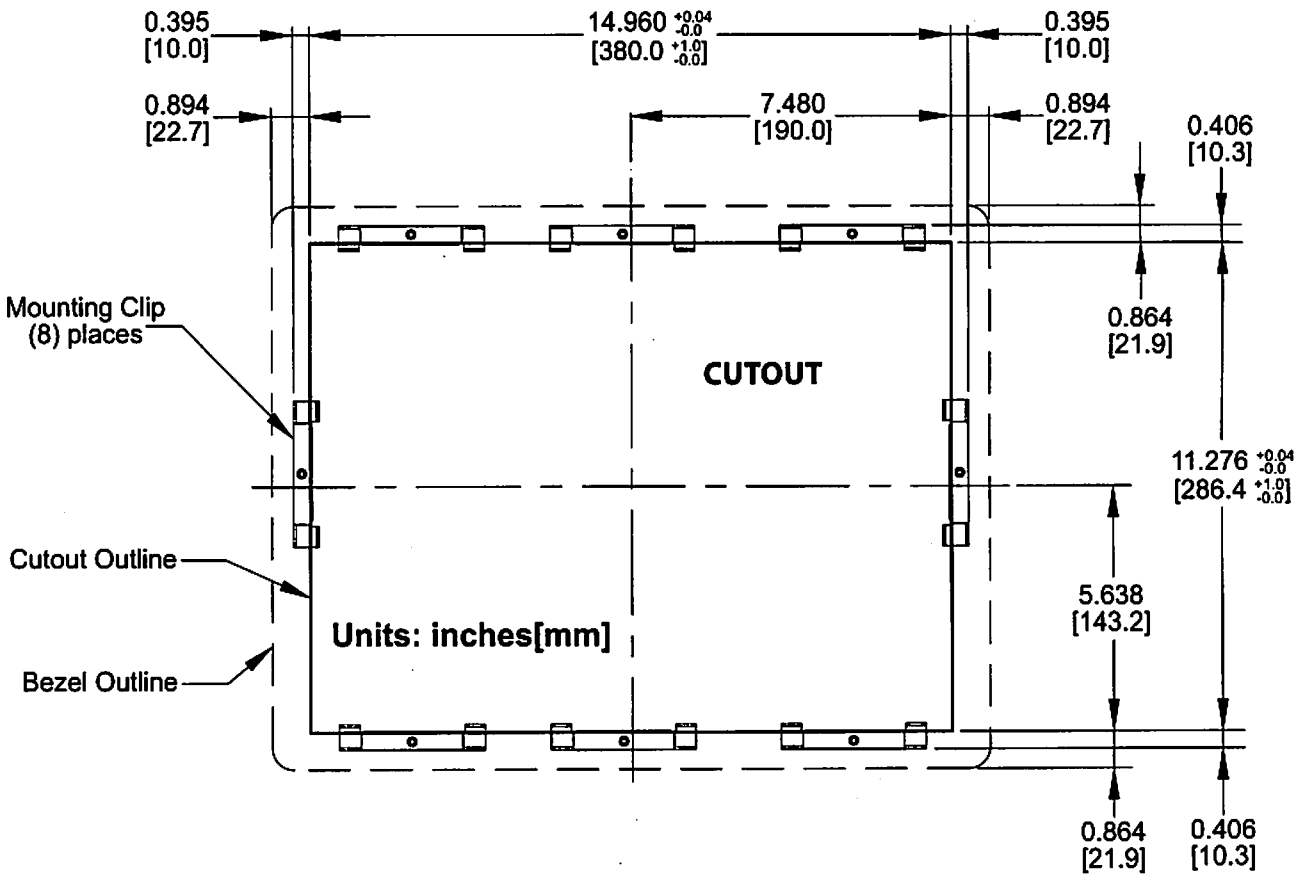


Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
8", 10", 12" & 15"	0.039 - 0.20 inch [1 - 5 mm]	42 ~ 57 oz-in [0.3 ~ 0.4 Nm]

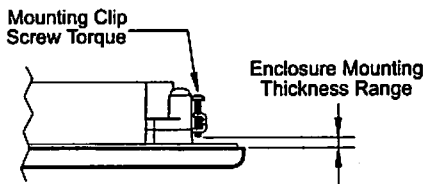
EA7-T15C – Cutout Dimensions

The *C-more* 15" touch panels are mounted into a cutout through the control cabinet and secured with eight (8) mounting clips. The mounting clips are provided with the touch panel. The mounting clips will insert into a series of slots around the rear perimeter of the touch panel. Each clip has two tabs that will mate to two slots, using the larger rectangular holes. The mounting clips are held in place by sliding the clip toward the smaller rectangular holes. The screw of each mounting clip needs to be tightened to the torque rating shown in the table below so that the gasket is compressed to form the proper seal between the panel and cabinet surface.

Note: Mount the touch panel on a vertical surface to allow convection air flow for proper cooling.



Enclosure Mounting Thickness Ranges and Mounting Clip Screw Torque

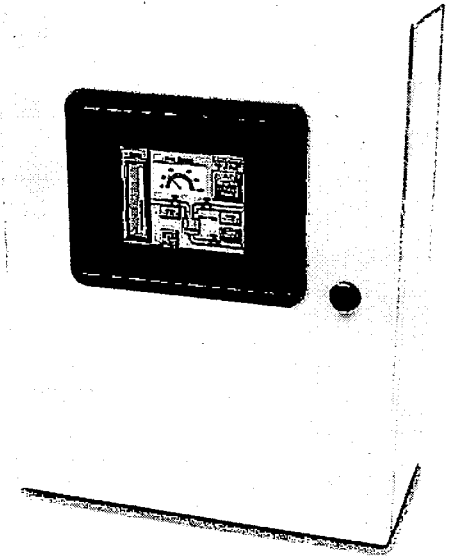
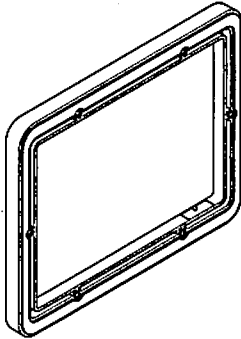


Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
8", 10", 12" & 15"	0.039 - 0.20 inch [1 - 5 mm]	42 ~ 57 oz-in [0.3 ~ 0.4 Nm]

6" Adapter Plate

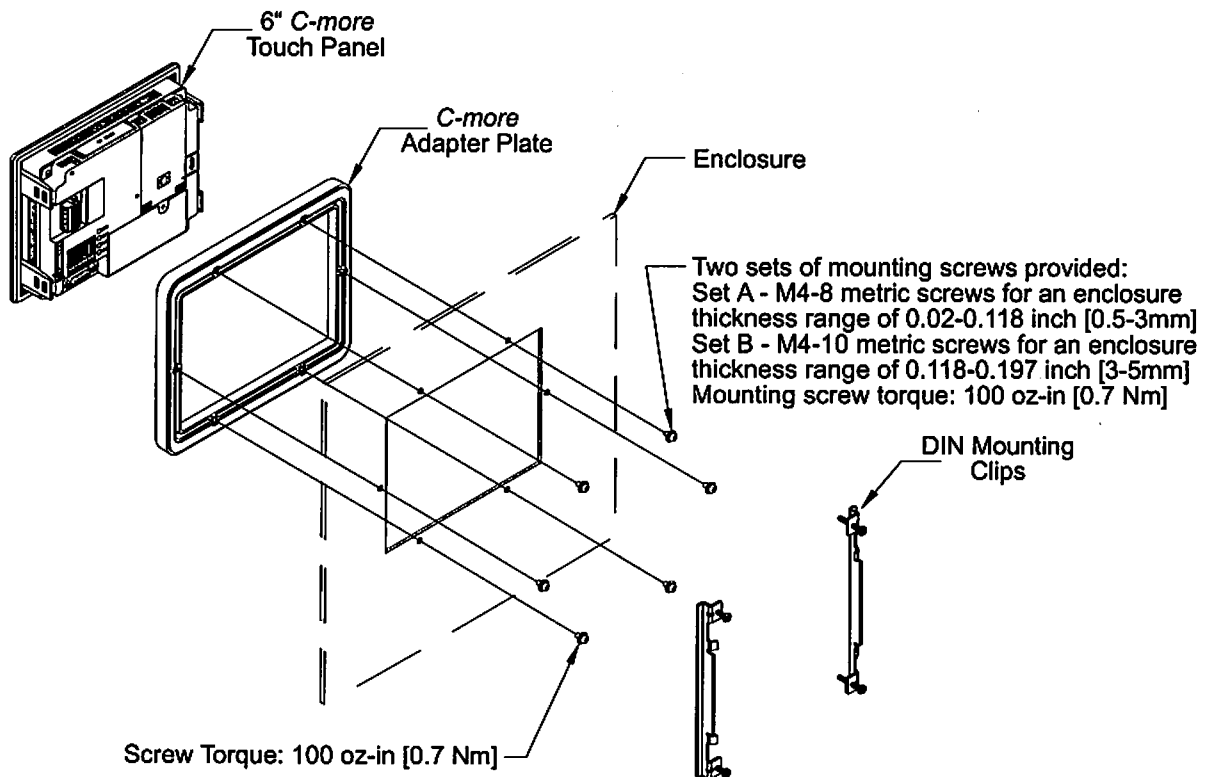
Use the *C-more* 6" Adapter Plate, p/n EA-6-ADPTR, to install a *C-more* 6" touch panel into the existing cutout of an EZTouch 6" non-slim (rounded bezel) touch panel. Gasket and mounting hardware is included.

Part No. EA-6-ADPTR



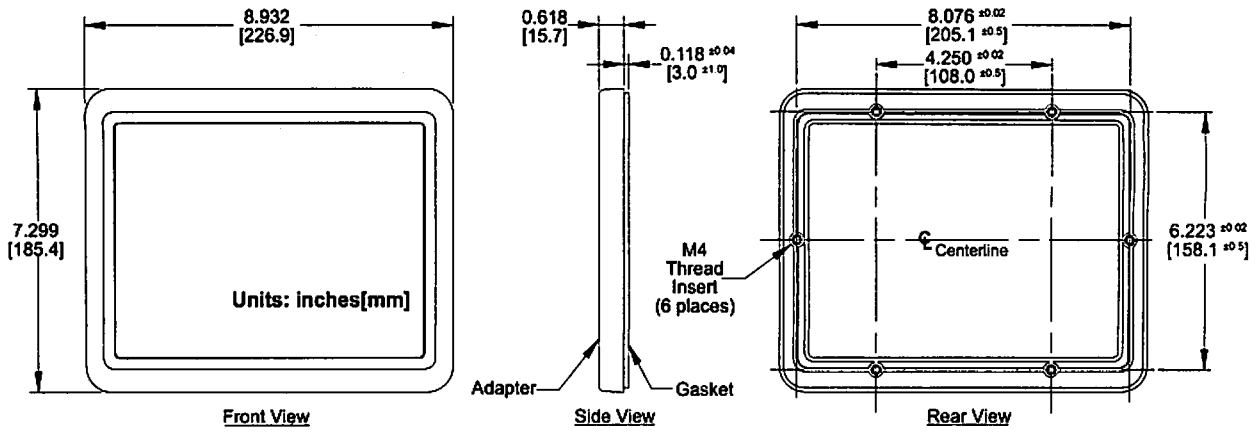
4

6" Adapter Plate Assembly

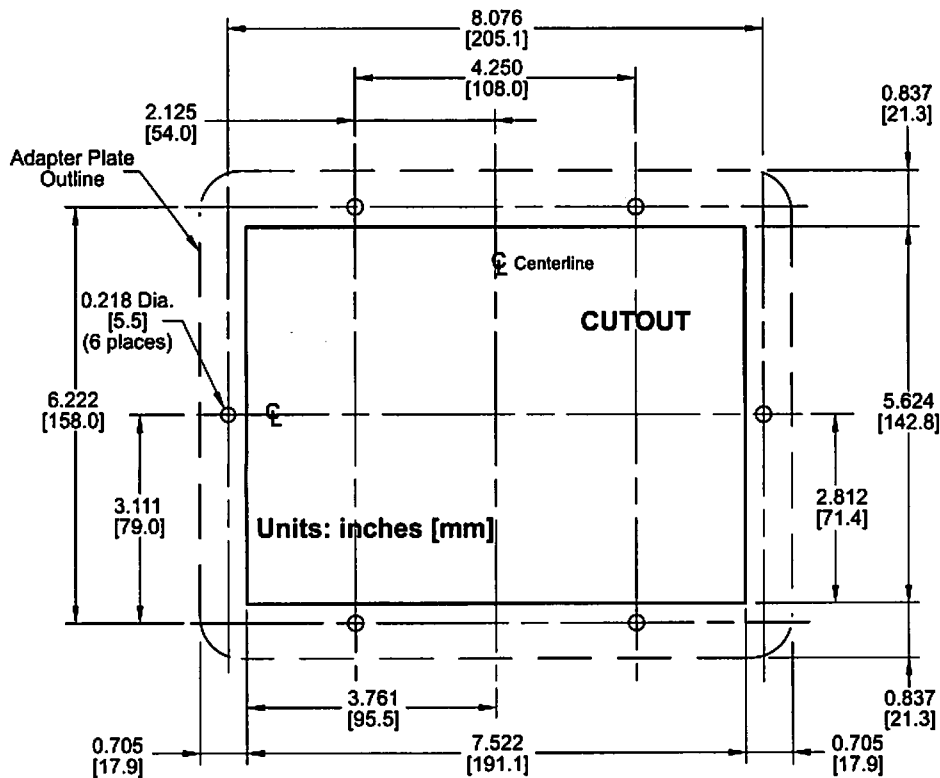


6" Adapter Plate (cont'd)

6" Adapter Plate Dimensions



6" Adapter Plate Cutout Dimensions

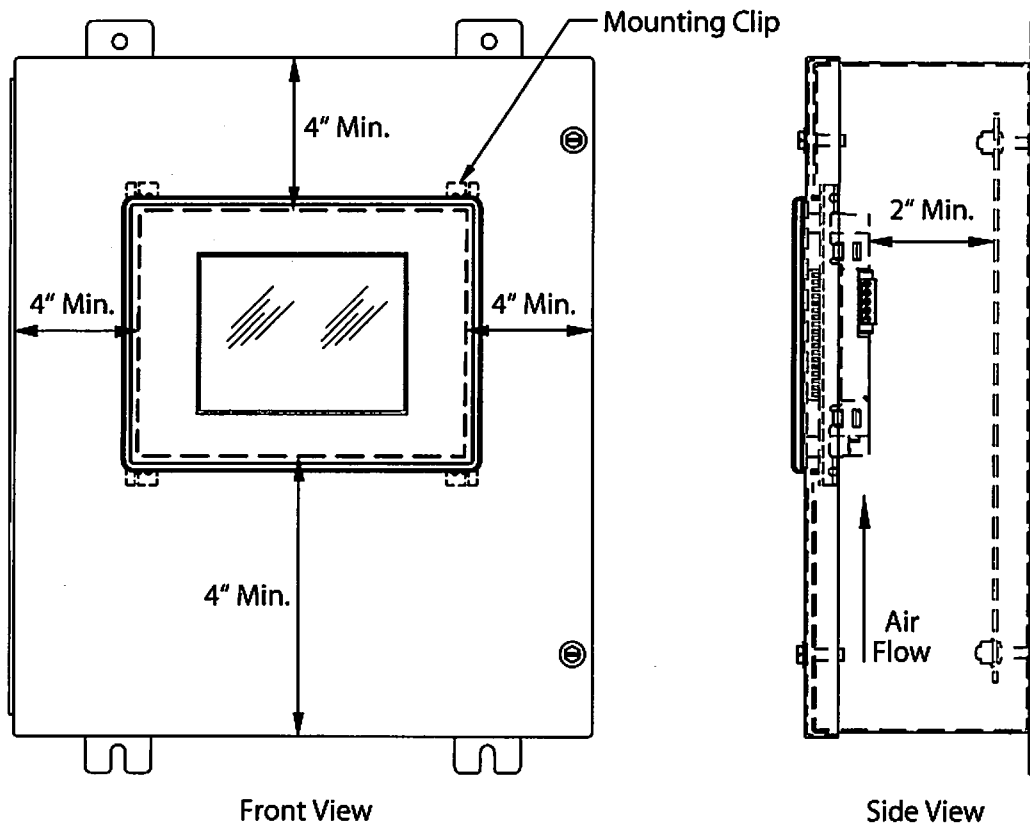


Mounting Clearances

The following drawing shows the mounting clearances for the *C-more* touch panel. There should be a minimum of 4 inches of space between all sides of the panel and the nearest object or obstruction and at least 2 inches between the rear of the panel and the nearest object or obstruction.



Note: Make sure the touch panel is mounted on a vertical surface to allow convection air flow for proper cooling.



Wiring Guidelines



WARNING: To minimize the risk of potential safety problems, you should follow all applicable local and national codes that regulate the installation and operation of your equipment. These codes vary from area to area and it is your responsibility to determine which codes should be followed, and to verify that the equipment, installation, and operation are in compliance with the latest revision of these codes.

Equipment damage or serious injury to personnel can result from the failure to follow all applicable codes and standards. We do not guarantee the products described in this publication are suitable for your particular application, nor do we assume any responsibility for your product design, installation, or operation.

If you have any questions concerning the installation or operation of this equipment, or if you need additional information, please call us at 1-800-633-0405 or 770-844-4200.

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Agency Approvals

Some applications require agency approvals for particular components. The *C-more* touch panel agency approvals are listed below:

- UL (Underwriters' Laboratories, Inc.)
- CUL (Canadian Underwriters' Laboratories, Inc.)
- CE (European Economic Union)

Marine Use

American Bureau of Shipping (ABS) certification requires flame-retarding insulation as per 4-8-3/5.3.6(a). ABS will accept Navy low smoke cables, cable qualified to NEC "Plenum rated" (fire resistant level 4), or other similar flammability resistant rated cables. Use cable specifications for your system that meet a recognized flame retardant standard (i.e. UL, IEEE, etc.), including evidence of cable test certification (i.e. tests certificate, UL file number, etc.).



NOTE: Wiring needs to be "low smoke" per the above paragraph. Teflon coated wire is also recommended.

Wiring Guidelines (cont'd)

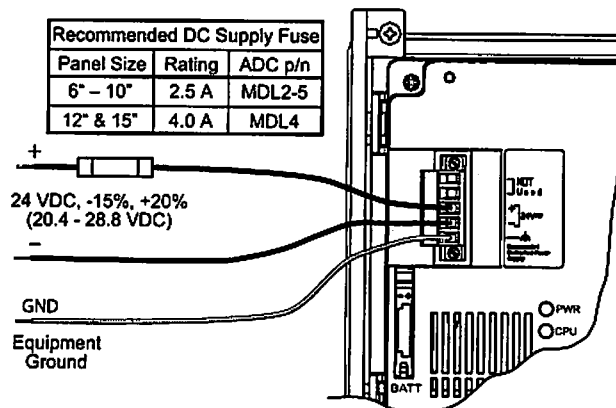
Providing Power to the Touch Panel

- Connect a dedicated 24 VDC (20.4 - 28.8 VDC) switching power supply rated for a minimum of 1.5 A to the DC connector on the rear of the *C-more* touch panel. Connect the ground terminal to a proper equipment ground.
- or install a *C-more* AC/DC Power Adapter (EA-AC) to the rear of the touch panel and connect an AC voltage source of 100-240 VAC, 50/60Hertz, to its AC connector.
- then turn on the power source and check the LED status indicators on the rear of the *C-more* touch panel for proper operation. See the LED Status Indicator diagram on the next page for reference.

4

DC Wiring Diagram

DC Wiring



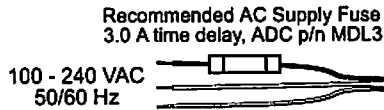
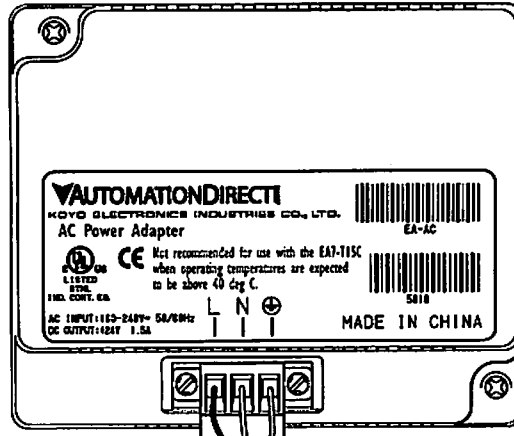
Recommended DC Power Supply:
AutomationDirect Part No. PS24-050D

Wiring Guidelines (cont'd)

AC Wiring Diagram

AC Wiring

AC/DC Power Adapter EA-AC



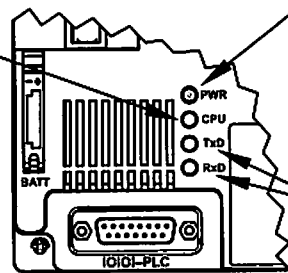
WARNING: The AC/DC Power Adapter is not recommended for use with the EA7-T15C touch panel when operating temperatures are expected to exceed 40 °C [104 °F].



Note: Power Fault features help protect data being logged to CompactFlash during power failures. The C-more panel must have firmware version 1.21 Build 6.18E or higher for proper operation.

C-more LED Status Indicators

CPU Status LED (Green, Orange & Red)	
Off	Power Off
Green	Normal – CPU Run State
Blinking Red	Memory Error
Blinking Red	Operating System not found
Blinking Orange	LCD Backlight Failure
Blinking	Power Loss Detection



Rear View

Power LED (Green)	
On	Power On
Off	Power Off

Serial TxD/RxD LED (Green)	
On	Comm. is active
Off	No communication

SYSTEM SETUP SCREENS



In This Chapter...

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Information Menu5-15
Setting Menu5-19
Test Menu5-25
Memory Menu5-35

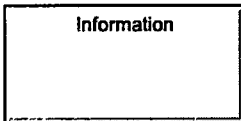
Introduction

The *C-more* touch panels include a series of built-in System Setup Screens that allow the user to view detailed information about the panel, adjust certain features, configure communications, test various functions of the touch panel, backup & restore system, recipe, log and project memory, clear memory, and reset all values and conditions back to the original factory defaults.

The following is presented to give the user a detailed step by step look at 1.) how to access the System Setup Screens, 2.) what adjustments and features are available, 3.) when and why the feature may need to be adjusted or used, and 4.) how to adjust and/or interrupt the features.

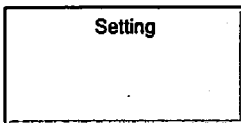
The System Setup Screens from the Main Menu are split into four different categories to make it simple for the user to select the area for viewing information, making adjustments, testing the touch panel or working with the internal and/or external memory options. The four Main Menu selections are:

Information



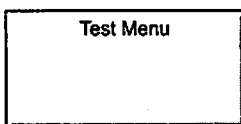
Here you will find detailed information in regards to the touch panel model, the panel's name, version information for the hardware, boot loader and firmware, clock source, battery status and beeper status. Also available are details on the panel's internal memory and the status of any external memory devices, such as CompactFlash memory and USB pen drives. Communication port details are also available in this area, as well as an error log to help in trouble-shooting the system.

Setting



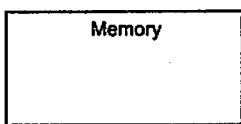
This is the area for 1.) making adjustments to the internal clock, 2.) adjusting the brightness and contrast of the display (There are some differences of what can be adjusted between the STN and TFT type displays, see details later in this chapter.), 3.) adjusting (calibrating) the touch panel, 4.) enabling or disabling the internal beeper, and 5.) the IP Address of the touch panel can also be configured from this menu area. Access to the IP Address Setting screen is covered later in this chapter.

Test Menu



From this sub menu, the user can 1.) test the touch panel, 2.) test the display, 3.) test the communication ports, and 4.) test both the internal beeper or the audio line output, if a speaker with an amplifier is connected. A WAV sound file is system provided for the audio line output test.

Memory

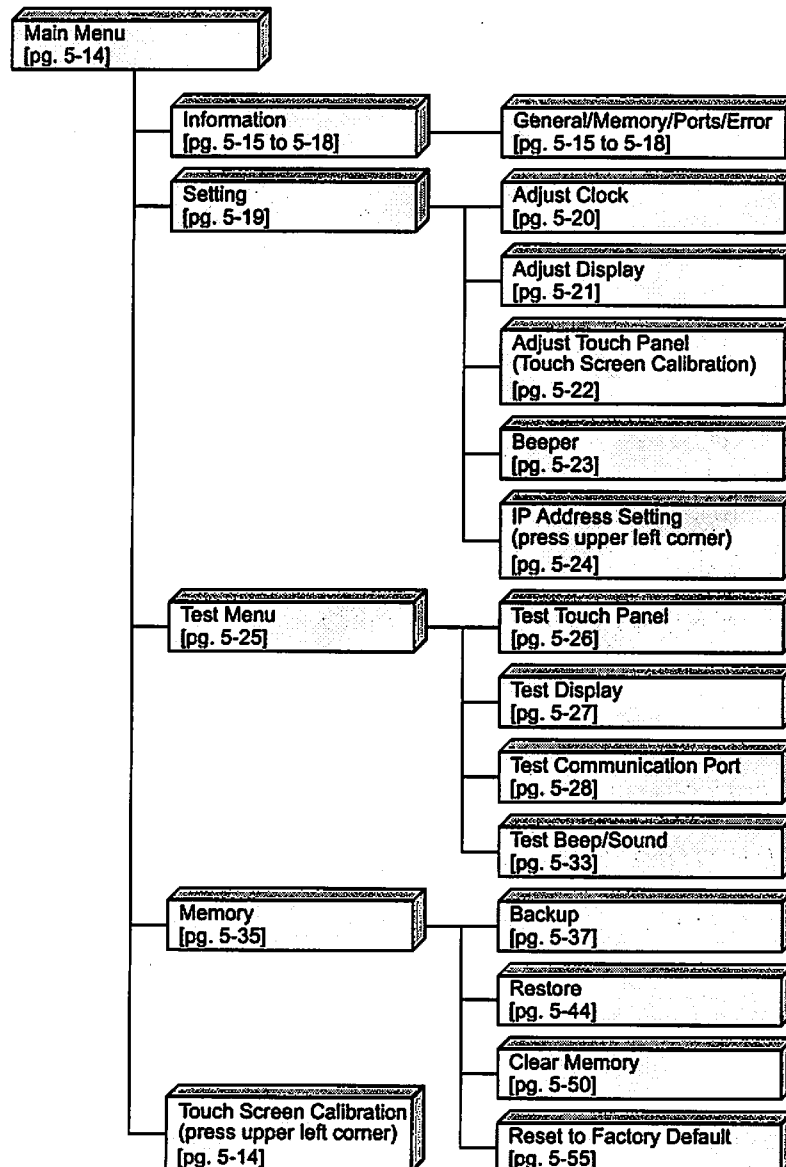


Select the Memory menu item to either backup or restore your project, log data, recipe data and/or system memory. Selections can be made to backup to optional CompactFlash memory or USB pen drive memory. The menu selections also give the user the ability to clear the memory, and there is also a selection to reset all of the touch panel settings back to the original factory defaults.

Chapter Organization

The System Setup Screens chapter is organized in the following order:

- 1.) Accessing the system setup screens with no project loaded will take the user directly to the Main Menu – page 5-4.
- 2.) Accessing the system setup screens with a project loaded will first take the user to a dialog box warning the user that the panel will stop running and waits for an acknowledgement – page 5-5.
 - a.) If a password is not enabled, the user is taken directly to the Main Menu after the warning message is acknowledged – page 5-6.
 - b.) If a password is enabled, then the Enter Security Code keypad is presented after the warning message is acknowledged – page 5-6.
- 3.) How to enable a password in the *C-more* Programming software is explained – page 5-7.
- 4.) System Setup Screens organized as shown in the following flowchart:

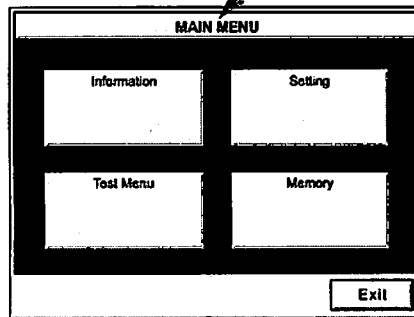
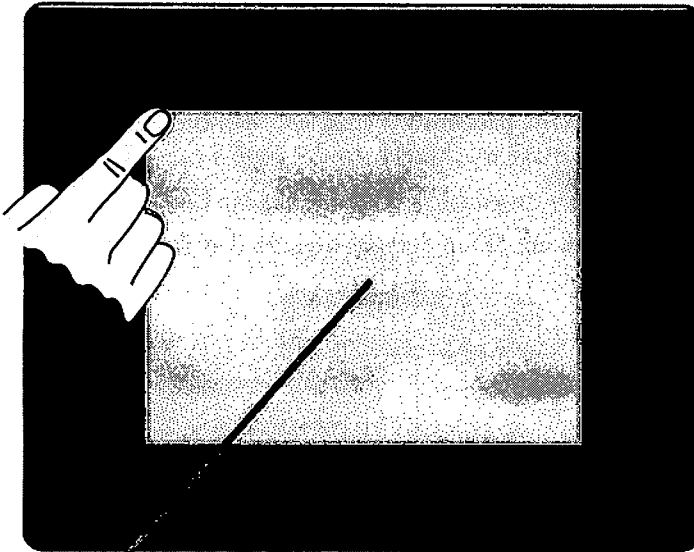


Accessing the System Setup Screens (no project loaded)

To access the Main Menu of the touch panel System Setup Screens prior to downloading a project, press the extreme upper left corner of the panel display area for 3 seconds as shown below. The Main Menu will then be displayed as shown below.

5

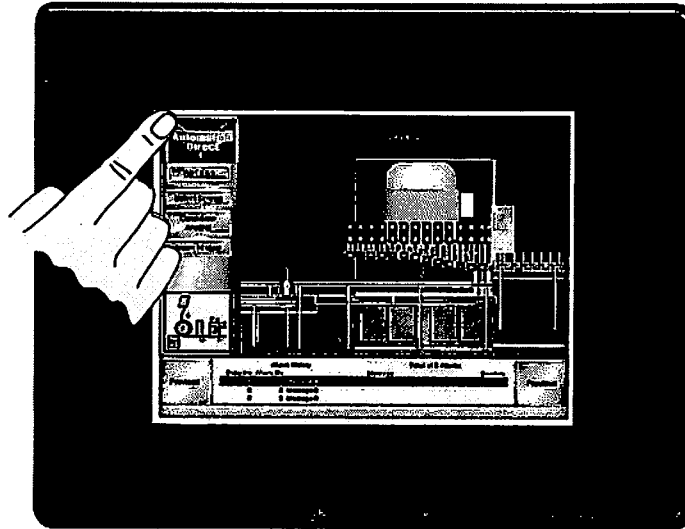
Press in the extreme upper left corner for 3 seconds to bring up the System Setup Screens' Main Menu.



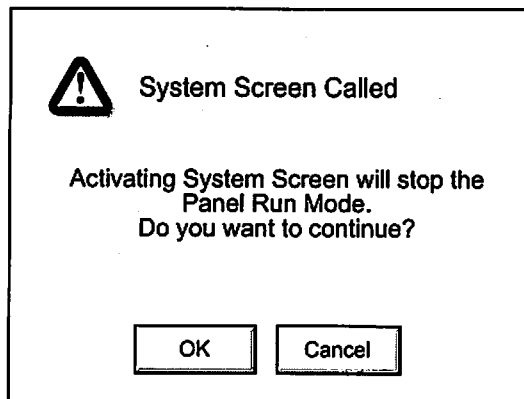
NOTE: The ability to directly activate the **Main Menu** of the **System Setup Screens** by pressing the upper left corner of the touch panel for 3 seconds will only occur when there is no project loaded into the memory of the panel. Refer to the next section on accessing the **System Setup Screens** with a project loaded for procedure details and recommendations.

Accessing the System Setup Screens (with project loaded)

To access the Main Menu of the touch panel System Setup Screens with a project loaded into memory, press the upper left corner of the panel display area for 3 seconds as shown below.



The following WARNING dialog box will appear on the touch screen.



Dialog Box Actions:

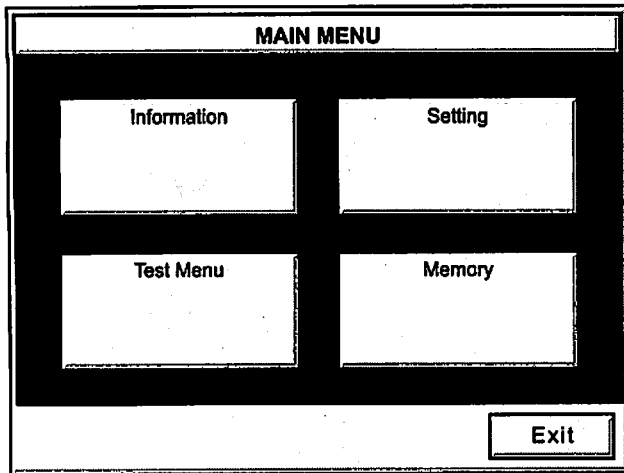
- Pressing OK will display the system setup screen. See the WARNING below!
- Pressing Cancel will take you back to the project screen.
- Communications with the PLC is active while the Warning is displayed.
- The dialog box will close if no action is taken for 60 seconds.
- The dialog box will not display if the touch panel does not have a project loaded.
- The dialog box will not display if the System Screen password is enabled.



WARNING: Pressing OK at this point will STOP the PLC driver and therefore all communications between the touch panel and PLC will cease. It is strongly recommended that the password system tag "SYS SYSTEMSCREENPW" be enabled to add a safeguard step in accessing the system setup screens. See the next section for a quick overview for setting the System Tags in the Event Manager Database.

System Setup Screens (no password enabled)

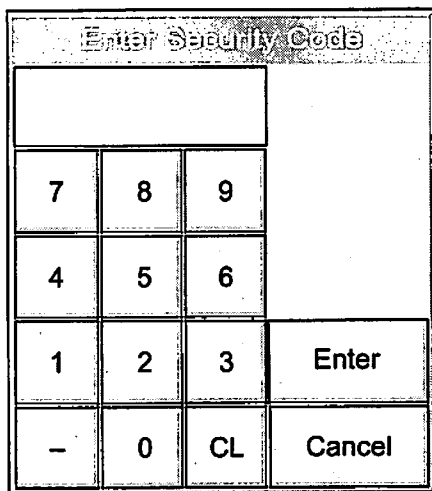
If no password is enabled for the system setup screens, then pressing the OK button in the Warning dialog box will bring up the Main Menu as shown below. You can then proceed to the other system setup screens.



System Setup Screens (password enabled)

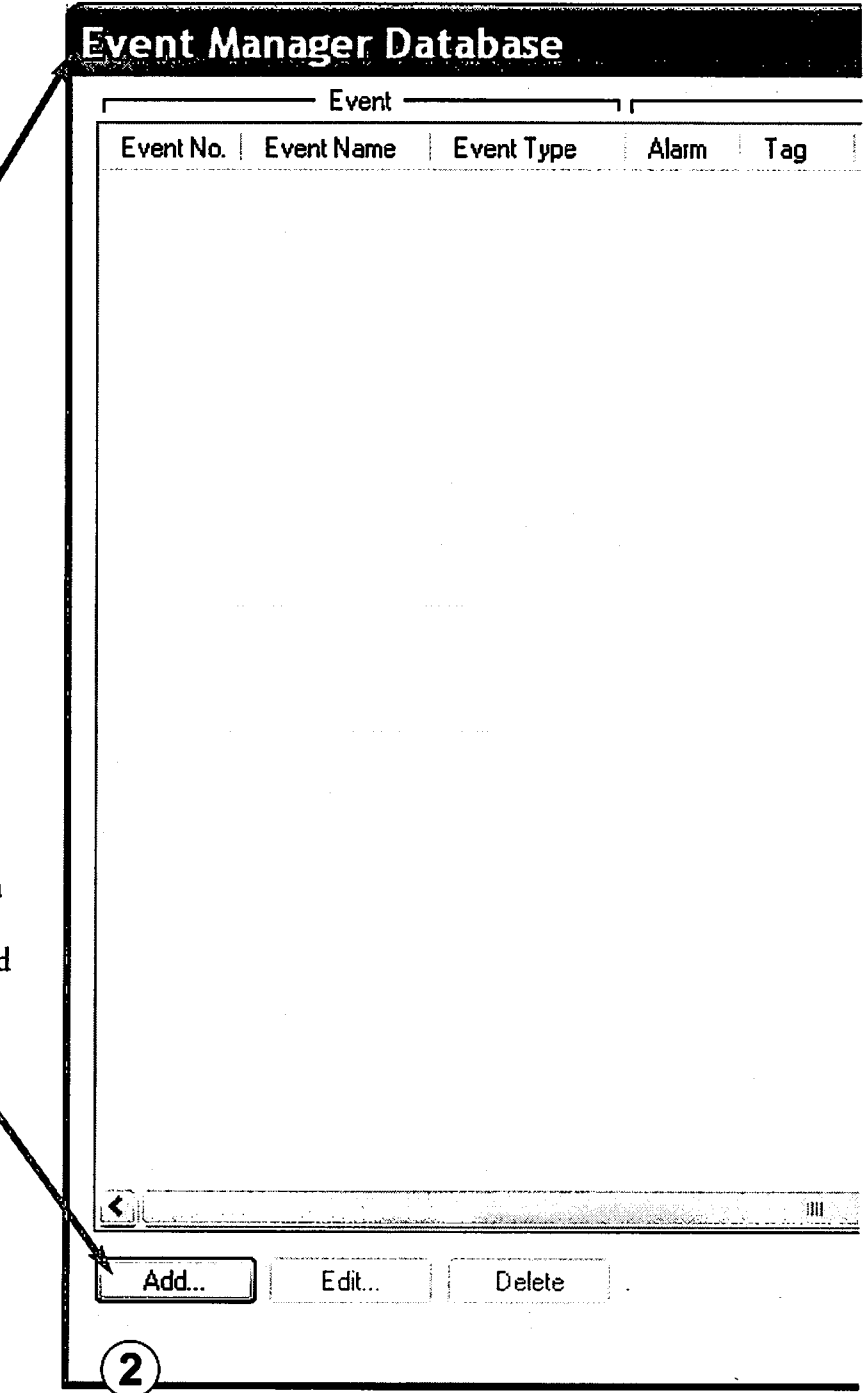
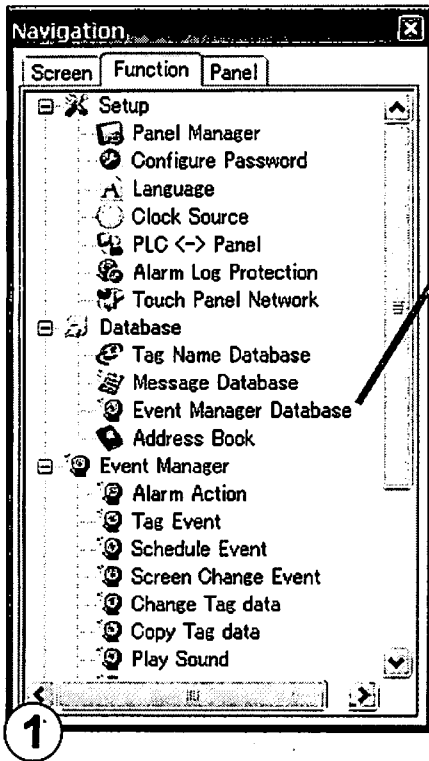


NOTE: If the password system tag **SYS SYSTEMSCREENPW** is enabled, procedure described on the next page, then the **Enter Security Code** keypad shown below will be displayed. Entering the correct password code will then bring up the **Main Menu** system setup screen. If the wrong password code is entered, the keypad clear from its display the value entered and will stay present until the correct value is entered or the **Cancel** key is pressed.



System Setup Screens – Enable Password in Software

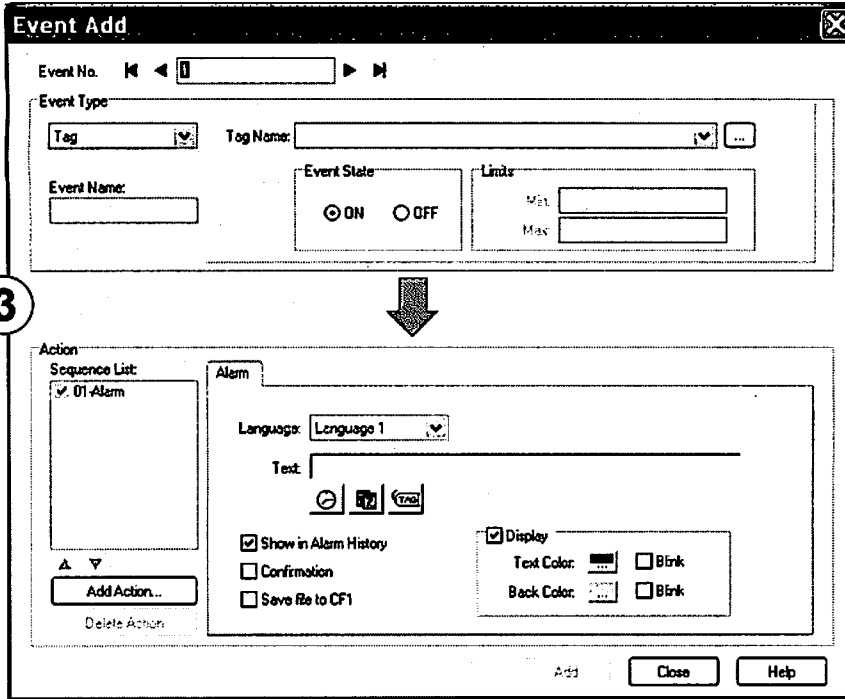
Under the C-more Programming Software's Navigation window, select the Function tab, then select the Event Manager's Database function to display the Event Manager Database shown below:



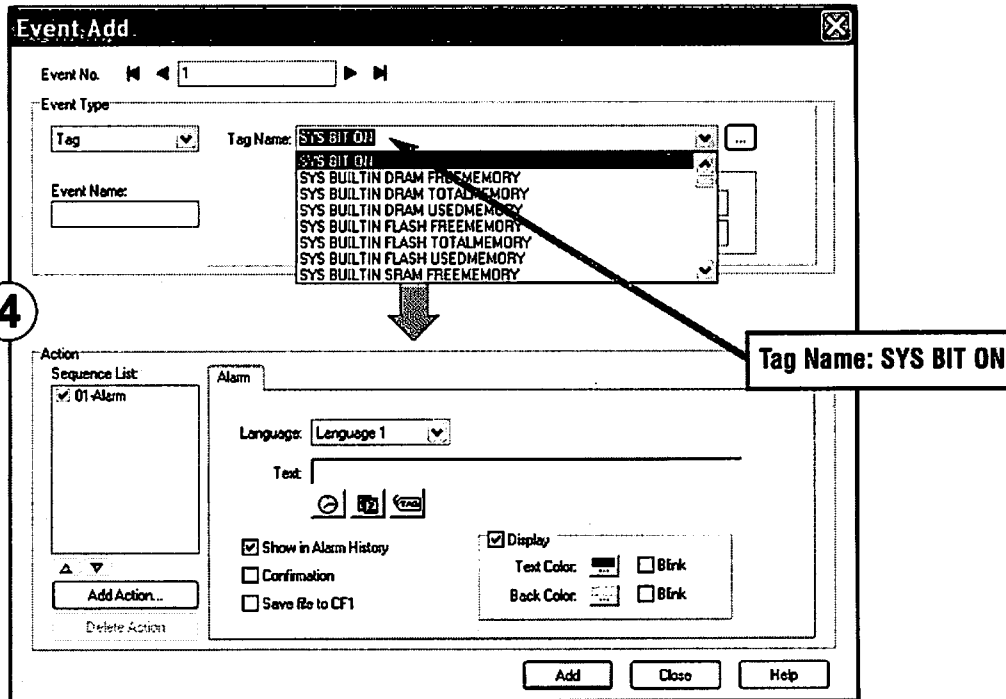
Click on the Add button to add an event to the database that will be used to enable the System Screen Password.

System Setup Screens – Enable Password (cont'd)

The Event Add dialog box will be displayed as shown next:



Click on the Tag Name: pull down menu and select the internal System Bit On (SYS BIT ON) tag as shown. This will force the tag event type to be continuously active.



System Setup Screens – Enable Password (cont'd)

Use the Event Name: text box to document the event as “System Screen PW” for record keeping. This is optional.

In the Action box, click once on the displayed 01-Alarm under the Sequence List: so that 01-Alarm is highlighted. Then click the Delete Action button to remove the 01-Alarm.

5

Event Add

Event No. 1

Event Type

Tag: Tag Name: SYS BIT ON

Event Name: System Screen PW

Event State: ON OFF

Limits: Min: Max:

Action

Sequence List: 01-Alarm

Alarm

Language: Language 1

Text:

Show in Alarm History

Confirmation

Sequence to CF1

Display

Text Color: Blink

Back Color: Blink

Add Action... Delete Action

Add Close Help

6

Event Add

Event No. 1

Event Type

Tag: Tag Name: SYS BIT ON

Event Name: System Screen PW

Event State: ON OFF

Limits: Min: Max:

Action

Sequence List:

Add Action... Delete Action

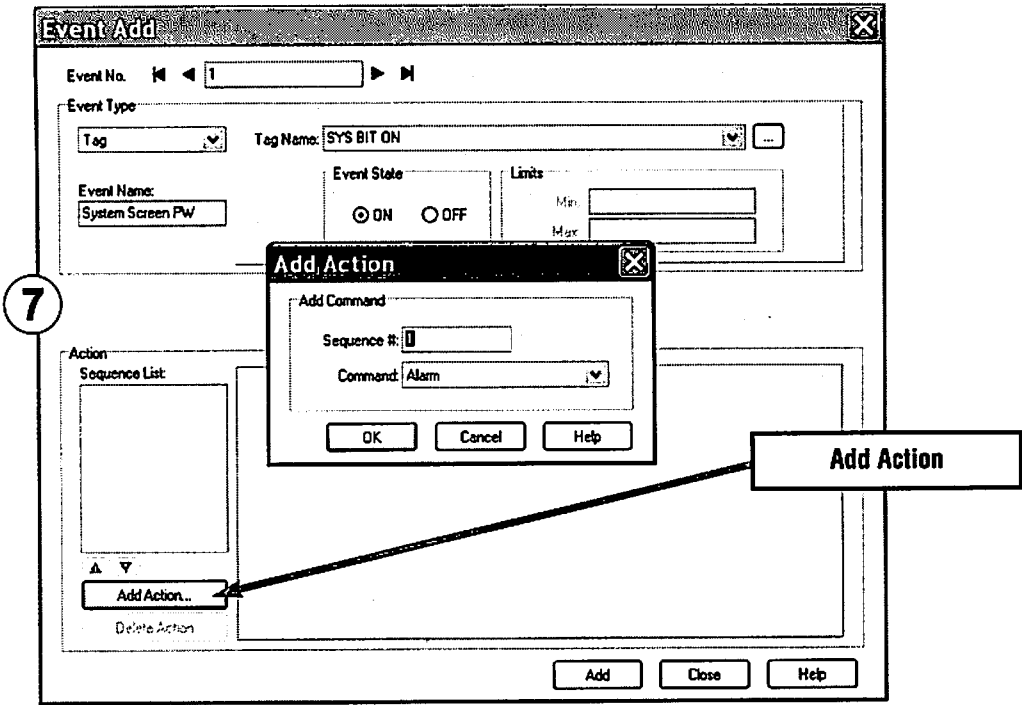
Add Close Help

The Sequence List will now be cleared out.

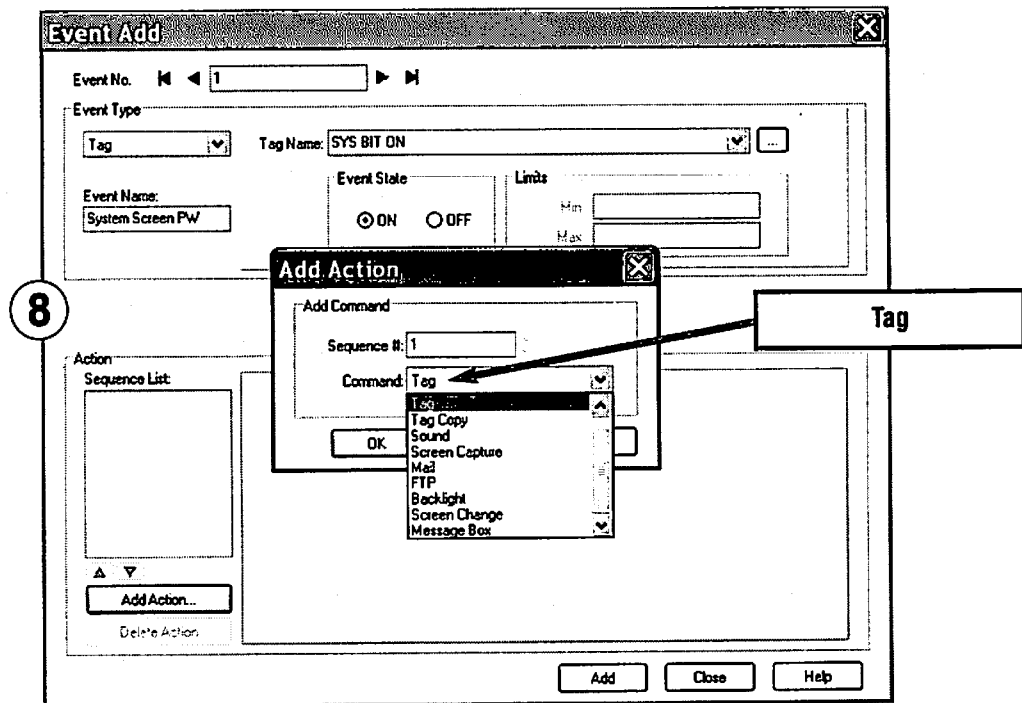
System Setup Screens – Enable Password (cont'd)

In the Action box, click on the Add Action... button. This will bring up the Add Action dialog box as shown below:

5

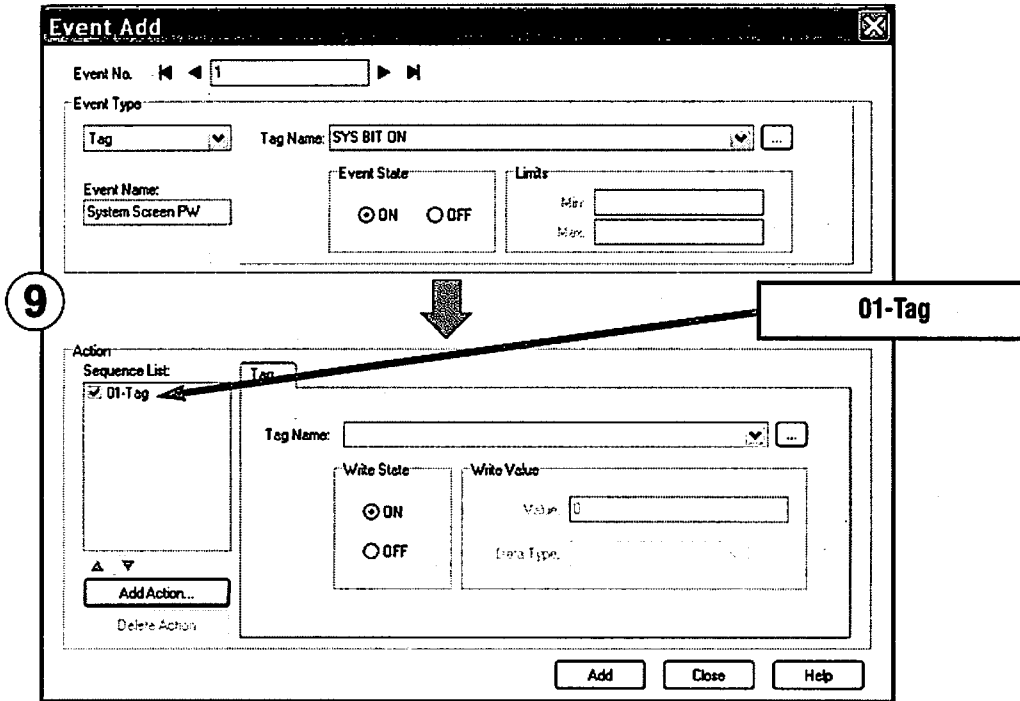


Click on the Command: pull down list in the Add Command box, select Tag from the list, then click OK.



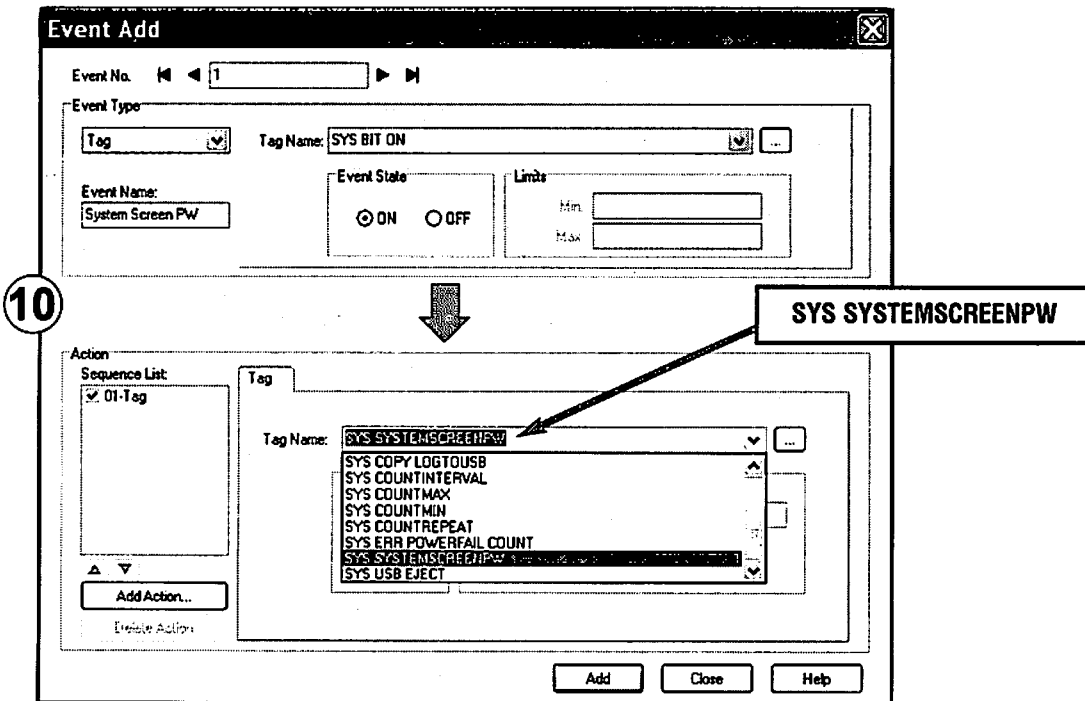
System Setup Screens – Enable Password (cont'd)

A 01-Tag action item will then be added to the Sequence List.



5

Click on the Tag Name: pull down list down arrow in the Action box's Tag tab, select SYS SYSTEMSCREENPW from the list, and click OK.



System Setup Screens – Enable Password (cont'd)

Enter a numeric value into the Value: box, such as “777”. This value becomes the Password code to access the System Setup Screen’s Main Menu.

5

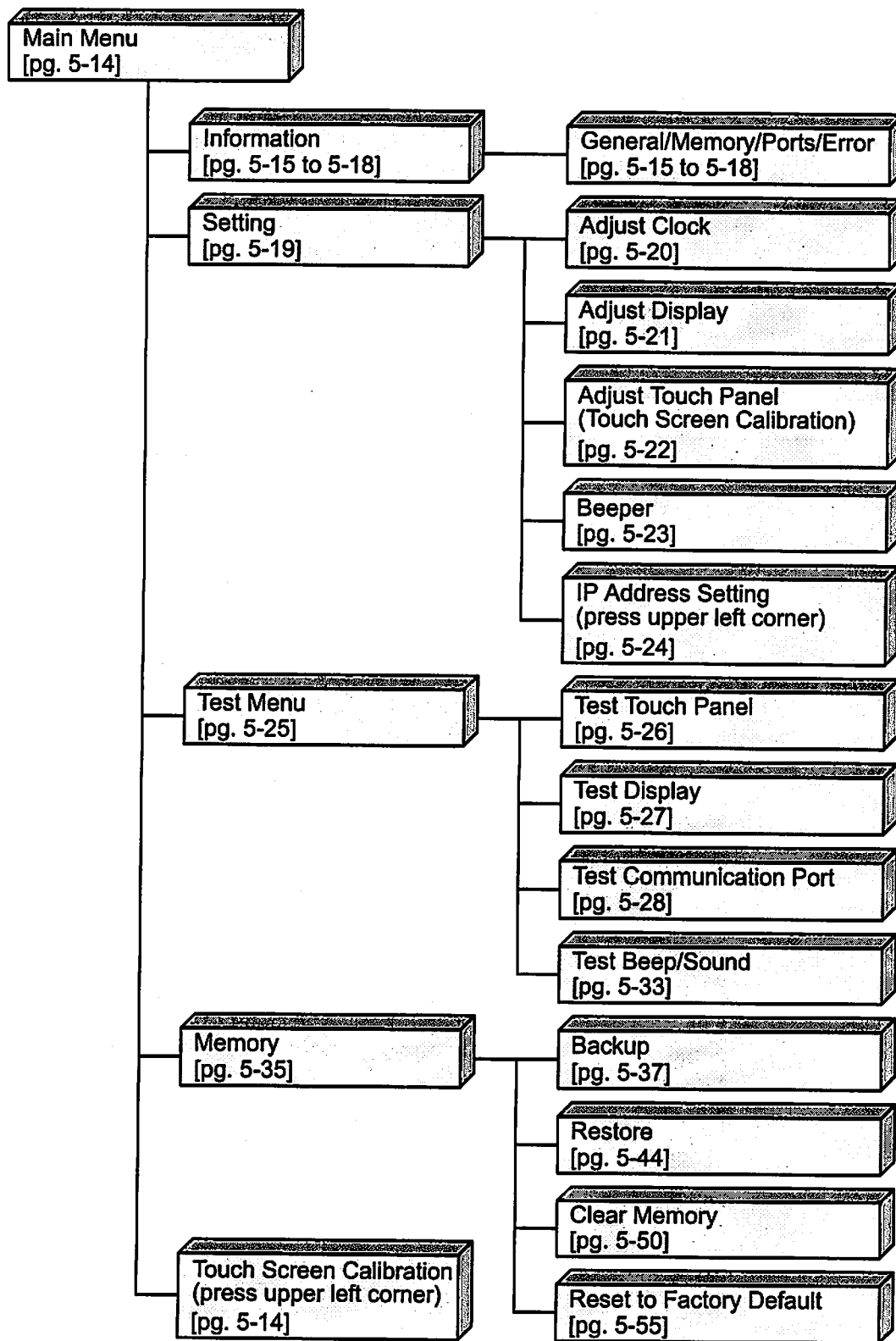
11

Click the Add button in the Event Add dialog box and then the Close button to return to the Event Manager Database. You now will see that the first event in the database is for the System Screen Password and it is enabled.

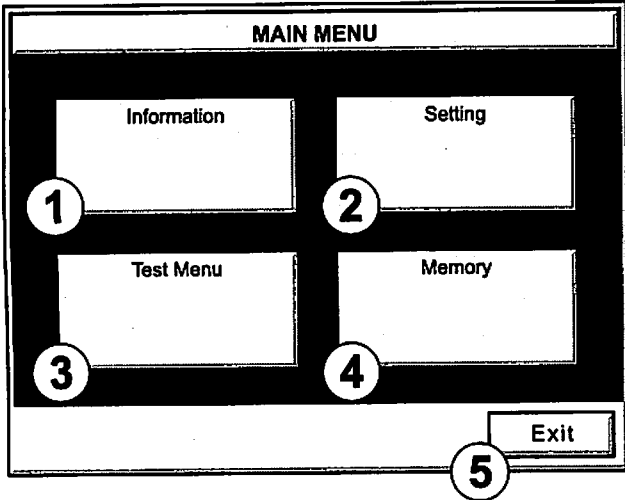
12

Event Manager Database						
Event						
Event No.	Event Name	Event Type	Alarm	Tag	Tag Copy	Sound
1	System Scre...	Tag		Yes		

System Setup Screens Flowchart



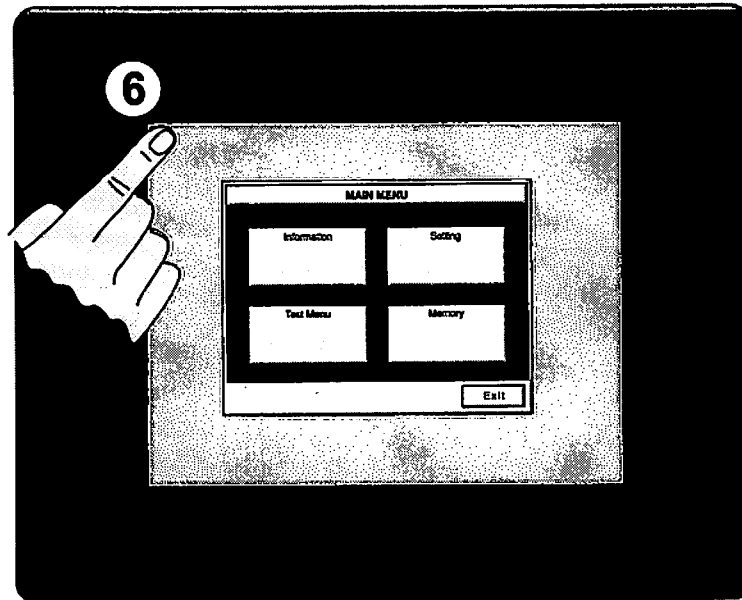
Main Menu



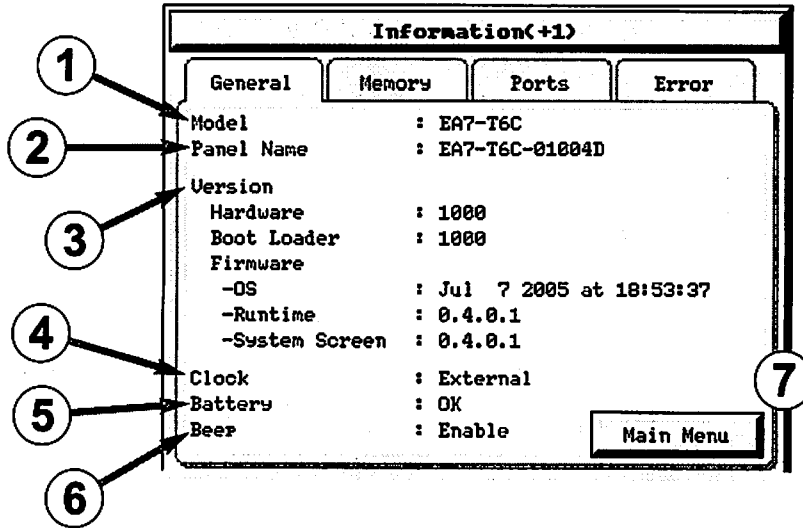
The Main Menu system setup screen is the top layer in the menu structure.

The menu is displayed at full screen on the 6 inch touch panel models. It is displayed in the center on the 8, 10, 12, or 15 inch models.

Item No.	Function	Description	Comment
1	Information	Press to go to the Information Menu.	
2	Setting	Press to go to the Setting Menu.	
3	Test Menu	Press to go to the Test Menu.	
4	Memory	Press to go to the Memory Menu.	
5	Exit	Press to return to the user screen.	
6	Touch Screen Calibration	While the Main Menu system setup screen is being displayed, the extreme upper left corner of the touch panel can be pressed for 3 seconds to access the Touch Screen Calibration display.	This feature is only used if the touch panel data becomes corrupted and touching the Main Menu buttons does not work. It allows a shortcut to the touch panel calibration screen.



Information Menu – General tab

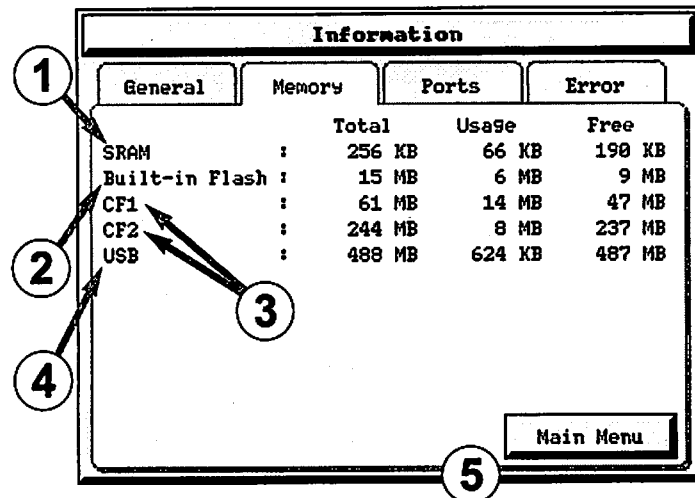
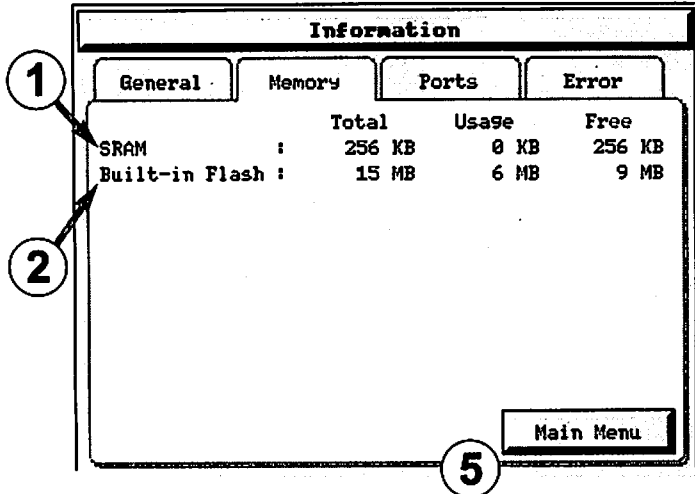


The General tab under the Information menu provides detailed information of the *C-more* Touch Panels model, Panel Default Name based on Model type and MAC address, hardware, boot loader and firmware versions, etc.

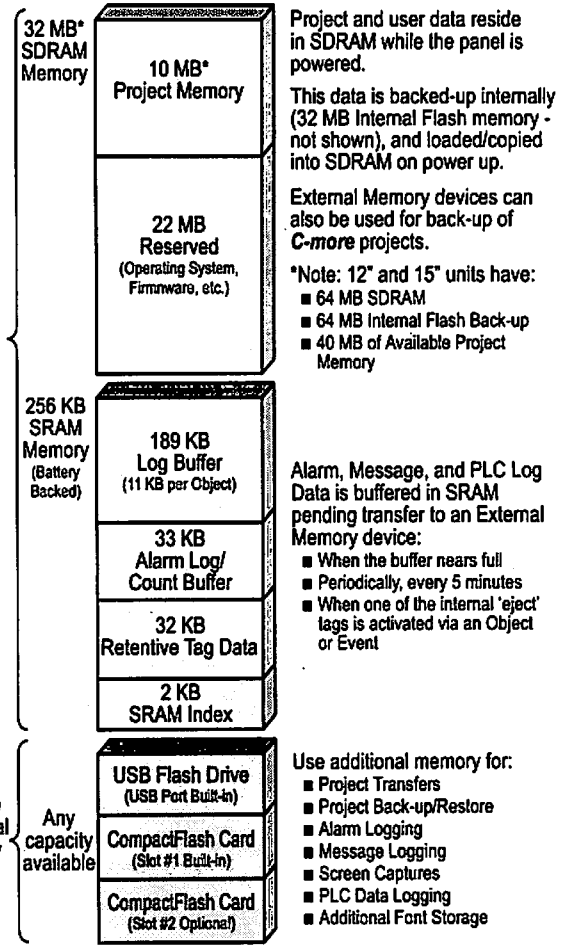
5

Item No.	Function	Description	Comments
1	Model	EA7-S6M-R, EA7-S6C-R, EA7-S6M, EA7-S6C, EA7-T6C, EA7-T8C, EA7-T10C, EA7-T12C, EA7-T15C	
2	Panel Default Name	[Model Name]-01XXXX "01 XXXX" is the lower 3 bytes of the Mac Address MAX: 15 characters (15 bytes)	e.g. EA7-S6M-01004D This is the default name. The name can be changed in the <i>C-more</i> Programming Software.
3	Version	1.)Hardware: XXXX 2.)Boot loader: XXXX 3.)Firmware a) OS:Timestamp of NK.BIN file b) Runtime: X.X.X.X (Version of Runtime.EXE file) c) System Screen: X.X.X.X (Version of Panel.exe file)	Files reside in the <i>C-more</i> touch panel's memory.
4	Clock	Internal/External clock selection.	Configured in the <i>C-more</i> Programming Software.
5	Battery	Battery status, either OK or Battery Low.	
6	Beep	Enable/Disable the internal beeper.	Configurable in the Setting Menu – Beeper shown on page 5-23 or in the <i>C-more</i> Programming Software.
7	Main Menu	Press to return to the Main Menu screen.	Main Menu shown on page 5-14.

Information Menu – Memory tab

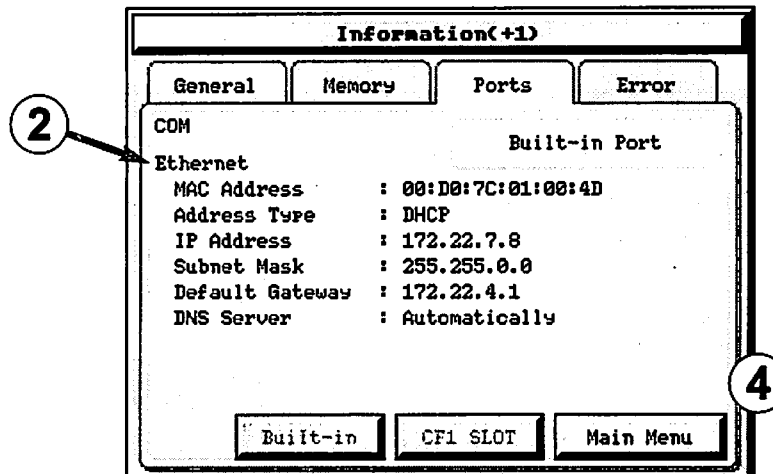
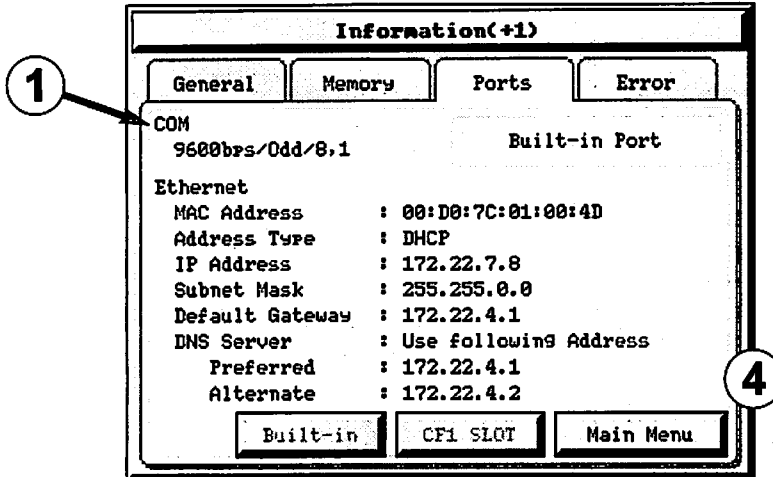


C-more Memory Organization



Item	Function	Description	Comment
1	SRAM System Memory	1.) Total: 2.) Usage: 3.) Free:	Size of unit displayed: 1.) KB When size is 1 to 999 bytes. It will be shown as 1KB. 2.) KB or MB 3.) MB or GB
2	Built-in Flash Memory	1.) Total: 2.) Usage: 3.) Free:	
3	Expansion Memory 1.) CF1: 2.) CF2: (only visible when present)	1.) Total: 2.) Usage: 3.) Free: Note: N/A - not available on base featured models (-R)	
4	Expansion Memory 3.) USB: (only visible when present)	1.) Total: 2.) Usage: 3.) Free:	
5	Main Menu	Press to return to the Main Menu screen.	

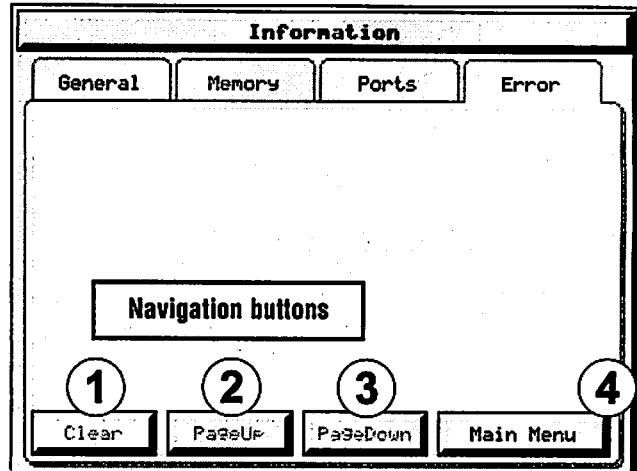
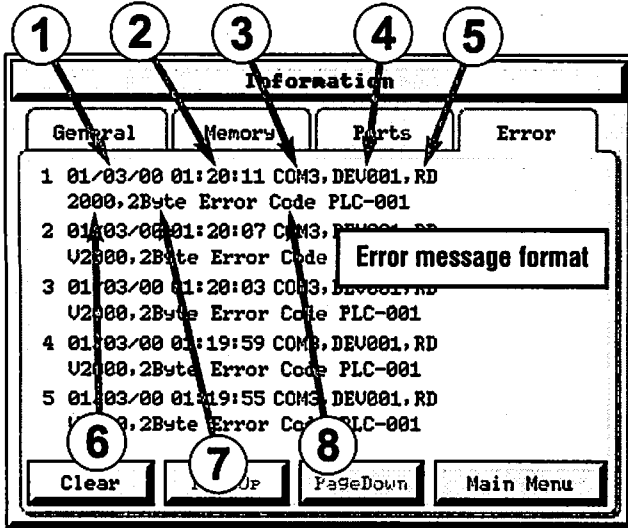
Information Menu – Ports tab



5

Item No.	Function	Description	Comment
1	COM (Built-in Ports)	PLC Serial Communications Port Settings: baud rate/party/data bit, stop bit	Configured in the <i>C-more</i> Programming Software.
2	Ethernet (Built-in Ports)	Ethernet Settings: MAC Address: 00 D0 7C 01 XX XX Address Type: DHCP/Static IP Address: Subnet Mask: Default Gateway: DNS: 1.) Automatically 2.) Use Designated Address Note: N/A - not available on base featured models (-R)	Configurable in the Setting Menu – IP Address Setting shown on page 5-24 or in the <i>C-more</i> Programming Software.
3	Ethernet (CF1 Slot)	Future	Future
4	Main Menu	Press to return to the Main Menu screen.	

Information Menu – Error tab



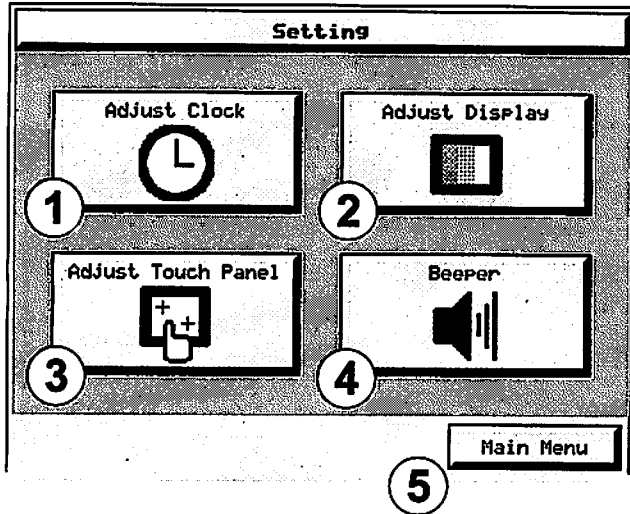
Error message format:

Item No.	Function	Description	Comment
Order of error message functions: Error Number, Date, Time, Error Port, Device Name, Error Type, PLC Device, Access Bytes, Error Message			
1	Date	Format: MM/DD/YY	Date error occurred.
2	Time	Format: HH/MM/SS	Time error occurred.
3	Error Port	PLC Serial Communications Port: Ethernet:	
4	Device Name	The assigned device name in the programming software.	Configurable in the <i>C-more</i> Programming Software Panel Manager
5	Error Type	RD: Read WT: Write	
6	PLC Address	The assigned address of the PLC that caused the error.	
7	Access Bytes	The number of access bytes.	
8	Error Message	The error message is the same as the message displayed in the upper left of the <i>C-more</i> touch panel's display.	A list of Error Messages is shown in Appendix A

Error message navigation buttons:

Item No.	Function	Description	Comment
1	Clear	Press to clear all error messages. This button is grayed out when there are no error messages to display.	
2	Page Down	Press to go to the next page. This button is grayed out when there is no error messages on the next page.	
3	Page Up	Press to go to the previous page. This button is grayed out when there is no error messages on the previous page.	
4	Main Menu	Press to return to the Main Menu screen.	

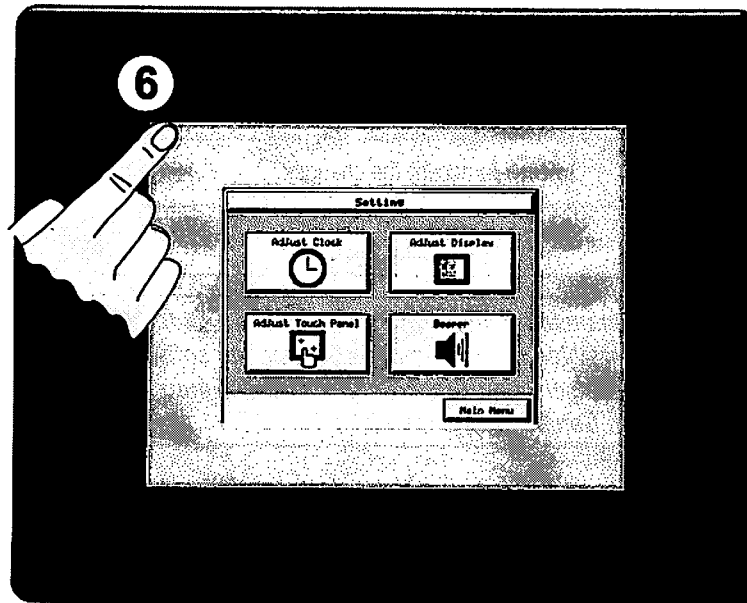
Setting Menu



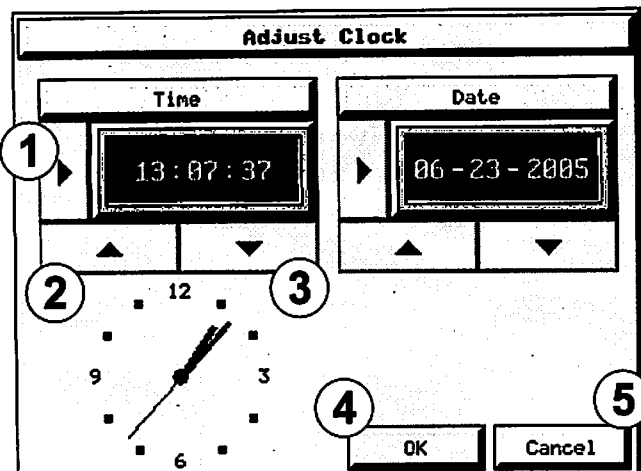
The Setting Menu is used to adjust the time & date, adjust the contrast or brightness of the display depending on which model is being used, adjust (calibrate) the touch screen, and enable or disable the internal beeper.

5

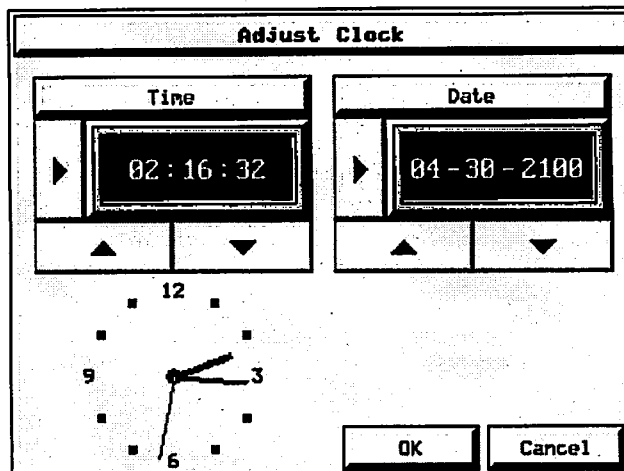
Item No.	Function	Description	Comments
1	Adjust Clock	Press to go to the Adjust Clock screen.	
2	Adjust Display	Press to go to the Adjust Display screen.	
3	Adjust Touch Panel	Press to go to the Adjust Touch Panel screen.	
4	Beeper	Press to go to the Adjust Beeper screen.	
5	Main Menu	Press to return to the Main Menu screen.	
6	IP Address setting	While the Setting Menu system setup screen is being displayed, the extreme upper left corner of the touch panel can be pressed for 3 seconds to access the IP Address setting screen.	The IP Address setting screen is only accessible form the Setting Menu screen as described. There is no direct button to call it from any of the setup screens. The IP Address can also be assigned in the <i>C-more</i> Programming Software.






Setting – Adjust Clock



Color Touch Panel



Grayscale Touch Panel

Item No.	Function	Description	Comments
1	Select 	Time: Each press of the Select button will cycle thru the following settings. 1.) No Selection to Hours 2.) Hours to Minutes 3.) Minutes to Seconds 4.) Seconds back to Hours Date: Each press of the Select button will cycle thru the following settings. 1.) Month to Day 2.) Day to Year 3.) Year back to Month	
2	Up 	Press to increment the value by "1" with each press.	
3	Down 	Press to decrement the value by "1" with each press.	
4	OK	Press to accept the changes.	
5	Cancel	Press to return to the Setting Menu screen without accepting the changes.	

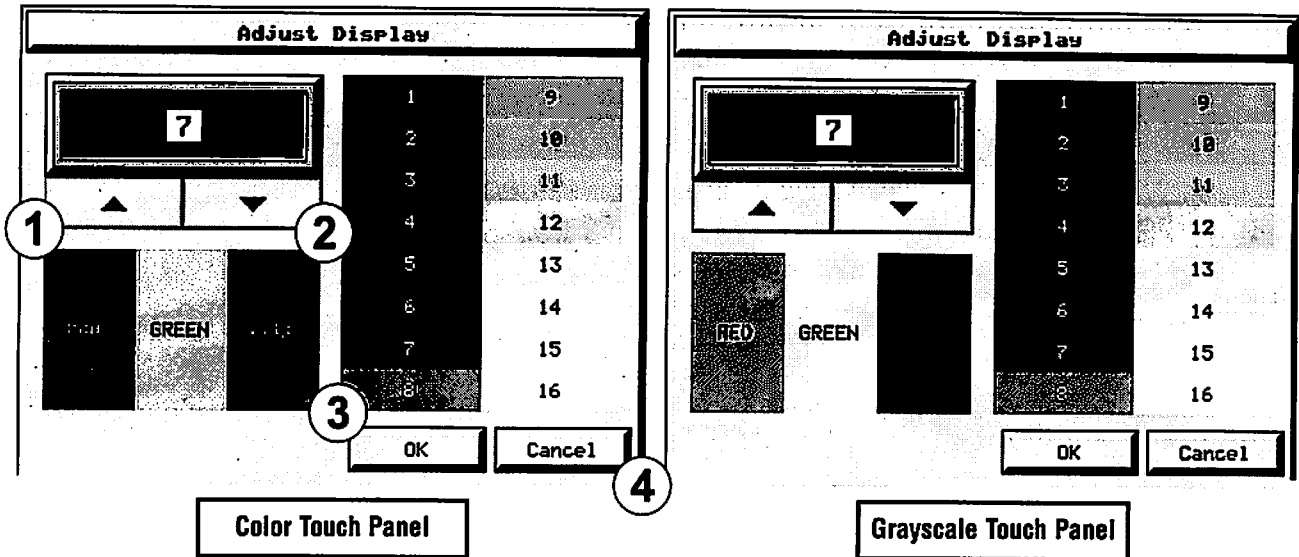


NOTE: The function buttons used to adjust the clock settings on the panel's setup screen are disabled if an External clock source is selected in the C-more programming software. The choice of an internal or external clock source is available by selecting Clock Source in the C-more programming software under the Main Menu drop down function Setup.





NOTE: The panel's clock can also be adjusted from the C-more programming software. The Adjust Clock function can be accessed in the software by selecting Adjust Clock under the Main Menu drop down function Panel or selecting Adjust Clock under the Panel tab in the software's Navigation window.

Setting – Adjust Display



5

Item No.	Function	Description	Comments
<p>The STN type display models, both color and grayscale, can have the contrast adjusted. The TFT type display models can have the brightness adjusted. See the table below.</p>			
1	Up 	Press to increment the value by "1" with each press.	
2	Down 	Press to decrement the value by "1" with each press.	
3	OK	Press to accept the changes.	
4	Cancel	Press to return to the Setting Menu screen without accepting the changes.	

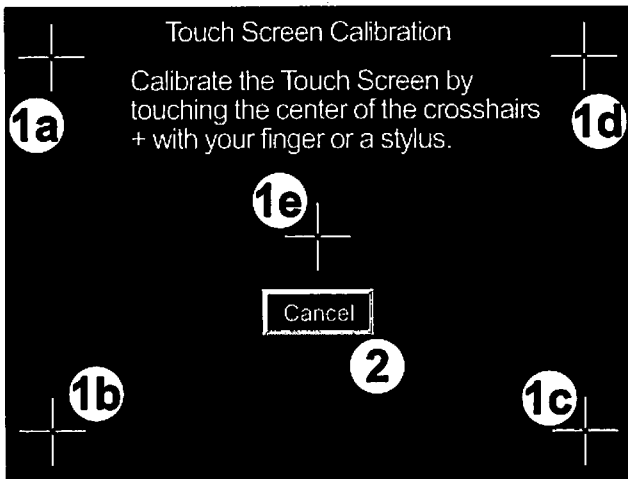
Item No.	Model	Selection Range		Default	
		Brightness	Contrast	Brightness	Contrast
A	TFT Models: EA&-T6C, EA7-T8C, EA7-T10C, EA7-T12C & EA7-T15C	1 to 7	N/A	7	N/A
B	STN Color: EA7-S6C-R & EA7-S6C	N/A	1 to 7	N/A	3
C	STN Grayscale: EA7-S6M-R & EA7-S6M	N/A	1 to 7	N/A	6

Setting – Touch Screen Calibration

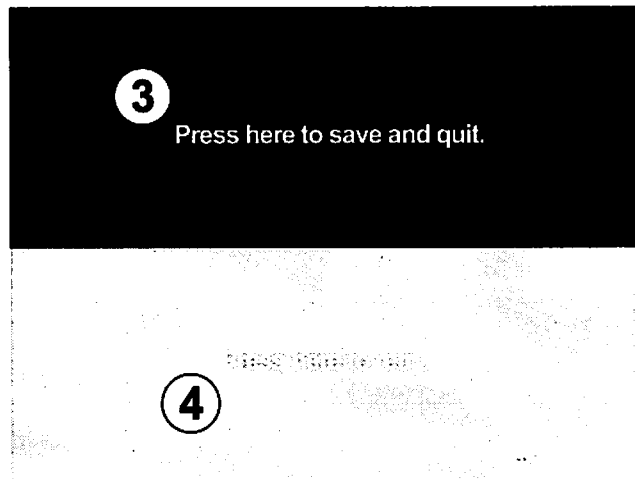
This procedure is used to calibrate the touch screen to ensure accuracy of the touch areas. There are five points on the touch screen that the calibration is based around. The adjustment relies on very narrow areas for the calibration points.

5

Item No.	Function	Description	Comment
1	Points 1a thru 1e	The touch screen calibration crosshairs will appear individually in the order of point 1a thru 1e respectively as each proceeding crosshair is pressed.	If the touched co-ordinate point is too far off from normal, then the procedure will return to Point 1a.
2	Cancel	Press to return to the Setting Menu screen without accepting the changes.	
3	Press here to save & quit.	Press to accept the changes and return to the Setting Menu screen.	If you do not save, you will have to calibrate the panel again after the next power cycle.
4	Press here to retry.	The current adjustment data is canceled and the procedure is returned to point 1a.	

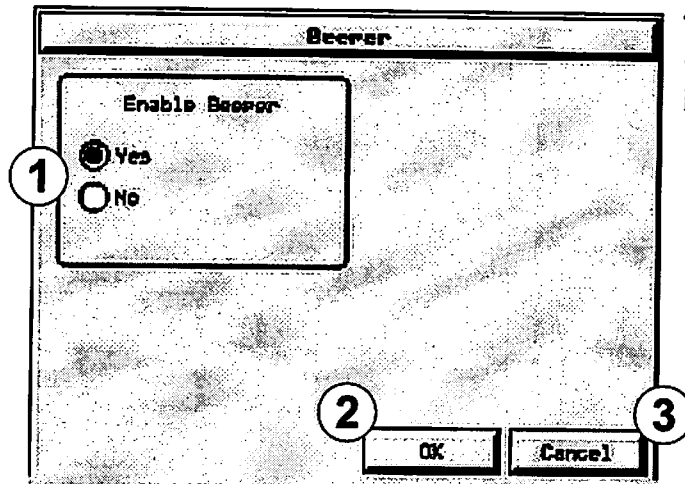


Points 1a thru 1e



Final

Setting – Beeper



This system setup screen function is used to enable or disable the touch panel's internal beeper.

5

Item No.	Function	Description	Comments
1	Yes	Change Enable to Beeper.	
2	No	Change Disable to Beeper.	
3	OK	Press to accept the changes and return to the Setting Menu screen.	
4	Cancel	Press to return to the Setting Menu screen without accepting the changes.	



NOTE: The project settings in the **C-more** programming software **Panel Manager** will override the touch panel's internal setting upon initial download.

Setting – IP Address Setting

IP Address Setting(Ethernet Port)

DHCP **1**

Use the following IP Address **2**

IP Address : 172.22.7.8 **3**

Subnet Mask : 255.255.0.0

Default Gateway : 172.22.4.1

Keypad: 1 2 3 4 5 CL DEL
6 7 8 9 0 . ENT **4**

OK Cancel

IP Address Setting(Ethernet Port)

DHCP

Use the following IP Address

IP Address : 172.22.7.8

Subnet Mask : 255.255.0.0

Default Gateway : 172.22.4.1

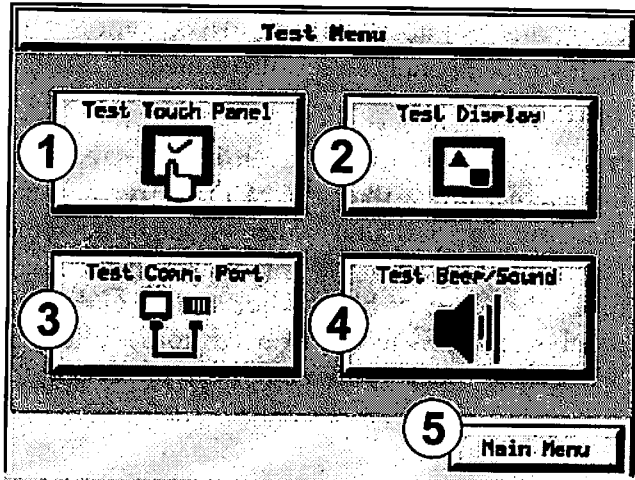
Keypad: 1 2 3 4 5 CL DEL
6 7 8 9 0 . ENT

OK Cancel **5** **6**

5

Item No.	Function	Description	Comment
1	DHCP	"DHCP" is enabled as the default when this system setup screen is first selected. All of the other selections on this screen are dimmed when "DHCP" is selected and are not available.	
2	IP Address	The "Use the following IP Address" setting is selected when its radio button is pressed. An IP Address can be assigned as follows: 1.) Select the address type: a.) IP Address b.) Subnet Mask c.) Default Gateway 2.) Use the numerical keypad to input the address. Use the decimal key to enter the dot separator. 3.) Press the "ENT" key when finished with each field.	Note: If an Ethernet cable is not connected to the touch panel from an active Ethernet device, then the IP Address will show as 0.0.0.0.
3	IP Address Subnet Mask Default Gateway	Select the field that needs to be assigned by touching the entry value and use the keypad to enter the desired address.	Each field can be independently assigned.
4	Keypad	The keypad is used to enter the Address: Use the numeric keys and the "dot" key to enter the address, e.g: 192.168.10.1 "ENT" = Enter key sets value "CL" = Clear value entered "DEL" = Delete 1 character with each press	The "ENT" key must be pressed to accept the entry. If the "ENT" key is not pressed, then the previous value will remain when another area is selected or the "Cancel" key is pressed.
5	OK	Press to accept the changes and return to the Setting Menu screen.	
6	Cancel	Press to return to the Setting Menu screen without accepting the changes.	

Test Menu

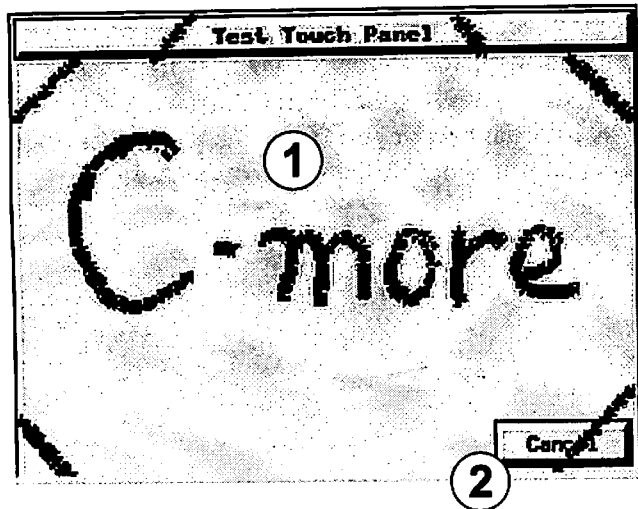


The Test Menu gives the user the ability to test the operation of the touch screen, test the LCD display, test the various communication ports, and also test the internal beeper and the audio line out through an user supplied amplified (stereo) speaker(s).

5

Item No.	Function	Description	Comments
1	Test Touch Panel	Press to go to the Test Touch Panel screen.	
2	Test Display	Press to go to the Test Display screen.	
3	Test Communication Port	Press to go to the Test Communication Port screen.	
4	Test Beep/Sound	Press to go to the Test Beep/Sound screen.	
5	Main Menu	Press to return to the Main Menu screen.	

Test Menu – Test Touch Panel



Using this test, normal or unusual operation of the analog touch panel can be determined.

Testing:

If an area of the touch screen is suspected to be inoperable, touch that area of the screen while in the Test Touch Panel screen mode. The screen pixels should turn black in that area. If the screen pixels do not turn black when touched, then the touch screen is defective or needs to be calibrated. See Setting - Adjust Touch Screen on page 5-22.

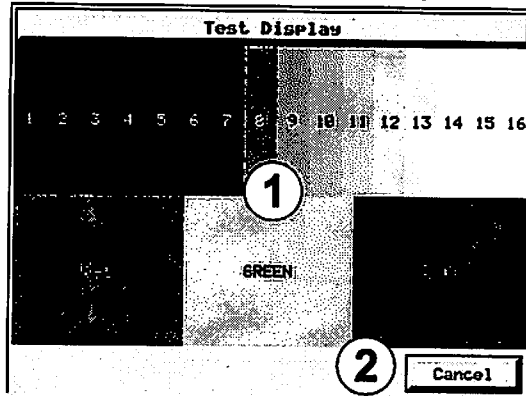
5

Item No.	Function	Description	Comments										
1	Touch area	<table border="0"> <tr> <td>Display Size</td> <td>Touch Area</td> </tr> <tr> <td>6 Inch</td> <td>320 X 240</td> </tr> <tr> <td>8/10 Inch</td> <td>640 X 480</td> </tr> <tr> <td>12 Inch</td> <td>800 X 600</td> </tr> <tr> <td>15 Inch</td> <td>1024 X 768</td> </tr> </table>	Display Size	Touch Area	6 Inch	320 X 240	8/10 Inch	640 X 480	12 Inch	800 X 600	15 Inch	1024 X 768	Both the title bar (Test Touch Panel) and Cancel button can be drawn across to test the touch operation.
Display Size	Touch Area												
6 Inch	320 X 240												
8/10 Inch	640 X 480												
12 Inch	800 X 600												
15 Inch	1024 X 768												
2	Cancel	Press to return to the Test Menu screen.											

Test Menu – Test Display

There are two different test patterns ran on the LCD display to allow the user to check for display screen defects. If the screen is not touched within 3 seconds of Test Pattern 1 being displayed, then Test Pattern 2 will be displayed until such time as the screen is touched during its test, otherwise Test Pattern 1 will remain until cancelled.

Test Pattern 1 displays a test pattern of 16 grayscale graduations and RGB colors.



5

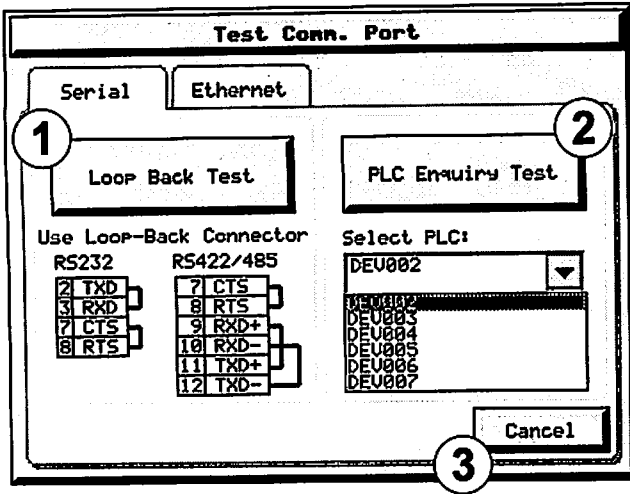
Test Pattern 2 will follow the pattern as shown in the following chart with the color wiping across the screen in the direction indicated by the arrows, then repeats:

Color	1st Time	2nd Time	3rd Time	4th Time
RED	→	↑	↓	←
GREEN	←	→	↑	↓
BLUE	↓	←	→	↑

Item No.	Function	Description	Comments
1	Touch the Test Display screen.	Press the screen anywhere except the Cancel button and the shown Test Pattern 1 remains.	If the Test Display screen is not touched, then in three seconds the display will move to Test Pattern 2.
2	Cancel (Test Pattern 1)	Press to return to the Test Menu screen.	
3	Touch Anywhere (Test Pattern 2)	Touch the screen anywhere during Test Pattern 2 and return to the Test Menu screen.	

Test Results: If any pixels on the screen do not appear the same color as its surrounding pixels, the LCD screen may be defective. A single pixel gone bad is relatively common. Surrounding pixels going bad over time is another indication the LCD screen may be defective.

Test Menu – Test Communication Ports: Serial

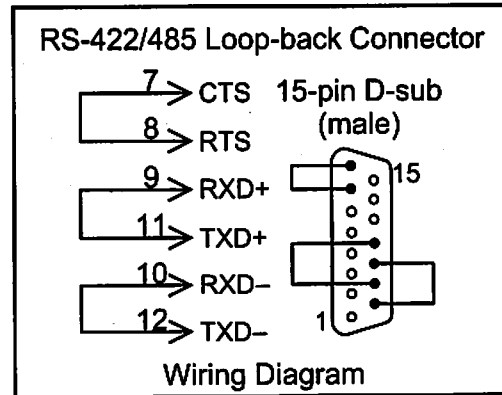
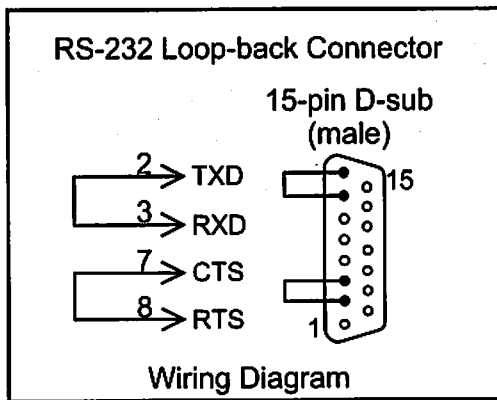


The following test can be used to check the operation of the serial communication port, with the use of a loop back connector and can also check the status of the serial communications to any connected and configured PLC.

Continued on the next two pages.

5

Item No.	Function	Description	Comments
1	Loop Back Test	This function checks the serial comm port for proper operation with a loop back connector.	
2	PLC Enquiry Test	This function allows the ability to select any PLC that that may be connected to the touch panel via a serial connection and checks to see if the communications are working correctly.	Note: The PLC serial communications port settings must be configured in the <i>C-more</i> programming software.
3	Cancel	Press to return to the Test Menu screen.	

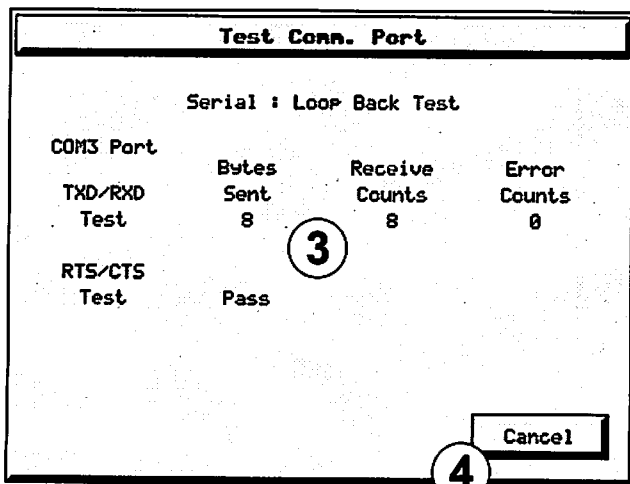


Test Menu – Serial Port Test

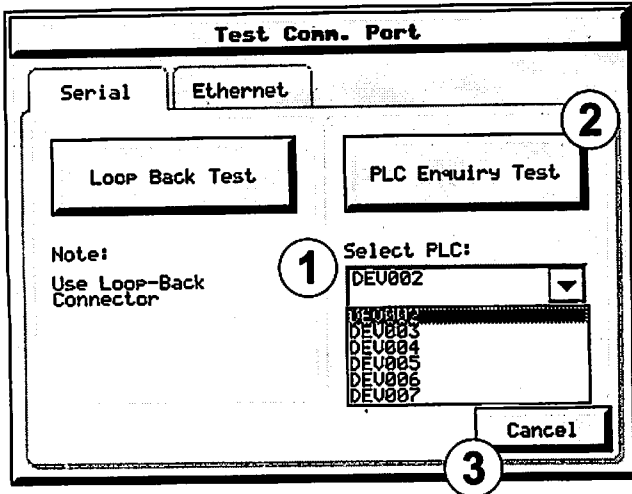
PLC Serial Comm Port – Loop Back Test

Item No.	Function	Description	Comments
1	Determine Loop Back Connector	1.) When testing an RS-232C serial connection, connect pin 2 to 3 and pin 7 to 8 on an appropriate D-SUB 15-pin male connector and plug it into the serial PLC comm port on the rear of the touch panel. 2.) When testing an RS-422 or RS-485 serial connection, connect pin 9 to 11, pin 10 to 12 and pin 7 to 8 on an appropriate D-SUB 15-pin male connector and plug it into the serial PLC comm port on the rear of the touch panel.	
2	Start Test	Press the Loop Back Test button to start the serial comm port test.	
3	Test Results	1.) Bytes Sent: The number of bytes sent after a test is started. 2.) Receive Counts: The number of bytes which are received after the test is started. 3.) Error Counts: The number of bytes which have not been received after the test is started. 4.) RTS/CTS Test: Pass/Fail RTS is turned on and if CTS receives the signal then the test shows "Pass", otherwise the test shows "Fail".	Note: The test will continue to run until the Cancel button is pressed. If there are any error counts, check the loop back connector. If it is OK, call Tech Support.
4	Cancel	Press to return to the Test Comm. Port screen.	

5



Test Menu – PLC Enquiry Test: Serial Connection



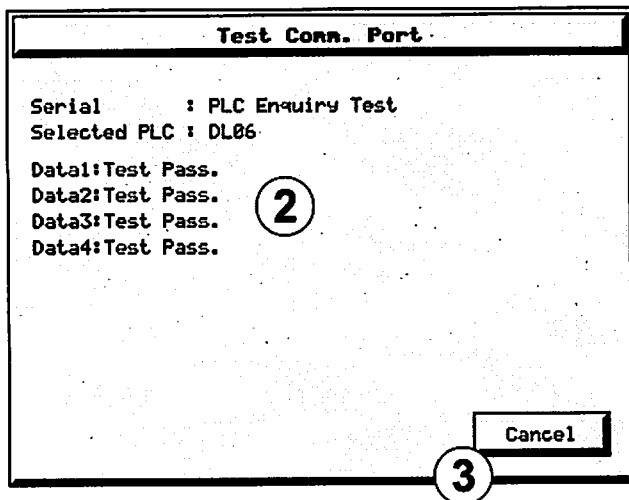
This function allows the ability to select any PLC that may be connected to the touch panel through a serial comm. port connection and checks to see if the communications are working correctly.



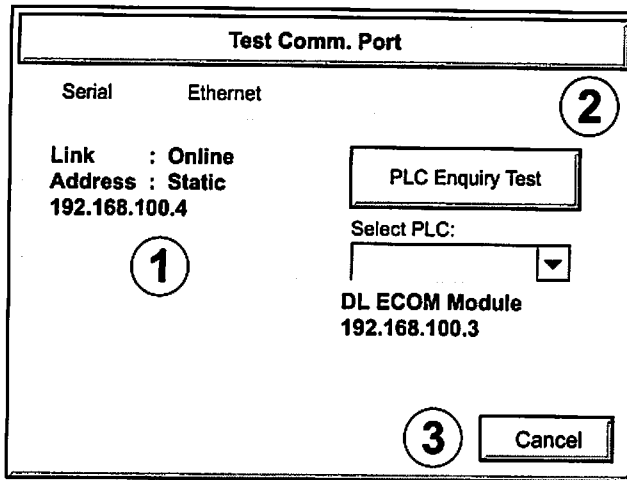
Note: The communications protocol for the PLC being selected must be configured the same as the C-more touch panel. The touch panel's PLC serial communications are configured using the C-more Programming Software's Panel Manager.

5

Item No.	Function	Description	Comments
1	Select PLC	Select any PLC that is shown in the drop down menu. The PLC selected will connect to the touch panel at the time of a test.	Only PLC's that have been configured in the C-more Programming Software will appear in the Select PLC: list.
2	PLC Enquiry Test	Four test read packets are sent to the selected PLC. Test result will be either Pass or Fail.	
3	Cancel	Press to return to the Test Menu screen.	



Test Menu – Test Communication Ports: Ethernet



The following test feature can be used to check the operation of the Ethernet communication port by indicating if an Ethernet link has been established or not, and can also check the status of the Ethernet communications to any connected PLC.

Base featured models (-R) do not include an Ethernet port, therefore this check is not displayed.

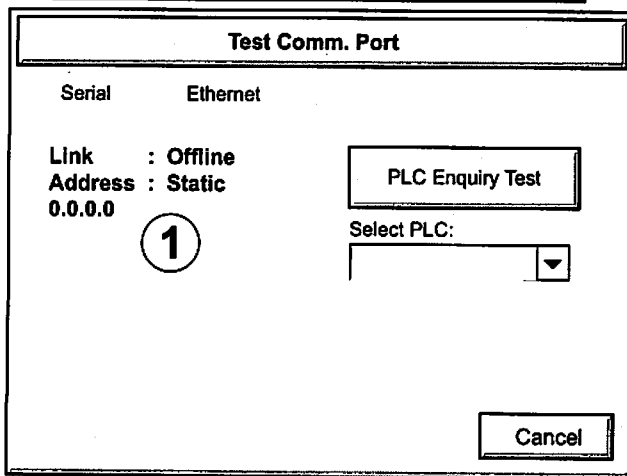


Note: The communications protocol for the PLC being selected must be configured the same as the C-more touch panel. The touch panel's PLC Ethernet communications are configured using the C-more Programming Software's Panel Manager.

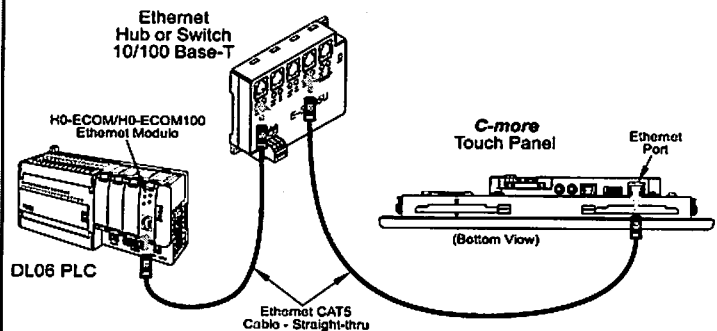
5

Item No.	Function	Description	Comments
1	Ethernet Connected	This area displays information to whether an Ethernet link has been established for the touch panel's Ethernet comm port or not. Displays panel's IP address and shows whether it is static or assigned by a DHCP server.	
2	PLC Enquiry Test	This function allows the ability to select any PLC configured in the project that may be connected to the touch panel via an Ethernet connection and checks to see if the communications are working correctly.	
3	Cancel	Press to return to the Test Menu screen.	

Example of displayed message when the touch panel's Ethernet port is not connected.



Typical Ethernet connection with Ethernet switch.



Test Menu – PLC Enquiry Test: Ethernet Connection

This function allows the ability to select any PLC configured in the project that may be connected to the touch panel through an Ethernet port connection and checks to see if the communications are working correctly.

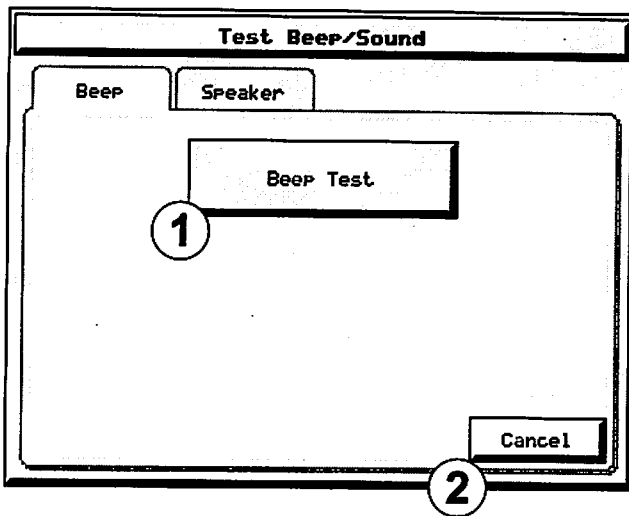


Note: The communications protocol for the PLC being selected must be configured the same as the C-more touch panel. The touch panel's PLC Ethernet communications are configured using the C-more Programming Software's Panel Manager.

5

Item No.	Function	Description	Comments
1	Select PLC	Select any PLC that is shown in the drop down menu.	
2	PLC Enquiry Test	The following are the steps that the Ethernet PLC Enquiry Test performs: 1.) Ping the network 4 times for the PLC selected. 2.) Four of the test read packets are sent to the selected PLC. Test result will be either Pass or Fail. However, if the result of pinging the network shows an error, the test is stopped.	
3	Cancel	Press to return to the Test Menu screen.	

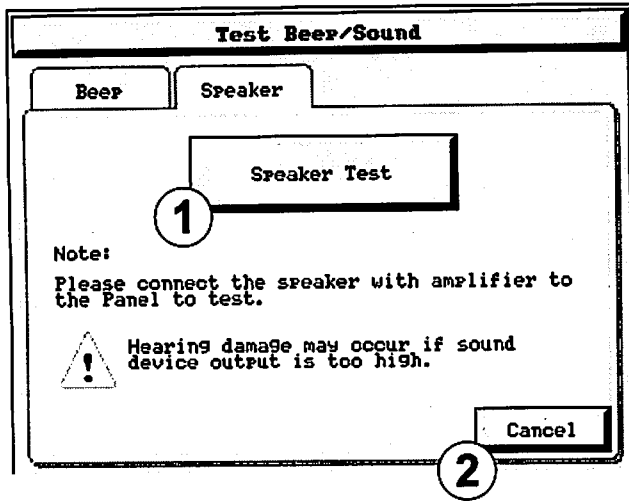
Test Menu – Test Beep/Sound



5

Item No.	Function	Description	Comments
1	Beep Test	The internal Beeper can be tested from this system setup screen whether the Beeper is enabled or disabled. After the Beep Test button is pressed then released, the Beeper will sound for 500 msec.	
2	Cancel	Press to return to the Test Menu screen.	

Test Menu – Test Beep/Sound (cont'd)



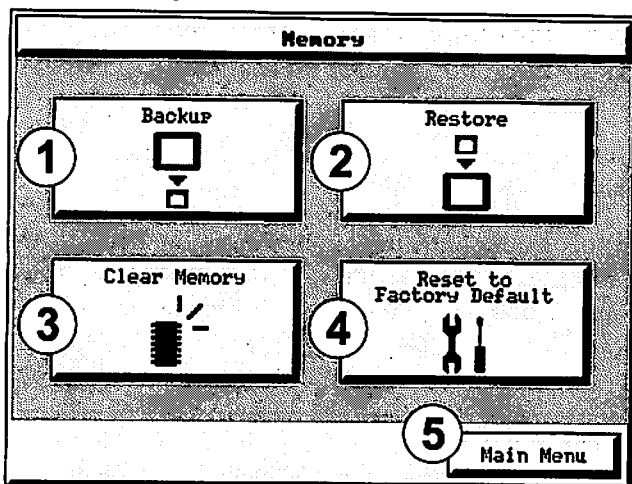
5



WARNING: Hearing damage may occur if the volume on the user supplied external amplified speaker is set too high.

Item No.	Function	Description	Comments
1	Speaker Test	The Speaker Test function requires that a speaker(s) with an amplifier (can be stereo) be connected to the Audio Line Out stereo jack on the rear of the touch panel. After the Speaker Test button is pressed then released, a system provided Test.WAV file will play once.	
2	Cancel	Press to return to the Test Menu screen.	

Memory Menu



The user's project, system, log and recipes files can be backed up and restored to either a CompactFlash memory card (CF1 or CF2), or a USB memory device. From this menu the user can also clear the project log files. The user also has the ability to clear the memory within the *C-more* touch panel.

Base featured models (-R) do not include CF1 or CF2.

5

Item No.	Function	Description	Comments
1	Backup	Backup project, system, log & recipe files to the following memory devices: USB port - Type A: USB pen drive CF Slot #1 (standard port): CompactFlash CF Slot #2 (optional port): CompactFlash See page 5-37 for details.	Any USB pen drive or CompactFlash memory device capacity available is supported. The backup data files are created and copied to a folder on the memory device named "EA_Memory Copy." The project file is named StartupStorage.eas "Log" and "Recipe" folders with the appropriate data files are also created on the memory device.
2	Restore	Restore project, system, log & recipe files to the internal memory from one of the following memory devices: USB port - Type A: USB pen drive CF Slot #1 (standard port): CompactFlash CF Slot #2 (optional port): CompactFlash See page 5-44 for details.	A folder on the memory device named "EA_Memory Copy" must exist containing a file named "StartupStorage.eas". The project data file is stored in this file, and if the system data file was backed up, it also will be stored in this file. Any backed up log or recipe data files will be located under the appropriate "Log" or "Recipe" folders.
3	Clear Memory	Clear selected data files from the memory of the following internal memory or external memory devices: Built-in FLASH Memory USB port - Type A: USB pen drive CF Slot #1 (standard port): CompactFlash CF Slot #2 (optional port): CompactFlash See page 5-50 for details.	Can only clear project, log and recipe data files of the Built-in FLASH memory. Can clear entire contents or individual data files of external memory devices.
4	Reset to Factory Default	The touch panel's internal memory is set to the original factory defaults.	Clears all project memory.
5	Main Menu	Press to return to the Main Menu screen.	

Project Executed from CompactFlash (CF Slot #1)

If a CompactFlash card is located in the CF1 slot at the time a project is transferred to the panel, the project will be stored on the CompactFlash card, not in the internal Built-in FLASH memory.

If CF1 slot contains a CompactFlash with a project and:

- 1.) The touch panel's power is cycled, then
- 2.) The project file stored on the CompactFlash is loaded into the touch panel's internal DRAM memory and executed. Please note that the project stored in the panel's internal FLASH memory is NOT loaded into the internal DRAM memory when a CompactFlash memory card is present. Any project in the internal FLASH memory is cleared.

5



WARNING: During power up with a CompactFlash plugged into the CF1 Slot, please do not remove the memory card from the slot. Damage to the CompactFlash and possibly the touch panel may result.

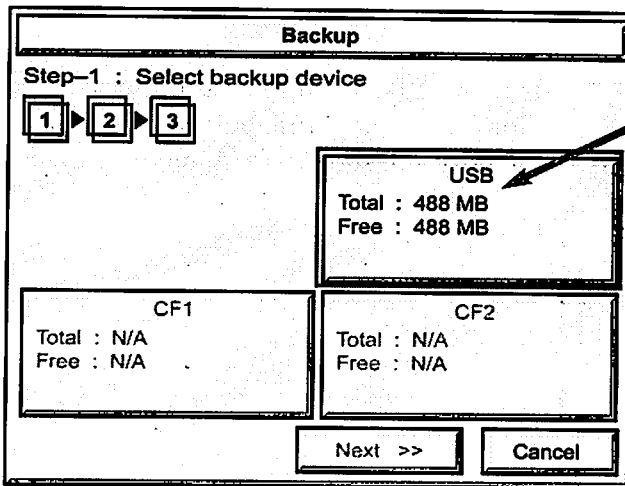


WARNING: After a firmware update, the project files which are located in either the touch panel's internal FLASH memory or the CompactFlash plugged into CF1 Slot are cleared. The programming software will need to be used to Transfer the project file back into the panel. If you wish to retain the project on the CompactFlash, power down the panel and remove the CompactFlash before performing a firmware upgrade.

Increasing Project Memory Size using a CompactFlash in CF1 Slot:

If a project is transferred to the panel with a CompactFlash card in CF1 Slot, the Font and Recipe data files are not included in the 10MB (40MB for 12" and 15" models) project size. Therefore using CF1 can allow a project to be loaded that is larger than 10MB if the excessive size is caused by Fonts and/or Recipe Sheets.

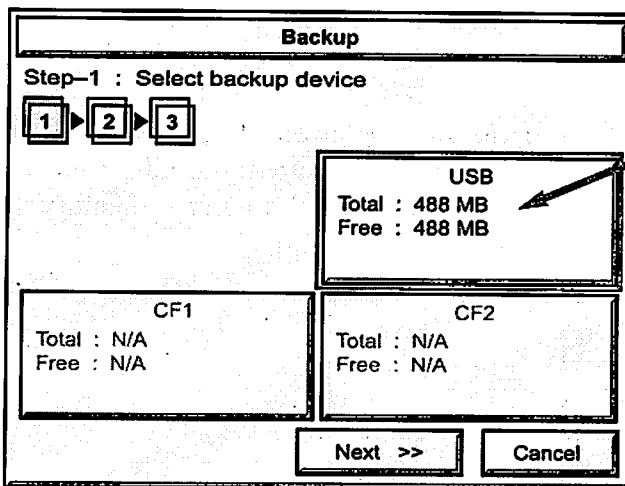
Memory – Backup



The Memory - Backup selection allows you to backup the panel's Project, Log files, Recipe files or even the System (firmware & OS) files to either a CompactFlash (CF) or USB pen drive. The available memory devices will be displayed showing the total and free available memory for that device. If the device is not available, it will be grayed out. The Next button is grayed out until a device is selected.

The Cancel button can be pressed at any time to return to the Memory Menu screen.

5



This is an example of a USB memory device selected to be used for backing up the panel's data file(s).

The selected device is highlighted. Pressing again un-selects it.

When there are more than two available backup devices, the one selected will be highlighted. If there is only one available memory device, it still needs to be highlighted in order to go to the next step.

Press the Next button to continue to Step 2.

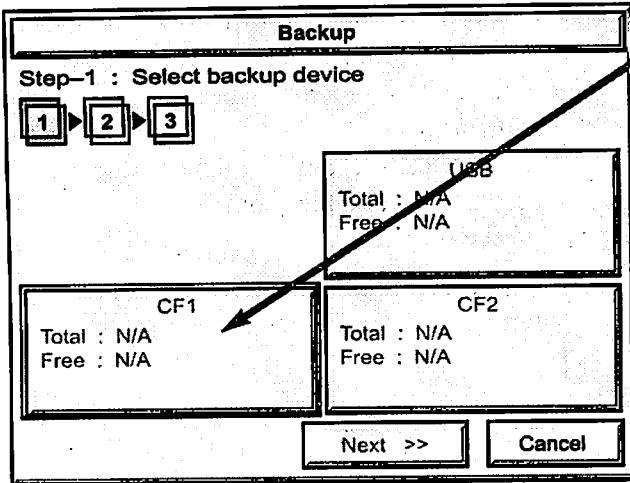


Note: If you have a memory device inserted into the proper port on the touch panel, but it doesn't show up as highlighted in Step 1 of the **Backup** setup screen, then try a different device to determine if the memory device is defective or if there is a possible problem with the memory device connection. It may not be compatible with the panel. This rarely happens with CF memory, but some USB pen drives are not USB 1.1 compatible and will not work with C-more touch panels. Also, some USB pen drives may take several minutes before they are recognized by the panel.

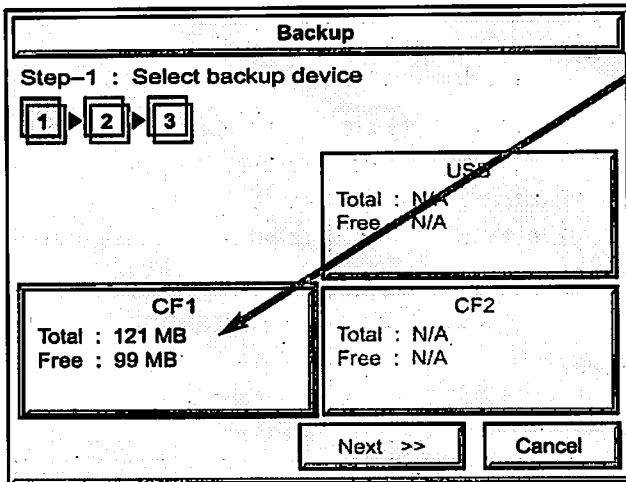
Please read the explanation for the availability of CF1 under different conditions as shown on the next two pages.

Memory – Backup (cont'd)

CF1 Availability Explanation:



If there is no CompactFlash inserted into CF1 Slot, then the CF1 button's Total and Free memory will show as N/A and be grayed out.

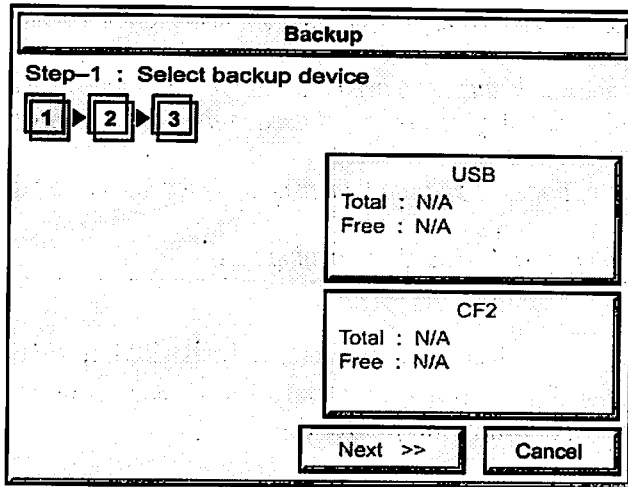


If the panel is powered up or rebooted with a CompactFlash inserted into CF1 Slot, then the CF1 button's Total and Free memory will be displayed.

5

Memory – Backup (cont'd)

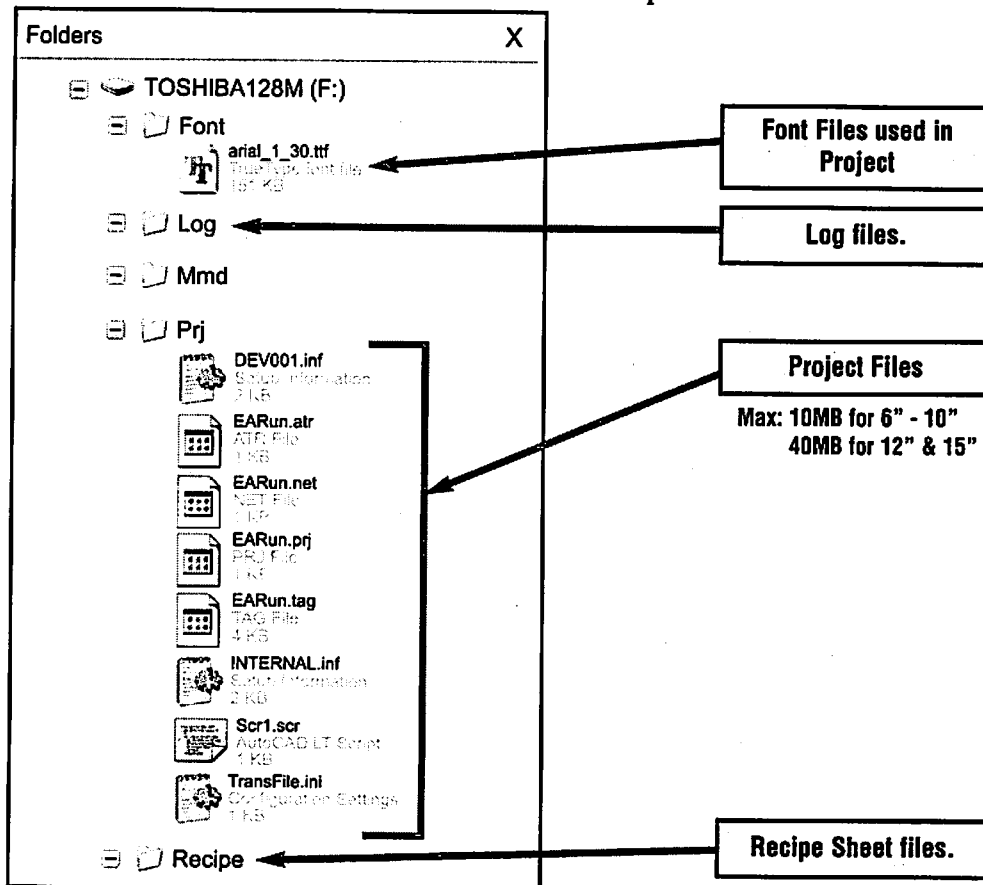
CF1 Availability Explanation (cont'd):



If a CompactFlash is inserted into CF1 Slot and a project is transferred using the *C-more* Programming Software's Project Transfer utility Panel > Transfer, then the CF1 will not show up in the Memory - Backup Step 1 device choices. The CompactFlash will have the runtime files stored on it that get loaded into the touch panel's internal DRAM memory when powered up or rebooted.

5

Below is an example of the folder and file structure that is stored on the CompactFlash in the CF1 Slot for a project that was directly transferred from the *C-more* Programming Software's Project Transfer function when viewed in Windows® Explorer on a PC.



Memory – Backup (cont'd)



Note: The following definitions are for the various file types that can be backed up:

Project data – consists of the actual developed project data that is created in the **C-more** programming software and includes all functionality, objects, screens, tag names, labels, comments, graphics, etc. Included in backup file name *StartupStorage.eas*.

Recipe data – consists of all the data values and labels that have been created for the various recipe sheets. Includes all recipe sheets loaded to the panel. Only recipe sheets used in the project are loaded to the panel.

System data – consists of the operating system, firmware and run time files. Included in backup file name *StartupStorage.eas*.

Log data – consists of the Alarm Log, Message Log and Trend Data Logging files.

5

Backup

Step-2 : Select Data Area to Backup

1 2 3

Project Total : 172 KB	Recipe Total : 1 KB
Log Total : 268 KB	System Total : 16 MB

<< Prev. Next >> Cancel

Select the data file(s) to be backed up by pressing the appropriate data file button. The selection will be highlighted.

Pressing the highlighted data file button again will turn it off.

The Next >> button will stay grayed out until at least one data file is selected.

Any file type not available will be grayed out.

Backup

Step-2 : Select Data Area to Backup

1 2 3

Project Total : 172 KB	Recipe Total : 1 KB
Log Total : 268 KB	System Total : 16 MB

<< Prev. Next >> Cancel

This is an example of data files selected for backing up.

The selected data files are highlighted.

The Next >> button is now enabled.

Pressing Cancel will return to the previous menu.

Press the Next button to continue.

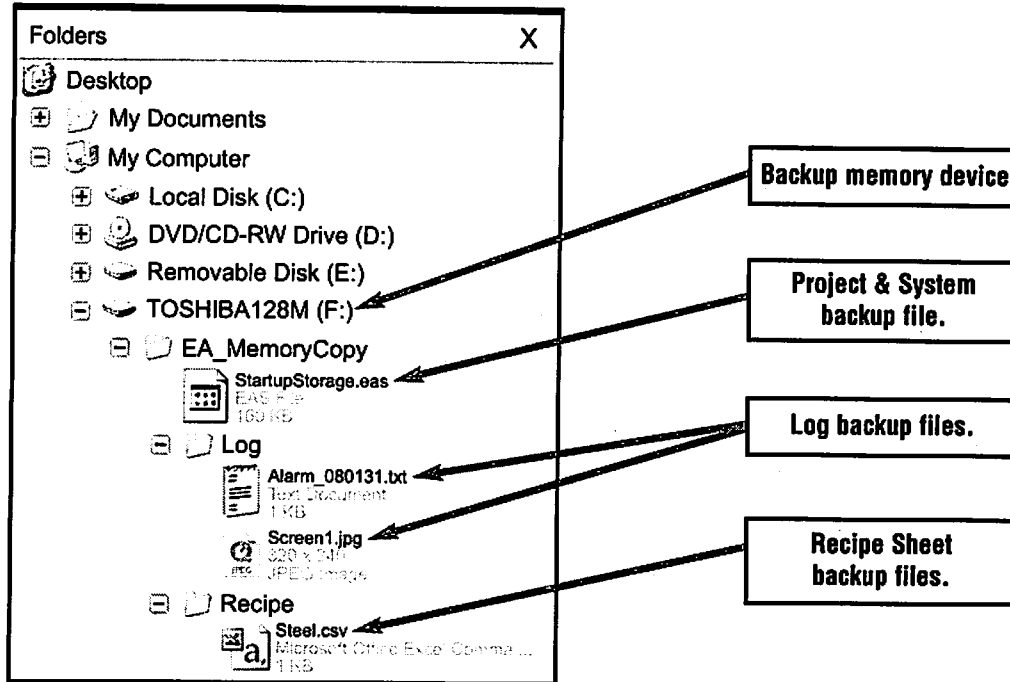


Note: In the case of the **Project** and **System** files, these can be **Restored** later to another panel. In the case of the **Recipe** files, they can be edited externally from the panel and then **Restored** to the panel. The **Log** files are for viewing purposes only. See Page 5-44 for instructions on Restoring the Project, System and or Recipe files to a Panel.

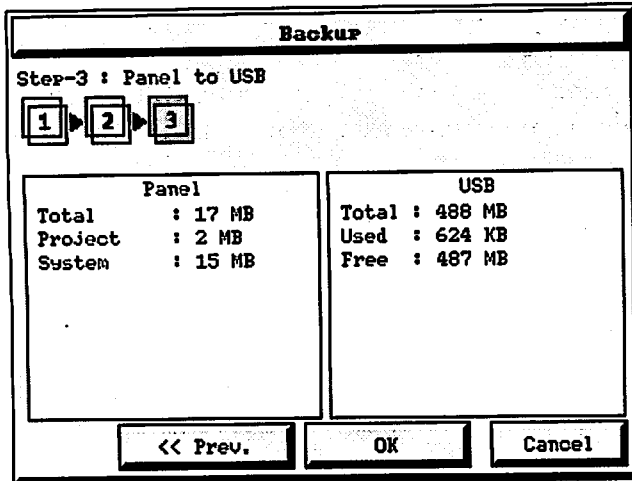
Memory – Backup (cont'd)

Backup Data Files Naming and Organization

The following graphic shows how the various data files are organized on the memory device when doing a Backup and also the file naming convention that is used when viewed in Windows® Explorer on a PC.



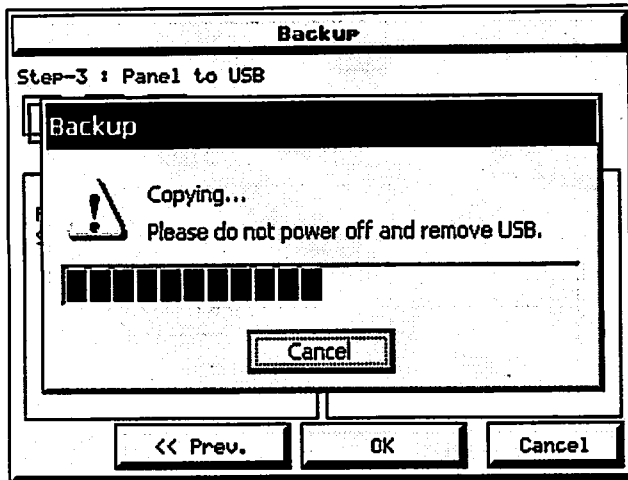
Memory – Backup (cont'd)



The next system setup screen allows the verification of the data file selections. When the OK button is pressed, the backup begins.

The user can return to the previous screen by pressing the << Prev. button.

5



This message is displayed during the Backup copying process. Press the Cancel button to abort the backup.

The following text is shown in the copying progress message box:

Copy to USB Memory:

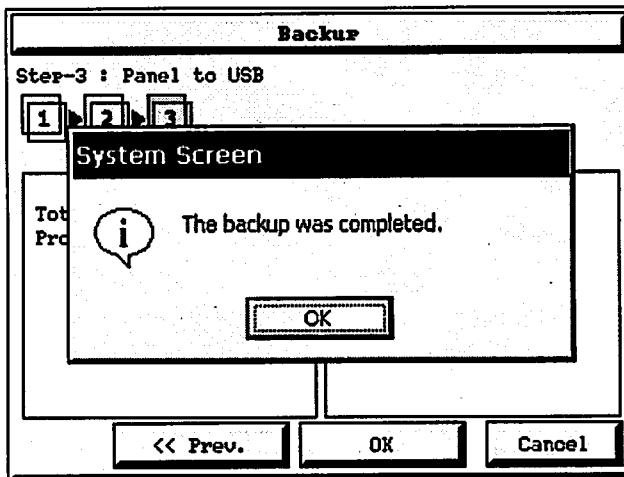
"Please do not Power Off or Remove USB"

Copy to CF1 or CF2:

"Please do not Power Off or Remove CF"

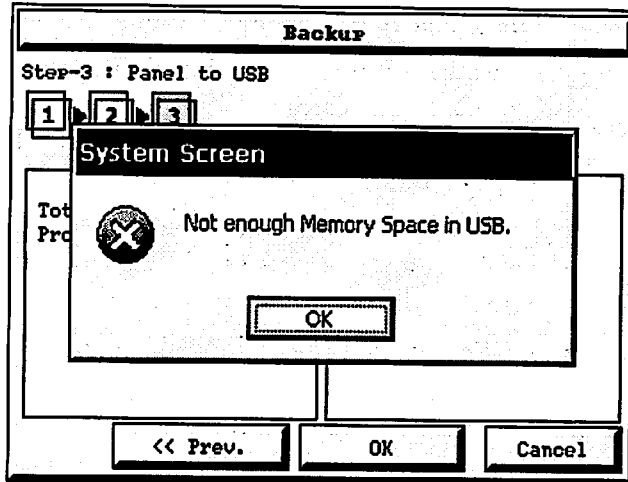


WARNING: During the copying process, Do not power off the touch panel or remove the memory device.



This message is displayed to indicate the Backup is complete. Press the OK button to return to the previous menu selection.

Memory – Backup (cont'd)



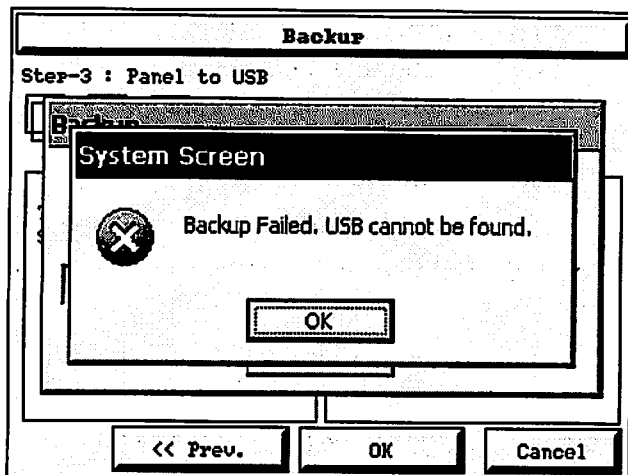
Warning Messages

If the destination does not have enough space to store the selected memory size, then the message shown here will be displayed. Press the OK button to clear the warning message.

The warning message will read "Not enough Memory Space in %Device%".

%Device% will show either "CF1", "CF2", or "USB".

5

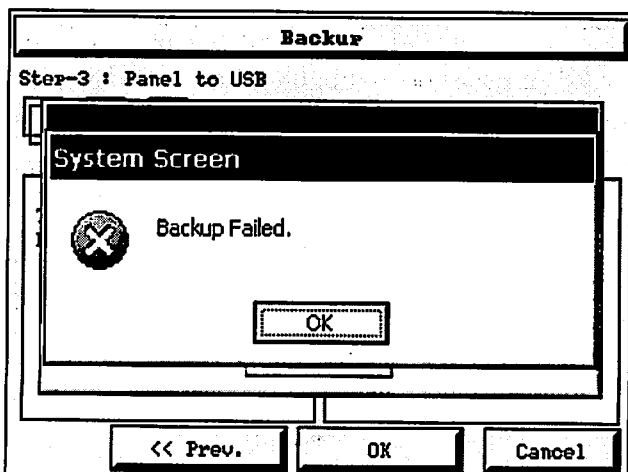


This warning message will be displayed if the backup Memory device fails or is removed during the backup. Press the OK button to clear the warning message.

The warning message will read "Backup Failed. %Device% cannot be found".

%Device% will show either "CF1", "CF2", or "USB".

Refer to Chapter 8: Troubleshooting for additional help.

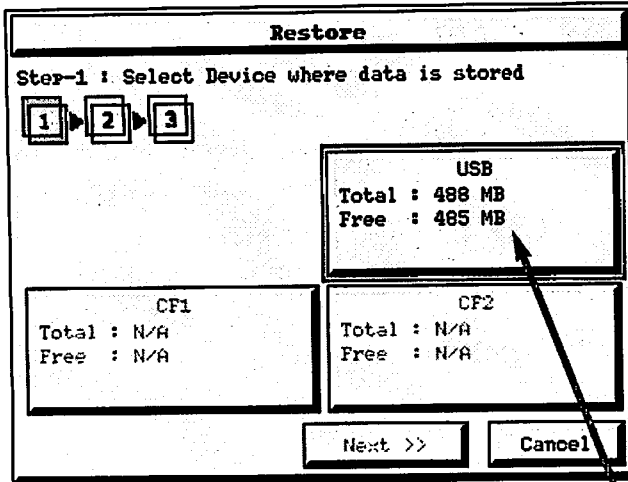


For any other reason the backup fails, then this warning message will be displayed. Press the OK button to clear the warning message.

The warning message will read "Backup Failed".

Refer to Chapter 8: Troubleshooting for additional help.

Memory – Restore

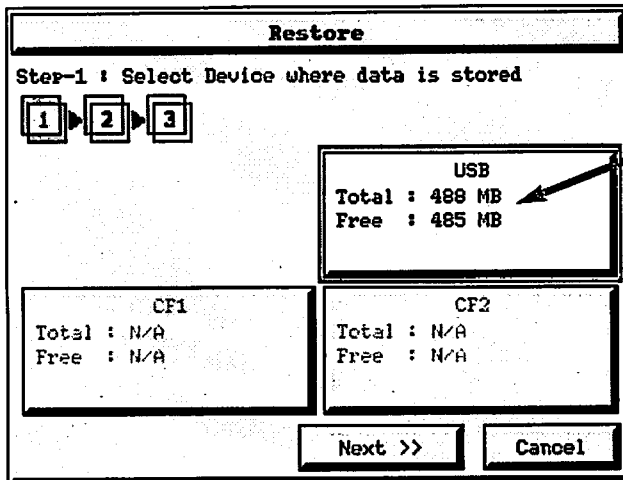


The Memory - Restore function is used to:

- 1.) Restore a project previously backed up on a CompactFlash card or USB pen drive memory device to the same panel. See Memory - Backup on page 5-37.
- 2.) Copy a project from one panel to another panel using a memory device to physically transport the data files.
- 3.) Restore a project into the panel that was transferred to an "External Memory Device" using the C-more Programming Software.
- 4.) Restore Recipe Sheet(s) previously backed up to a memory device or copied to the memory device using a PC.

The available memory devices will be displayed showing the total and free available memory for that device. If the device is not available, it will be grayed out. The Next button is grayed out until a device is selected.

The Cancel button can be pressed at any time to return to the Memory Menu screen.



This is an example of a USB memory device selected to be used for restoring the data file(s).

The selected device is highlighted. Pressing again unselects it.

When there are more than two available restore devices, the one selected will be highlighted. If there is only one available memory device, it needs to be highlighted in order to go to the next step.

Press the Next button to continue to continue to Step 2.

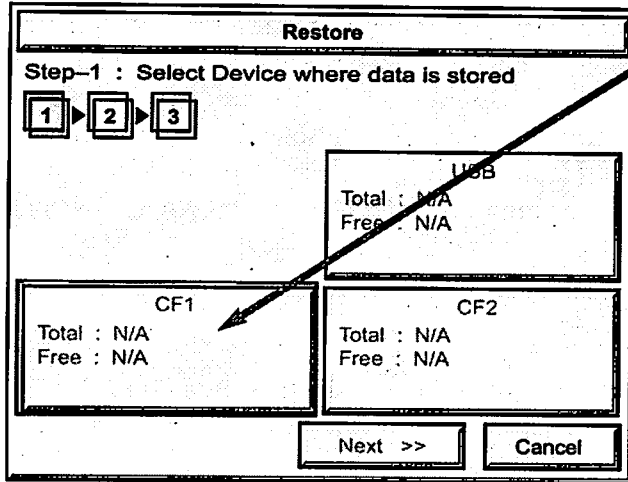


Note: If you have a memory device inserted into the proper port on the touch panel, but it doesn't show up as highlighted in Step 1 of the Restore setup screen, then try a different device to determine if the memory device is defective or if there is a possible problem with the memory device connection. It may not be compatible with the panel. This rarely happens with CF memory, but some USB pen drives are not USB 1.1 compatible and will not work with C-more touch panels. Also, some USB pen drives may take several minutes before they are recognized by the panel.

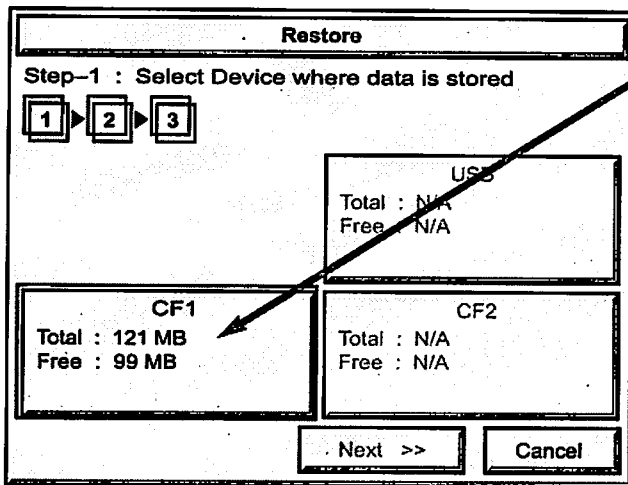
Memory – Restore (cont'd)

Please read the explanation for the availability of CF1 under different conditions as shown on this page and the next.

CF1 Availability Explanation:

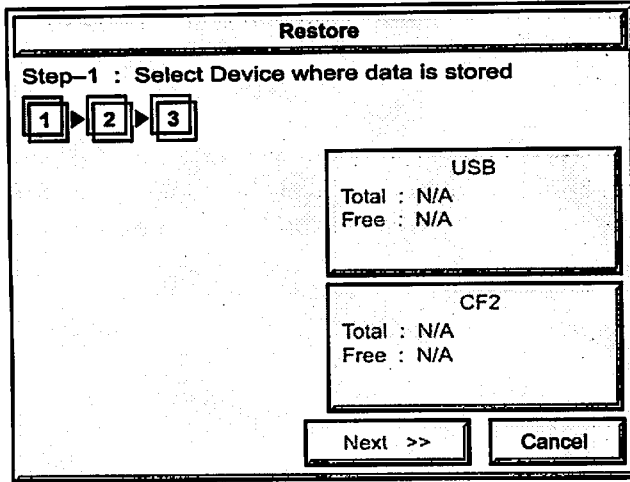


If there is no CompactFlash inserted into CF1 Slot, then the CF1 button's Total and Free memory will show as N/A and be grayed out.



If the panel is powered up or rebooted with a CompactFlash inserted into CF1 Slot, then the CF1 button's Total and Free memory will be displayed.

Memory – Restore (cont'd)



CF1 Availability Explanation (cont'd):

If a CompactFlash is inserted into CF1 Slot and a project is transferred using the *C-more* Programming Software's Project Transfer utility Panel > Transfer, then the CF1 will not show up in the Memory - Backup Step 1 device choices. The CompactFlash will have the runtime files stored on it that get loaded into the touch panel's internal DRAM memory when powered up or rebooted.

See page 5-39 for an example of the folder and file structure that is stored on CF1.

Memory – Restore (cont'd)

Restore

Step-2 : Select Data Area to Restore

1 2 3

Project Total : 172 KB	Recipe Total : 1 KB
Log Total : 268 KB	System Total : 16 MB

<< Prev. Next >> Cancel

Select the data file(s) to be restored by pressing the appropriate data file button. The selection will be highlighted. The data file can be either the Project, System and / or Recipe files.. The selected data is restored to the internal built-in FLASH memory if there is no CompactFlash memory card inserted into the CF1 slot.

Pressing the highlighted data file again will turn it off.

The Next >> button will stay grayed out until at least one data file is selected.

Any file type not available will be grayed out.

5

Restore

Step-2 : Select Data Area to Restore

1 2 3

Project Total : 172 KB	Recipe Total : 1 KB
Log Total : 268 KB	System Total : 16 MB

<< Prev. Next >> Cancel

This is an example of a file selected to restore.

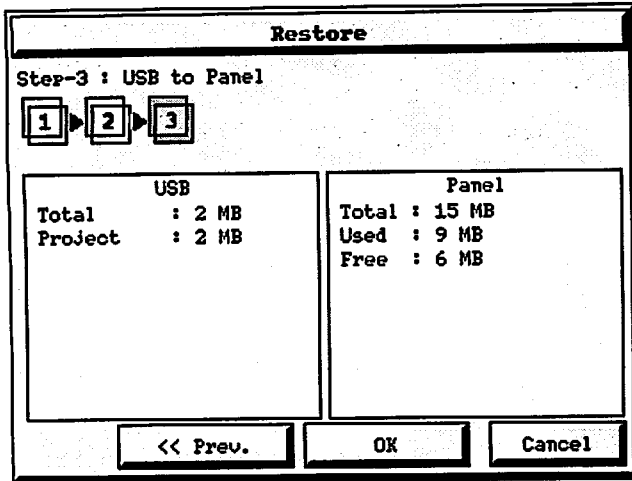
The selected file is highlighted.

The Next >> button is now enabled.

Pressing Cancel will return to the previous menu.

Press the Next button to continue.

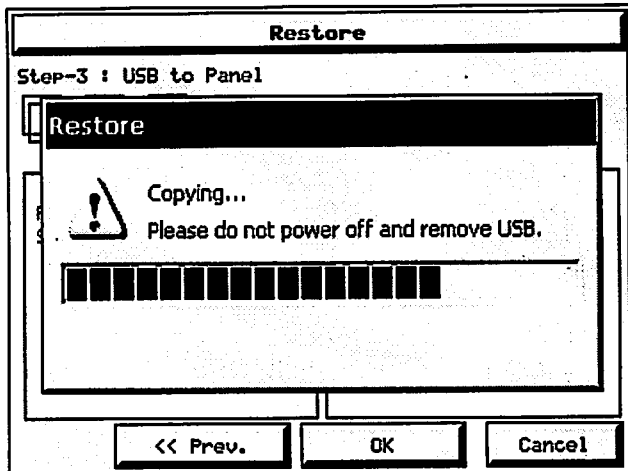
Memory – Restore (cont'd)



The data selected to restore is checked. If the data is good, then the OK button can be pressed to start the restore.

If there is a problem with the data, the OK button will remain grayed out and the user can return to the previous screen by pressing the << Prev button.

The problem could be caused by a corrupted data file. See Chapter 8: Troubleshooting for additional help.



This message is displayed during the Restore process. Press the Cancel button to abort the backup.

The following text is shown in the copying progress message box:

Copy to USB Memory:

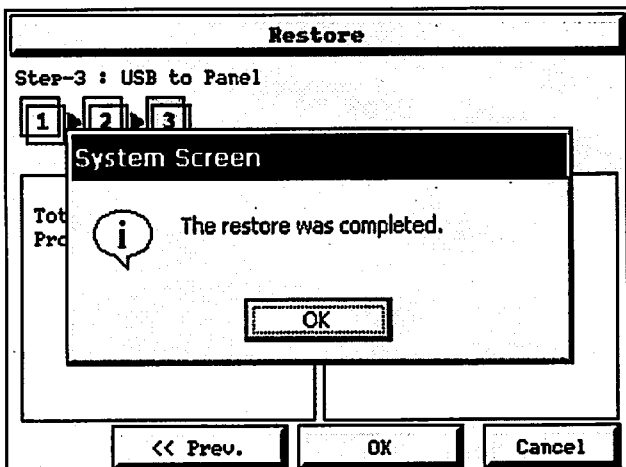
"Please do not Power Off or Remove USB"

Copy to CF1 or CF2:

"Please do not Power Off or Remove CF"

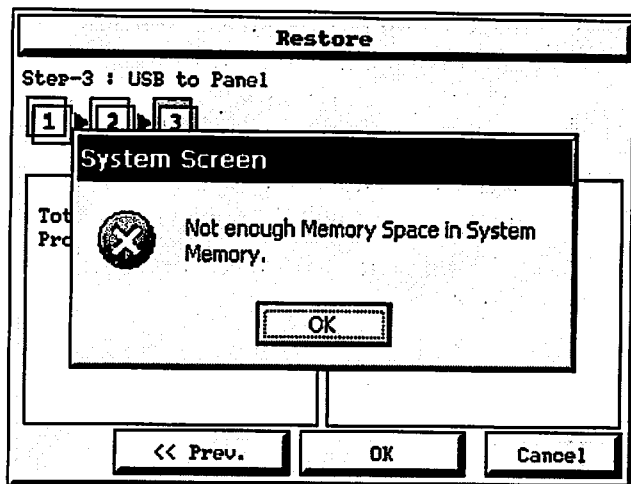


WARNING: During the copying process, Do not power off the touch panel or remove the memory device.



This message is displayed to indicate the Restore is complete. Press the OK button to return to the previous menu selection.

Memory – Restore (cont'd)



Warning Messages:

If the system memory does not have enough space to restore the selected memory size, then the message shown here will be displayed. Press the OK button to clear the warning message.

The warning message will read "Not enough Memory Space in System Memory".

The Project size must be less than 10 MByte for 6"-10" panels and less than 40 MByte for 12" & 15" panels.

5

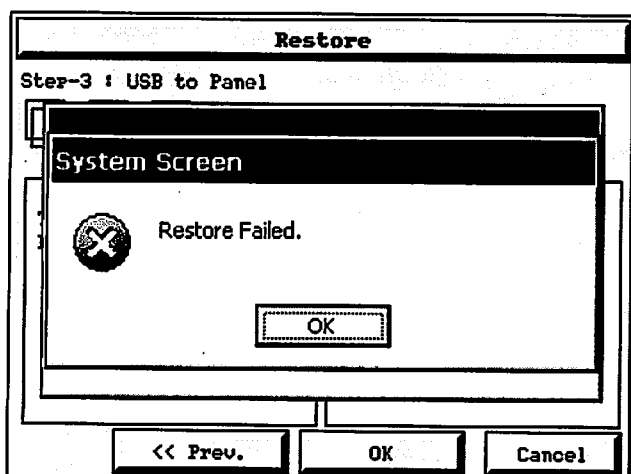


This warning message will be displayed if the restore Memory device fails or is removed during the backup. Press the OK button to clear the warning message.

The warning message will read "Restore Failed. %Device% cannot be found".

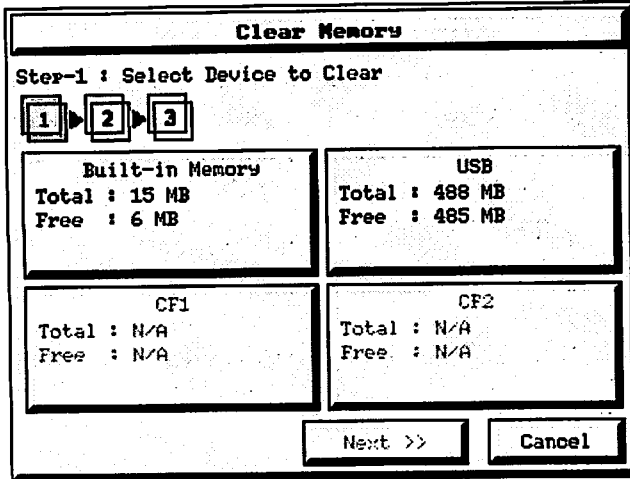
%Device% will show show "CF1", "CF2", or "USB".

Try using a different device with known good data in the same connector or using the device that is causing the error in a different connector.



For any other reason the restore fails, then this warning message will be displayed. Press the OK button to clear the warning message.

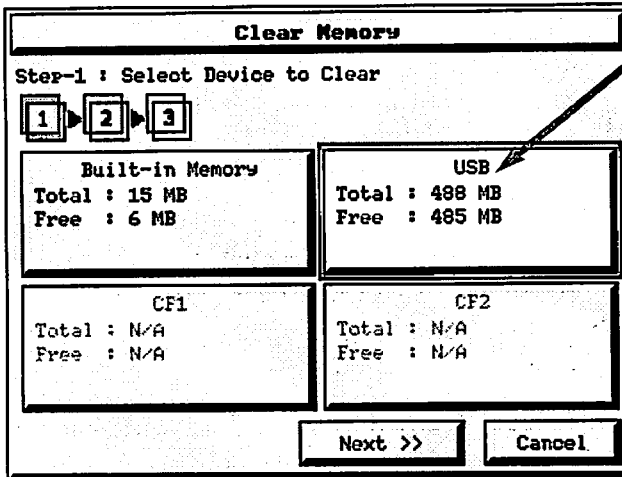
Memory – Clear Memory



This function is used to clear individually selected data files, or all data files, within the panel's Built-in Memory, or any installed memory device such as a USB pen drive, CompactFlash (CF1 or CF2).

Select the memory device to clear. If the device is not available, it will be grayed out.

The Next button is grayed out until a device is selected.

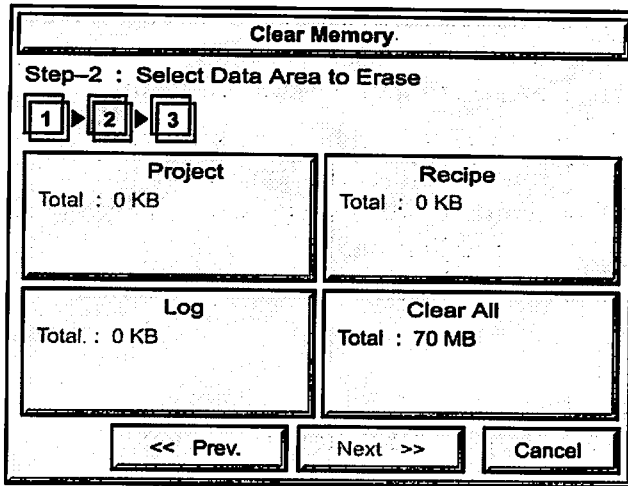


The selected device is highlighted. Pressing again un-selects it.

When there are more than two available backup devices, the one selected will be highlighted. If another is selected, then the highlight will change to the last one pressed. Only one device can be selected at a time.

Press the Next button to continue.

Memory – Clear Memory (cont'd)



Select the data file(s) to be cleared.

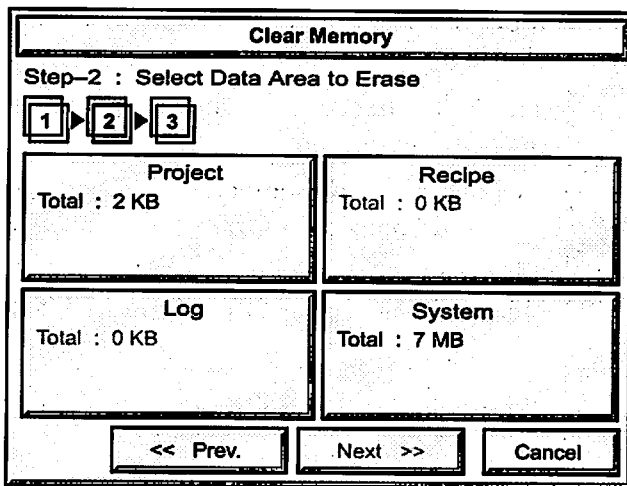
This is an example of CF1, CF2 or USB memory that was selected in Clear Memory - Step-1.

The selected file will be highlighted. Pressing again un-selects it.

The Next >> button will stay grayed out until file(s) are selected.

Selecting Clear All will erase all files located on the memory device.

5

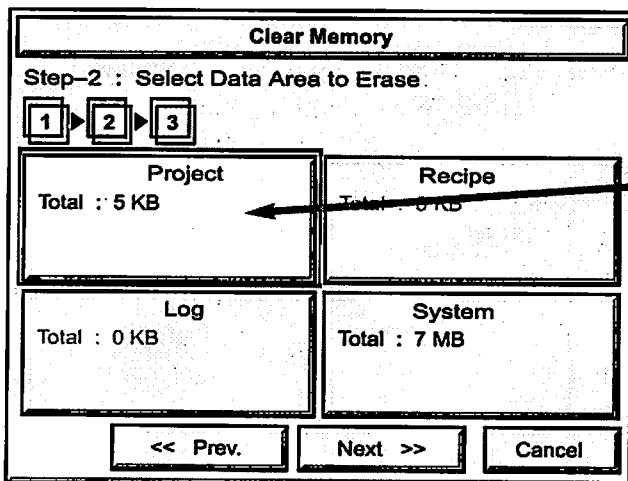


This is an example of Built-in Memory that was selected in Clear Memory - Step-1.

Notice the ability to select either the Project file, Log files, Recipe files, or the System files.



Note: System files can not be cleared from the internal memory.



This is an example of the Project data file being selected for clearing.

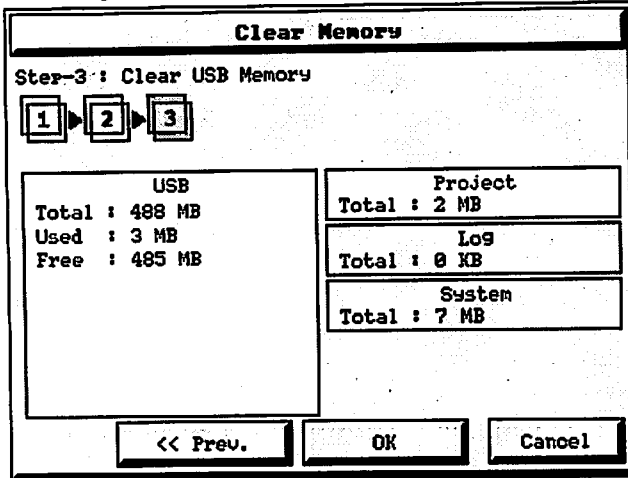
The selected memory area is highlighted. Pressing again un-selects it.

The Next >> button is now enabled.

Pressing Cancel will un-select the file(s).

Press the Next button to continue.

Memory – Clear Memory (cont'd)

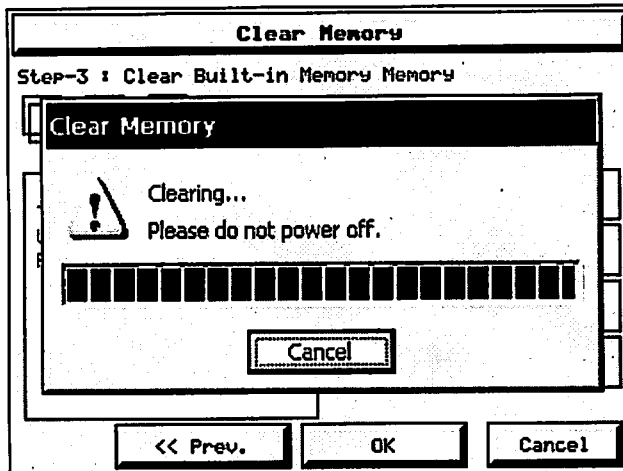


The data file(s) selected to clear are checked. If the data file is good, then the OK button can be pressed to start the clear procedure.

If there is a problem with the data file, the OK button will remain grayed out and the user can return to the previous screen by pressing the << Prev button.

5

Press the OK button to continue.



This message is displayed during the clearing process. Press the Cancel button to abort the clearing.

The following text is shown in the clearing progress message box:

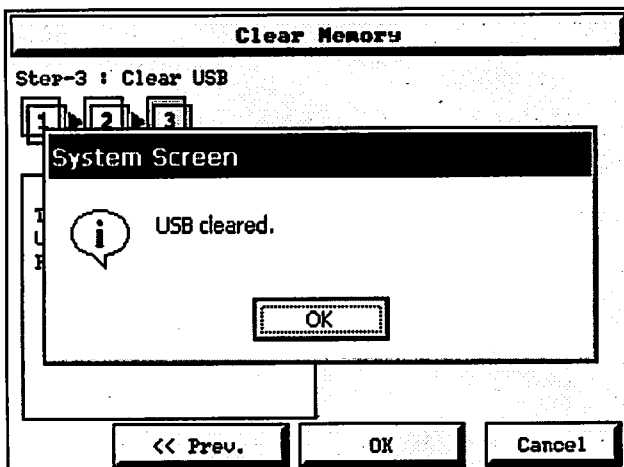
Clearing Built-in Memory:
"Please do not Power Off"

Clearing USB Memory:
"Please do not Power Off or Remove USB"

Clearing CF1 or CF2
"Please do not Power Off or Remove CF"



WARNING: During the clearing process, do not power off the touch panel or remove the memory device.



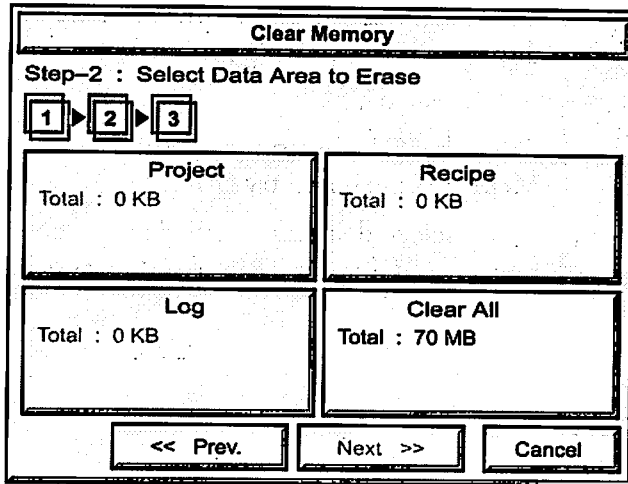
The following message is displayed when the clearing process is complete:

"%Device% cleared"

%Device% will show either "CF1", "CF2", or "USB".

Press the OK button to return to the Memory Menu screen.

Memory – Clear Memory (cont'd)



The following is an example of Clear All selected for clearing.

The selected device is highlighted.

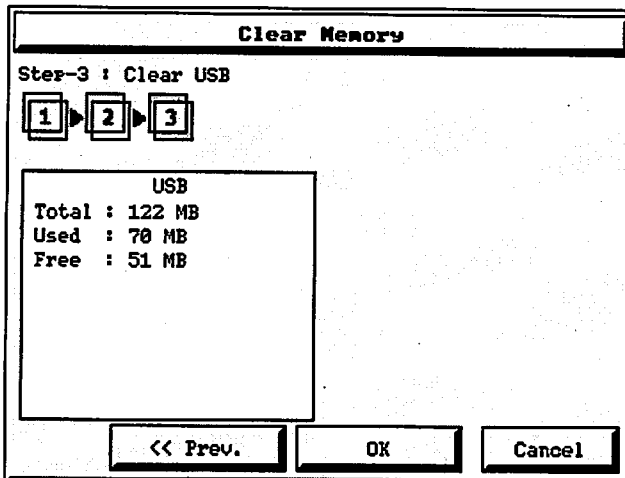
The Next >> button is now enabled.

Pressing Cancel will un-select the Clear All.

5



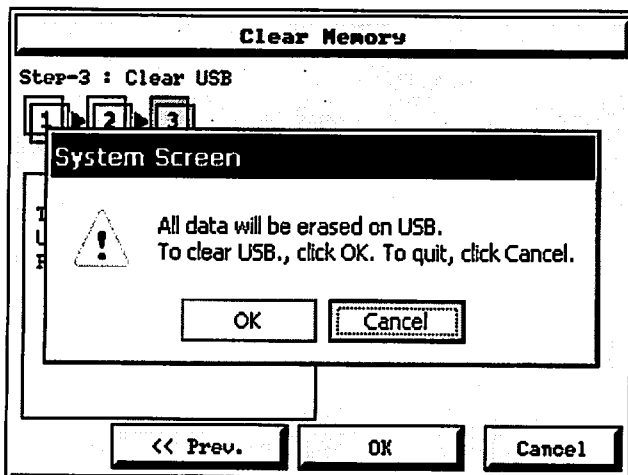
Note: If Clear All is selected, all files will be erased from the memory device, even those not related to the C-more touch panel.



The data file(s) selected to clear are checked. If the data file is good, then the OK button can be pressed to start the clear procedure.

If there is a problem with the data file, the OK button will remain grayed out and the user can return to the previous screen by pressing the << Prev button.

Press the OK button to continue.

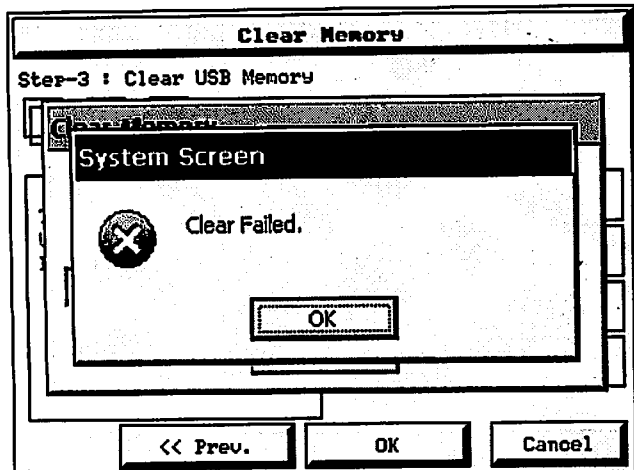


The warning message shown here will be displayed to give the user the opportunity to decide if they want to proceed or not.

Press the OK button to continue.

The Clear All process will start with a warning message as seen in the first example and continue until a message saying the device is cleared or a warning message as shown on the next page will appear.

Memory – Clear Memory (cont'd)



The warning message shown here will be displayed if the clearing process fails.

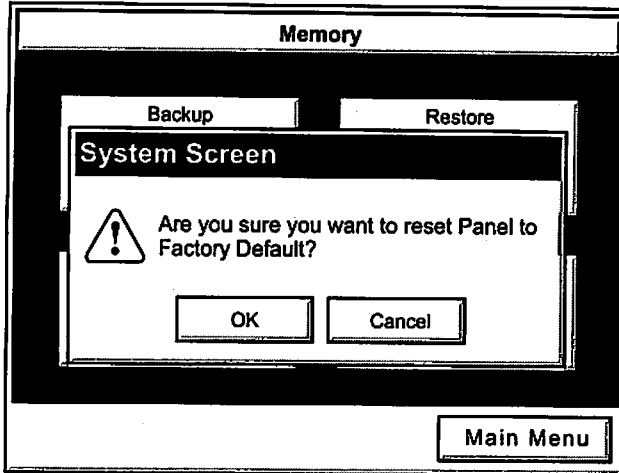
"Clear Failed".

Press the OK button to return to the Clear Memory screen and try again.

If the selected memory still fails to clear, then refer to Chapter 8: Troubleshooting for additional help.

5

Memory – Reset to Factory Default



After pressing the Reset to Factory Default button from the Memory Menu, the message box shown will be displayed.

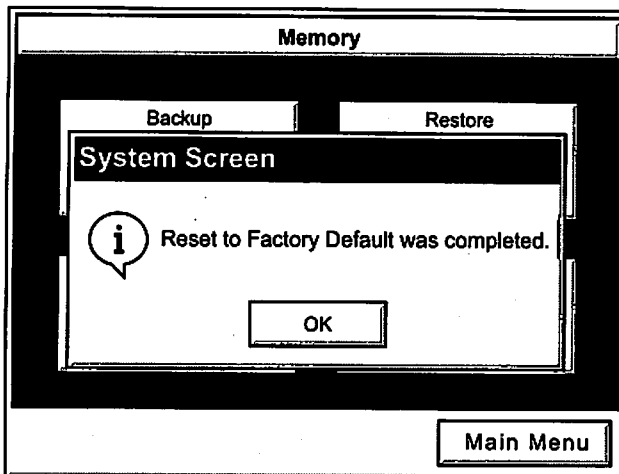
Resetting to the Factory Defaults produces the following actions:

- 1.) The touch screen calibration is reset to the Factory Defaults.
- 2.) The project file is cleared.
- 3.) The log, recipe & WAV files are cleared.
- 4.) The IP address is set to DHCP.

5

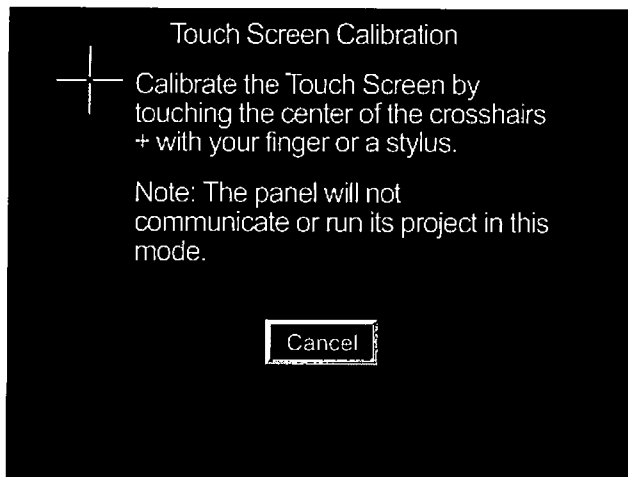


WARNING: Please make a backup file to either a CF or USB memory device using the Memory Backup function before resetting to the Factory Defaults as a precautionary measure.



The message shown here is displayed once the Factory Default values have been stored into the system memory.

Press OK to continue.



After pressing OK, the touch panel will reboot and startup on the Touch Screen Calibration procedure as shown here.

The following note is also shown on the calibration screens to remind the user that the Project File has been cleared, there's no communications with the PLC, and the calibration procedure must be performed in order to ready the panel to download a project:

Note: The panel will not communicate or run its project in this mode.

Also, the *C-more* Programming Software will not connect to the panel in this situation.

PLC COMMUNICATIONS



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Introduction

The *C-more* family of touch panels is capable of communicating with a wide variety of Programmable Logic Controllers. *C-more* is capable of communicating over RS232, RS422 and RS485 serial networks as well as Ethernet networks. It communicates with all controllers in the *Direct LOGIC* family of PLC's utilizing various protocols. *C-more* also communicates with other brands of PLCs by their different protocols. The table on the next page lists all of the various PLCs and protocols that can be configured. The page after the protocol table lists the various serial communication cables that are available to purchase. The rest of this chapter is devoted to show the pin to pin connections of all the available cables plus wiring diagrams that the user can refer to in order to construct their own cables, along with wiring diagrams of cables that are not available for purchase. To simplify RS422/RS485 wiring schemes, we have included wiring diagrams showing connections for available terminal connectors such as our ZIPLink Communication Adapter Module, p/n DN-15TB, used for example with our DL-06 and D2-260 PLCs and *C-more* D-Sub 15-pin to Terminal Block Adapter p/n EA-COMCON-3.

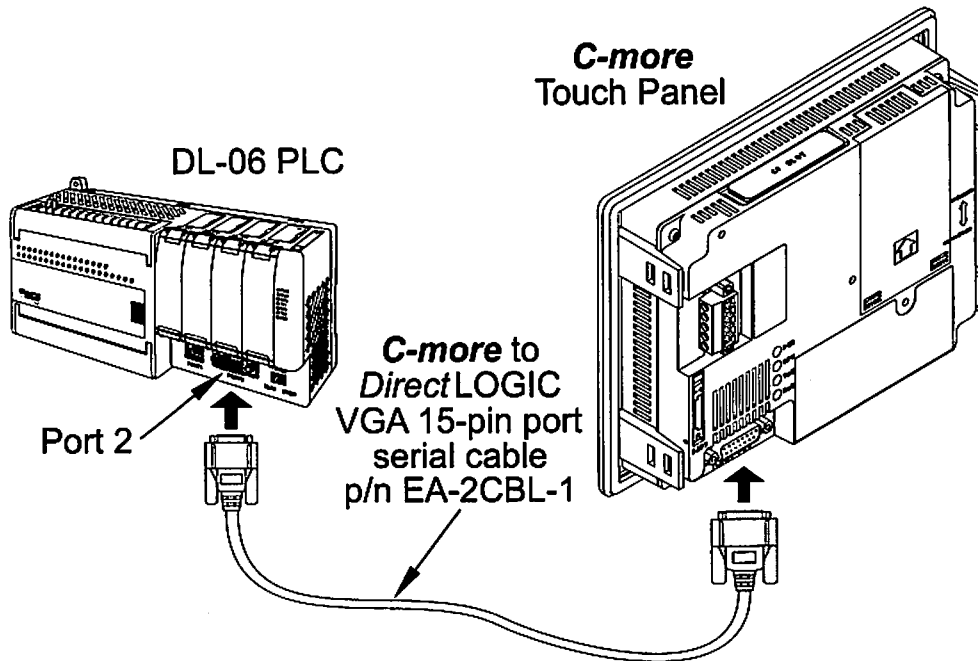
If you have difficulty determining whether the particular PLC and/or protocol you are using will work with the *C-more* series of touch panels, please contact our technical support group at 770-844-4200

6

DirectLOGIC PLCs Password Protection



NOTE: *DirectLogic* PLCs support multi-level password protection of the ladder program. This allows password protection while not locking the communication port to an operator interface. The multilevel password can be invoked by creating a password with an upper case "A" followed by seven numeric characters (e.g. A1234567). Please refer to the specific PLC user manual for further details.



PLC Protocol & Cables

PLC Compatibility Table			
PLC Family	Model	Protocols	
DirectLOGIC	DL05/DL06	all	K-Sequence
			<i>Direct</i> NET
		H0-ECOM/H0-ECOM100	Modbus (Koyo addressing)
			<i>Direct</i> LOGIC Ethernet
	DL105	all	K-Sequence
	DL205	D2-230	K-Sequence
		D2-240	K-Sequence
			<i>Direct</i> NET
		D2-250/D2-250-1/D2-260	K-Sequence
			<i>Direct</i> NET
			Modbus (Koyo addressing)
		D2-240/D2-250-1/D2-260 Using DCM	<i>Direct</i> NET
			Modbus (Koyo addressing)
		H2-ECOM/H2-ECOM100	<i>Direct</i> LOGIC Ethernet
	DL305	D3-330/330P (Requires the use of a Data Communications Unit)	<i>Direct</i> NET
		D3-340	<i>Direct</i> NET
		D3-350	K-Sequence
			<i>Direct</i> NET
			Modbus (Koyo addressing)
		D3-350 DCM	<i>Direct</i> NET
			Modbus (Koyo addressing)
	DL405	D4-430	K-Sequence
			<i>Direct</i> NET
		D4-440	K-Sequence
		<i>Direct</i> NET	
D4-450		K-Sequence	
		<i>Direct</i> NET	
		Modbus (Koyo addressing)	
	All with DCM	<i>Direct</i> NET	
		Modbus (Koyo addressing)	
	H4-ECOM/H4-ECOM100	<i>Direct</i> LOGIC Ethernet	
	H2-WinPLC (Think & Do) Live V5.2 or later and Studio any version	Think & Do Modbus RTU (serial port)	
	H2-WinPLC (Think & Do) Live V5.5.1 or later and Studio V7.2.1 or later	Think & Do Modbus TCP/IP (Ethernet port)	

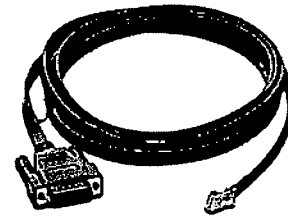
PLC Compatibility Table continued on the next page.

PLC Protocol & Cables (cont'd)

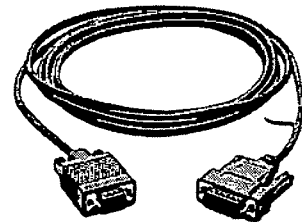
PLC Compatibility Table (cont'd)		
PLC Family	Model	Protocols
Allen-Bradley	MicroLogix 1000, 1100, 1200, 1500, SLC 5-01/02/03, PLC5	DH485/AIC/AIC+
	MicroLogix 1000, 1100, 1200 and 1500	DF1 Half Duplex; DF1 Full Duplex
	SLC 5-03/04/05	
	ControlLogix™, CompactLogix™, FlexLogix™	DF1 Full Duplex
	PLC-5	
	ControlLogix, CompactLogix, FlexLogix - Tag Based	DF1 Half Duplex; DF1 Full Duplex
	ControlLogix, CompactLogix, FlexLogix - Generic I/O Messaging	EtherNet/IP Server
	ControlLogix, CompactLogix, FlexLogix - Tag Based	EtherNet/IP Client
	MicroLogix 1100 & SLC 5/05, both via native Ethernet port	
MicroLogix 1000, 1100, 1200, 1500, SLC 5-03/04/05, all via ENI adapter		
Modbus TCP/IP	Modbus TCP/IP devices	Modbus TCP/IP
GE	90/30, 90/70, Micro 90, VersaMax Micro	SNPX
Mitsubishi	FX Series	FX Direct
Omron	C200 Adapter, C500	Host Link
	CJ1/CS1 Serial	FINS
	CJ1/CS1 Ethernet	
Modicon	984 CPU, Quantum 113 CPU, AEG Modicon Micro Series 110 CPU: 311-xx, 411-xx, 512-xx, 612-xx	Modbus RTU
Siemens	S7-200 CPU, RS-485 Serial	PPI
	S7-300, Ethernet	Ethernet ISO over TCP

PLC Communication Cables & Wiring Diagrams

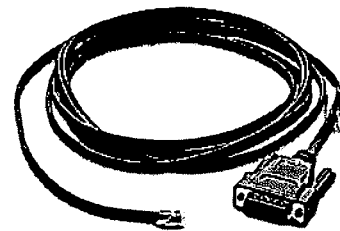
Purchased Cable Description	Cable Part Number
DirectLOGIC PLC RJ-12 port, DL05, DL06, DL105, DL205, D3-350, D4-450 & H2-WINPLC (RS-232C)	EA-2CBL
DirectLOGIC (VGA Style) 15-pin port, DL06, D2-250 (250-1), D2-260 (RS-232C)	EA-2CBL-1
DirectLOGIC PLC RJ-11 port, D3-340 (RS-232C)	EA-3CBL
DirectLOGIC DL405 PLC 15-pin D-sub port, DL405 (RS-232C)	EA-4CBL-1
DirectLOGIC PLC 25-pin D-sub port, DL405, D3-350, DL305 DCU and all DCM's (RS-232C)	EA-4CBL-2
Allen-Bradley MicroLogix 1000, 1100, 1200 & 1500 (RS-232C)	EA-MLOGIX-CBL
Allen-Bradley SLC 5-03/04/05, ControlLogix, CompactLogix, FlexLogix DF1 port (RS-232C)	EA-SLC-232-CBL
Allen-Bradley PLC-5 DF1 port (RS-232C)	EA-PLC5-232-CBL
Allen-Bradley MicroLogix, SLC 5-01/02/03, PLC5 DH485 port (RS-232C)	EA-DH485-CBL
GE 90/30, 90/70, Micro 90, VersaMax Micro 15-pin D-sub port (RS-422A)	EA-90-30-CBL
MITSUBISHI FX Series 25-pin port (RS-422A)	EA-MITSU-CBL
MITSUBISHI FX Series 8-pin mini-DIN (RS-422A)	EA-MITSU-CBL-1
OMRON Host Link C200 Adapter, C500 (RS-232C)	EA-OMRON-CBL



Part No. EA-2CBL



Part No. EA-2CBL-1



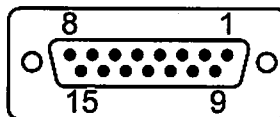
Part No. EA-3CBL



NOTE 1: The above list of pre-made communications cables may be purchased. See further in this chapter for wiring diagrams of additional **user constructed cables**. This chapter also includes wiring diagrams for the pre-made cables.

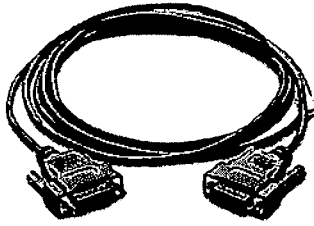
NOTE 2: EZTouch serial PLC communication cables are compatible with **C-more touch panels**.

C-more PLC Serial Communications Port

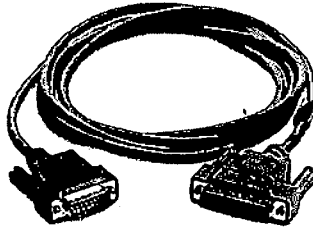


D-Sub 15-pin female on rear of touch panel

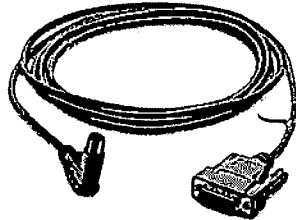
PLC Communication Cables & Wiring Diagrams



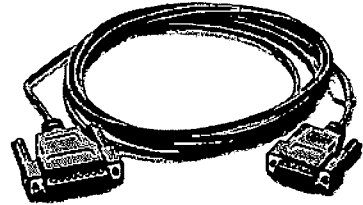
Part No. EA-4CBL-1



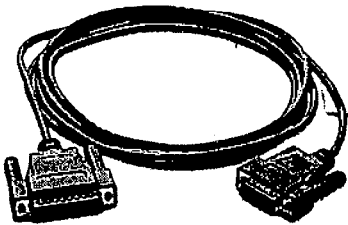
Part No. EA-4CBL-1



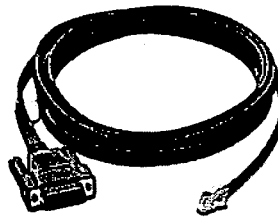
Part No. EA-MLOGIX-CBL



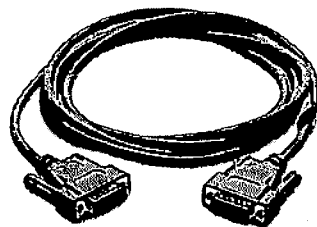
Part No. EA-SLC-232-CBL



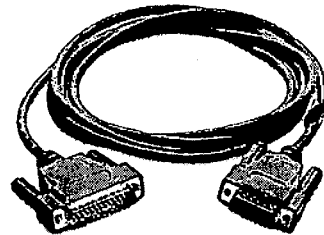
Part No. EA-PLC5-232-CBL



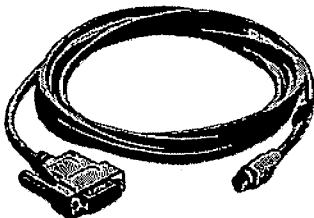
Part No. EA-DH485-CBL



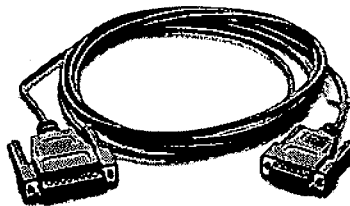
Part No. EA-90-30-CBL



Part No. EA-MITSU-CBL



Part No. EA-MITSU-CBL-1



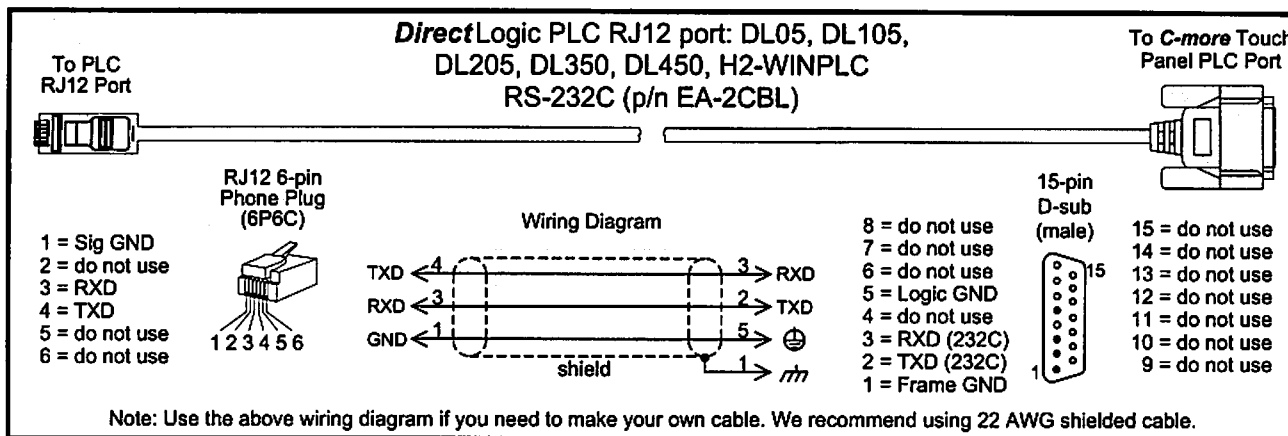
Part No. EA-OMRON-CBL

PLC Communication Cables & Wiring Diagrams (cont'd)

The following series of wiring diagrams show the connectors and wiring details for the communication cables that are used between the *C-more* touch panels and various PLC controllers. Part numbers are included with the pre-made cables that can be purchased from *AutomationDirect*. The information presented will allow the user to construct their own cables if so desired.

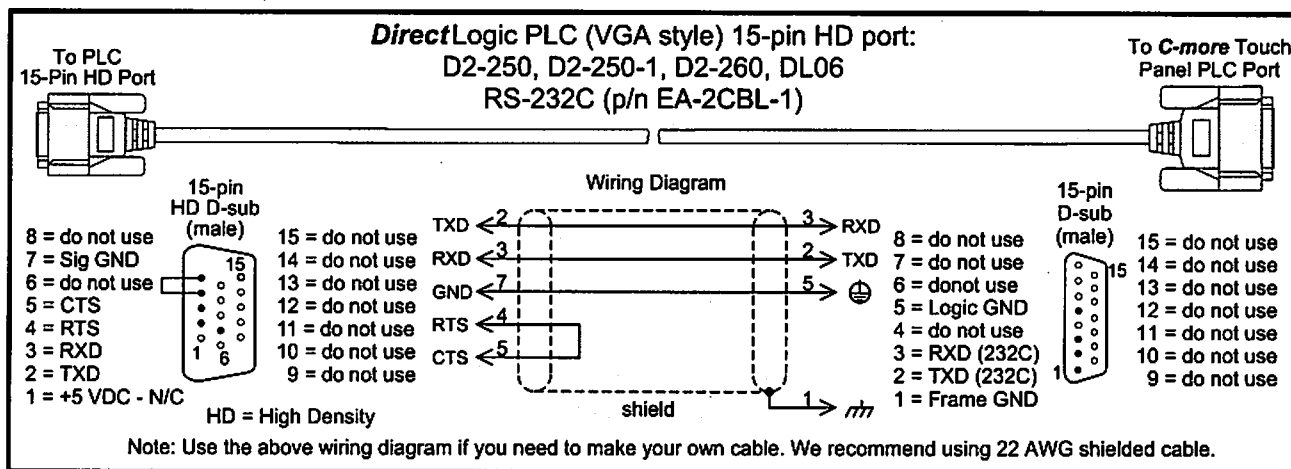
DirectLOGIC PLCs RS-232C Serial:

EA-2CBL



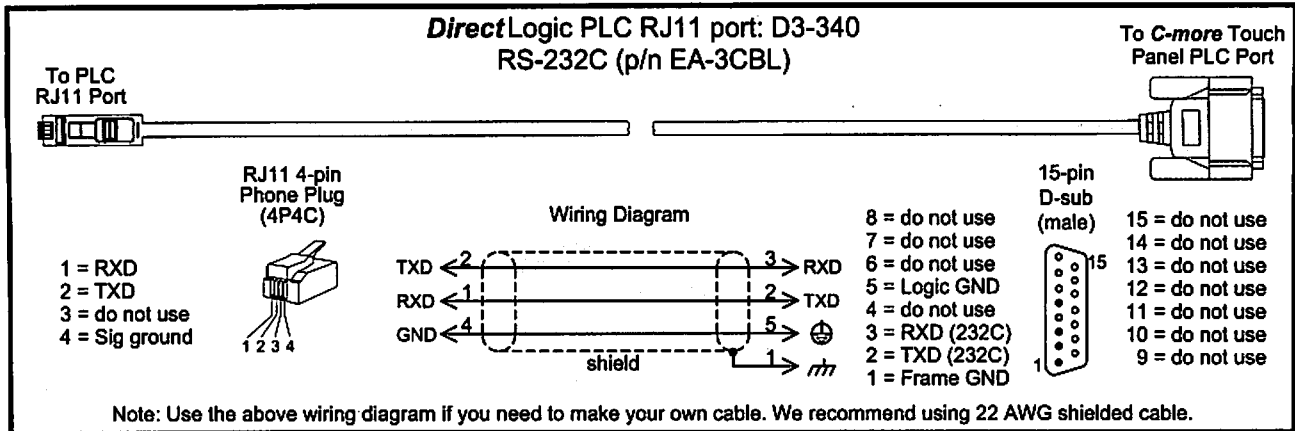
6

EA-2CBL-1



Direct LOGIC PLCs RS-232C Serial (cont'd):

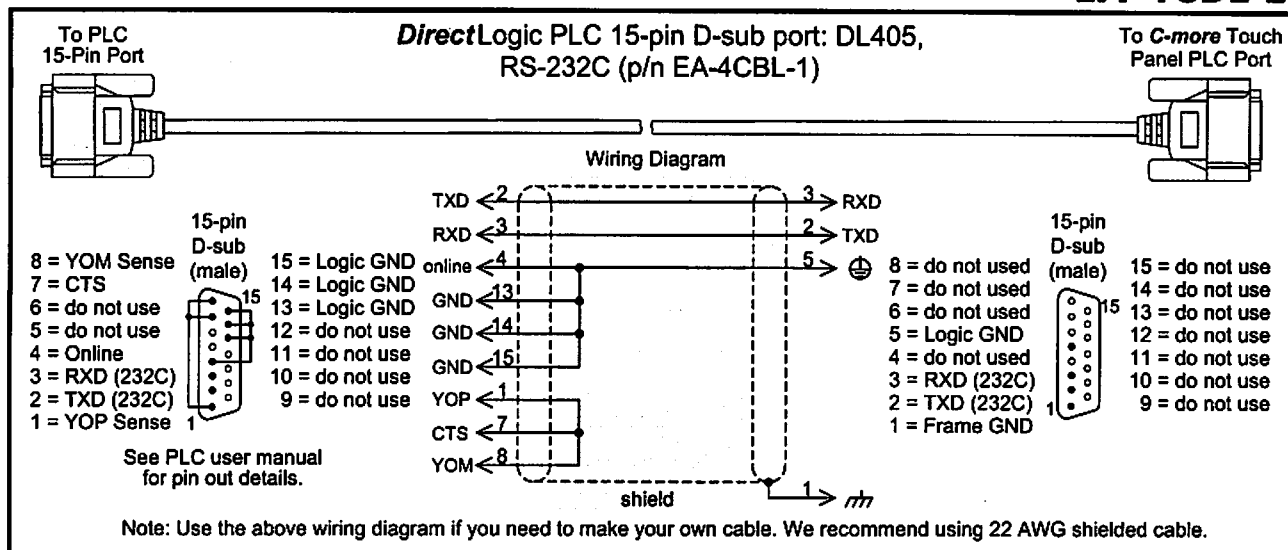
EA-3CBL



6

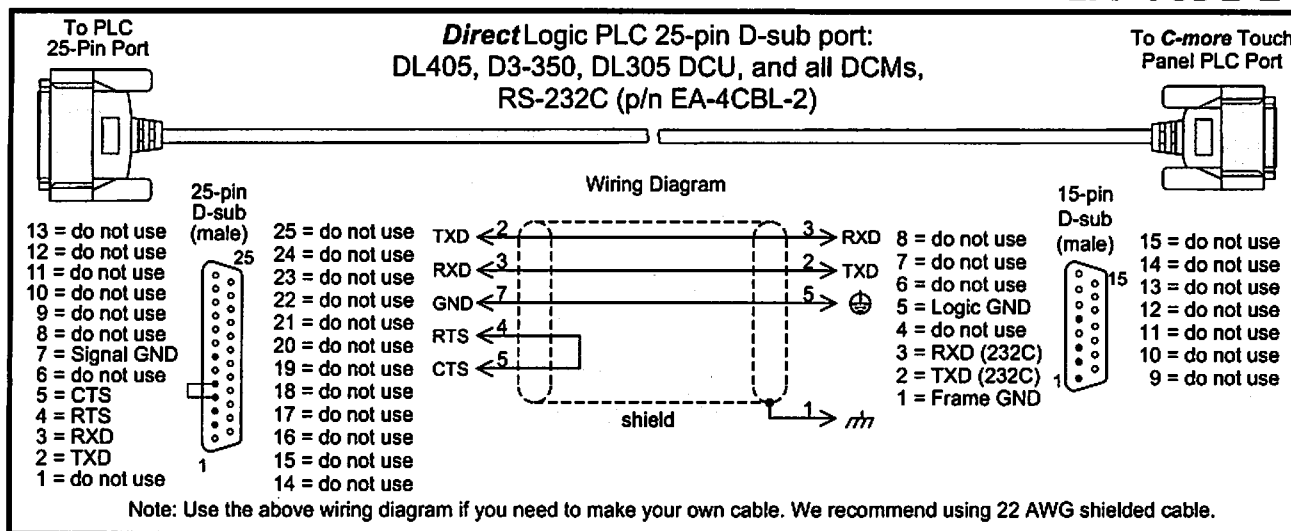
Direct LOGIC PLCs RS-232C Serial (cont'd):

EA-4CBL-1



6

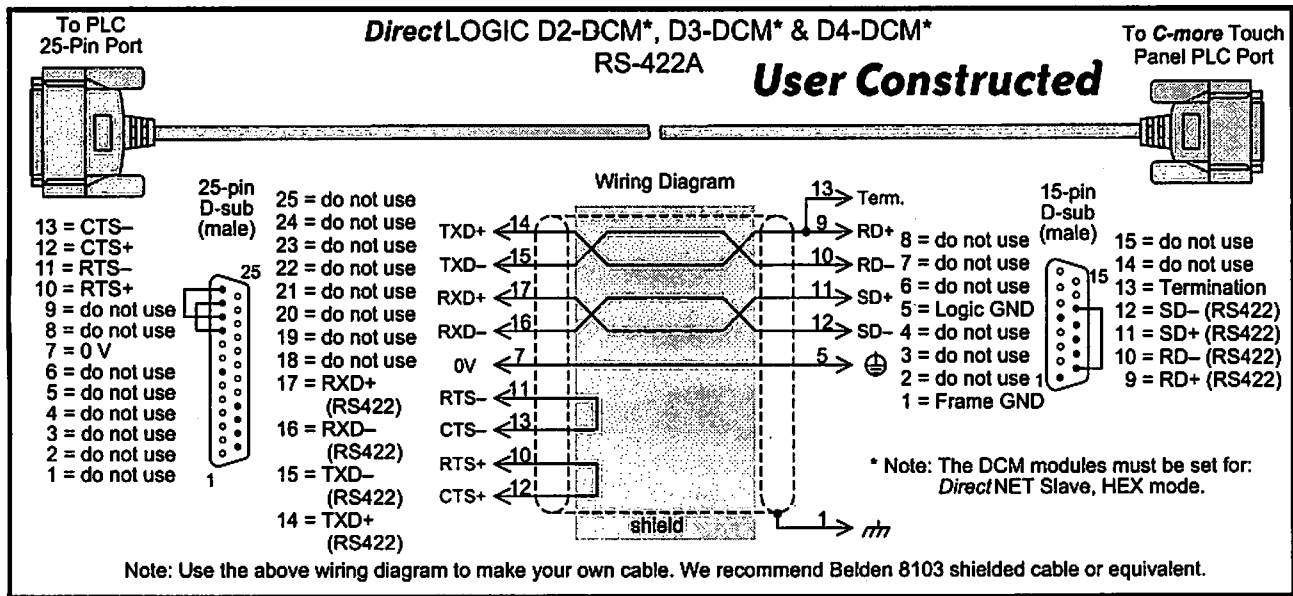
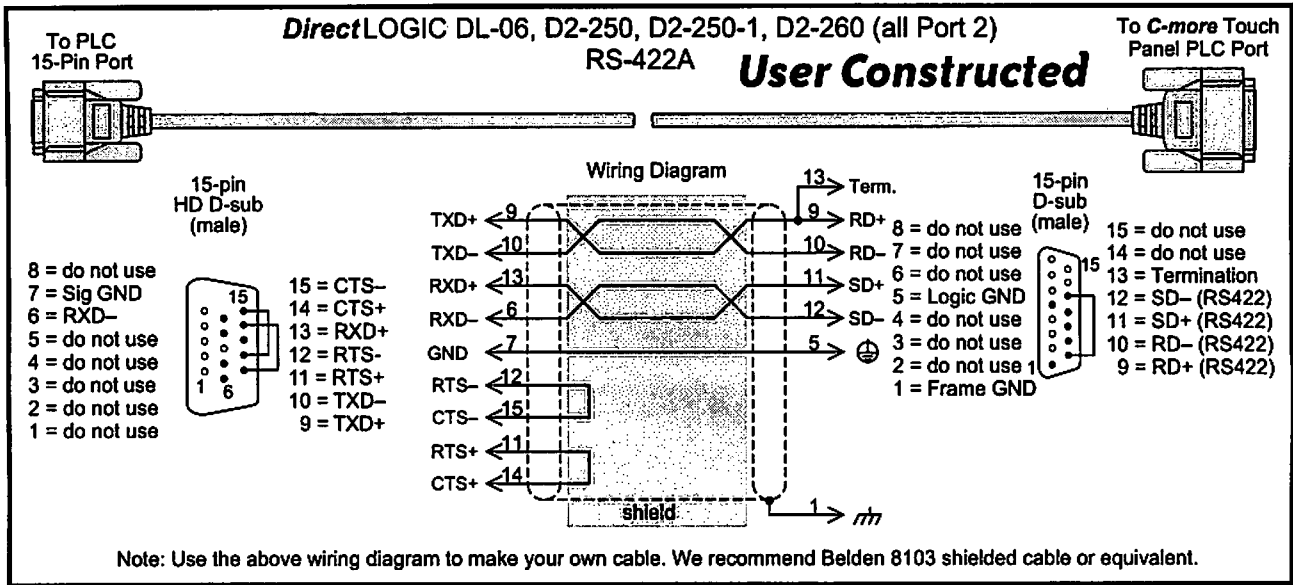
EA-4CBL-2



Direct LOGIC PLCs RS-422A/RS-485A:

When using the RS-422A/RS-485A capabilities of the *C-more* PLC communications port, the termination resistor is placed between the RXD- and RXD+ terminals on the PLC side of the connection between the touch panel and PLC. The Termination Resistor value is based on the characteristic impedance of the cable being used. To enable the built-in 120 Ohm Termination Resistor, jumper pin 13 to pin 9 (RXD+) on the *C-more* 15-pin PLC communications port.

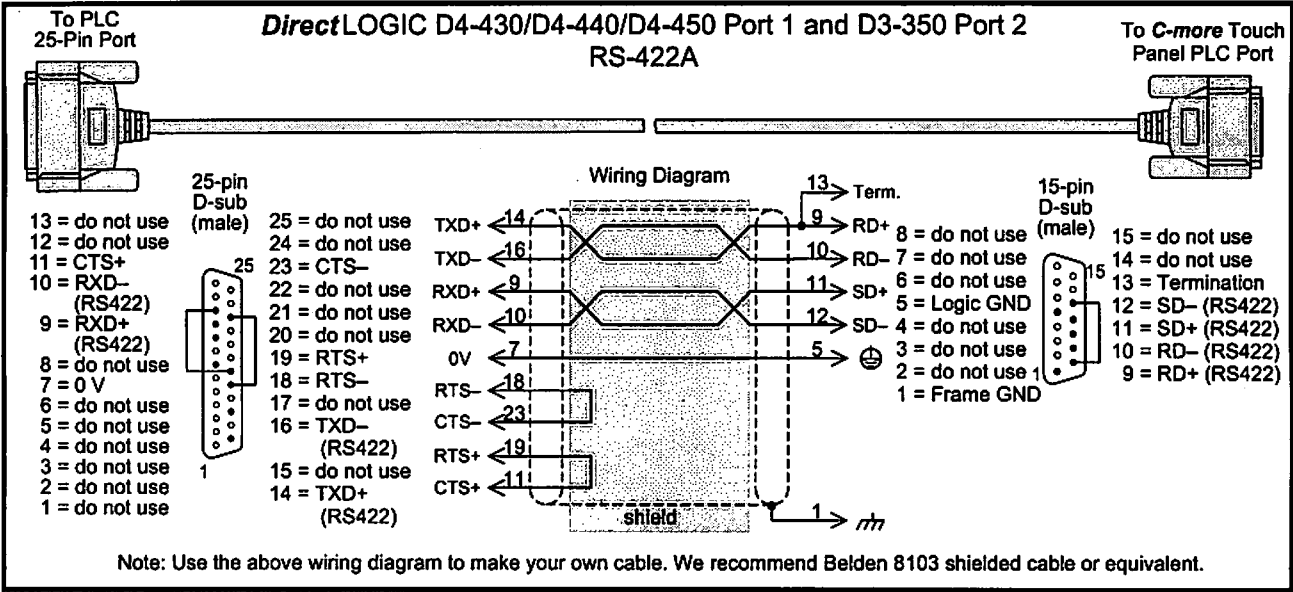
6



NOTE: The RS-422 wiring diagrams shown above are not for multi-drop networks involving connecting more than one PLC to a panel. Refer to the wiring diagram example on page 6-14 if more than one PLC will be connected to a panel.

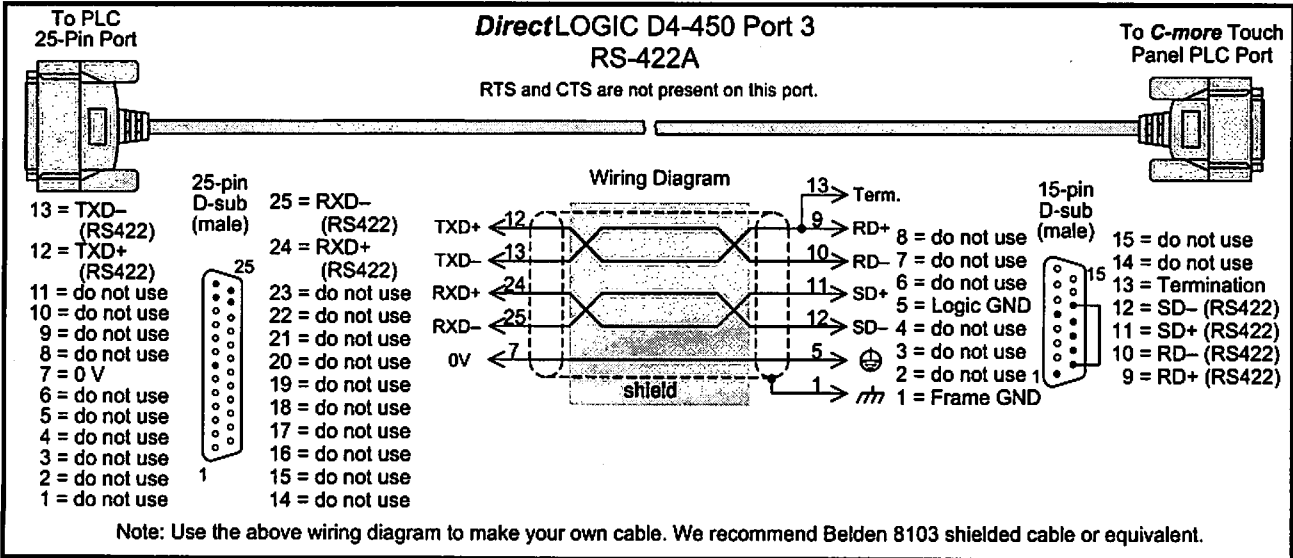
Direct LOGIC PLCs RS-422A/RS-485A (cont'd):

User Constructed



6

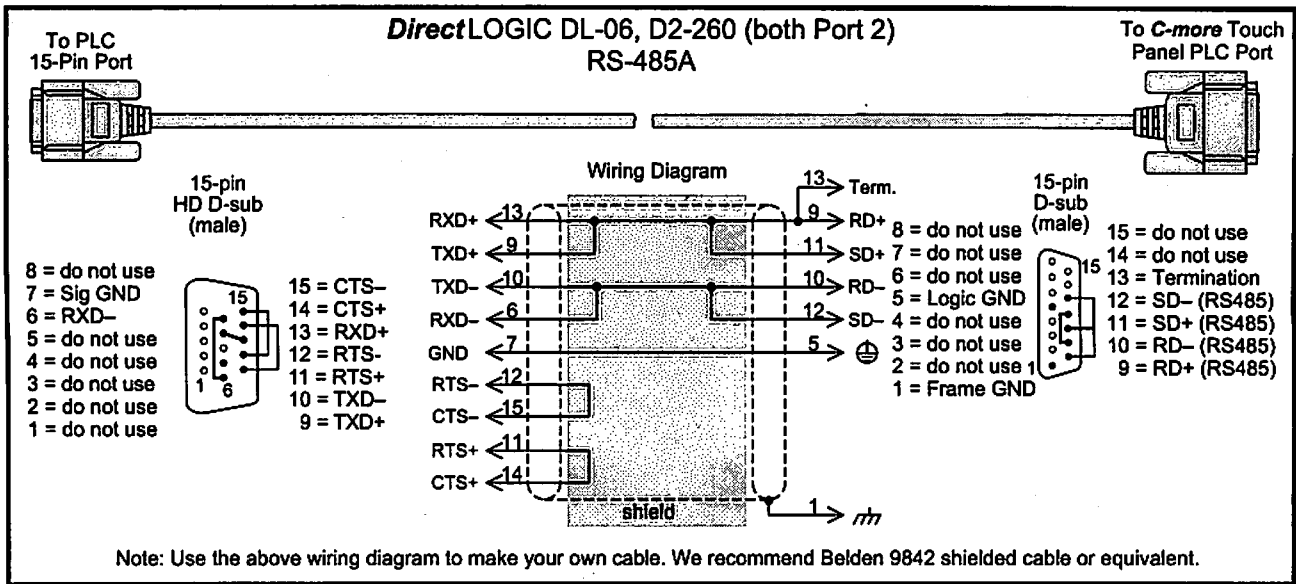
User Constructed



NOTE: The RS-422 wiring diagrams shown above are not for multi-drop networks involving connecting more than one PLC to a panel. Refer to the wiring diagram example on page 6-14 if more than one PLC will be connected to a panel.

Direct LOGIC PLCs RS-422A/RS-485 (cont'd):

User Constructed

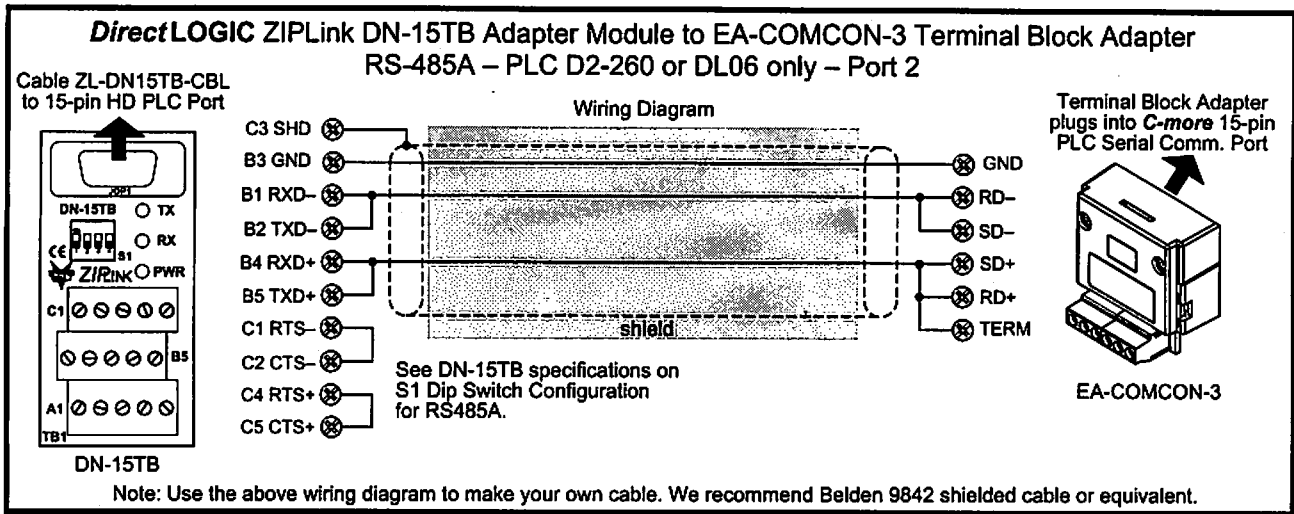


6

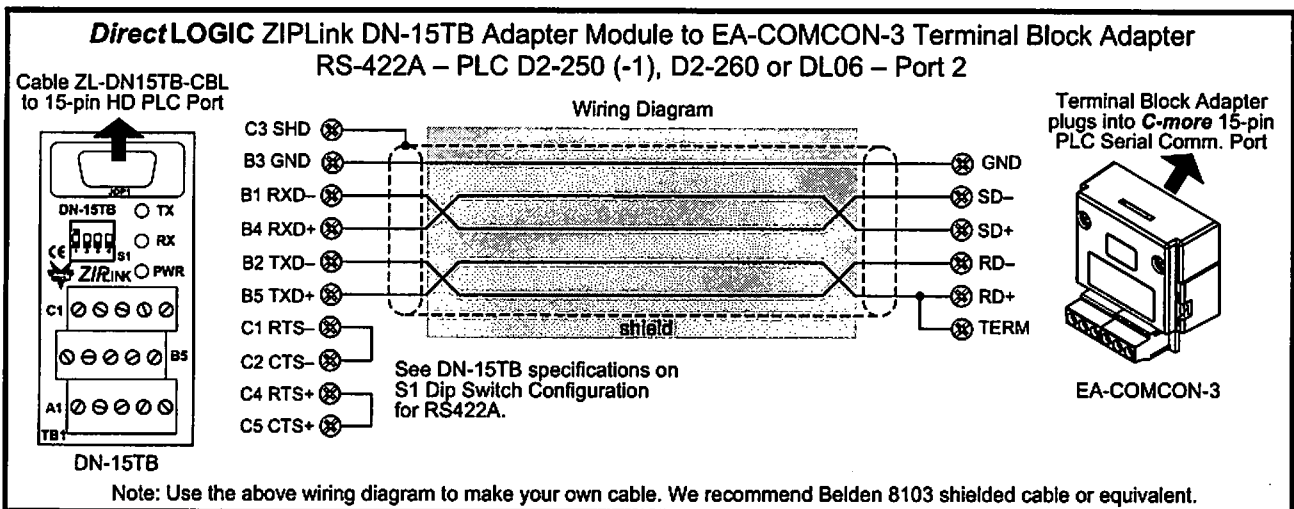


NOTE: The RS-485 wiring diagram shown above is not for multi-drop networks involving connecting more than one PLC to a panel. Refer to the wiring diagram example on page 6-16 if more than one PLC will be connected to a panel.

Direct LOGIC PLCs RS-422A/RS-485A (cont'd):



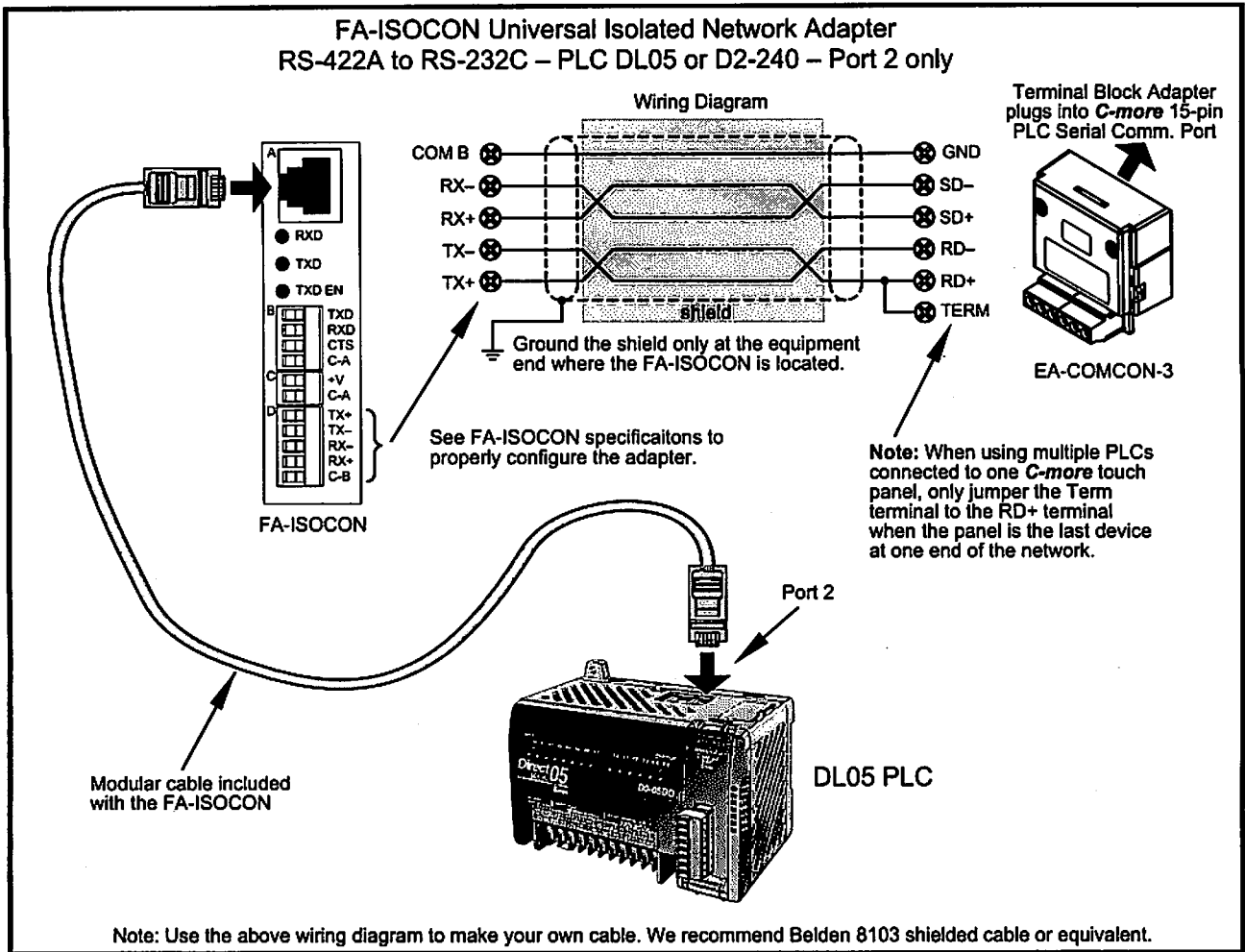
6



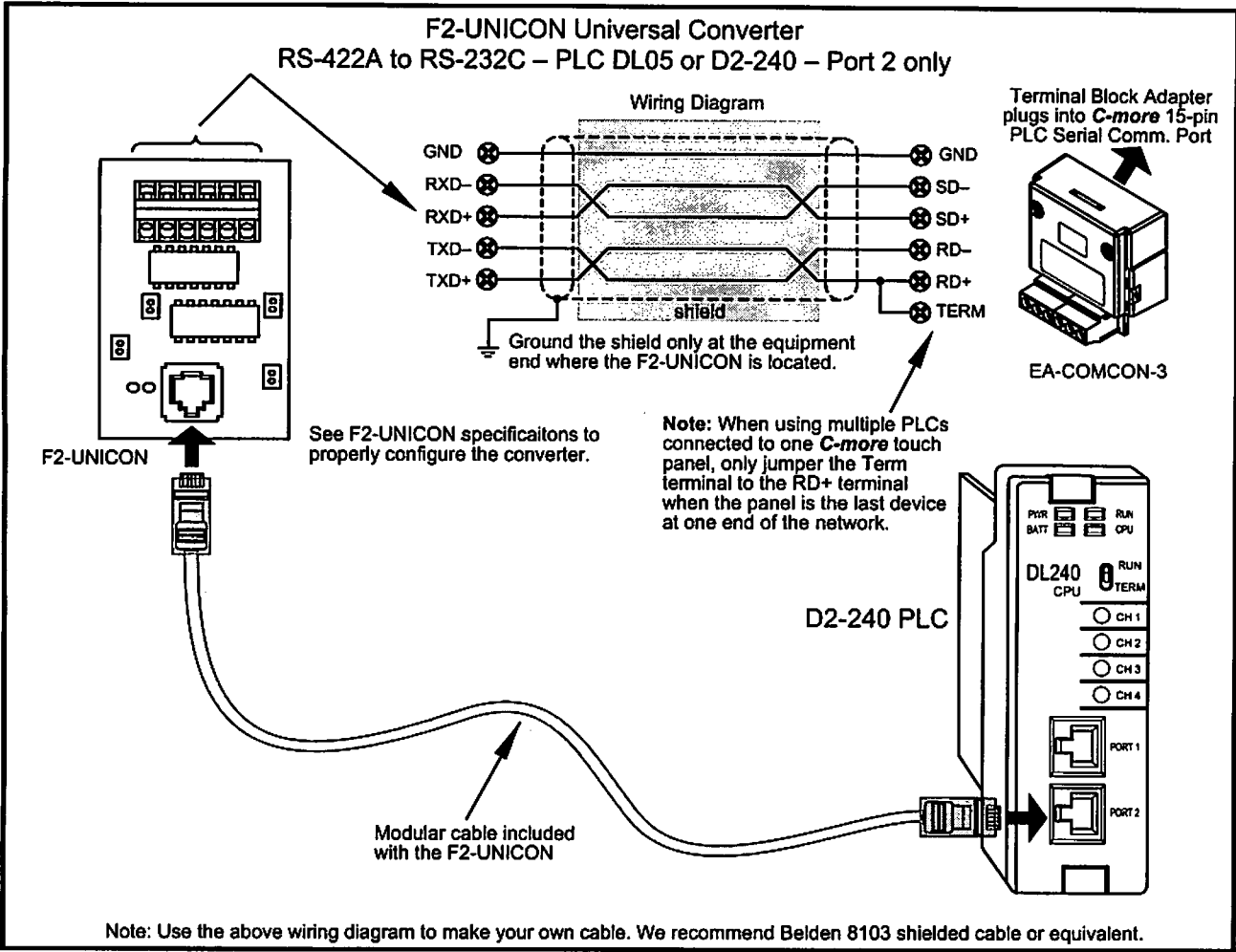
NOTE: The RS-422 and RS-485 wiring diagrams shown above are not for multi-drop networks involving connecting more than one PLC to a panel. Refer to the wiring diagram examples starting on page 6-14 if more than one PLC will be connected to a panel.

DirectLOGIC Universal Isolated Network Adapter, p/n FA-ISOCON:

6

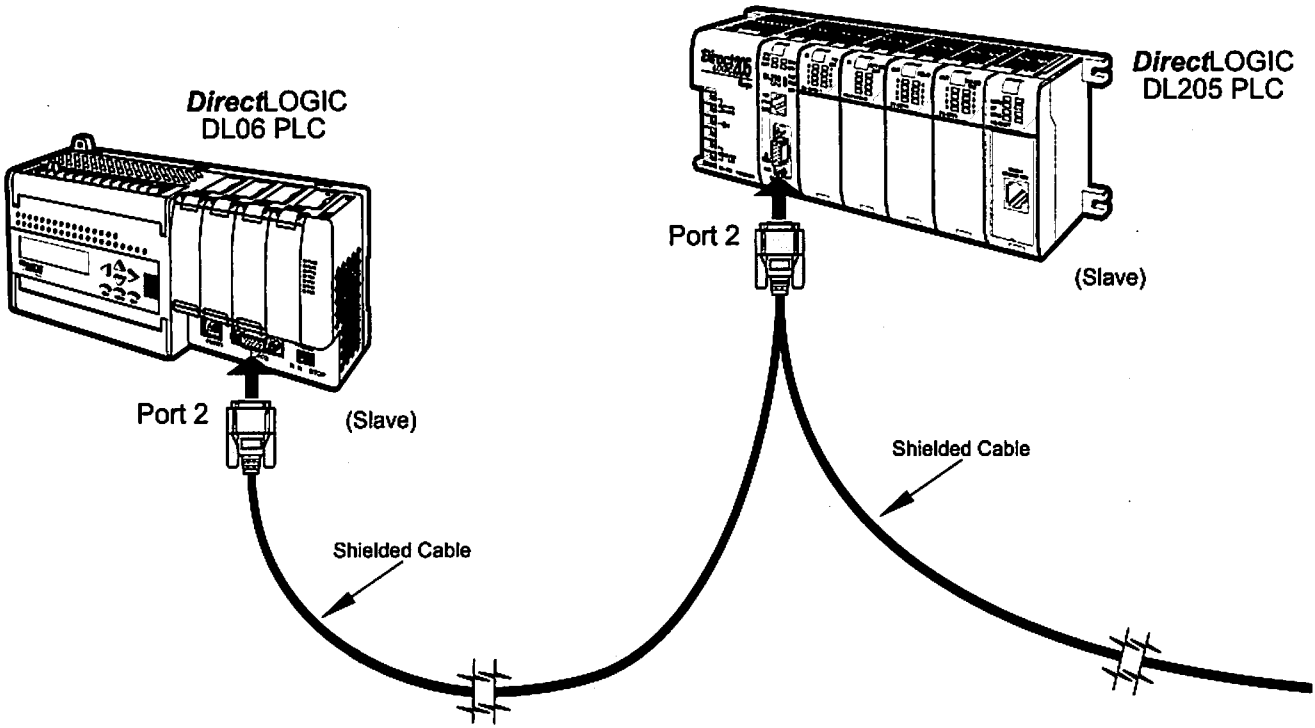


Direct LOGIC Universal Converter, p/n F2-UNICON:

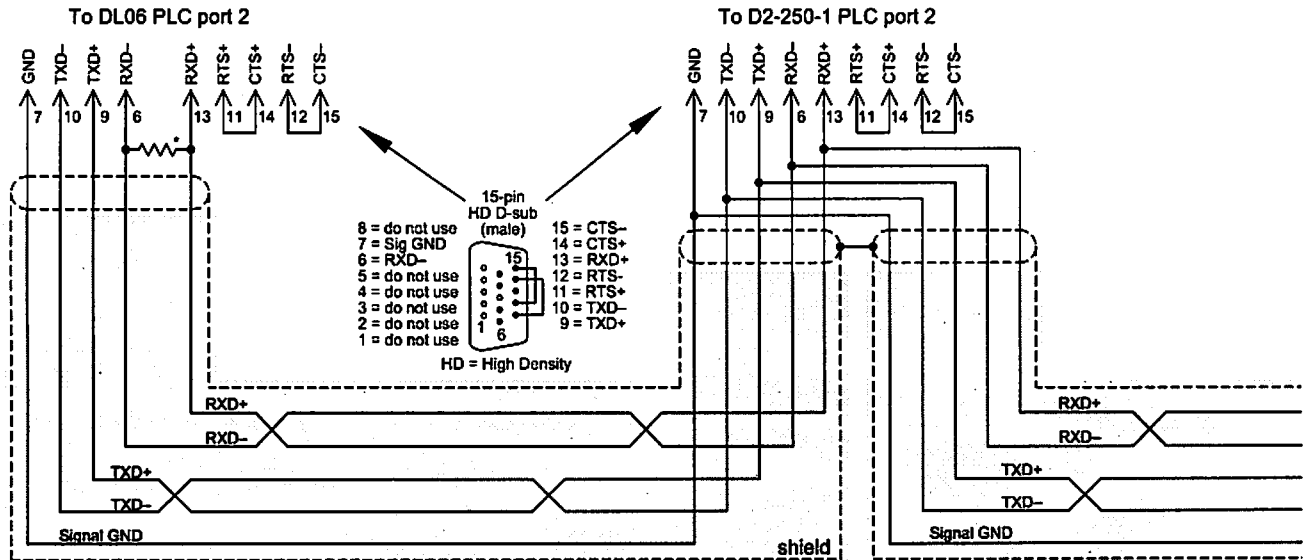


RS-422A/RS-485A Multi-Drop Wiring Diagram Examples

6



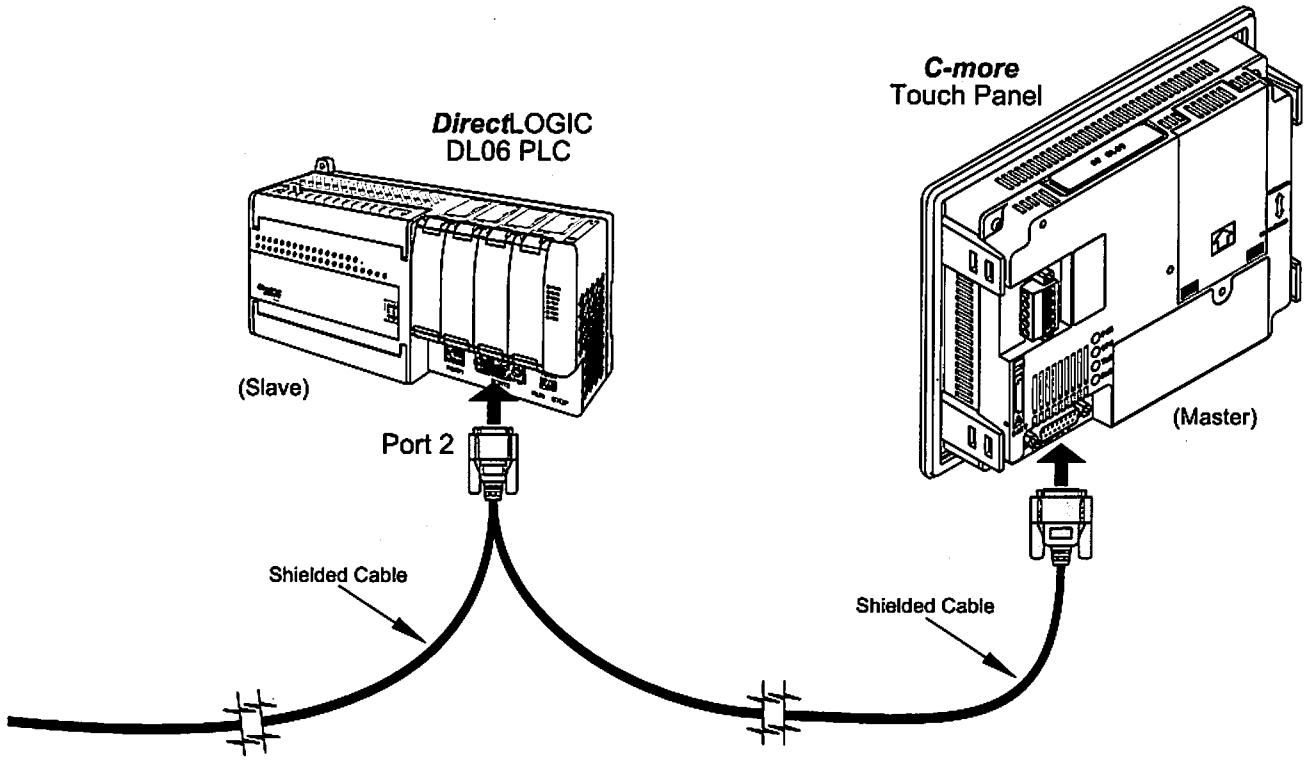
Note: We recommend Belden 8103 shielded cable or equivalent.



* Termination resistors required at both ends of the network receive data signals to match the impedance of the cable (between 100 and 500 ohms).

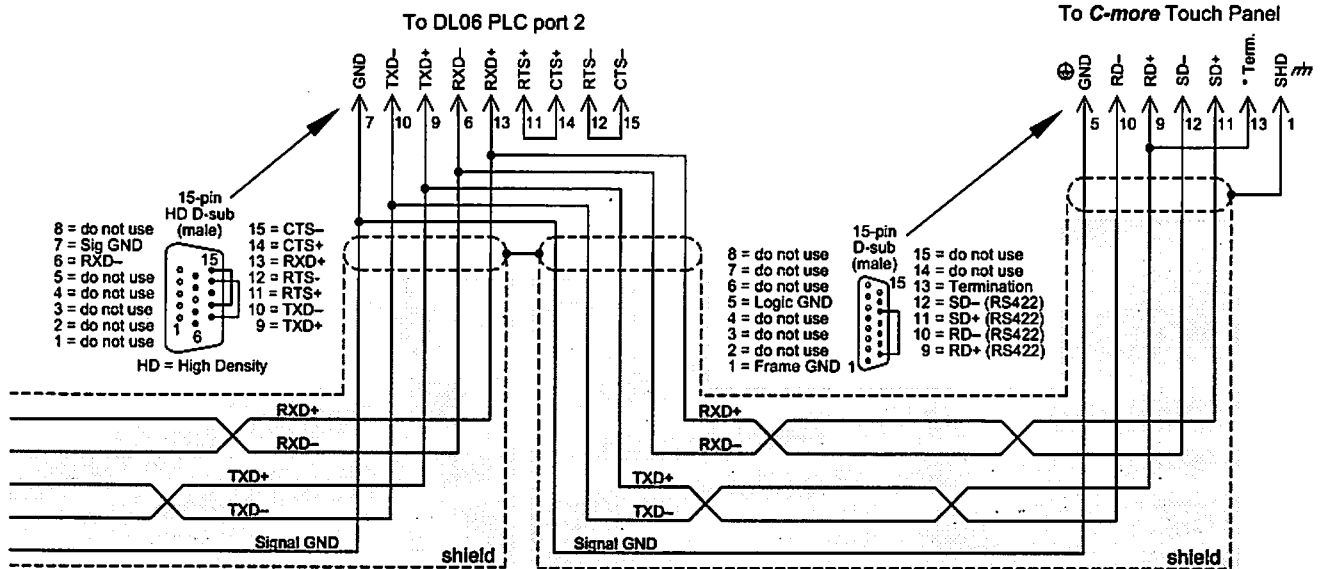
Typical RS-422 Multi-Drop Wiring Diagram

RS-422A/RS-485A Multi-Drop Wiring Diagram Examples (cont'd)



6

Note: We recommend Belden 8103 shielded cable or equivalent.

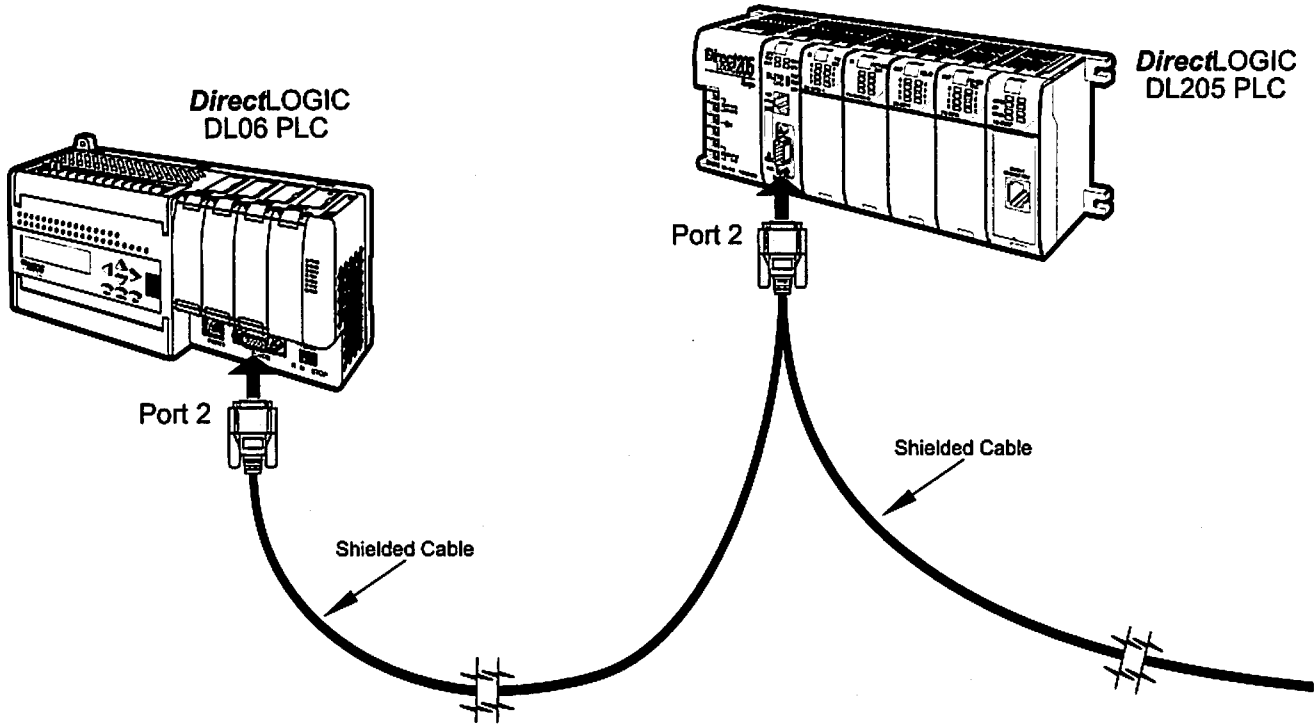


Typical RS-422 Multi-Drop Wiring Diagram (cont'd)

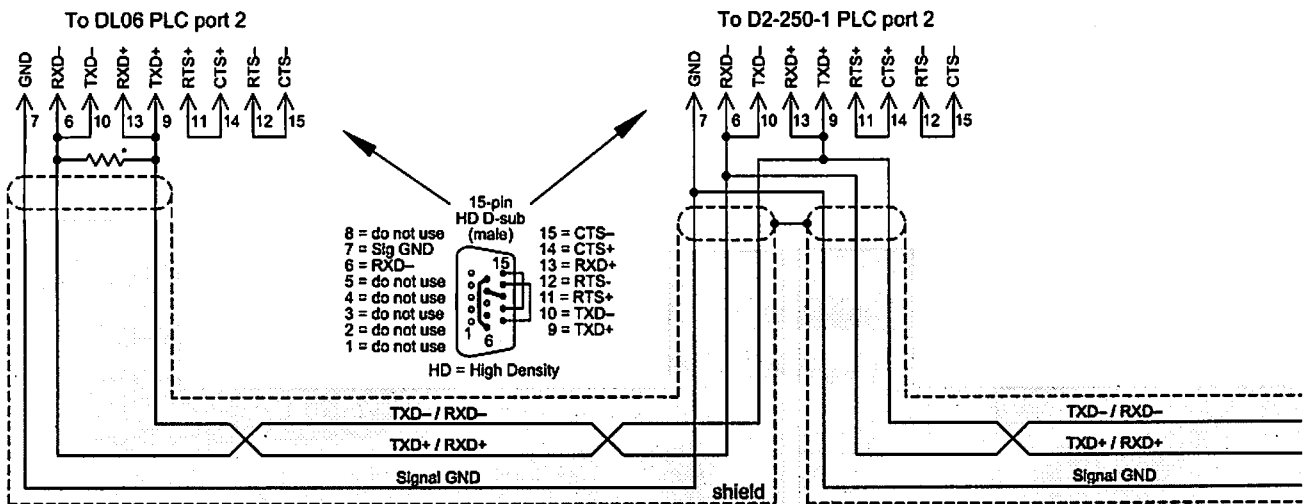
* Termination resistors required at both ends of the network receive data signals to match the impedance of the cable (between 100 and 500 ohms). Jumper pin 13 to 9 on the C-more Touch Panel 15-pin connector to place the 120Ω internal resistor into the network. If the cable impedance is different, then use an external resistor matched to the cable impedance.

RS-422A/RS-485 Multi-Drop Wiring Diagram Examples (cont'd)

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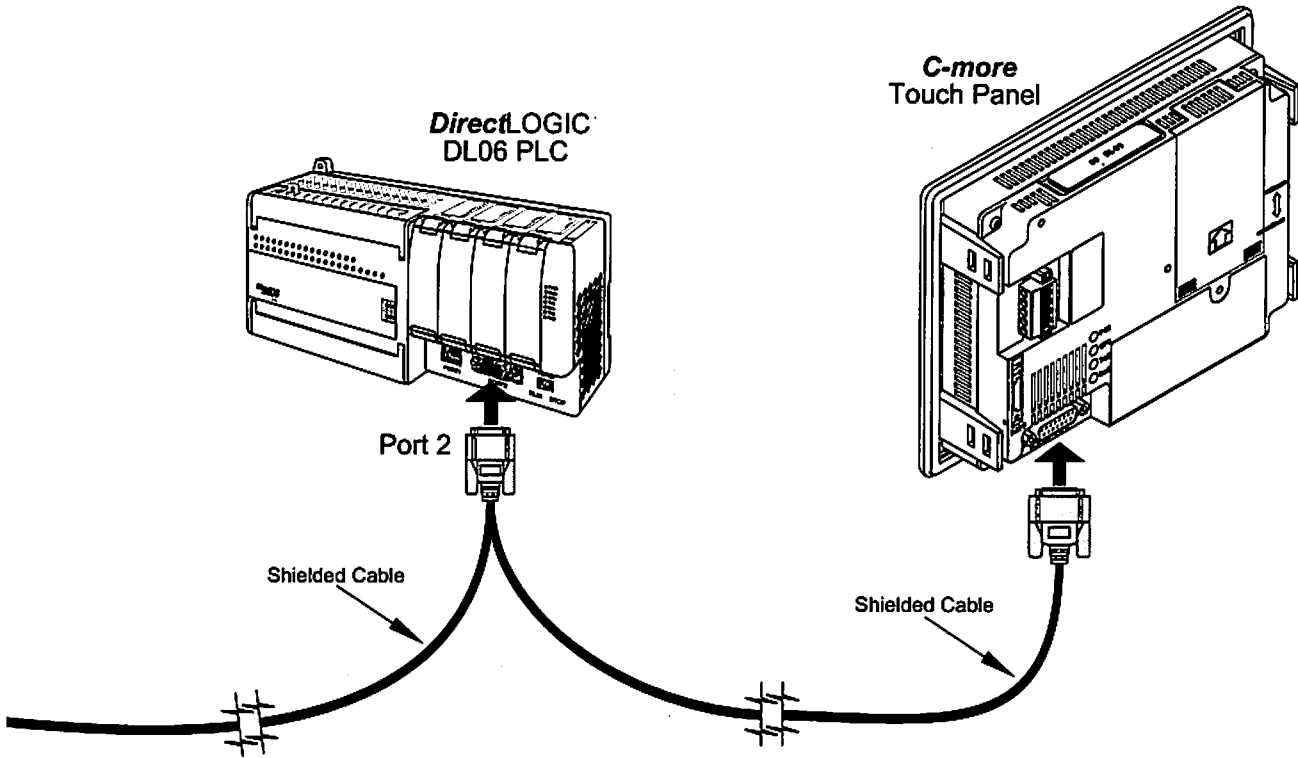
Note: We recommend Belden 88102 shielded cable or equivalent.



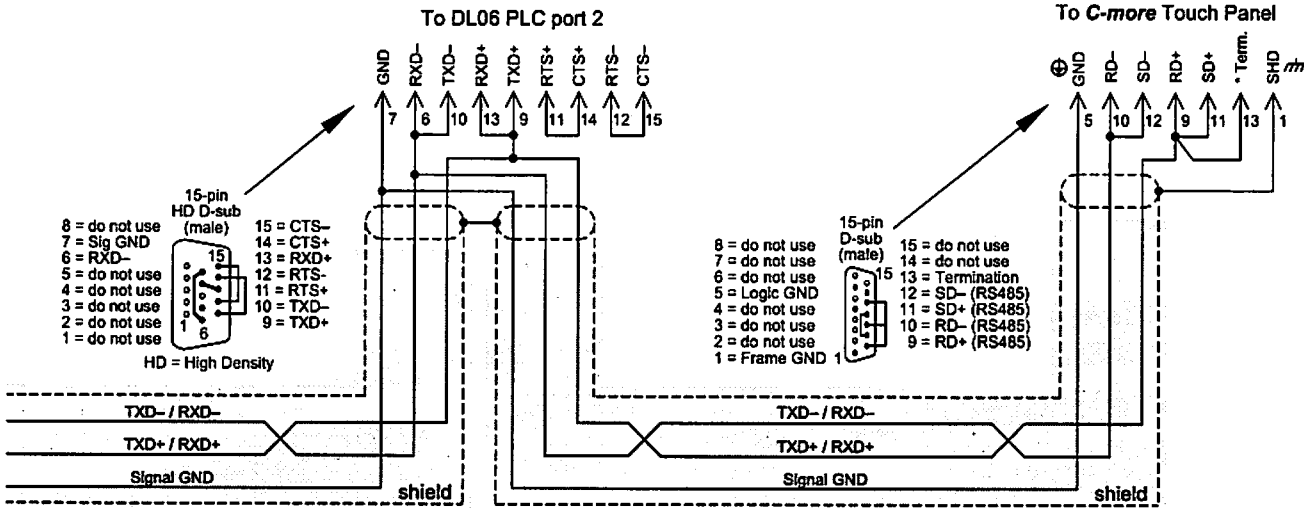
* Termination resistors required at both ends of the network to match the impedance of the cable (between 100 and 500 ohms).

Typical RS-485 Multi-Drop Wiring Diagram

RS-422A/RS-485 Multi-Drop Wiring Diagram Examples (cont'd)



Note: We recommend Belden 88102 shielded cable or equivalent.

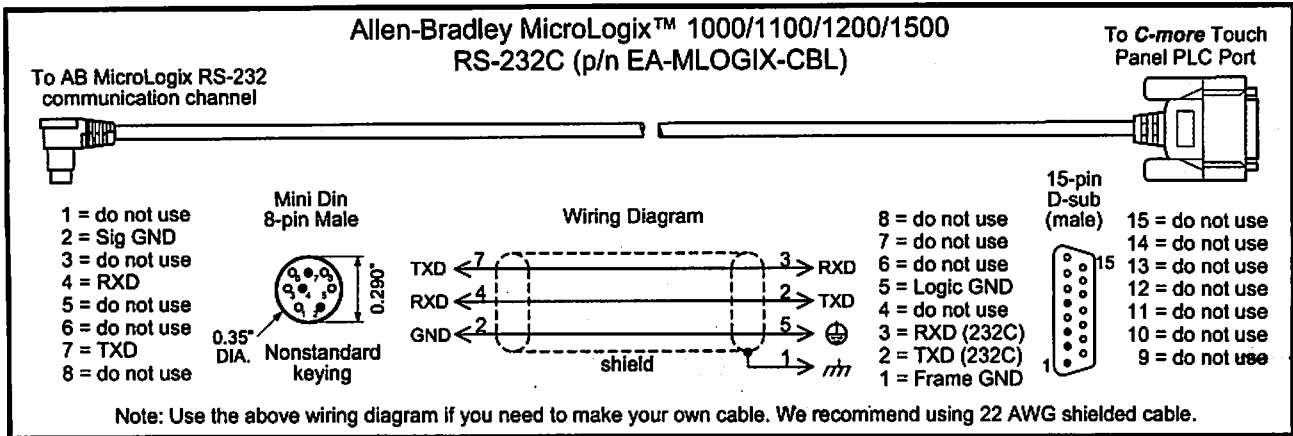


* Termination resistors required at both ends of the network receive data signals to match the impedance of the cable (between 100 and 500 ohms). Jumper pin 13 to 9 on the C-more EA-MG-SP1 15-pin connector to place the 120Ω internal resistor into the network. If the cable impedance is different, then use an external resistor matched to the cable impedance.

Typical RS-485 Multi-Drop Wiring Diagram (cont'd)

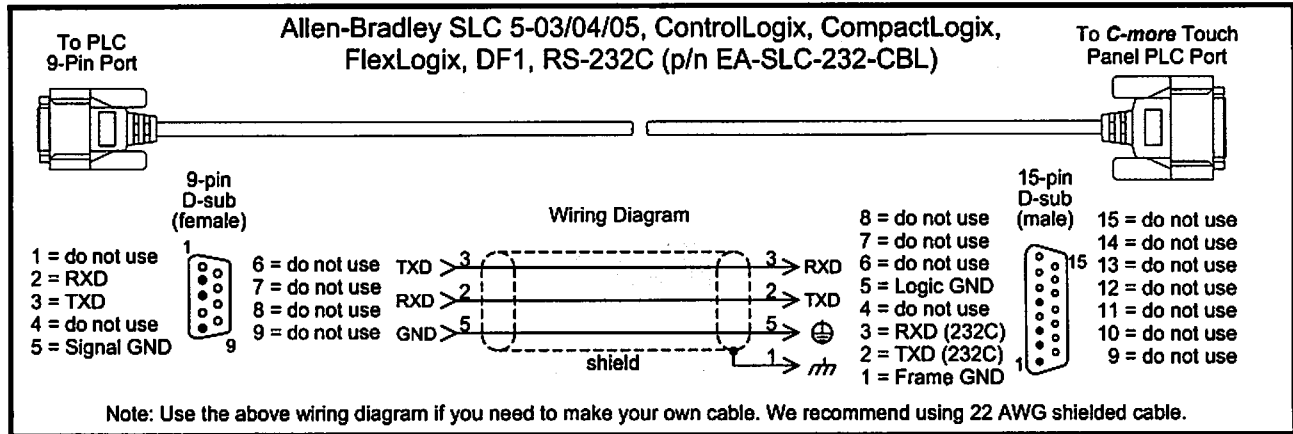
Allen-Bradley:

EA-MLOGIX-CBL

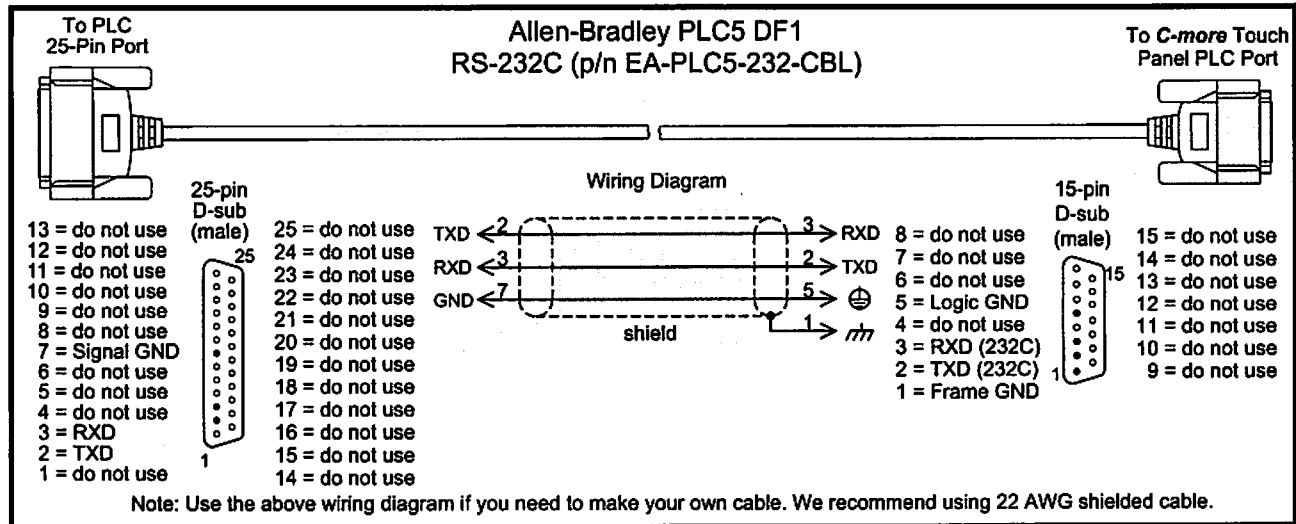


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EA-SLC-232-CBL

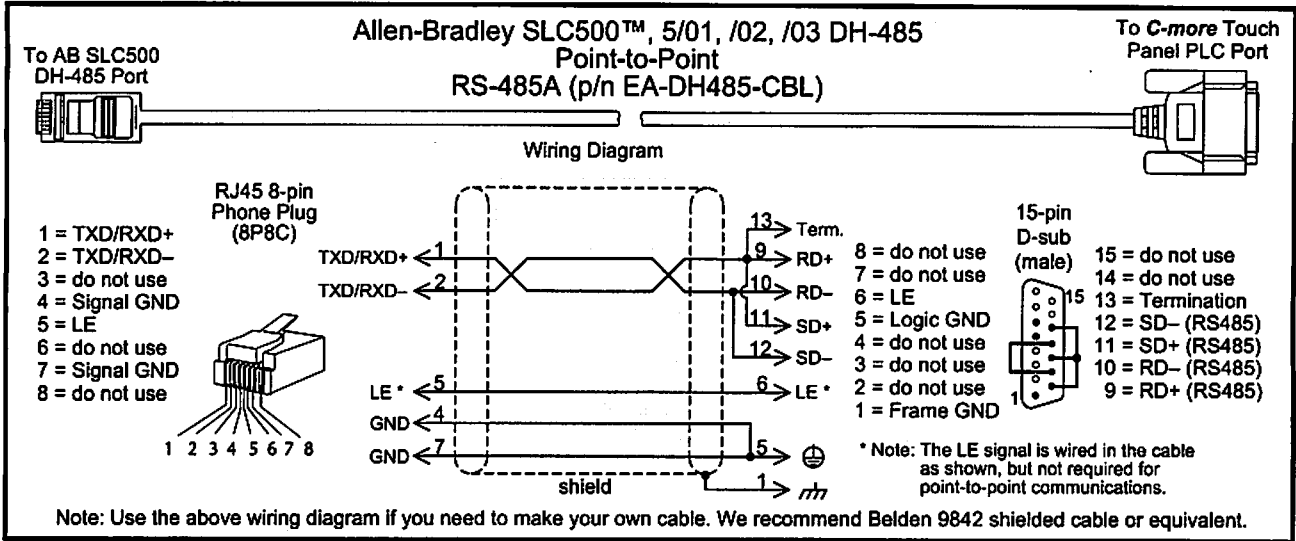


EA-PLC5-232-CBL

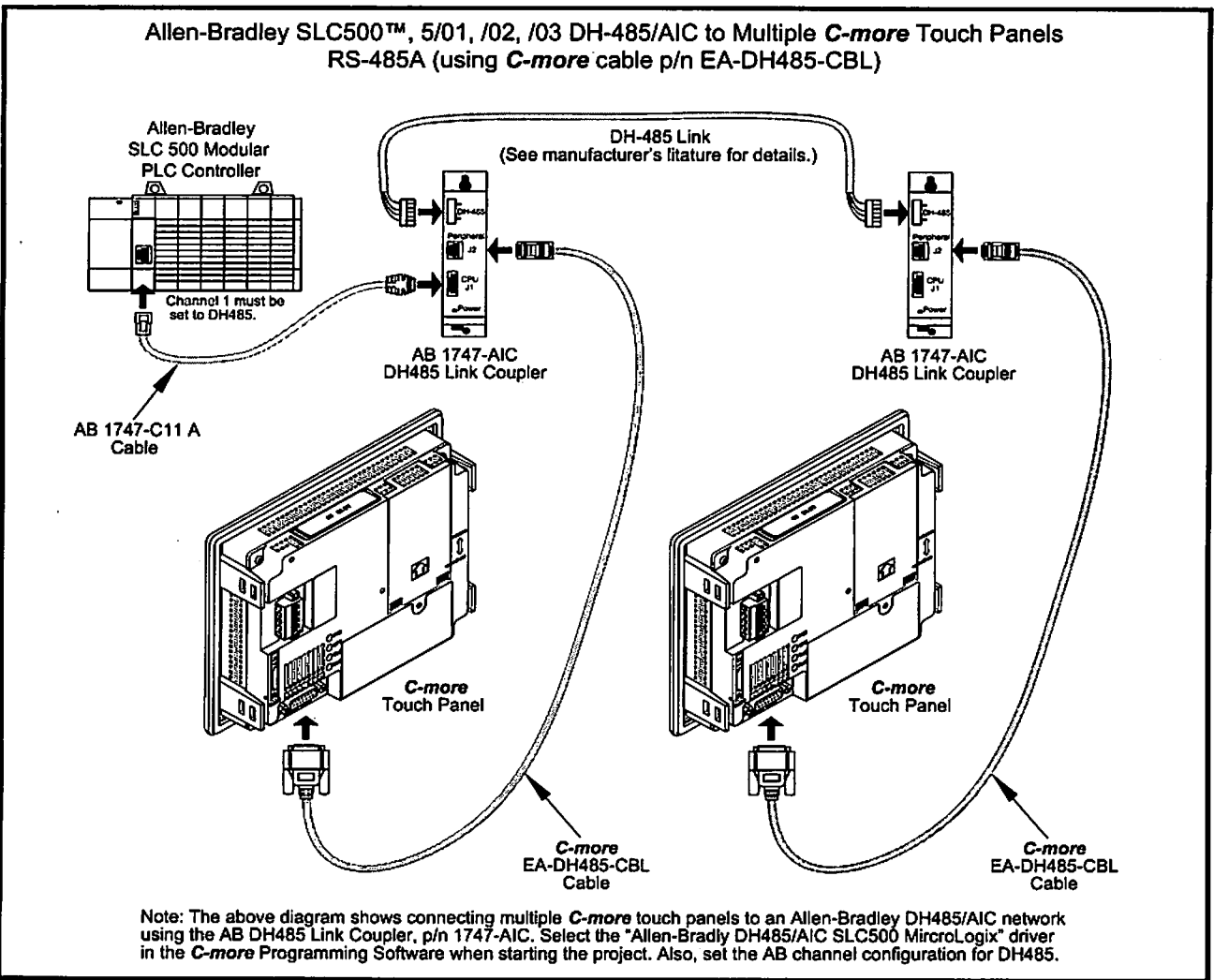


Allen-Bradley (cont'd):

EA-DH485-CBL

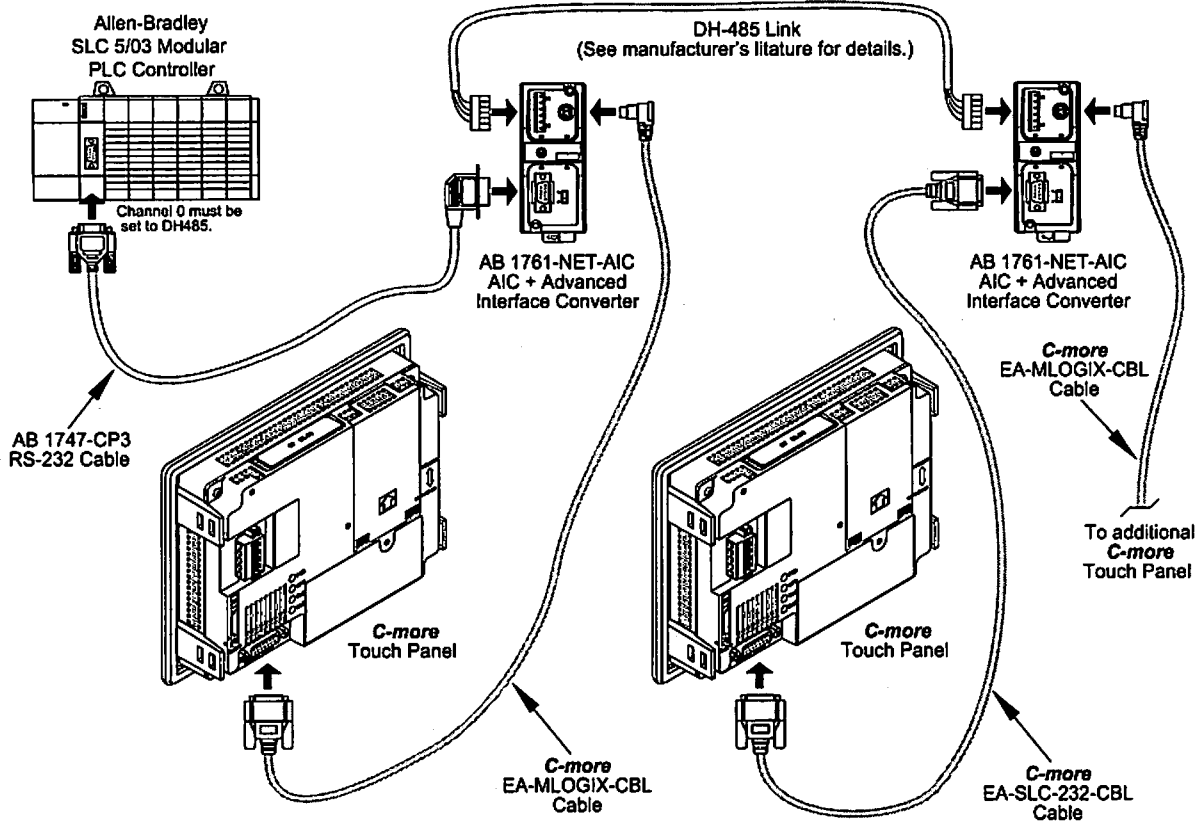


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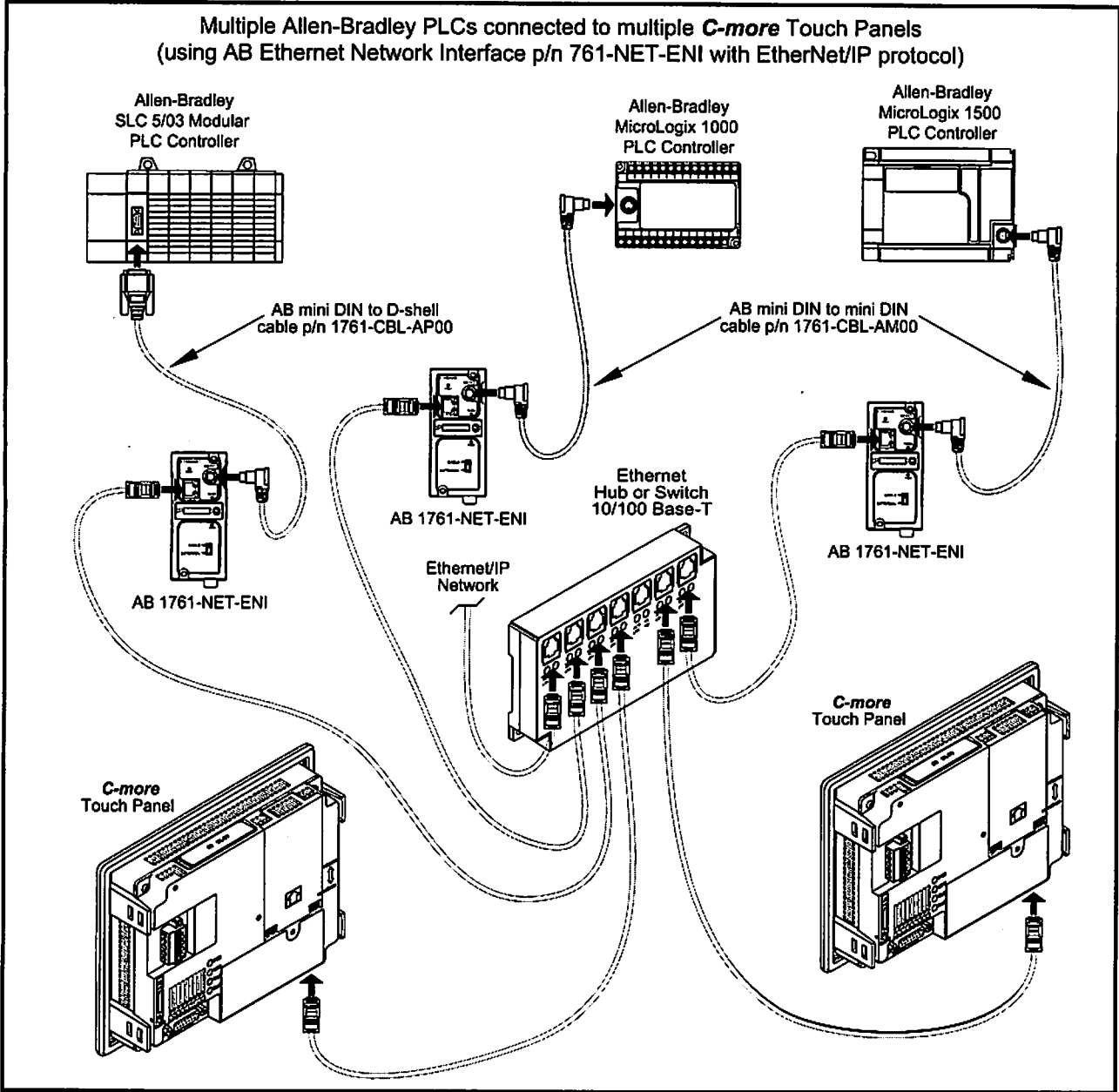
Allen-Bradley (cont'd):

Allen-Bradley SLC500™ 5/03 DH-485/AIC to Multiple *C-more* Touch Panels
(using *C-more* cables p/n EA-MLOGIX-CBL, EA-SLC-232-CBL)



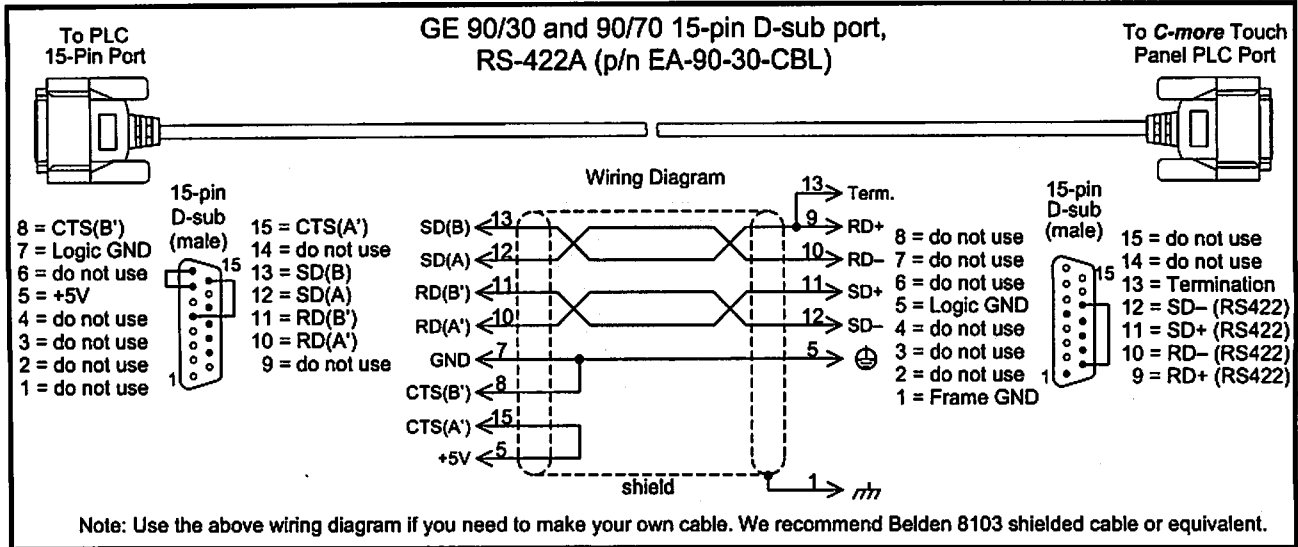
Note: The above diagram shows connecting multiple *C-more* touch panels to an Allen-Bradley DH485/AIC network using the AB AIC+ Advanced Interface Converter, p/n 1761-NET-AIC. Select the "Allen-Bradley DH485/AIC SLC500 MicroLogix" driver in the *C-more* Programming Software when starting the project. Also, set the AB channel configuration for DH485.

Allen-Bradley (cont'd):



GE:

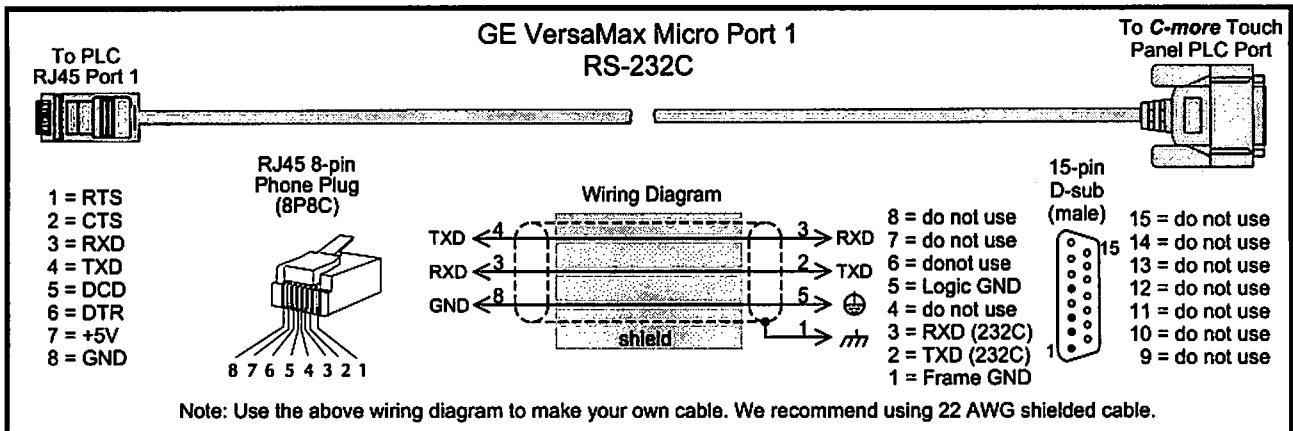
EA-90-30-CBL



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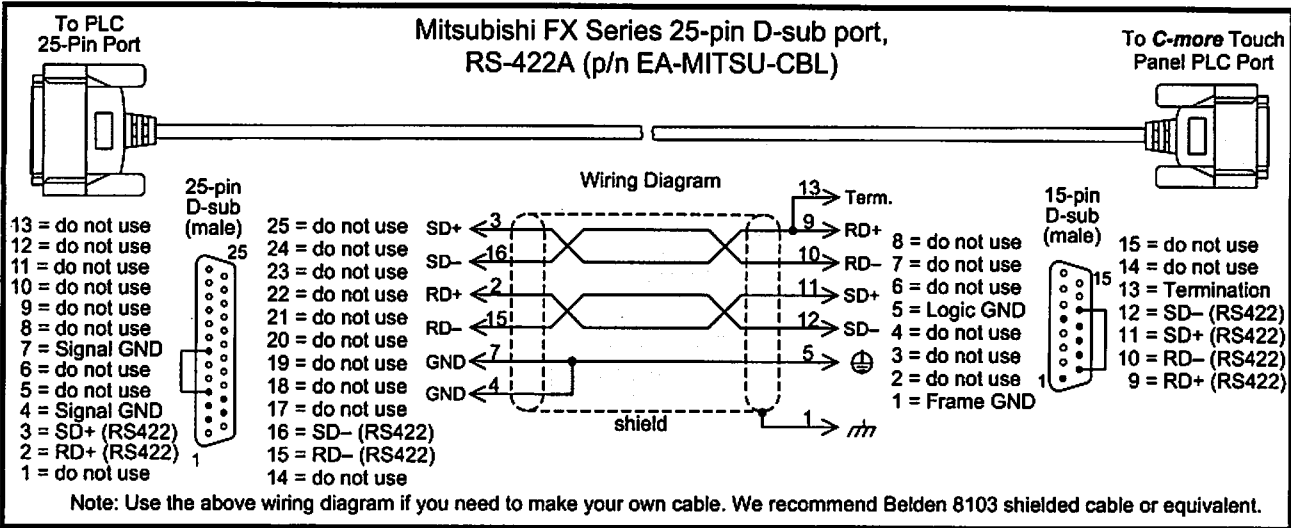
GE VersaMax Micro:

User Constructed



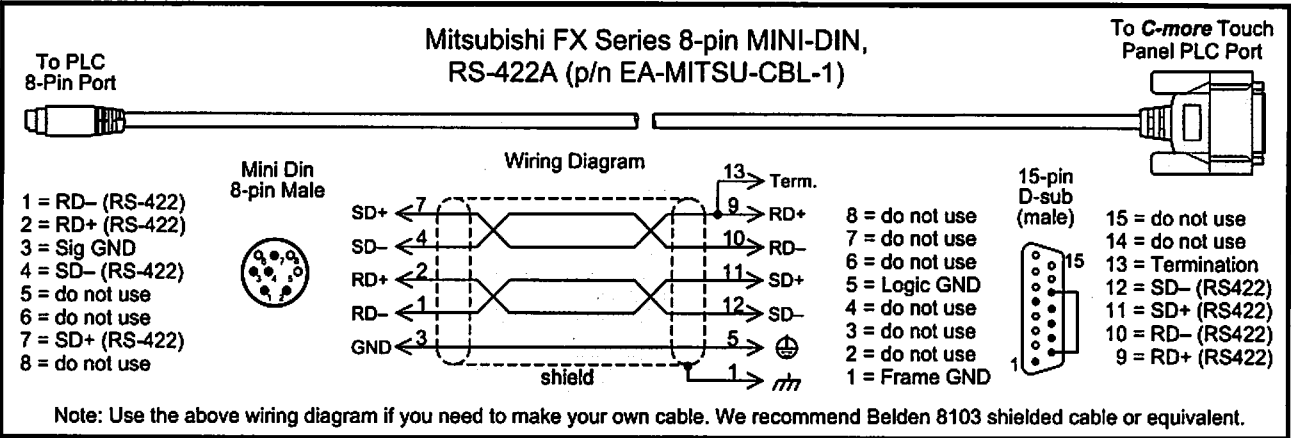
Mitsubishi:

EA-MITSU-CBL



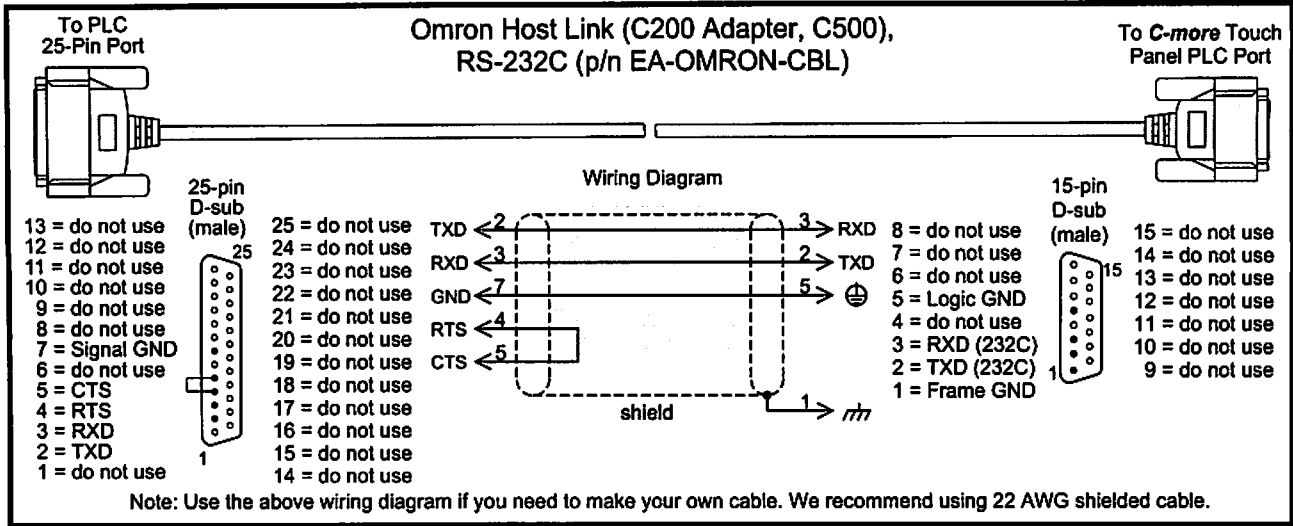
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EA-MITSU-CBL-1



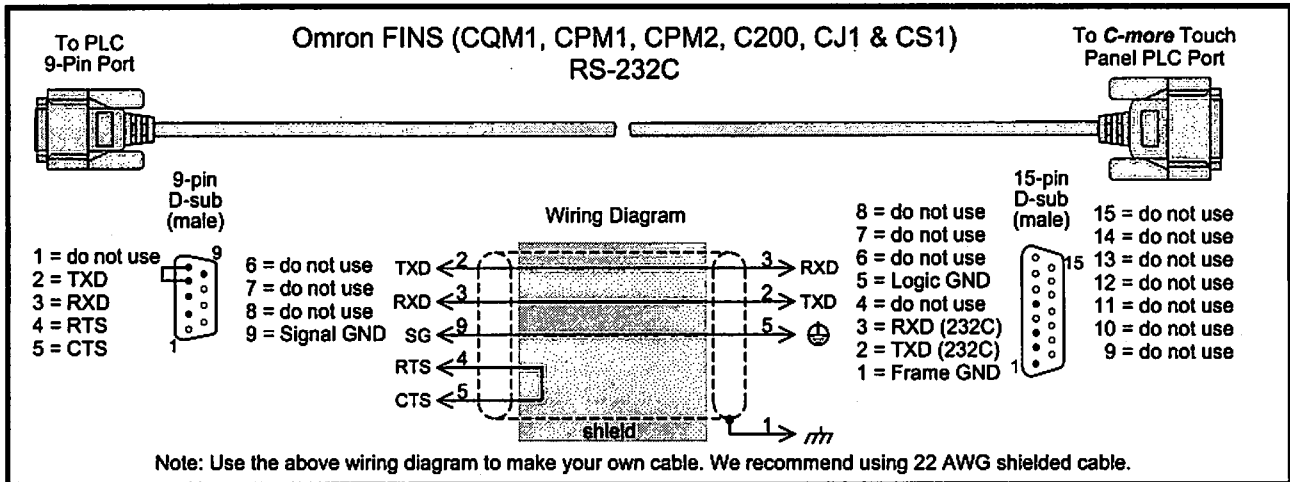
Omron:

EA-OMRON-CBL

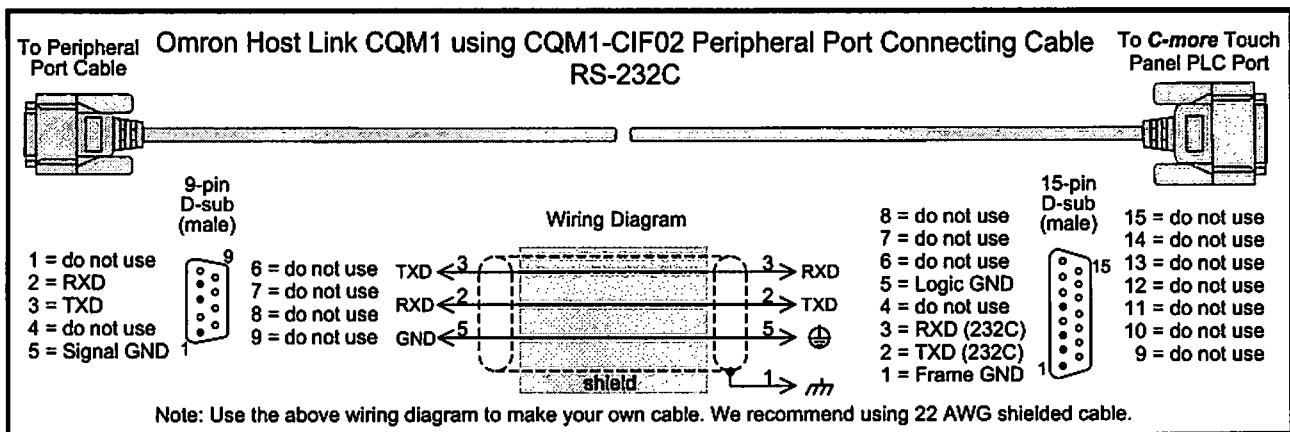


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User Constructed

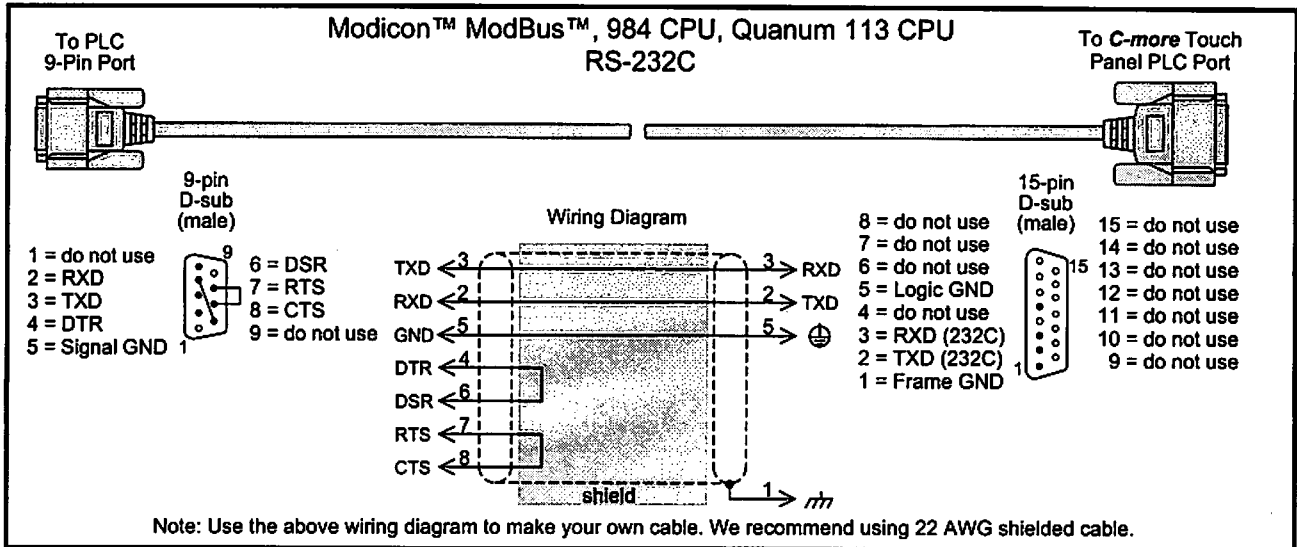


User Constructed



Modicon ModBus RS-232:

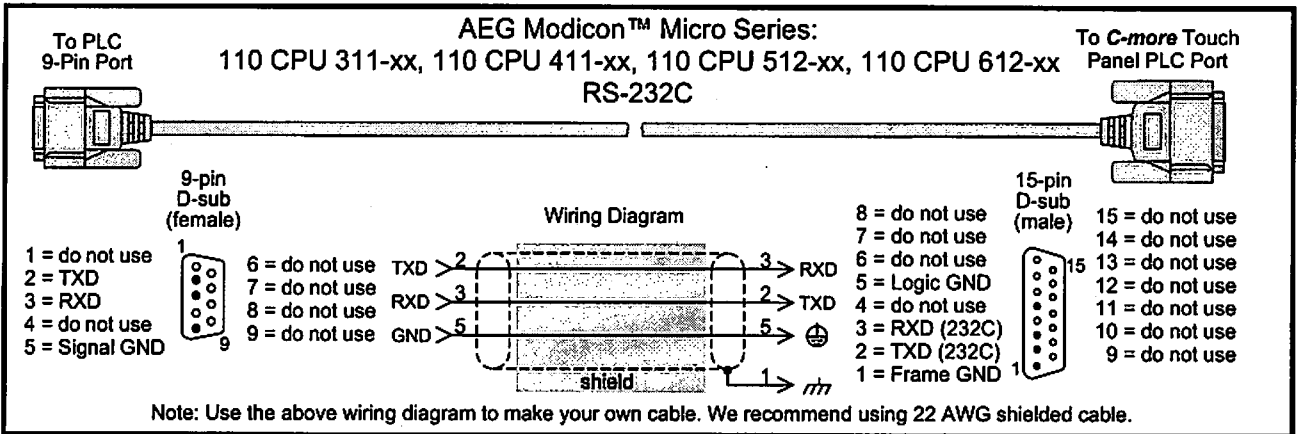
User Constructed



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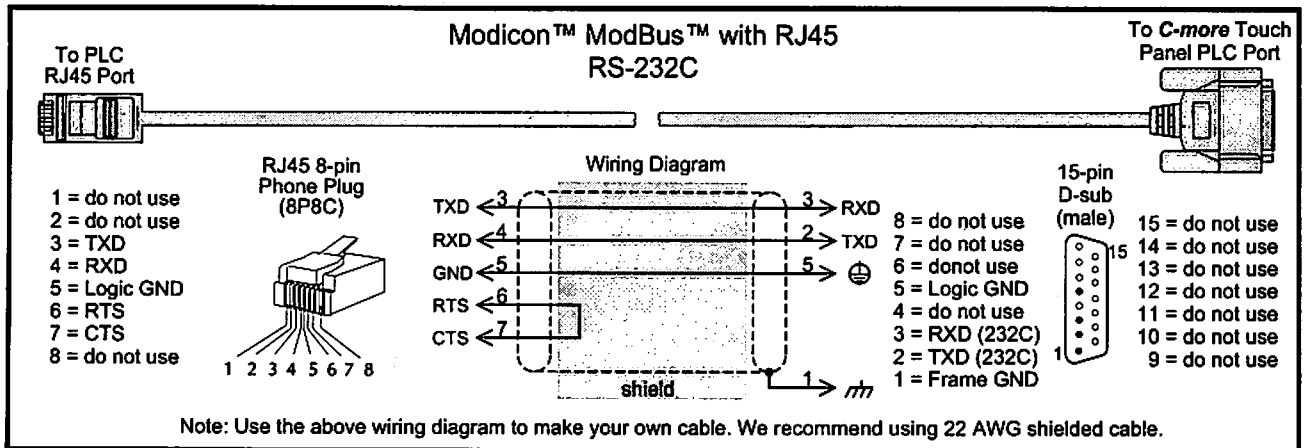
Modicon Micro Series:

User Constructed



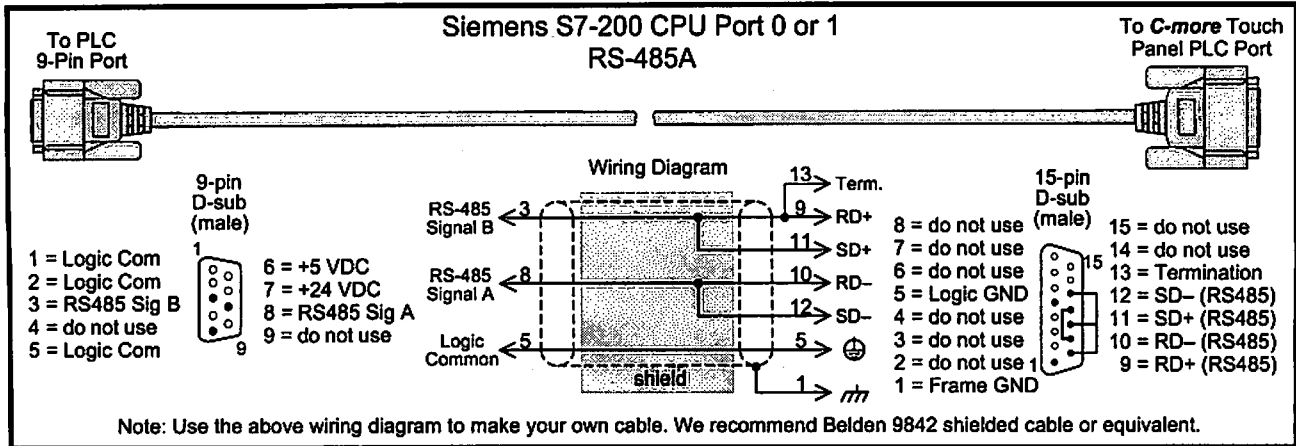
Modicon ModBus with RJ45:

User Constructed



Siemens:

User Constructed



6

MAINTENANCE



In This Chapter...

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Check Operating Voltage7-2
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Maintenance



Although the *C-more* touch panels require very little maintenance, setting up a routine maintenance schedule will insure the longevity of the product in your application.

The following are some suggestions of items to include in a preventive maintenance list or schedule. Most of these items should be scheduled quarterly or bi-annually.

Project Backup

- During a routine preventive maintenance schedule is a good time to make sure that there is an up-to-date backup of the application project. Although the *C-more* touch panel with its programming software has the ability to upload the complete project from a panel through the programming software, insurance is warranted just in case the worse case scenario happens and the entire touch panel is destroyed.

Check Operating Environment

- Make sure the touch panel is operating in the proper temperature range: (0 to 50 °C (32 to 122 °F)).
- Make sure the touch panel is operating within the specified humidity range: (10–85% RH, non-condensing).
- Make sure the operating environment is free of corrosive gasses.



Check Operating Voltage

- Check the input voltage that is powering the touch panel to make sure it is within the appropriate range,

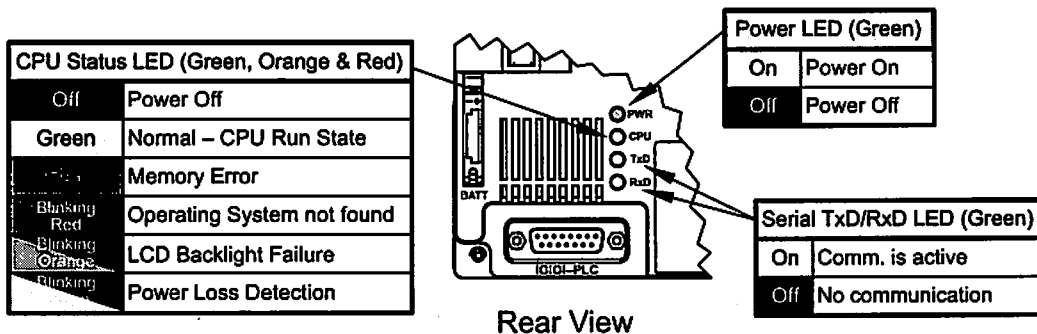


DC: If the panel is being powered with a DC power source, then the acceptable range is 20.4 to 28.8 VDC. (24 VDC, -15%, +20%, minimum of 1.5 A)

AC: If the panel is being powered from an AC/DC Power Adapter, EA-AC, then the acceptable input voltage range to the adapter is 100-240 VAC, 50/60 Hertz.

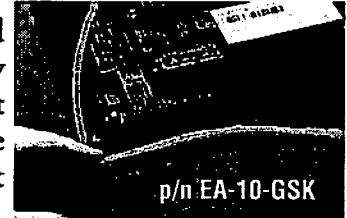
Check Status Indicators

- During a routine maintenance check is a good time to take a quick look at the status indicators on the rear of the touch panel. The Power LED (PWR) indicator should be on and there should be activity on the TxD and RxD LED indicators when connected serially to a PLC or control device. Check the status of the CPU LED and compare it to the chart shown in the illustration below. Any indication of the CPU LED other than a solid green shows there is a possible problem, and the condition needs to be corrected.



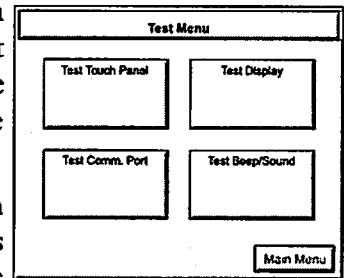
Check Physical Conditions

- Make sure that harmful chemicals are not being used around the panel. Look for any deterioration of the touch panel's bezel and front display area. See Chapter 2: Specifications for a chemical compatibility list.
- Check the mounting gasket to make sure it is sealing properly and has not deteriorated. Replace the mounting gasket if there are any signs of deterioration, or if there is any evidence that moisture/liquids have penetrated to the inside of the enclosure where the panel is mounted. Information on a replacement gaskets can be found in Chapter 9: Replacement Parts.
- Check to make sure that none of the cooling vents around the inside section of the touch panel are clogged with dust or debris. Also make sure that there is clearance around the touch panel as shown in Chapter 4: Installation and Wiring.



Run Tests under System Setup Screens

- Use the touch panel's System Setup Screens to test the touch screen, display, communication ports, beeper and audio output (only with external amplifier and speaker(s) connected). See Chapter 5: System Setup Screens for additional details for the Test Menu.



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Test Touch Panel - allows the user to check the analog touch function of the screen by drawing free hand lines and shapes across the entire touch area. The display will retain the lines where the screen has been touched until the Cancel button is pressed.

Test Display - used to test the display and color rendition. A test pattern will first show both the primary colors (if applicable) and a gray scale. If the touch screen is not pressed within a few seconds, the display will go into alternating color sweeps across the screen until the panel is pressed again. If the screen is pressed when the test pattern first appears, it will stay in this mode until the Cancel button is pressed.

Test Comm. Port - used to test the functionality of both the 15-pin PLC communication serial port and the Ethernet port (non -R models only). A loop-back connector can be fabricated and used on the 15-pin serial port to test both the RS-232 and RS-422/485 communications for the TxD and RxD signals and also the RTS and CTS signals if applicable. The Test Comm. Port setup screen and Chapter 5 show pin-outs for the both the RS-232 and RS-422/485 loop-back connectors. The Ethernet connection can also be tested for communications if it is at least connected to an Ethernet hub or switch. If the touch panel is connected to a PLC, then an inquiry test can also be done to test the communications between the panel and the PLC. Press the Cancel button when finished to return to the Test Menu screen.

Test Beeper/Sound - used to test the touch panel's internal beeper and also test the audio line output port with an external amplifier and speaker(s) connected. Testing the audio output is done by playing an included internal WAV file. Press the Cancel button when finished to return to the Test Menu screen.

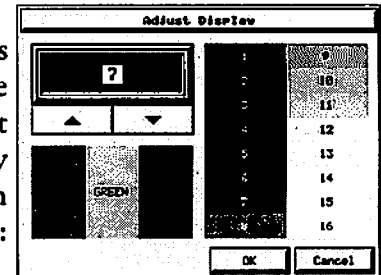
Check Memory Usage via System Setup Screens

- A good time to check and record the touch panel's memory usage for future reference is during a routine maintenance schedule. The various memory devices being used by the panel are listed under the tab. This includes the SRAM, Built-in Flash and any external memory device such as a USB pen drive or CompactFlash memory. If no external memory device is inserted, it will not show up on the list. The amount of total, used and free memory is shown. The memory usage can be viewed by use of the panel's System Setup Screen's Main Menu, and then selecting the Information button. Look under the Memory tab. See Chapter 5: System Setup Screens for additional details on using the Memory tab.

Information				
General	Memory	Ports	Error	
	Total	Used	Free	
SRAM	256 KB	66 KB	190 KB	
Built-in Flash	15 MB	6 MB	9 MB	
CF1	64 MB	14 MB	47 MB	
CF2	244 MB	0 MB	237 MB	
USB	488 MB	624 KB	487 MB	

Check/Adjust Display Brightness or Contrast

- It is good practice to occasionally check the display brightness or contrast and adjust as required. This is done by using the Setting Menu in the System Setup Screens. Keep in mind that only the contrast can be adjusted on the STN type display models, both color and grayscale, and only the brightness can be adjusted on the TFT type display models. See Chapter 5: System Setup Screens for additional details.



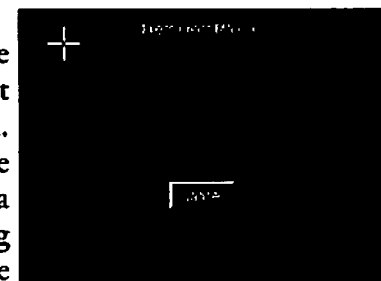
Check Error Log via System Setup Screens

- Another good practice is to review the touch panel's Error Log. The log can be viewed by use of the panel's System Setup Screen's Main Menu, and then selecting the Information button. Look under the Error tab. See Chapter 5: System Setup Screens for additional details on using the Error tab, Appendix A: PLC Protocol Error Codes for a list of the error codes as they relate to the specific PLC that is being used with a description of the error, and Appendix B: Touch Panel Runtime Errors for a list of errors that may occur when the panel is in operation.

Information			
General	Memory	Ports	Error
1	01/03/00 01:20:11	COM3, DEV001, RD	2000, 2Byte Error Code PLC-001
2	01/03/00 01:20:07	COM3, DEV001, RD	U2000, 2Byte Error Code PLC-001
3	01/03/00 01:20:03	COM3, DEV001, RD	U2000, 2Byte Error Code PLC-001
4	01/03/00 01:19:59	COM3, DEV001, RD	U2000, 2Byte Error Code PLC-001
5	01/03/00 01:19:55	COM3, DEV001, RD	U2000, 2Byte Error Code PLC-001

Adjust Touch Panel via System Setup Screens

- It is recommended that a regularly scheduled maintenance program include adjusting the touch panel. The adjustment can be looked at as "calibrating" the touch area of the panel. The procedure should also be done anytime that it seems the touch area being pressed for an object is out of position by a small amount. The procedure is done by using the Setting Menu in the System Setup Screens and then selecting the Adjust Touch Panel button. See Chapter 5: System Setup Screens for additional details.



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Replace Battery Periodically

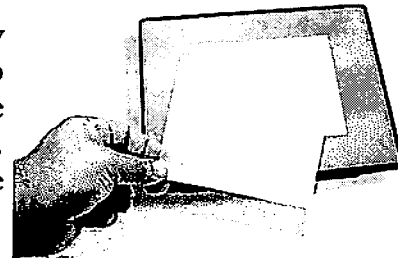
- The lithium battery in the touch panel is used to maintain the system SRAM retentive memory and the CPU date/time registers when the unit is without external power. Before replacing the battery, back-up the data in your SRAM retentive memory as a precaution. Input power needs to be maintained to the panel during battery replacement or the SRAM retentive memory and date/time registers will be cleared. Typical battery life is five years, which includes panel runtime and normal shutdown periods. The battery's status can be checked under the General tab of the Information screen of the System Setup Screens, see Chapter 5. However, consider installing a fresh battery if your battery has not been replaced recently and the unit will be without power for a period of more than ten days. A replacement battery can be purchased from *AutomationDirect* as part number D2-BAT-1 (#CR2354).



D2-BAT-1

Cleaning the Display Screen

- The display screen should be cleaned periodically by wiping it with a lint free damp cloth using a mild soap solution. Dry the surface when finished with a lint free cloth. Do not clean with ammonia based products. The ABS material the bezel is made from is reactive with ammonia.
- The longevity of the display can be increased by the use of a non-glare screen protector, p/n EA-XX-COV2, where XX = touch panel screen size, 6, 8, 10, 12, or 15. See Chapter 3: Accessories for additional information on the screen protectors.
- To prevent damage to the display screen, avoid touching the screen with sharp objects, striking the screen with a hard object, the use of abrasives near the screen, or using excessive force when pressing the touch screen. In the event that the touch screen membrane becomes damaged or scratched, the bezel, which includes the clear membrane window, can be replaced on the 8", 10", 12" and 15" touch panels. See Chapter 9: Replacement Parts for additional information on the replacement bezels. The bezel with clear membrane window can be replaced on the 6" touch panels by calling our technical support department at 770-844-4200 to make arrangements for returning the unit for repair.



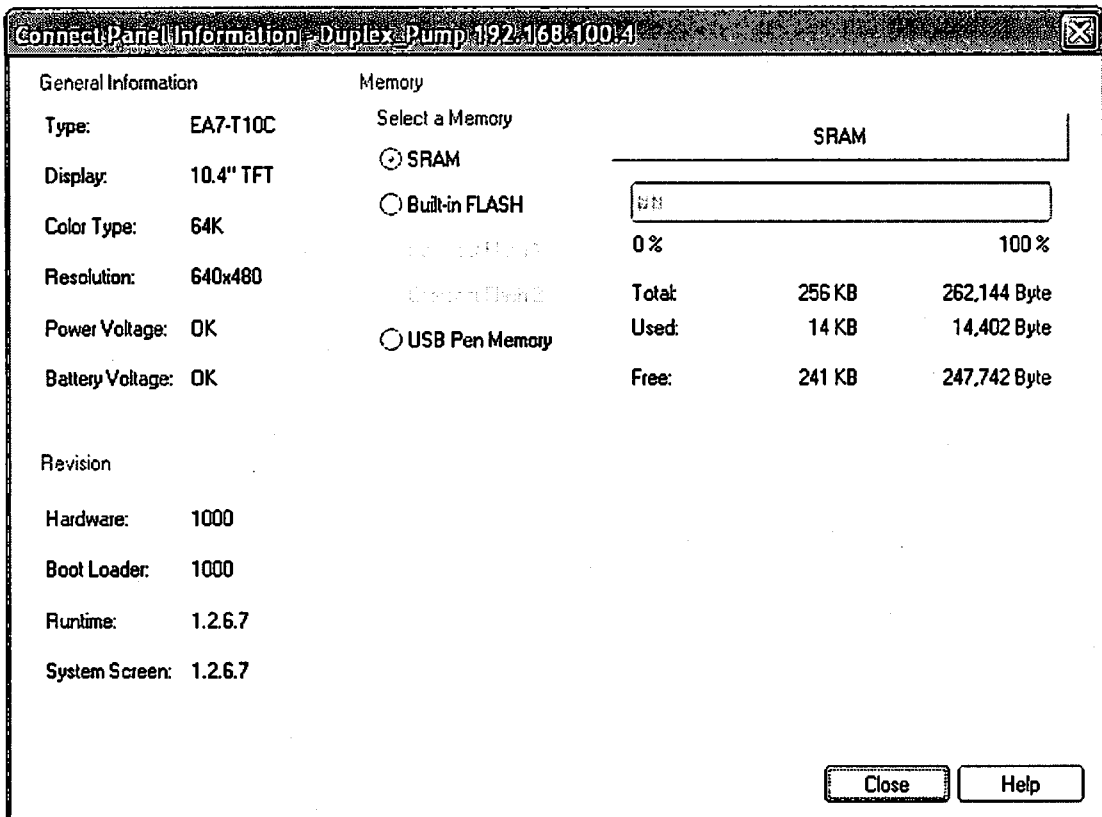
EA-6-COV2

Check Project Functionality

- During a routine maintenance schedule is a good time to check the functionality of your application, making sure that various areas on different screens do what they were designed to do. An outline or specification for the application is a useful tool for testing the various aspects of your application. As a starting point, you may want to run through all the screens to make sure they are accessible.
- If there are any trouble-shooting procedures built into the touch panel application, now is a good time to also check these aids.

Checks from *C-more* Programming Software

- If you have a PC available with the *C-more* programming software, EA-PGMSW, installed, and the PC is connected to the touch panel, there are checks you can make to the status of the touch panel by using the **Panel Information...** feature located under the **Main Menu** heading **Panel**. This includes the following:
 - Connect Panel Information
 - Memory availability and usage
 - Power Voltage
 - Battery Voltage:
 - Revisions



- Other functions that can be accessed from the programming software directly to the touch panel include: **Display Screen**, **Reboot**, **Adjust Clock**, **Memory Clear**, and **Update Firmware**. Additional information for these functions can be found in the *C-more* programming software on-line help.

7

TROUBLESHOOTING



In This Chapter...

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The following topics are some of the more likely problems that may be encountered during the installation and operation of your *C-more* touch panel. We have made some suggestions on what to check in order to correct the problem. Please start with the troubleshooting flow chart that covers the more common problems encountered by other users.

Common Problems

The troubleshooting flow chart shown on the following page is based on the more common problems fielded by our technical support team. If you are having problems, please start with the flow chart, follow the suggestions listed, and if you still need help, call our tech support team @ 770-844-4200. In addition to having ready the information suggested in the flow chart, please have the following available:

- 1) *C-more* touch panel part number including serial number with date code. See page 1-5 in this hardware user manual for an explanation of the part number, serial number, and date code breakdown. Why is this information important? The various sizes of the touch panel use different processors and memory sizes, and therefore can have different types of problems within the particular panel size.
- 2) Programming software version and build that you are currently using. For example: Version 1.21, Build 6.18E. Having the software version number will allow our tech support team member to assess whether there are similar problems that have been reported when using the same version of the software. The programming software version can be found by clicking on "About C-more Programming Software..." selection under the Help pull down menu in the software. Also, it is always a good practice to visit the Software/Firmware Downloads area under the Tech Support section of the *AutomationDirect* website and check to see if you are using the latest version of the programming software. If you aren't using the latest software version, we suggest that you upgrade to see if this resolves your problem.

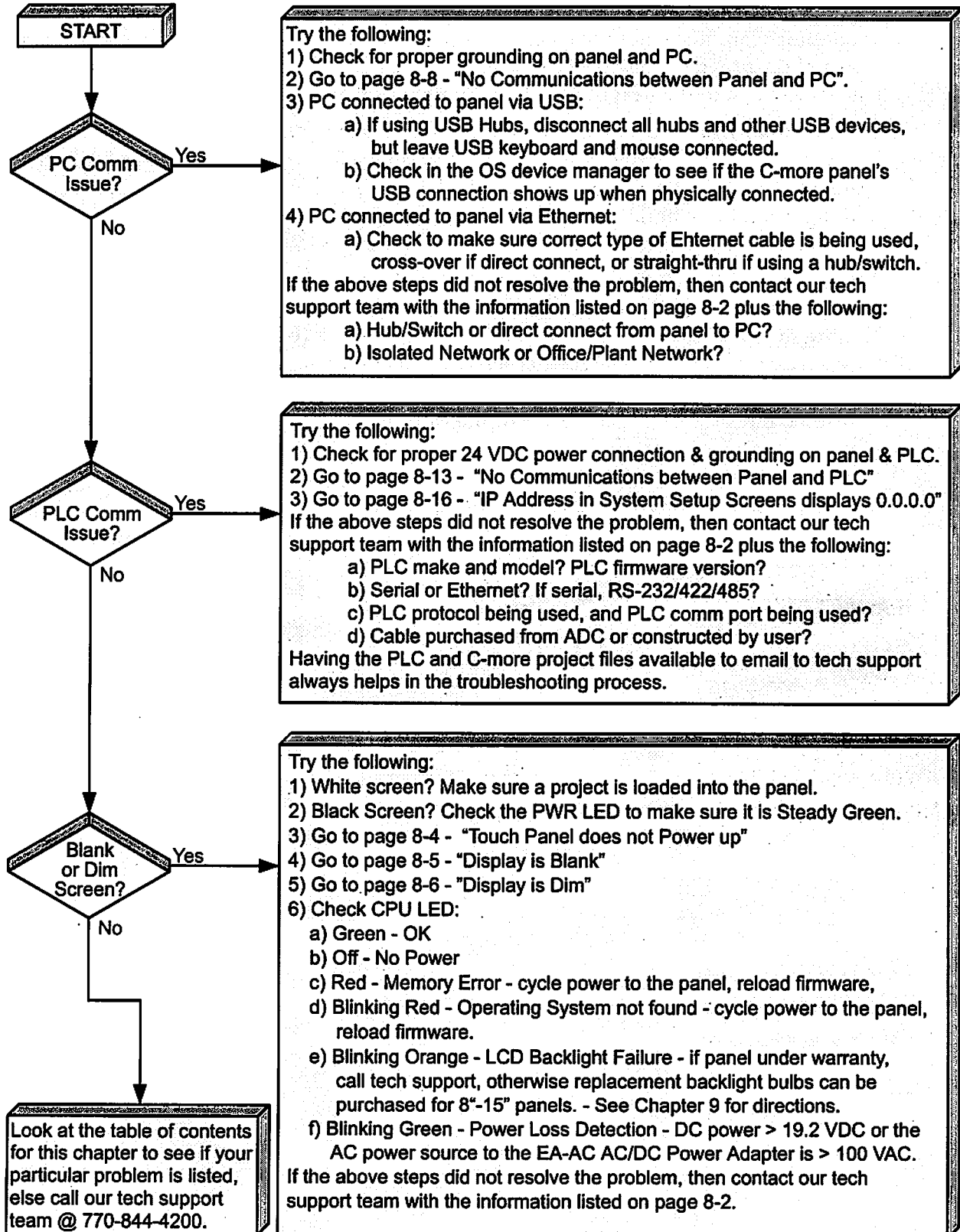


Note: The "About C-more Programming Software..." dialog box will show a Firmware version on the newer releases of the programming software. This is the current firmware version that is included with the programming software and does not reflect what firmware is actually loaded on your *C-more* touch panel. See the following for details on how to check the firmware version.

- 3) Firmware version of the *C-more* touch panel. For example: 2.0 Build 07.32 or 2.0.07.32. The firmware version can be checked by using the System Setup Screens, going to the Information menu under the Main Menu, and looking under the General tab for Firmware: -Runtime. The firmware version can also be checked by using the programming software, while connected to the panel, and clicking on the Panel Information selection under the Panel pull down menu. As with the programming software version, it is important for our tech support associates to know which firmware version you are using so they can check on any known problems. As with the programming software, we strongly suggest that the firmware be updated to the latest version. Check for the latest version and download from the Software/Firmware Downloads area of the *AutomationDirect* website.

It is also helpful to have a copy of your project file for our tech support associates to use in troubleshooting a problem, so please be prepared to forward a copy of your project if it is requested.

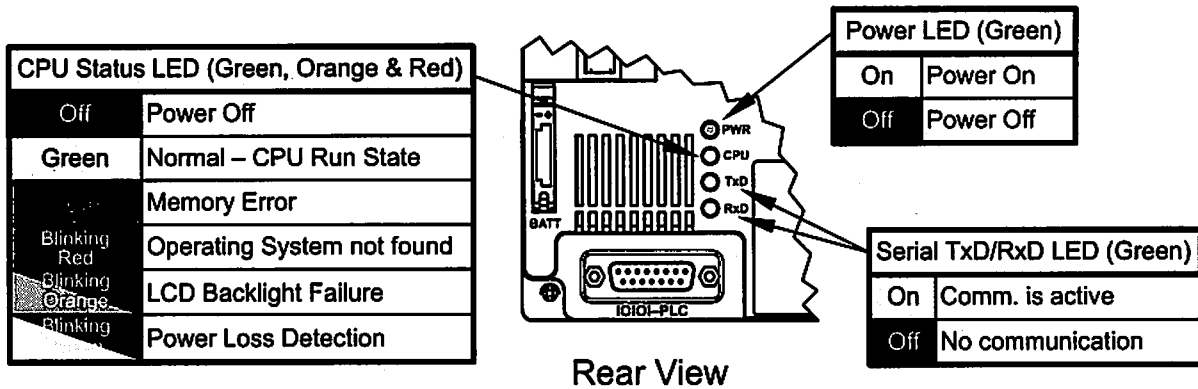
Troubleshooting Flow Chart



Touch Panel does not Power up

- 1.) Check the status indicators on the rear of the panel to see if the Power LED (Green) indicator is on. Reference the diagram shown below. If the Power LED (Green) indicator is on and the panel was observed showing "Initializing..." during power up, but the display is now blank, go to the next troubleshooting tip, Display is Blank.
- 2.) If the Power LED (Green) indicator is off and the panel is being powered with a 24 VDC power source, use a voltmeter to check the incoming DC voltage level. The DC voltage level should be in the range of 20.4 to 28.8 VDC. If the incoming DC voltage is zero, check any fusing that may be in the circuit. If the fuse is open, determine cause and replace. If the DC voltage level is out of range, the DC power source needs to be corrected or replaced.
- 3.) If the Power LED (Green) indicator is off and the panel is being powered with an AC/DC Power Adapter, EA-AC, use a voltmeter to check the incoming AC power. The AC voltage to the AC/DC Power Adapter should be in the range of 100 to 240 VAC, 50/60 Hertz. If the incoming AC voltage is zero, check any fusing that may be in the circuit. If the fuse is open, determine cause and replace. If proper AC voltage is present on the AC/DC Power Adapter, but the Power LED (Green) indicator is off, replace the AC/DC Power Adapter, EA-AC.

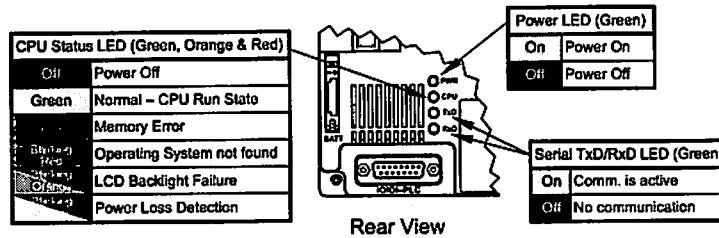
C-more LED Status Indicators



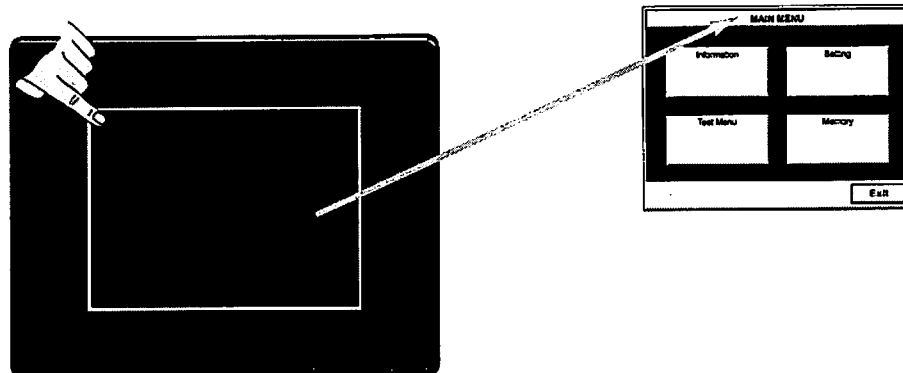
Display is Blank

- 1.) Touch the screen to make sure the panel is not in the Screen Saver mode.
- 2.) If the panel is not in Screen Saver mode, check the status indicators on the rear of the panel.

C-more LED Status Indicators

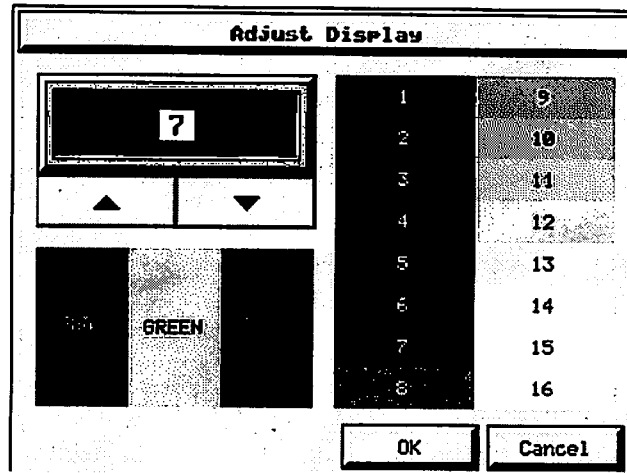


- The Power LED (Green) should be on. If not, check the incoming power as explained in the “Touch Panel does not Power Up” section.
 - Make sure the CPU status LED (Green, Orange, Red) is a steady Green.
 - A **blinking Orange** colored CPU status LED indicates a failed LCD display backlight. The backlights are user replaceable on the 8”, 10”, 12” and 15” C-more touch panels. See Chapter 9: Replacement Parts for additional information on the replacement backlights.
 - If the CPU status LED is **blinking Green**, then the supply voltage is below 19.2 VDC, or below 100 VAC when using the optional C-more AC/DC Power Adapter, EA-AC. The backlight will turn off immediately to extend the power retention period. The panel will continue to run and the LCD display will be slightly visible. This may be seen as the display being dim, so it is advisable to check the incoming voltage. The panel does not turn off until the DC voltage drops below 5 VDC or below 58 VAC when using the AC/DC Power Adapter, EA-AC.
 - A **blinking Red** CPU status LED indicates that the operating system could not be found. Reload the firmware to the touch panel. If this does not resolve the problem, contact the *AutomationDirect* returns department @ 1-800-633-0405 to make arrangements for returning the unit for repair.
- 3.) There is always the remote possibility that a project has been transferred to the touch panel that includes a screen that uses a black background and has no objects placed on the screen. To check for this possibility, access the Main Menu of the touch panel System Setup Screens by pressing the extreme upper left corner of the panel display area for three (3) seconds as shown below. If the System Setup Screen’s Main Menu is displayed, then most likely an empty black background screen is being displayed.



Display is Dim

- 1.) Check either the contrast or brightness setting found under the System Setup Screens. Keep in mind that the STN type display models, both color and grayscale, can have the contrast adjusted. The TFT type display models can have the brightness adjusted. See Chapter 5: System Setup Screens for additional information.



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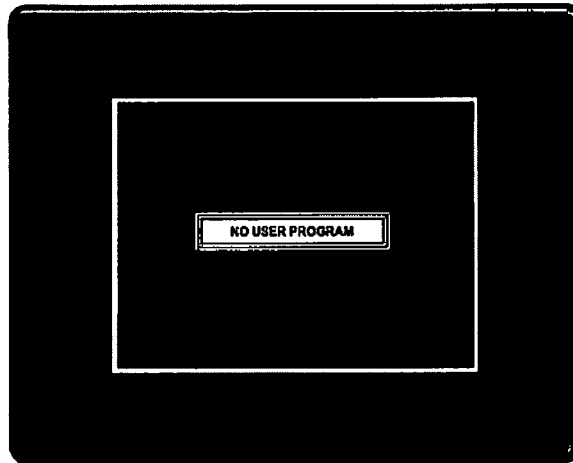
- 2.) Backlights will slowly lose some luminance causing the display to slightly dim. The backlight average lifetime is rated at 50,000 hours and is defined as the average usage time it takes before the brightness becomes 50% of the initial brightness. The lifetime of the backlight depends on the ambient temperature; the lifetime decreases in low or high temperatures. To improve the backlight life, use the Start Screen Saver function that is available in the *C-more* Programming Software in the Panel Manager dialog box. The backlights are user replaceable on the 8", 10", 12" and 15" *C-more* touch panels. See Chapter 9: Replacement Parts for additional information on the replacement backlights.
- 3.) Another condition that may make the display appear dim is to view the touch panel in direct sunlight or in a location where direct light is reflected onto the display. The *C-more* touch panel displays have Display Brightness ratings of 150 to 300 cd/m² (NITS), depending on the particular model. The higher the cd/m² (NITS) rating, the more visible the display will be under bright lighting conditions.

No User Program

If the touch screen is displaying the message “No User Program” after it has powered up, then either:

- the built-in Flash memory does not contain a recognized project, or
- a CompactFlash memory card is plugged into the CF1 slot and there is no project on the CompactFlash memory card.

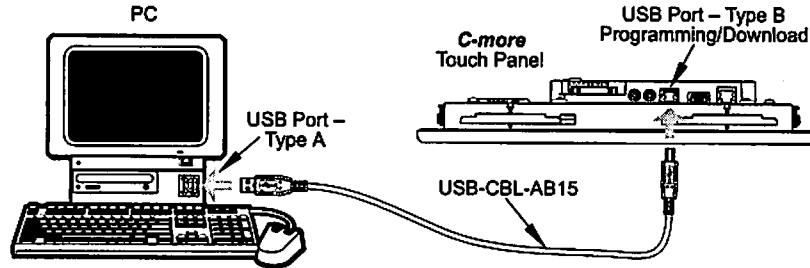
Keep in mind that on power up, the touch panel will either copy the project from its internal Flash memory to its internal SDRAM memory and run the project, or if a CompactFlash memory card is plugged into the CF1 slot, then any project contained on the CF memory card will be copied to the panel’s internal SDRAM memory and be run. In other words, the memory of a CompactFlash card on CF1 will override the panel’s internal Flash memory on power up or reboot, even if the CompactFlash memory card does not contain a project.



No Communications between Panel and PC (Personal Computer)

The *C-more* touch panel is programmed using the *C-more* Programming Software, EA-PGMSW. The developed project is transferred from the PC to the touch panel by either a USB or an Ethernet connection between the two. (Ethernet available on full feature units only.)

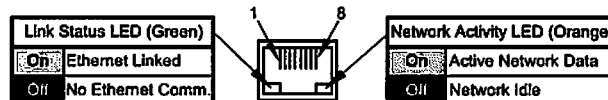
- 1.) If using USB, then a USB type AB programming cable, such as p/n USB-CBL-AB15, should be used to make a connection between the panel's USB Port, Type B and a USB port on the PC. The *C-more* Programming Software will install a USB driver on the PC during the software installation.



Use the programming software to check the status of the USB communications. From the Navigation window, select the Panel tab. At the bottom of the Panel tab is the Communication Config dialog box. If the USB communications to the panel is working, then the USB radio button should be checked and there should be a "green" indicator next to the USB selection. For reference, if the USB driver is working and you open the Device Manager in Windows, you should see a "C-more HMI" USB connection under Universal Serial Bus controllers selection. You can also make sure the *C-more* USB driver has been installed by looking for the following file: C:\WINDOWS\System32\Drivers\kyceusb.sys If the indicator is "red", then try using a different cable. If replacing the cable does not fix the communications, you may need to try a different USB port on the PC. If there are any USB hubs or other USB devices being used, you may need to temporarily eliminate them to see if this solves the problem.

Note: When transferring a project to the panel using the *Send Project to Panel* function, there is a possibility even with a USB programming cable properly connected between the touch panel and PC, and having a green indicator displayed next to the USB radio button in the **Step 3 - Project Transfer** dialog box, that the **Transfer** button in the dialog box will still be dim. The green indicator means that the very lowest level of USB communications is connected, but it does not necessarily mean the panel and PC are communicating. If the **Transfer** button is dim, then the panel and PC are not communicating. If a PLC is connected to the serial port of the panel, try disconnecting it. If this corrects the problem, then check your grounding for the PLC and the panel. If this does not correct the problem, see the *C-more* Programming Software Installation Guide for reinstalling the USB driver.

- 2.) When using an Ethernet connection to communicate between the touch panel and the PC and the communications does not seem to be working, the first area to check is the Ethernet status indicators located next to the 10/100 Base-T Ethernet Port on the rear of the panel. The Link Status LED must be displaying a Steady Green.

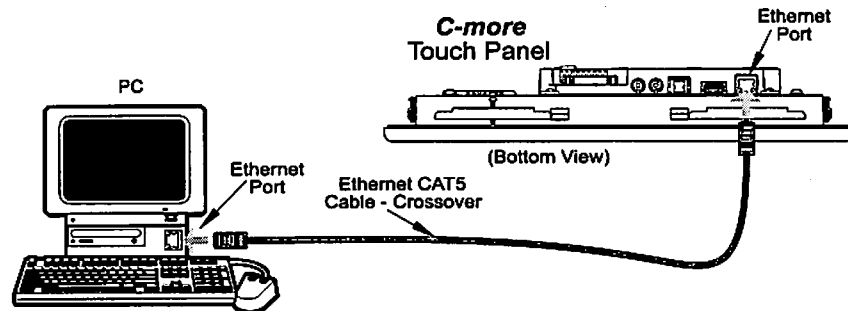


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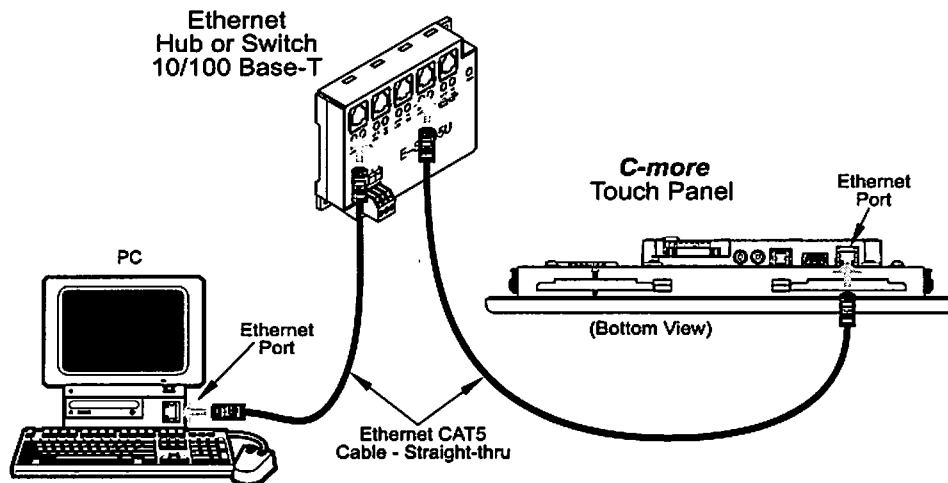


No Communications between Panel and PC (Personal Computer) (cont'd)

If using an Ethernet connection to program the touch panel, there are two basic ways to make the connection. You can use a “crossover” Ethernet cable to make a direct connection between



the touch panel and the PC or a “straight-thru” Ethernet cable from the touch panel to a hub, switch, etc. that is also connected to the PC.

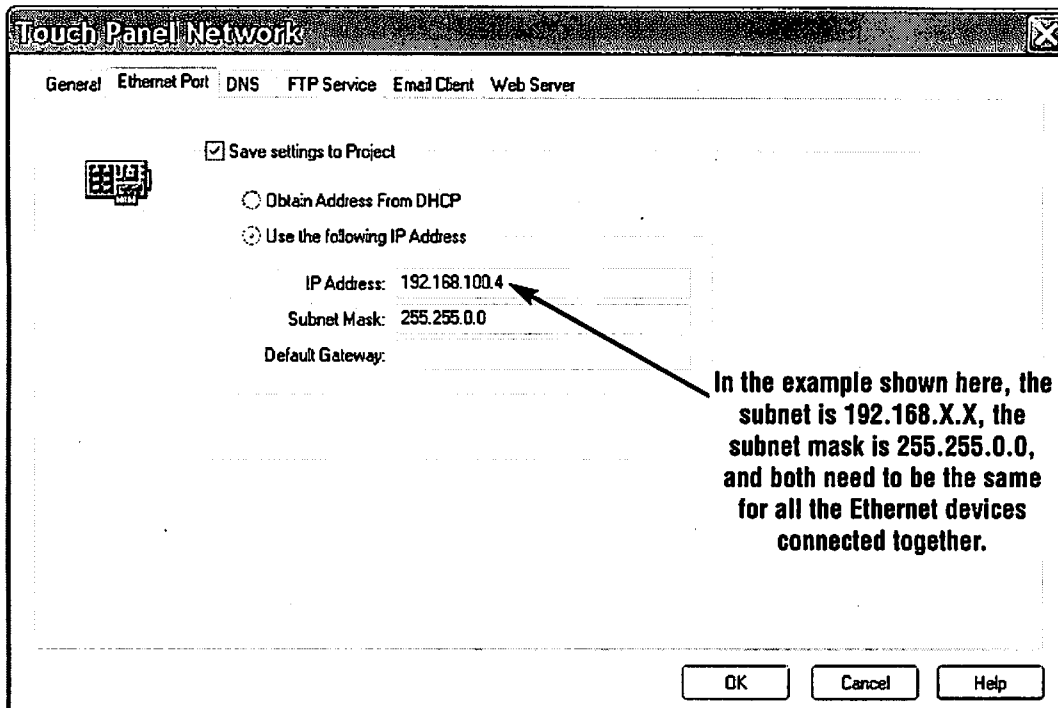


Use the *C-more* programming software to check the status of the Ethernet communications. From the Navigation window, select the Panel tab. At the bottom of the Panel tab is the Communication Config dialog box. Select the Browse button. If the connection is working the panel will be listed in the online link list. Select the panel and then select OK. If the Ethernet communications to the panel is working, then the Ethernet radio button should be checked and there should be a “green” indicator next to the Ethernet selection. There should also be an IP Address shown in the browse box below the Ethernet selection. If the Ethernet radio button is “red”, then you will need to check your Ethernet cables and connections or Browse for the panel. There can also be a conflict with another Ethernet connection that may be using the same IP Address. You may want to check the setup both in the touch panel and also in your PC. As a starting point, it is best to start with an assigned IP Address and Subnet mask, mainly to eliminate IP addressing conflicts. Use the *C-more* programming software and open the Touch Panel Network dialog box under the Main Menu’s Setup drop down menu. Click on the Ethernet Port tab to display the dialog box used to set up the touch panel’s Ethernet port.

Another cause of an Ethernet communications problem that may be encountered, is the touch panel doesn’t show up in the node list, which can be caused by the PC having a firewall.

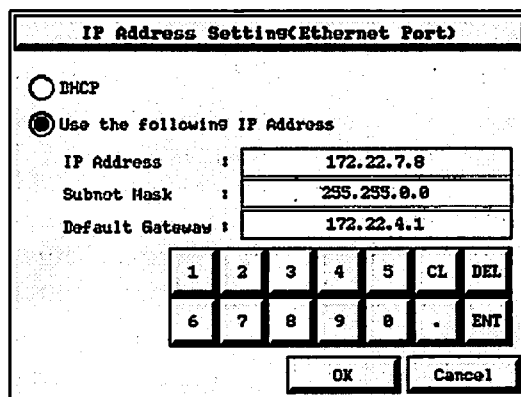
No Communications between Panel and PC (Personal Computer) (cont'd)

The figure below shows the Touch Panel Network dialog box with the Ethernet port tab opened. The Save settings to Project check box is checked and we are using the Use the following IP Address selection by checking its radio button. The subnet (192.168.X.X) and the subnet mask (255.255.0.0) must be the same for both the panel and the PC. See the *C-more* programming software on-line help for additional details regarding the Touch Panel Network.



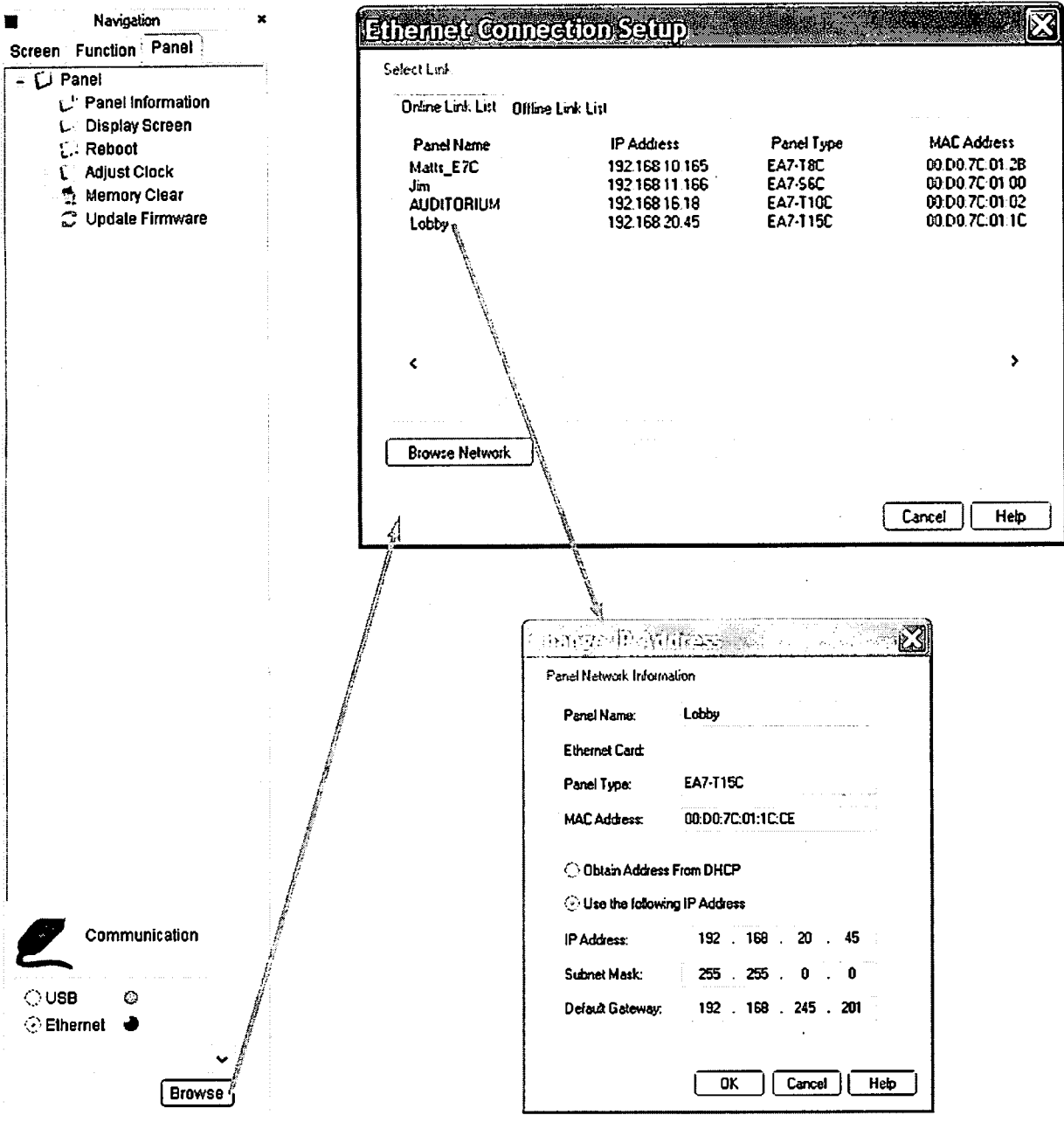
The IP Address assigned to the touch panel can also be checked or edited by using the system setup screens built into the touch panel. See Chapter 5: System Setup Screens for additional information.

The figure below shows a different example of the panel's System Setup Screens' Ethernet Port dialog box for configuring the Ethernet port. Again, make sure the subnet (172.22.X.X) and subnet mask (255.255.0.0) is the same for both the panel and the PC.



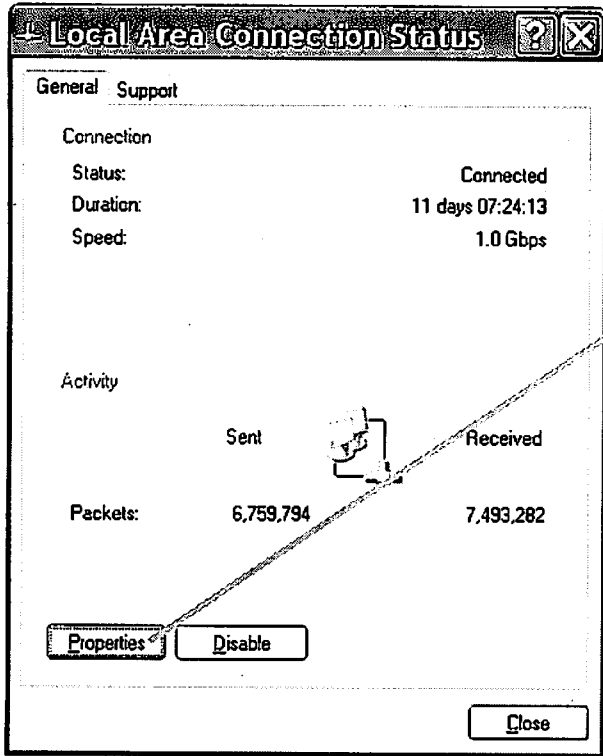
No Communications between Panel and PC (Personal Computer) (cont'd)

Another option for accessing the IP Address assigned to the touch panel is to use the *C-more* Programming Software. Open the Navigation window's Panel tab and click on the Browse button under the Communication window at the bottom. This will open the Ethernet Connection Setup window. The Online Link List tab will show all of the connected panels. If none are shown, try clicking the Browse Network button to search for attached devices. Double click on the Panel Name you want to access and this will bring up the Change IP Address window. In this window changes can be made to the panel's name, IP address, subnet mask, and default gateway.

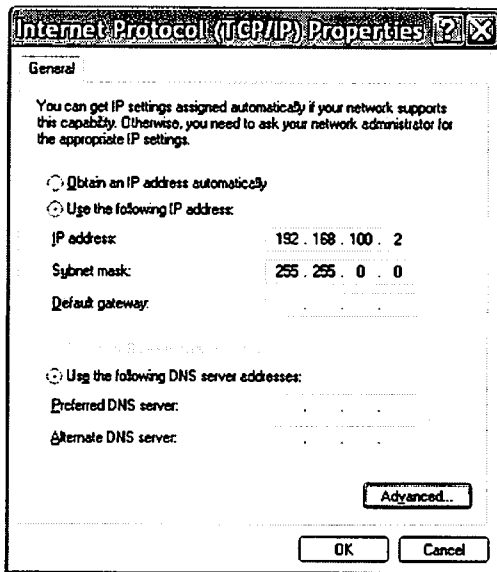
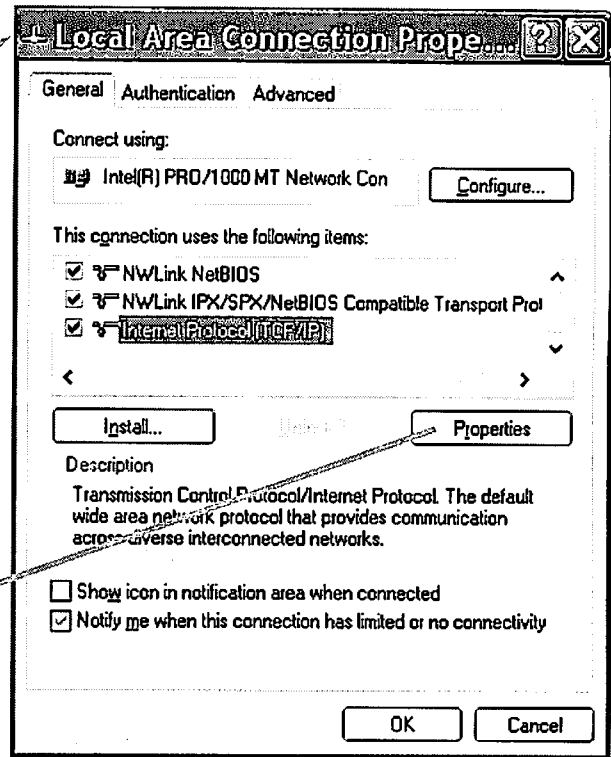


No Communications between Panel and PC (Personal Computer) (cont'd)

Check the IP Address setting of the PC by opening the Windows operating system's Control Panel and then selecting the Network Connections utility. Click on Properties, scroll down to Internet Protocol (TCP/IP) and click Properties. The Internet Protocol (TCP/IP) Properties dialog box will open. Again, make sure the Subnet Mask is set the same for both the panel and the PC and also make sure that the IP Addresses do not conflict.



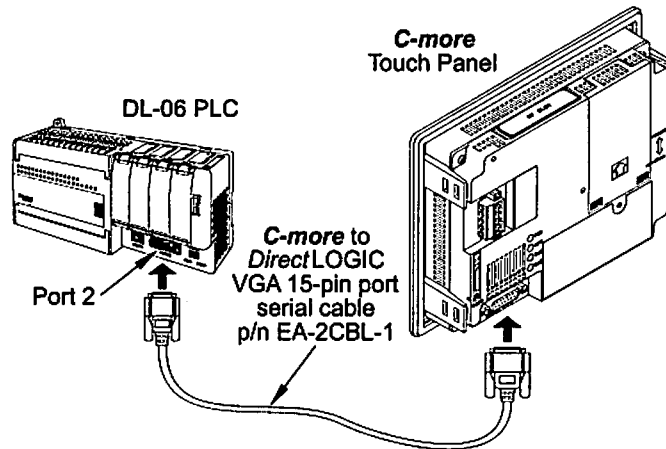
Note: If a DHCP Server is being used to obtain the IP Address for the PC, there are ways to identify the IP Address. For example, if using Windows XP, open a Command Prompt (Run > CMD) and type IPCONFIG /ALL. A list of all Ethernet assignments for the PC will be shown.



No Communications between Panel and PLC

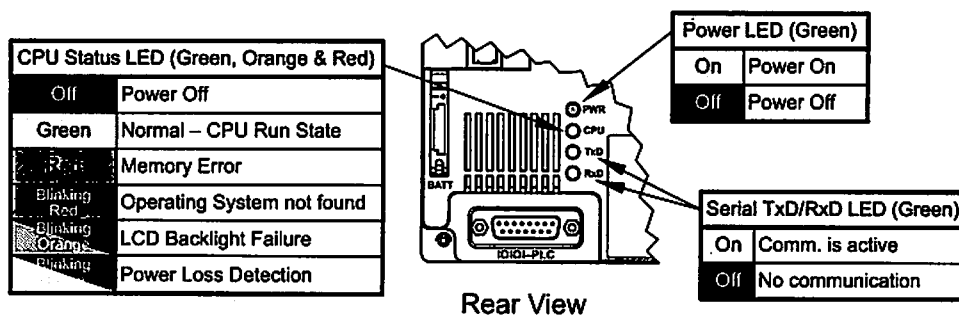
The communications between the *C-more* touch panel and designated PLC or controlling device can be accomplished by either a serial connection to the panel's 15-pin PLC Communications Port or by an Ethernet connection to the panel's 10/100 Base-T Ethernet Port. (Ethernet available on full feature units only.)

- 1.) If the touch panel and PLC are connected serially and the communications have seemed to stop working, then first check the TxD and RxD status indicators on the rear of the panel for activity.



If there is no activity on one or both the TxD and RxD status indicators, then it should be suspected that either:

- serial comm port settings are incorrect
- the cable is bad and needs to be replaced
- the serial port on the panel is defective
- the PLC serial port is bad



The status indicators will show activity whether the serial communications is wired for RS-232 or RS-422/485.

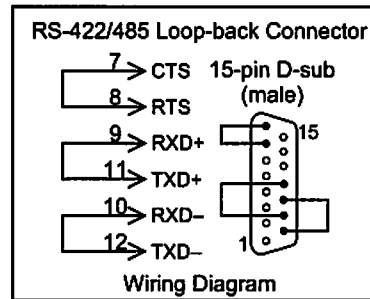
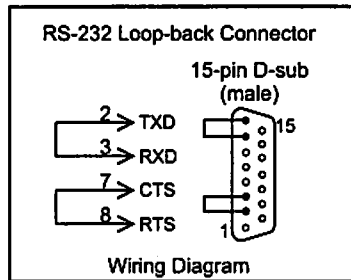
Electrical noise, pulse generating wiring and/or improper grounding can also cause problems with communications. Refer to the Electrical Noise Problems section on page 8-17 for additional help.

(Serial connections between the touch panel and PLC continued on next page.)

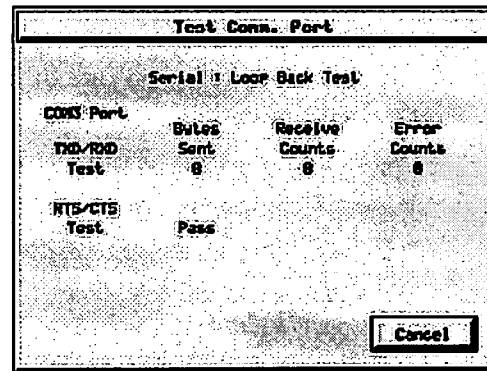
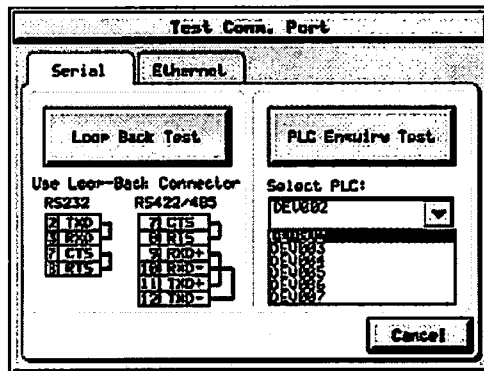
No Communications between Panel and PLC (cont'd)

The serial port on the *C-more* touch panel can be tested using the panel's system setup screens. Access the Main Menu of the panel's system setup screens, press the Test Menu button and then press the Test Comm. Port button. You will need to fabricate a Loop Back Connector for the type of serial connection that is being used in your application, either RS-232 or RS-422/485, per the wiring diagrams shown below. Plug the loop back connector into the panel's 15-pin PLC serial communications port and then press the Loop Back Test button to run the test. See Chapter 5: System Setup Screens for additional information.

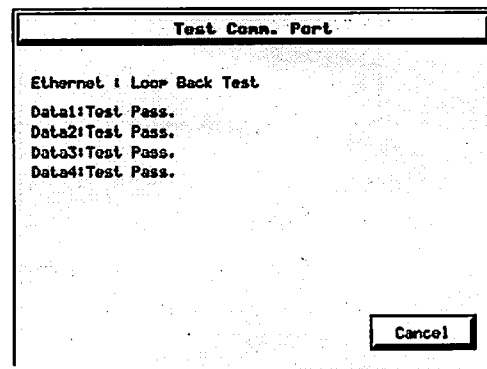
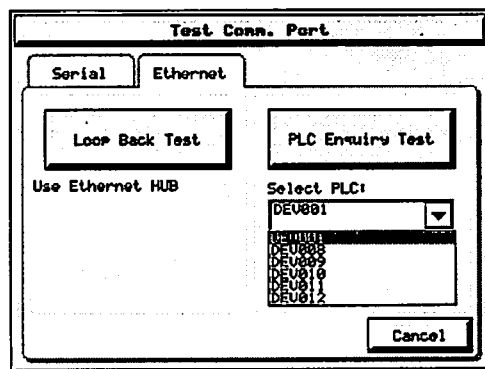
Loop back connector wiring diagrams:



System setup screens Test Comm. Port dialog boxes:



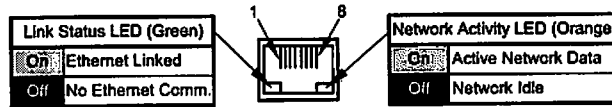
The PLC Enquiry Test can also be performed to determine if the Ethernet communication is working correctly between the panel and designated PLC .



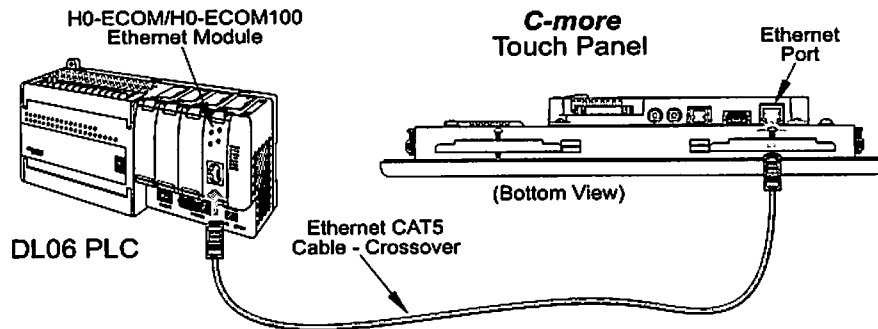
(Ethernet connections between the touch panel and PLC continued on next page.)

No Communications between Panel and PLC (cont'd)

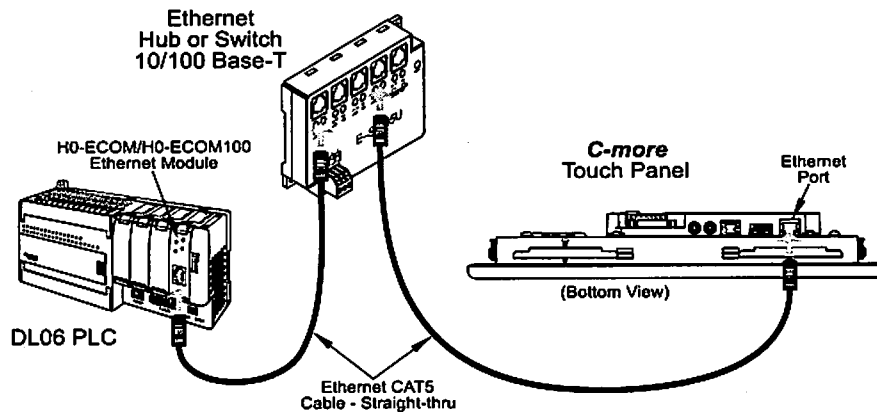
2.) If using an Ethernet connection between the touch panel and the PLC, and there is a problem with the communications, the first area to check is the Ethernet status indicators located next to the 10/100 Base-T Ethernet Port (shown below) on the rear of the panel.



There are two basic ways to make the connection. You can use a crossover Ethernet cable (shown below) to make a direct connection between the touch panel and the PLC or a



regular Ethernet cable (shown below) from the touch panel to a hub, switch, etc. that is also connected to the PLC.

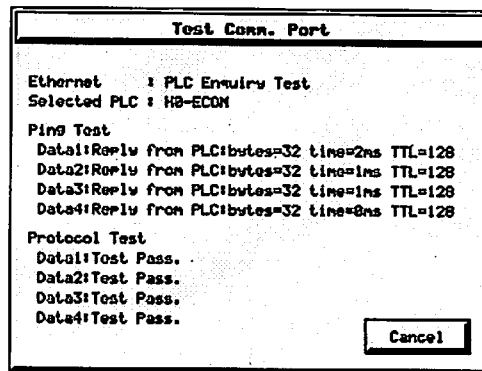
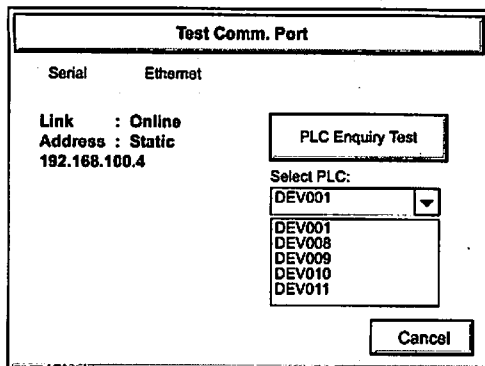


Check the status indicators that may be included with the Ethernet communications module or device that is part of the PLC. Refer to the PLC's Ethernet user manual for further troubleshooting information.

(Ethernet connections between the touch panel and PLC continued next page.)

No Communications between Panel and PLC (cont'd)

The Ethernet port on the *C-more* touch panel can be tested by using the panel's system setup screens. Access the Main Menu of the panel's system setup screens, press the Test Menu button and then press the Test Comm. Port button. Select the Ethernet tab in the Test Comm. Port dialog box, make sure the Ethernet port is connected to an Ethernet hub or other Ethernet communications device, and then press the Loop Back Test button to run the test. See Chapter 5: System Setup Screens for additional information.



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If a PC running the *C-more* programming software is connected to the Ethernet network that is also connected to both the touch panel and PLC, then certain functions in the software, such as the Main Menu's Setup drop down selection for Panel Manager or Touch Panel Network and the Main Menu's Panel drop down selection for Panel Information, can be used to help troubleshoot problems with the touch panel's communications and operation. See the *C-more* programming software's on-line help for additional information.

IP Address in System Setup Screens displays 0.0.0.0

Note: If entering an IP Address for the *C-more* touch panel using the System Setup Screens, and the IP Address keeps displaying 0.0.0.0, even after entering an IP address, the panel is not functionally connected to an active network. Either the cable, hub, or switch is bad. The entered IP Address is stored in the panel's memory, but won't show up until a good connection is established. Keep in mind that if in the *C-more* programming software's Touch Panel Network dialog box, under the Ethernet Port tab, you have checked the Save settings to Project check box and have entered an IP Address of 0.0.0.0, then anytime the project is transferred to the panel, the panel's IP Address will be overwritten with the entered address.

PLC Protocol Error Codes

The *C-more* touch panel includes built-in PLC communication protocol diagnostics that monitor the exchange of data between the panel and the PLC. The diagnostics look for the proper exchange of data, correct handshaking signals, addressing errors, incorrect data bytes, wrong packet format, etc. The diagnostics also monitor and report any of the errors that the designated PLC would normally generate if there is a problem with the PLC's communications. Each brand of PLC has its own unique set of diagnostic errors that are typically communicated over the PLC's communications port. The PLC generated errors are interpreted by the *C-more* software. See the PLC manufacturer's user manuals for additional details on the designated PLC's errors.

If a *C-more* communications error does occur, the error message will be displayed in the upper left of the *C-more* screen and the Error Code is recorded in the panel's error log. If a PLC error occurs, the PLC error code number will appear across the top of the screen, the PLC error message may not be included in some cases. The error log can be viewed using the system setup screens. See Chapter 5: System Setup Screens under the Information window to bring up the Error tab which includes a description of the logged data.

A detailed list and description of the various PLC protocol errors can be found in Appendix A: PLC Protocol Error Codes.

PLC Protocol Error Codes example:

Error Codes for <i>DirectLOGIC</i> K-Sequence		
Error Code	Error Message	Description
PLC-001	PLC Communication Timeout (for single PLC) %Device% PLC Communication Timeout (for multiple PLCs, such as RS-422/485)	A timeout occurred after sending a request to the PLC %Device%. %Device% indicates the device name, such as DEV001. Example error message for multiple PLCs: DEV001 PLC Communication Timeout
PLC-002	NAK received from PLC	A negative acknowledgement (NAK) control code has been generated during a read/write request.
PLC-004	STX is not found	A Start of Text (STX) control code was not found in the data packet received from the PLC.

Touch Panel Runtime Errors

The *C-more* touch panel includes built-in diagnostics that check for proper operation of the panel when it is running a project that has been transferred to its memory. Faults detected while the panel is running will produce a “Runtime” error. These errors are displayed in the upper left of the panel’s display and are also recorded in the panel’s error log. The error log can be viewed using the system setup screens. See Chapter 5: System Setup Screens under the Information window to bring up the Error tab which includes a description of the logged data.

A detailed list and description of the various touch panel runtime errors can be found in Appendix B: Touch Panel Runtime Errors.

Touch Panel Runtime Errors example:

No.	Error Log Code	Error Message Located at upper left of screen	Error Message Tag	Tag Error Code Value	System Screen Info > Error	Cause
Log Error						
1	RTE-001	Log Failed. Not enough Memory Space in %Device%	SYS ERR ERRORCODE	2001	MM/DD/YY HH/MM/SS Error Code RTE-001	The size of the destination memory is not large enough to store the data.
2	RTE-002	Log Failed. %Device% cannot be found	SYS ERR ERRORCODE	2002	MM/DD/YY HH/MM/SS Error Code RTE-002	No device available or the device is defective.
Battery						
1	RTE-031	Low Battery	SYS ERR ERRORCODE	2031	MM/DD/YY HH/MM/SS Error Code RTE-031	The panel's backup battery voltage level has fallen below 1.8 VDC and should be replaced.

8

Panel Constantly Displays “Initializing” when Powering up

If the touch panel constantly displays a message reading “Initializing” while powering up, then check the following possible causes.

- 1.) The project that is loaded into the panel’s internal SDRAM memory is corrupted. Either use the *C-more* programming software to clear the panel’s memory and re-transfer the project to the touch panel, or press the upper left corner of the touch panel screen while powering up to bypass the project and go directly to the System Setup Screen menu. Select the Memory menu, and use either the Clear Memory or Set to Factory Default utility to clear the panel’s memory and re-transfer the project to the touch panel.
- 2.) A CompactFlash memory card has been plugged into the CF1 slot and the CompactFlash either has no project stored on it or the project is corrupted. Remove the CompactFlash memory card from the CF1 slot and either load the project to the panel’s internal Flash memory, or use a CF card reader connected to a PC to clear and re-format the CompactFlash card, or try a different CompactFlash memory card.



Note: In the Error Log you may find the error RTE-500 - Check Sum Error, which is defined as “Memory in the panel has been corrupted by power loss, etc.” If this is the case, try cycling power to the panel, re-transfer the project to the panel, and re-transfer the firmware, etc. in sequential steps to try to correct the problem.

Data not Logging Problems

If the data log is missing entries, or a Runtime Error for the Log Errors as shown in Appendix B: Touch Panel Runtime Errors is seen, then check the following possible causes.

- 1.) Check that the memory devices, that were selected for Data Storage under the *C-more* programming software’s Main Menu - Setup drop down - Panel Manager dialog box, are plugged into their proper location. Alarms, messages and screen captures can be independently selected to be saved to either a USB pen drive plugged into the USB Port - Type A, or a CompactFlash memory card plugged into CF1 or CF2. (Full feature units only.)
- 2.) The memory device could be bad. If possible, check it by plugging it into a PC that has the ability to access the memory device. Also, not all USB devices are compatible with the *C-more* touch panels. Try using the *AutomationDirect* USB Pen Drive, p/n SDCZ4-2048-A10. Check System Screen, Memory for the presence of the USB device inserted.

Loss of Date/Time and Retentive Data

If power is cycled to the *C-more* touch panel and it is then noticed that either the Date/Time of the panel is no longer correct, or any data that has been setup to be retentive is inaccurate, most likely the backup battery is exhausted and needs to be replaced. See Chapter 9: Replacement Parts for additional information on replacing the panel’s battery.



D2-BAT-1

Electrical Noise Problems

Noise is one of the most difficult problems to diagnose. Electrical noise can enter a system in many different ways which fall into one of two categories, conducted or radiated. It may be difficult to determine how the noise is entering the system but the corrective actions for either of the types of noise problems are similar.

- Conducted noise is when the electrical interference is introduced into the system by way of an attached wire, panel connection, etc. It may enter through a power supply connection, the communication ground connection, or the chassis ground connection.
- Radiated noise is when the electrical interference is introduced into the system without a direct electrical connection, much in the same manner as radio waves.

While electrical noise cannot be eliminated, it can be reduced to a level that will not affect the system.

- Most noise problems result from improper grounding of the system. A good earth ground can be the single most effective way to correct noise problems. If a ground is not available, install a ground rod as close to the system as possible. Ensure all ground wires are single point grounds and are not daisy chained from one device to another. Ground metal enclosures around the system. A loose wire can act as a large antenna, introducing noise into the system. Therefore, tighten all connections in your system. Loose ground wires are more susceptible to noise than the other wires in your system. Review **Chapter 4: Installation & Wiring** if you have questions regarding how to ground the touch panel.
- Electrical noise can enter the system through the power source for the touch panel. Installing a properly wired isolation transformer (neutral grounded) for all AC sources can help the problem, but only if wired correctly. DC sources should be well-grounded good quality supplies.
- Never run communication cables or low-voltage power wiring close to high voltage wiring or pulse generating wiring that controls such devices as solenoids, servos, VFOs, etc.

REPLACEMENT PARTS



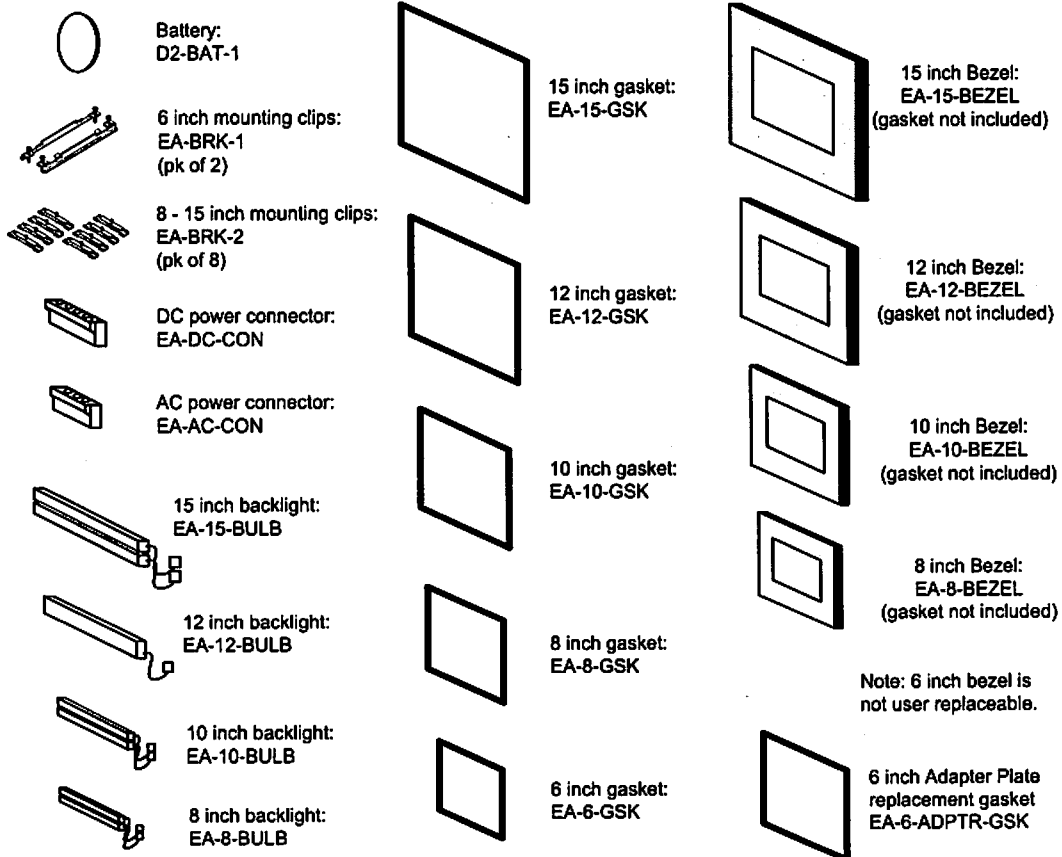
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6" Adapter Plate Gasket Replacement & Installation	9-14

Replacement Parts Overview

Part Number	Description	Part Number	Description
D2-BAT-1	Battery Replacement	EA-12-GSK	12" Panel Gasket Replacement
EA-BRK-1	6" Panel Mounting Clip Replacements (2 per pk.)	EA-10-GSK	10" Panel Gasket Replacement
EA-BRK-2	8-15" Panel Mounting Clip Replacements (8 per pk.)	EA-8-GSK	8" Panel Gasket Replacement
EA-DC-CON	DC Panel Power Connector Replacement	EA-6-GSK	6" Panel Gasket Replacement
EA-AC-CON	AC Power Adapter Connector Replacement	EA-15-BEZEL	15" Panel Bezel Replacement
EA-15-BULB	15" Panel Backlight Bulb Replacement	EA-12-BEZEL	12" Panel Bezel Replacement
EA-12-BULB	12" Panel Backlight Bulb Replacement	EA-10-BEZEL	10" Panel Bezel Replacement
EA-10-BULB	10" Panel Backlight Bulb Replacement	EA-8-BEZEL	8" Panel Bezel Replacement
EA-8-BULB	8" Panel Backlight Bulb Replacement	EA-6-ADPTR-GSK	6" Adapter Plate Gasket Replacement
EA-15-GSK	15" Panel Gasket Replacement		

9 Replacement Parts at a Glance:



Battery Replacement – D2-BAT-1



The *C-more* touch panels are supplied with a SRAM retentive memory backup battery that also is used to backup the internal CPU date/time registers. The battery should be replaced every 5 years or during any routine maintenance to the touch panel. As a note, the battery used in the *C-more* touch panels is the same battery that is used for backup in *AutomationDirect's* DL06, D2-250(-1), D2-260 and D3-350 PLCs.

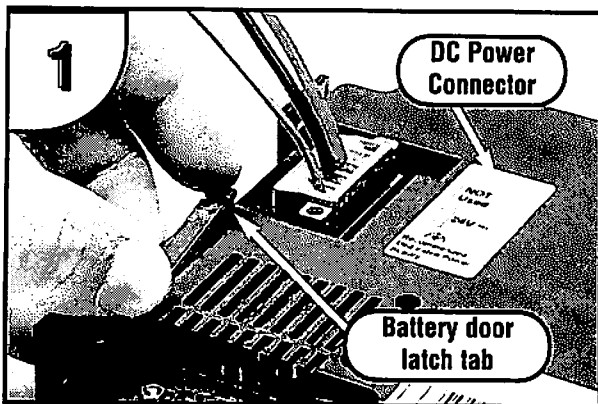
Battery Replacement Instructions:



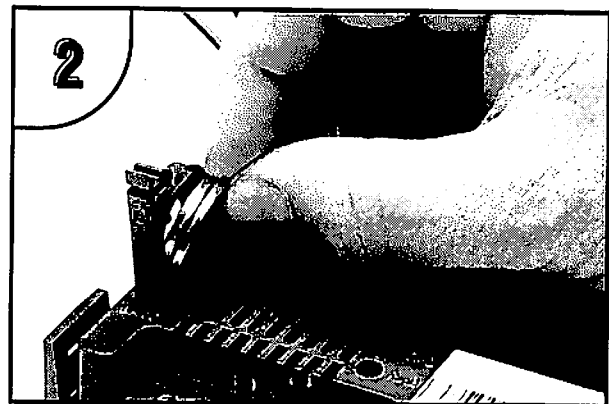
NOTE: The lithium battery in your panel is used to maintain the system **SRAM** retentive memory and the CPU date/time registers when the unit is without external power. Before replacing the battery, back-up the data in your **SRAM** retentive memory as a precaution. Input power needs to be maintained to the panel during battery replacement. Typical battery life is five years, which includes panel runtime and normal shutdown periods. However, consider installing a fresh battery if your battery has not been replaced recently and the unit will be without power for a period of more than ten days.

Preparation: If the touch panel is not mounted in or has been removed from a control cabinet, then it is recommended the panel be placed face down on a lint-free soft surface to prevent scratching the front of the panel. The battery door is located on the rear just below and to the left of the DC Power Connector.

9



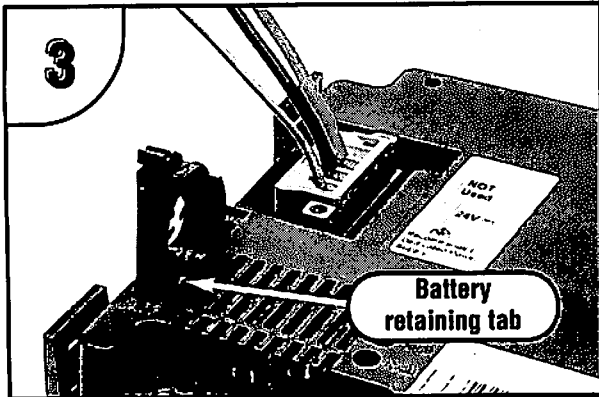
Open the battery holder door by pressing down on the upper latch tab while lifting upward and rotating the door in a downward motion. The battery door will pivot toward its bottom hinge point.



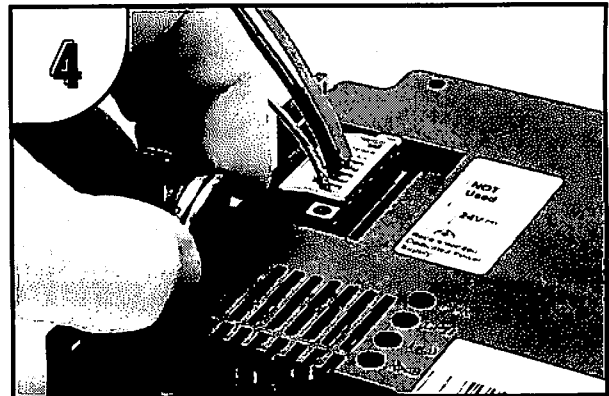
The coin cell style battery is located in the battery holder. To remove the battery, use the slot in the top of the holder to pry the battery away from the holder and while grasping the battery, lift it upward.

Continued on next page.

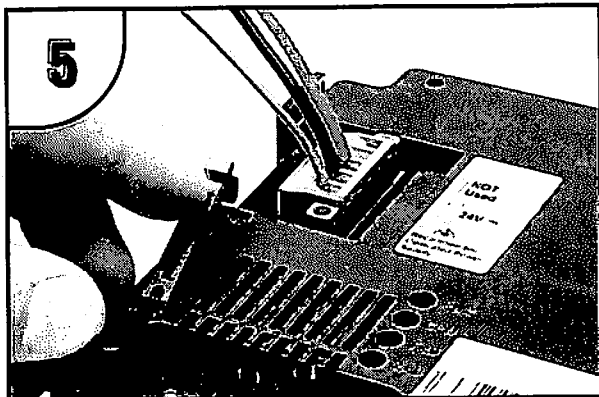
Battery Replacement Instructions (cont'd):



Above shows the empty battery holder and also points out the location of the battery retaining tab for reference in the next step.



To install the battery, hold the battery so that the larger diameter (+ symbol) is outward. Set the battery to the inside of the retaining tab and then press the upper top of the battery into the holder.



Press the battery holder door downward until the upper latch tab locks into place. Make a note of the date the battery was installed.

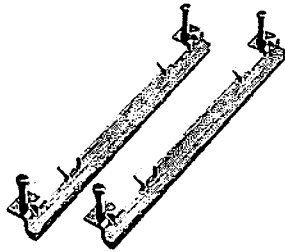


WARNING: DO NOT attempt to recharge the battery or dispose of an old battery by fire. The battery may explode or release hazardous materials. CR lithium batteries are safe for disposal in the municipal waste stream, but it is suggested that where possible, the battery be fully discharged prior to disposal. Additional precautions:

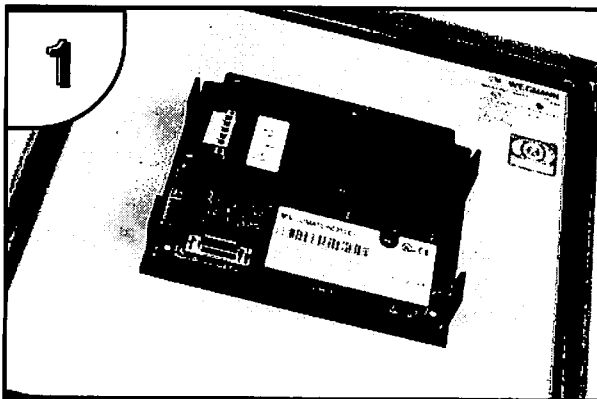
- Do not short circuit the battery and be sure to make the correct polarity connections.
- Avoid extremely high or low temperatures and high humidity when storing.
- Do not dismantle the battery.

6" Panel Mounting Clip Replacements – EA-BRK-1

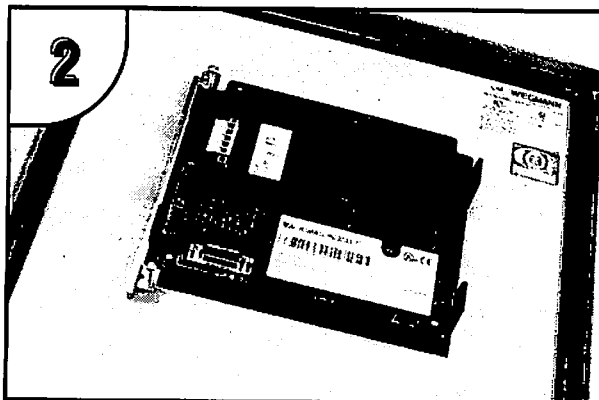
Spare panel mounting clips for 6 inch *C-more* touch panels.
Package of 2 clips with 4 screws.



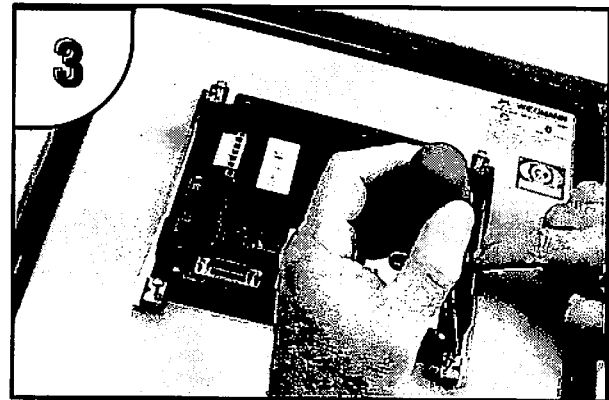
Installation Instructions



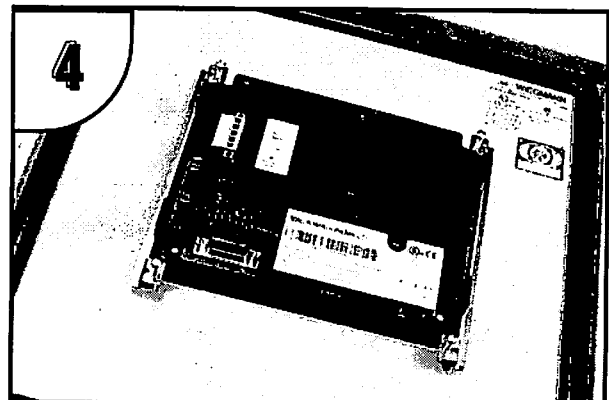
Position the touch panel through the cutout in the control cabinet door and hold in place. The mounting clips can be positioned into one of two different set of slots for different cabinet thicknesses. See table below.



The above photo shows one mounting clip in place. The example is using the lower mounting clip slots that accommodates an enclosure thickness of 0.039 – 0.24 inches [1 – 6 mm]. The upper slots can be used for an enclosure thickness of 0.20 – 0.63 inches [5 – 16 mm].



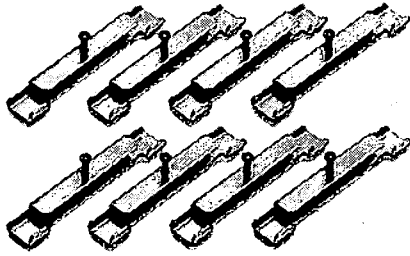
Tighten the mounting screws in an alternating fashion while observing the front of the touch panel. The goal is to make sure the front bezel is pulled up against the enclosure sheet metal uniformly, and the touch panel gasket is fully compressed all the way around its perimeter. Tighten the screws to a torque rating shown in the table below. Avoid over-tightening the screws to the point that they start to deform or bend the mounting clip.



The above photo shows both mounting clips in place and the touch panel secured.

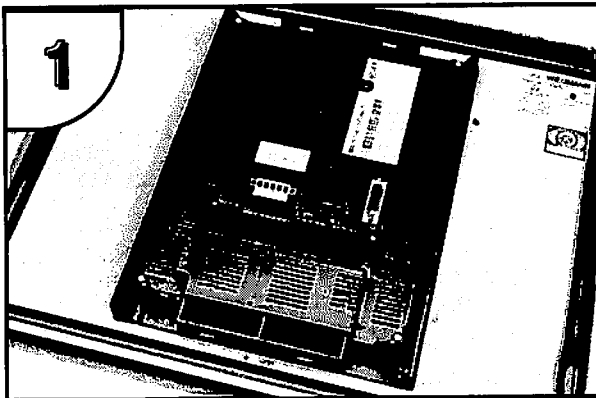
Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
6" lower mounting clip position	0.039 - 0.24 inch [1 - 6 mm]	35 ~ 50 oz-in [0.25 ~ 0.35 Nm]
6" upper mounting clip position	0.20 - 0.63 inch [5 - 16 mm]	35 ~ 50 oz-in [0.25 ~ 0.35 Nm]

8–15” Panel Mounting Clip Replacements– EA-BRK-2

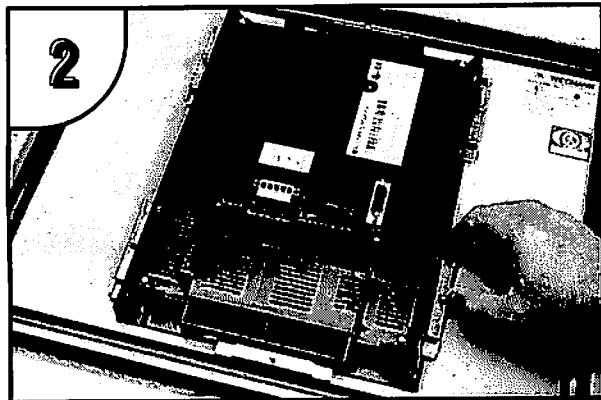


Spare panel mounting clips for the 8 inch through 15 inch *C-more* touch panels. Package of 8 clips with 8 screws.

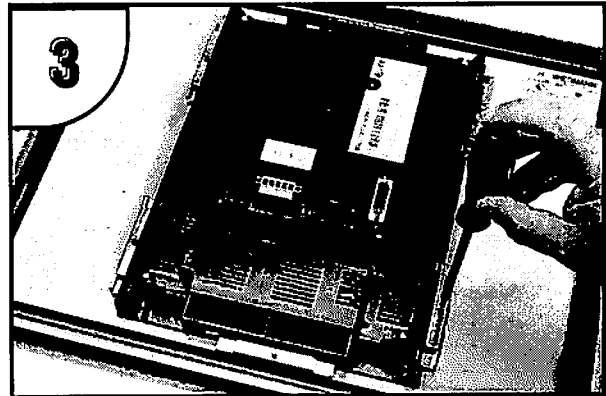
Installation Instructions



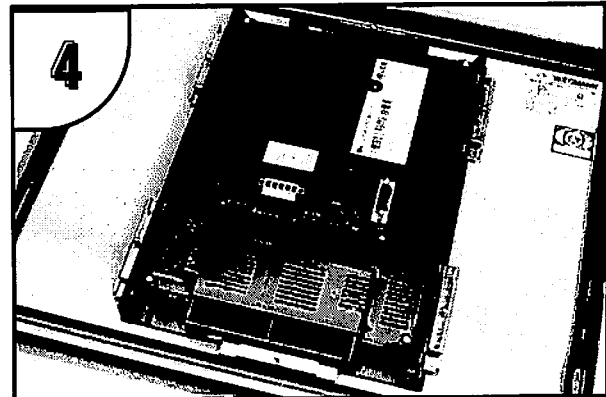
Position the touch panel through the cutout in the control cabinet door and hold in place. The mounting clips are positioned into the slots around the outside edge of the touch panel rear.



The mounting clips are positioned into the larger portion of the slot at two locations, and then slid toward the smaller portion of the slots to lock them in place. Some slots are arranged to slide to the left and others to the right.



Tighten the mounting screw for each mounting clip in an alternating fashion at all clips while observing the front of the touch panel. The goal is to make sure the front bezel is pulled up against the enclosure sheet metal uniformly, and the touch panel gasket is fully compressed all the way around its perimeter. Tighten the screws to a torque rating shown in the table below. Avoid over-tightening the screws to the point that they start to deform or bend the mounting clip.

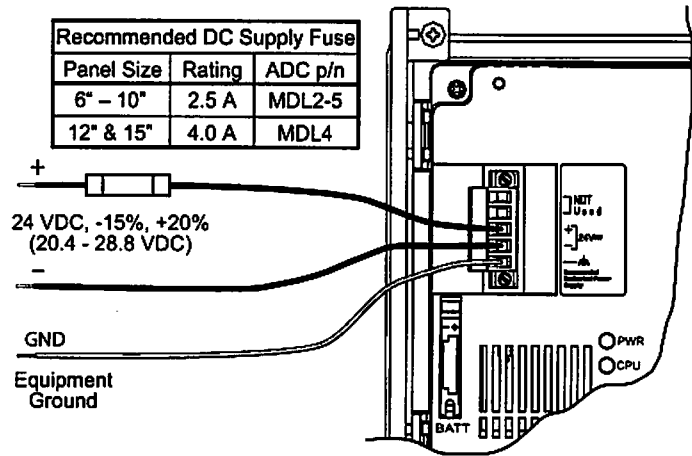
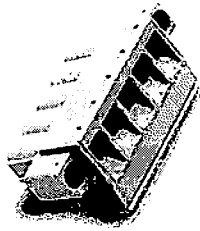


The above photo shows all mounting clips in place and the touch panel secured. The 8”, 10” and 12” touch panels require 6 mounting clips and the 15” touch panel requires 8 mounting clips.

Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
6” upper mounting clip position	0.20 - 0.63 inch [5 - 16 mm]	35 ~ 50 oz-in [0.25 ~ 0.35 Nm]

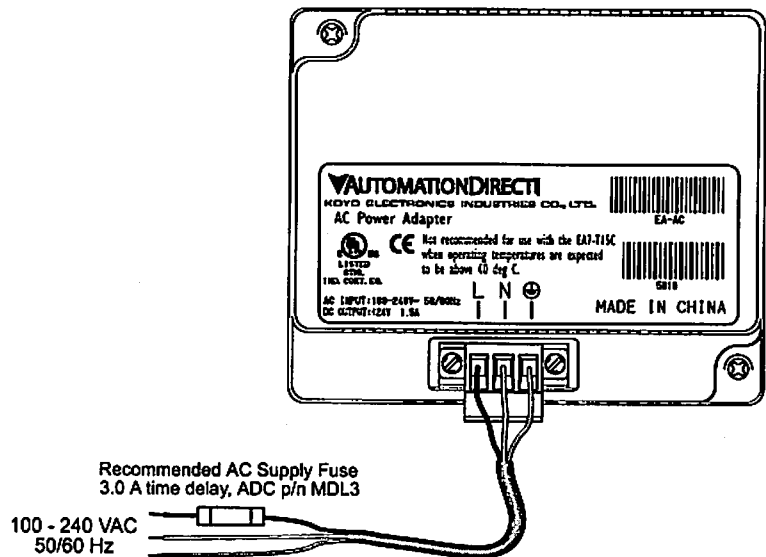
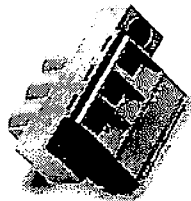
DC Panel Power Connector Replacement – EA-DC-CON

C-more touch panel 5-position DC power connector terminal block replacement. One (1) DC Power Connector is supplied with each touch panel.

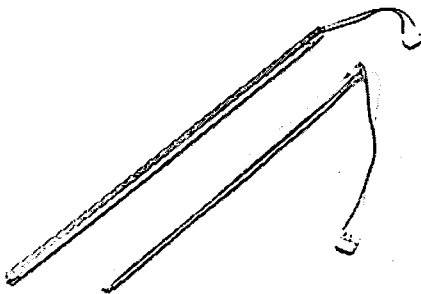


AC Power Adapter Connector Replacement – EA-AC-CON

C-more AC power adapter 3-position AC power connector terminal block replacement. One (1) AC Power Connector is supplied with each AC/DC Power Adapter, EA-AC.



8-15" Panel Backlight Bulb Replacements – EA-xx-BULB



Backlight assembly, customer replaceable, for *C-more* 8", 10", 12" and 15" touch panels. The 8", 10" and 15" touch panels use two bulbs per panel and the 12" touch panels use one bulb per panel. The bulbs are packaged two per box for the 8", 10" and 15" touch panels and one per box for the 12" touch panels.

(The part number is completed by substituting the panel size, 08, 10, 12 or 15, for the xx shown above.)

Backlight Bulb Installation Instructions Example:

(See the Data Sheet insert for the specific backlight bulb that is being replaced for more detailed information.)



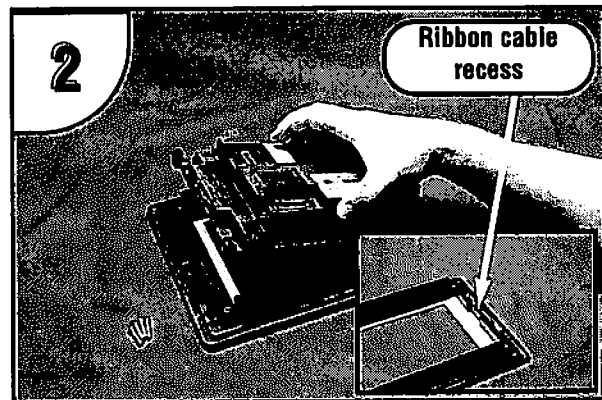
WARNING: This procedure should only be performed by qualified personnel who are experienced in working with electronic equipment. Take the necessary steps to prevent damage from static electricity discharge. Disconnect input power to the touch panel before proceeding. Be careful not to pinch the ribbon cable between the housing and bezel when re-assembling the panel.

9

Preparation: Disconnect input power and all other connections, then remove the touch panel from the control cabinet. In a clean environment, place the panel face down on a lint-free soft surface to prevent scratching the front of the panel.



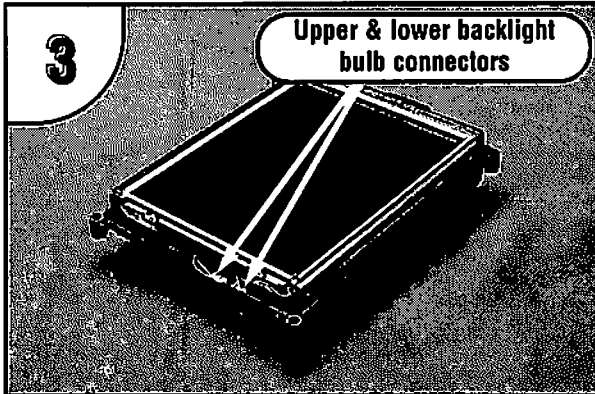
1
With power disconnected, use a #2 Phillips screwdriver to remove the four outer screws holding the touch panel's main electronics housing to the front bezel.



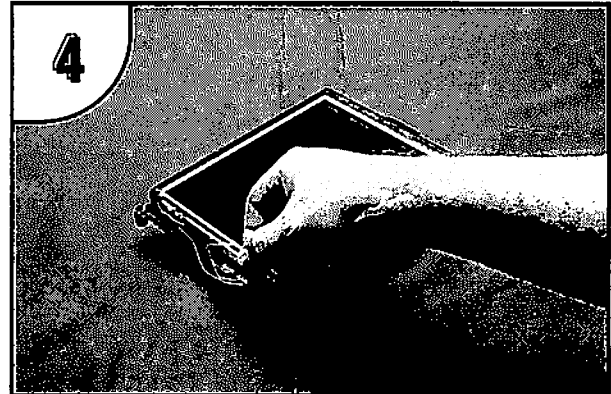
2
Lift the touch panel's main electronics housing from the front bezel. Set the front bezel and four screws to the side. Observe the ribbon cable recess on the front bezel (see detail) for use in re-assembling the panel.

Continued on next page.

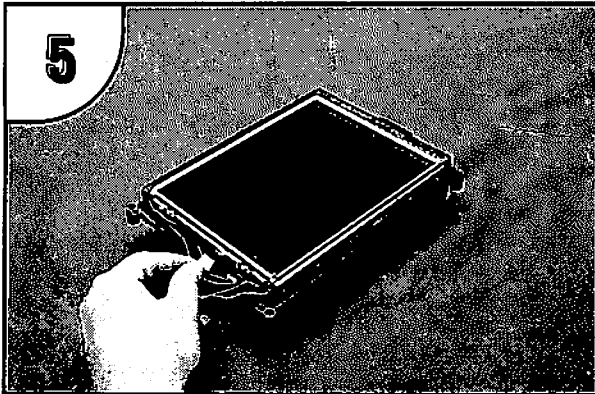
Backlight Bulb Installation Instructions Example (cont'd):



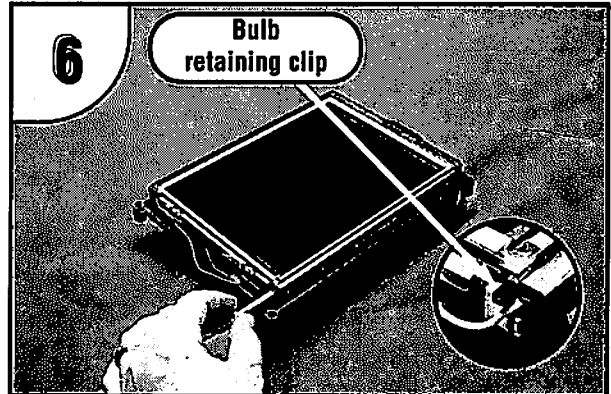
Place the touch panel's main electronics housing facing up on a lint-free soft surface. Position the housing so that the backlight bulb connectors are in plain view.



Carefully lift the bulb's wires out of the wire guides so they are free from obstructions. Do this for both the upper and lower backlight bulbs.



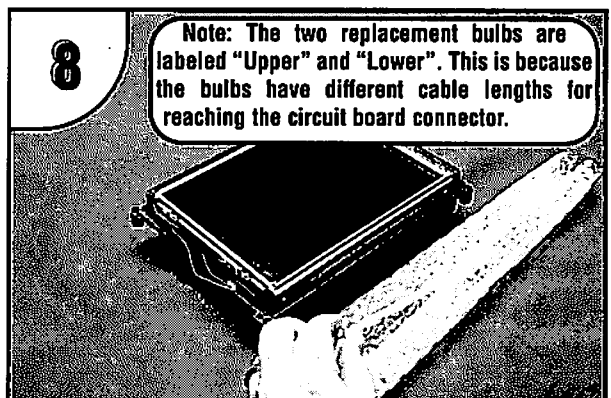
Unplug the backlight bulb's power cable connector from the circuit board connector. Again, do this for both the upper and lower backlight bulbs.



Push up on the bulb retaining clip (see detail) while grasping the plastic end of the bulb assembly and gently slide the bulb from its guide. Do this for both bulbs. The bulb is glass and fragile, so handle with care.



This photo shows the backlight bulb completely removed from its guide in the panel's main electronics housing. (Only one bulb shown.)

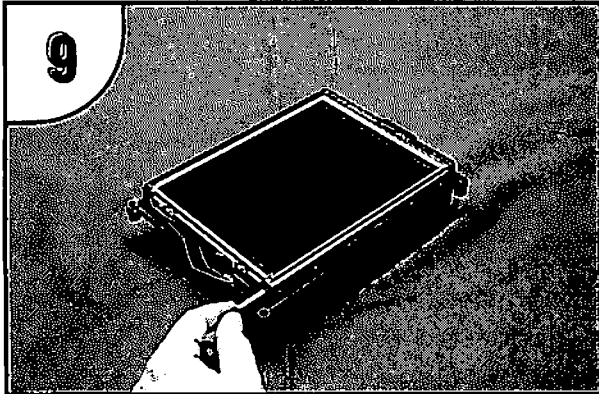


Remove the replacement bulb from its shipping tube and the protective bubble wrap. Note: The replacement bulbs come in pairs and should be replaced in pairs for longevity and maintenance convenience.

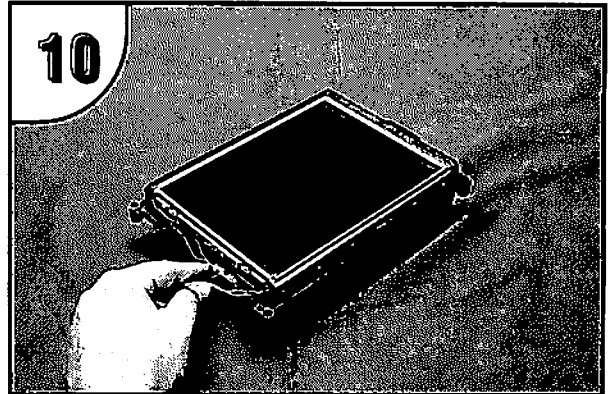
9

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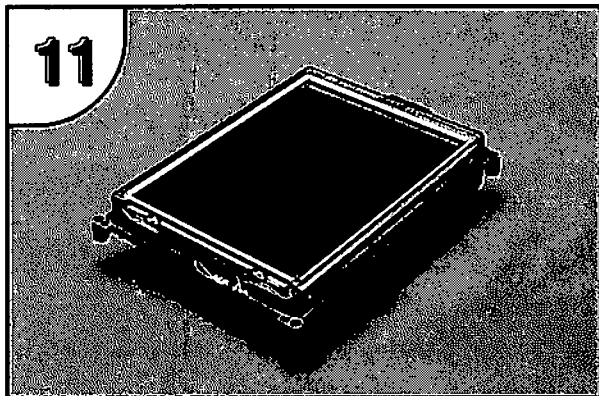
Backlight Bulb Installation Instructions Example (cont'd):



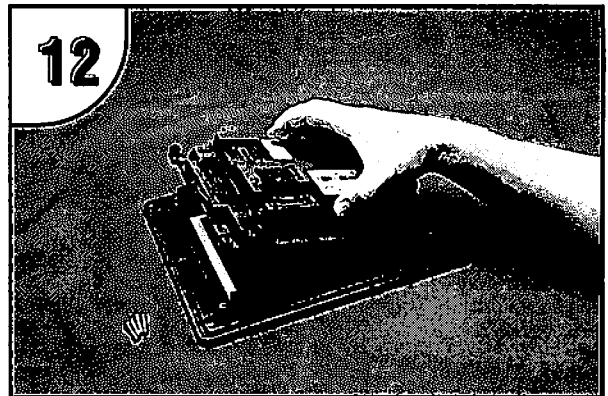
9
Position the replacement bulb so that the opening in its three-sided gold colored reflector faces toward the LCD touch screen. Using gentle pressure, slide the bulb into the guide until the retaining clip locks.



10
Plug each backlight bulb's power cable connector back into its respective circuit board connector.

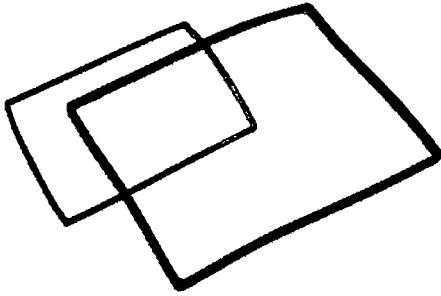


11
Gently position each backlight bulb's wires back into their respective wire guides to help clear any obstructions when inserting the panel's main electronics housing back into the front bezel. Position any excess wire length in between the printed circuit board and the LCD to prevent it from becoming pinched between the housing and bezel.



12
Position the touch panel's main electronics housing into the front bezel so that the flat ribbon cable on the housing aligns with the recess in the front bezel. Insert the four screws and tighten to a maximum of 70 oz-in [0.5 Nm].

6-15" Panel Gasket Replacements – EA-xx-GSK

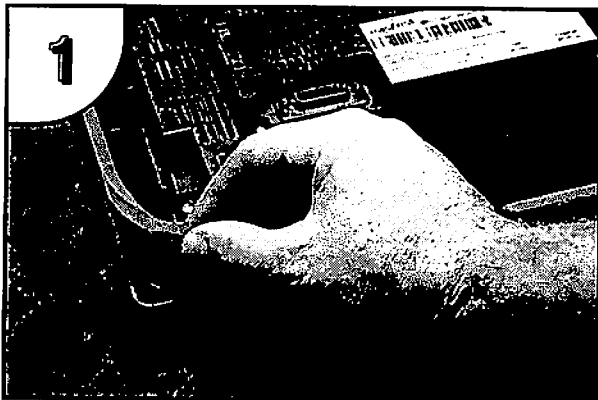


Replacement NEMA 4/4X touch panel gaskets for *C-more* 6", 8", 10", 12" and 15" touch panels.

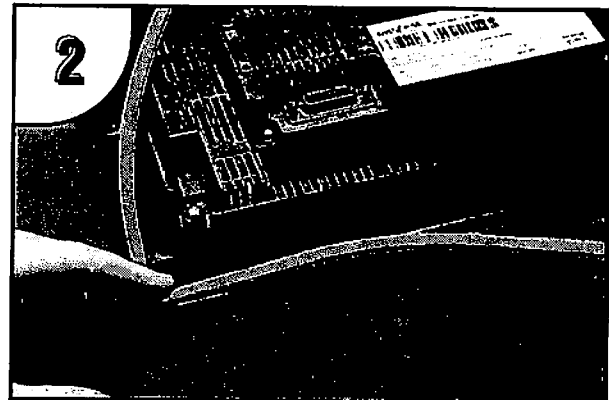
(The part number is completed by substituting the panel size, 06, 08, 10, 12 or 15, for the xx shown above.)

Gasket Replacement Installation Instructions:

Preparation: Disconnect input power and all other connections, then remove the touch panel from the control cabinet. In a clean environment, place the panel face down on a lint-free soft surface to prevent scratching the front of the panel.

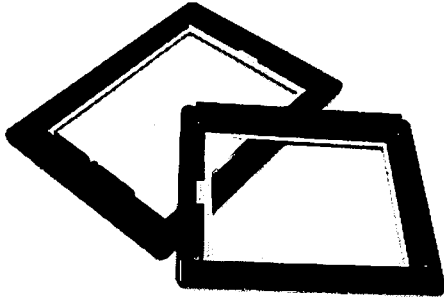


Start at one corner and pull the old gasket out of the channel that holds the gasket in place. Pull the gasket up as you work around the entire perimeter of the touch panel. Discard the old gasket.



Lay the new gasket over the channel so that the long and short sides of the gasket match up to the long and short sides of the touch panel. Start at one corner and match the gasket's corner to the channel's corner. Press the gasket into the channel and work all away around the perimeter of the touch panel. Re-install the touch panel.

8-15" Panel Bezel Replacement – EA-xx-BEZEL



The NEMA 4/4X bezels used on the *C-more* 8", 10", 12" and 15" touch panels can be easily replaced. The replacement bezel includes the clear membrane element that protects the touch sensitive area. A gasket is not included. The bezel and membrane element do not require replacement under normal use. In the event that the clear membrane is scratched from the use of sharp objects or abrasive materials, follow the procedure outlined below to replace the front bezel.

(The part number is completed by substituting the panel size, 08, 10, 12 or 15, for the xx shown above.)



Note: The bezel on the 6" *C-more* touch panels is not user replaceable and can only be replaced by *AutomationDirect*. Contact the *AutomationDirect* returns department @ 1-800-633-0405 to make arrangements for returning the unit for repair.

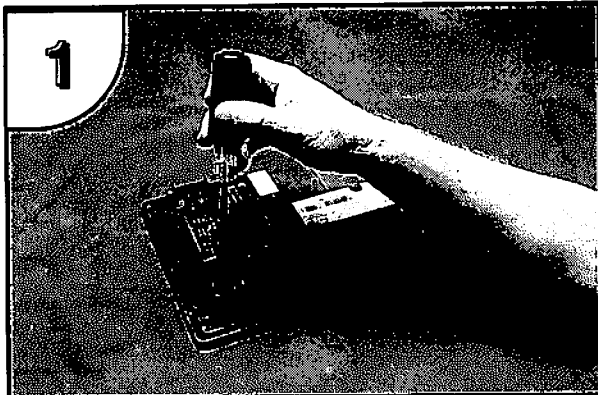
Bezel Replacement Instructions Example:

9

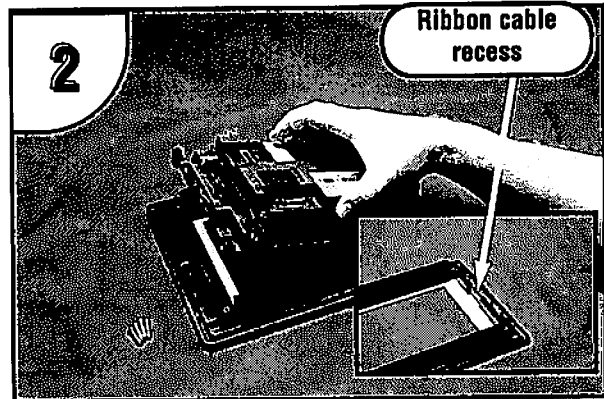


WARNING: This procedure should only be performed by qualified personnel who are experienced in working with electronic equipment. Take the necessary steps to prevent damage from static electricity discharge. Disconnect input power to the touch panel before proceeding. Be careful not to pinch the ribbon cable between the housing and bezel when re-assembling the panel.

Preparation: Disconnect input power and all other connections, then remove the touch panel from the control cabinet. In a clean environment, place the panel face down on a lint-free soft surface to prevent scratching the front of the panel.



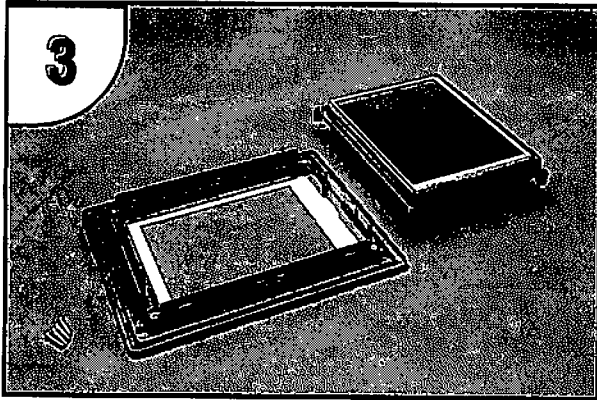
With power disconnected, use a #2 Phillips screwdriver to remove the four outer screws holding the touch panel's main electronics housing to the front bezel.



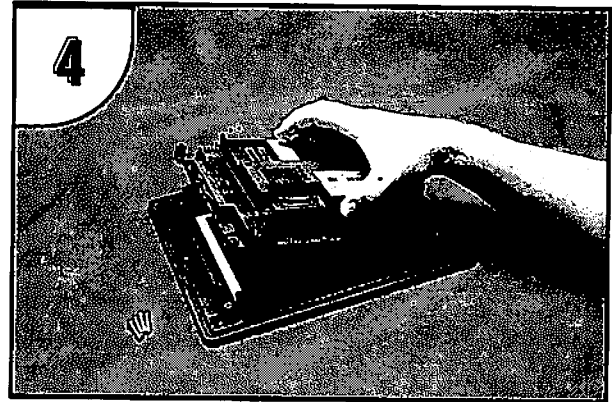
Lift the touch panel's main electronics housing from the front bezel. Set the four screws to the side and discard the original bezel. Observe the ribbon cable recess on the front bezel (see detail) for use in re-assembling the panel.

Continued on next page.

Bezel Replacement Instructions Example (cont'd):

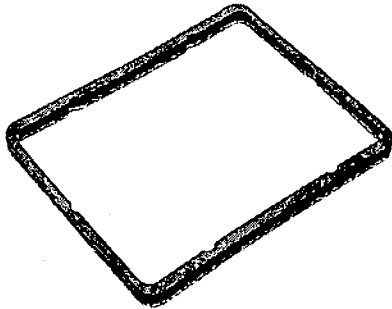


Place the new bezel facing down on the lint-free soft surface along with main electronics and four screws.



Position the touch panel's main electronics housing into the new bezel so that the flat ribbon cable on the housing matches up with the recess in the front bezel. Insert the four screws and tighten to a maximum of 70 oz-in [0.5 Nm].

6" Adapter Plate Gasket Replacement – EA-6-ADPTR-GSK

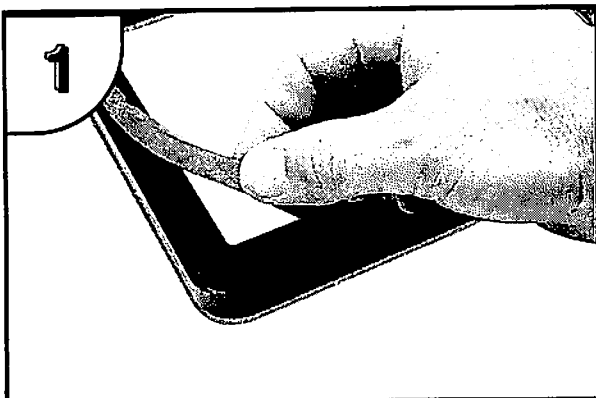


6-inch replacement NEMA 4/4X gasket for the *C-more* touch panel adapter plate.

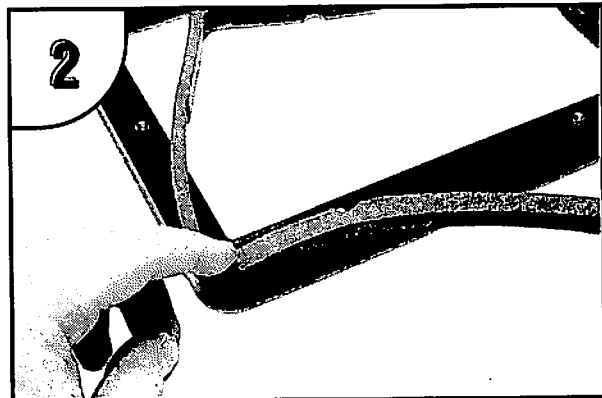
6" Adapter Plate Gasket Replacement Instructions:

Preparation: Disconnect input power and all other connections, remove the touch panel from the 6" adapter plate, and then remove the adapter plate from the control cabinet by removing the six (6) screws that secure the adapter to the control cabinet. In a clean environment, place the adapter plate face down on a lint-free soft surface to prevent scratching the adapter plate.

9

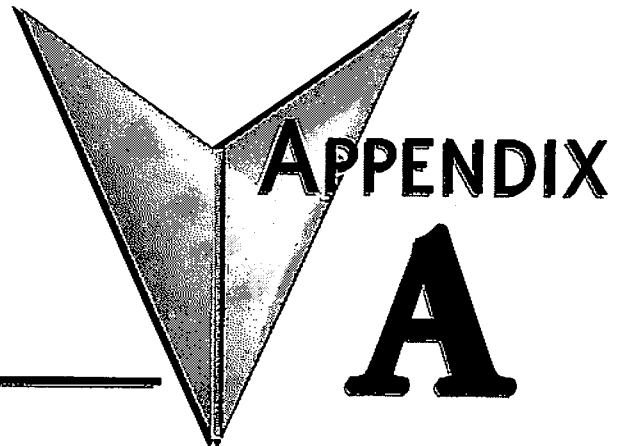


Start at one corner and pull the old gasket out of the channel that holds the gasket in place. Pull the gasket up as you work around the entire perimeter of the adapter plate. Discard the old gasket.



Lay the new gasket over the channel so that the long and short sides of the gasket match up to the long and short sides of the adapter plate. Start at one corner and match the gasket's corner to the channel's corner. Press the gasket into the channel and work all away around the perimeter of the adapter plate. Re-install the adapter plate and then the touch panel.

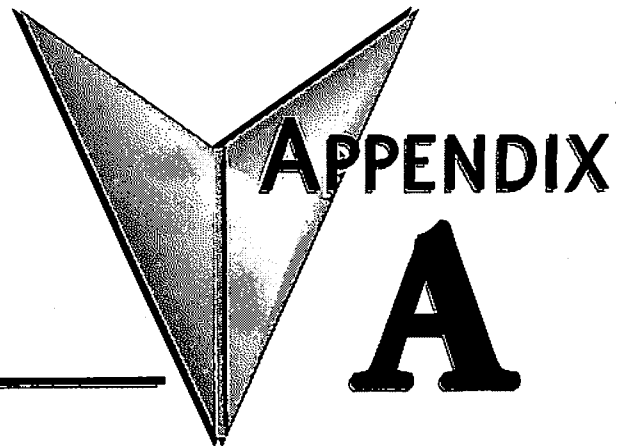
PANEL & PLC ERROR CODE TABLES



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PANEL & PLC ERROR CODE TABLES



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Introduction

A

The *C-more* family of touch panels is capable of communicating with a wide variety of Programmable Logic Controllers. *C-more* is capable of communicating over RS232, RS422 and RS485 serial networks as well as Ethernet networks. It communicates with all controllers in the *Direct* LOGIC family of PLCs utilizing various protocols. *C-more* also communicates with other brands of PLCs by their different protocols. For a complete list of PLCs and protocols, see the table on page 16 of Chapter 1: Getting Started.

As with any network communications, errors will occur. To make it more simple for the user to identify the cause of the possible error, we have provided a error code table for all of the possible errors that *C-more* can detect.

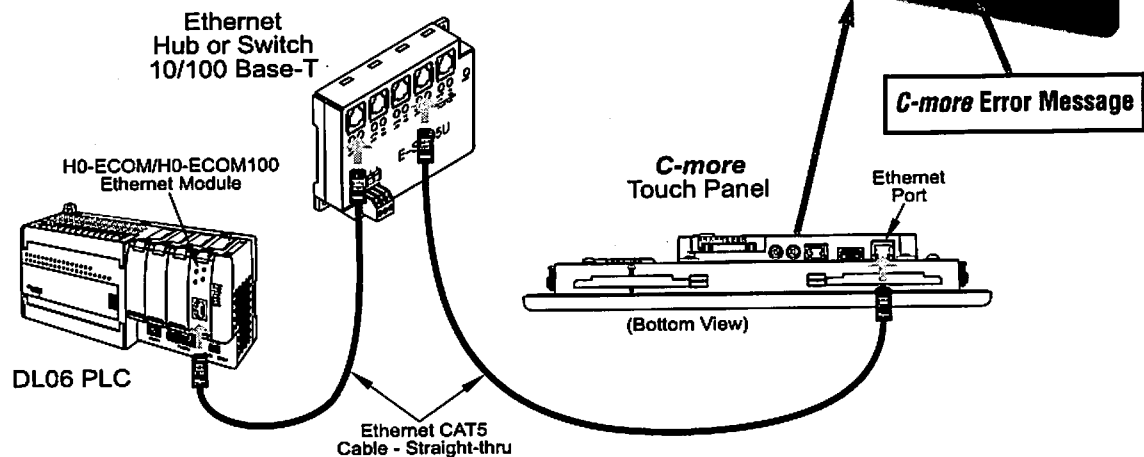
If a *C-more* communications error does occur, the error message will appear across the top of the screen. The *C-more* touch panel also monitors any errors that are generated by the various PLCs that are connected to it. If any of the PLC generated errors are detected, they are displayed across the top of the panel's display embedded as a hexadecimal value in error code P499's message. An explanation of how the specific PLC error is identified in the panel error code P499 is shown proceeding the specific manufacturer's PLC error tables. How the hexadecimal error code value is interrupted is slightly different between manufacturers, so it is important to check the explanation at the beginning of each manufacturer's tables.



Note: These PLC error codes are provided by the manufacturer of the related PLC and are subject to change by the PLC manufacturer. Please refer to the manufacturers documentation for a more complete and up-to-date list of error codes.

All errors are also logged into the panel's Error log under the Information tab in the panel's System Setup Screens and are identified by the error code number. See Chapter 5: System Setup Screens for additional details.

If you have difficulty determining the cause of the error, please refer to Chapter 8: Troubleshooting for some troubleshooting tips or contact our technical support group at 770-844-4200 or the 3rd party PLC manufacturer.



C-more Touch Panel Error Code Table

The following table includes all of the error codes and error messages that the panel will display if the listed cause is detected. All of these errors involve problems that could result with the panel communicating with the connected PLC. Be aware that not all of the panel errors are used with each type of PLC that can be connected to the panel.

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<i>C-more Touch Panel Error Code Table</i>		
Error Code	Error Message	Cause
PLC-001	PLC Communication Timeout (for single PLC) %Device% PLC Communication Timeout (for multiple PLCs, such as RS-422/485)	A timeout occurred after sending a request to the PLC %Device%. %Device% indicates the device name, such as DEV001. Example error message for multiple PLCs: DEV001 PLC Communication Timeout.
PLC-002	NAK received from PLC	A negative acknowledgement (NAK) control code has been generated during a read/write request.
PLC-003	EOT received from PLC	An End of Transmission (EOT) control code is sent by the PLC in response to a Read/Write/SetBit request..
PLC-004	STX is not found	A Start of Text (STX) control code was not found in the data packet received from the PLC.
PLC-005	ETX or ETB is not found	Neither an End of Text (ETX) nor an End of Transmission Block (ETB) control code was found in the data packet received from the PLC.
PLC-006	LRC does not match	There was an incorrect Longitudinal Redundancy Check (LRC) control code in the communications packet received from the PLC. This is an indication that the data in the packet is corrupted.
PLC-007	CRC does not match	There was an incorrect Cyclic Redundancy Check (CRC) control code in the communications packet received from the PLC. This is an indication that the data in the packet is corrupted.
PLC-008	Address does not match	The address value returned in the data packet from the PLC is incorrect.
PLC-009	Different function code received from PLC	The function code returned in the data packet from the PLC is incorrect.
PLC-010	Data size does not match	There are an incorrect number of bytes found in the data packet returned from the PLC.
PLC-011	Invalid value in function code	There is an invalid value in the function code.
PLC-012	Invalid command sent to PLC	There was an invalid command sent to the PLC that wasn't recognized by the PLC.
PLC-013	ENQ received from PLC	If the data packet does not include a negative acknowledgement (NAK - 0x15 value) in the defined packet field, then an enquiry (ENQ) control code error will be displayed.
PLC-014	Transaction ID does not match	This error will be displayed if after checking the Transaction ID Bytes in the data packet, there is no match to what was requested.
PLC-015	%Device% No device found	A PLC device designated as %Device% could not be found.
PLC-016	Data byte communication error	0 byte of data is recieved
PLC-017	Out of address range	The touch panel requested a file number larger than 255.
PLC-018	Panel communication timeout	The server panel did not respond when using the Panel Pass Through.
PLC-019	Found in parity error by hardware	An error detected in the PLC memory.
PLC-020	Can't open serial port	Cannot open the Serial Port. If this error shows on the panel, it indicates a hardware problem.
PLC-021	PLC number does not match	The PLC number does not match the PLC number configured.
PLC-022	Can't reset DCB	Unable to reset the data communication bit.
PLC-023	Cable not connected properly	Communication cable incorrectly installed.

C-more Touch Panel Error Code Table continued on the next page.

C-more Touch Panel Error Code Table (cont'd)

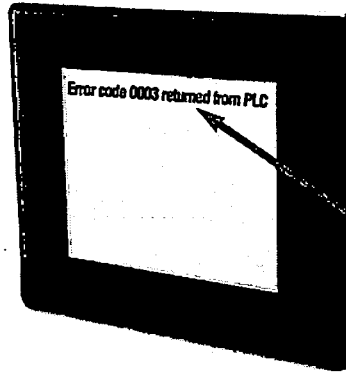
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<i>C-more</i> Touch Panel Error Code Table (cont'd)		
Error Code	Error Message	Cause
PLC-024	Cannot detect other devices on network	The panel is not communicating with other devices on the network.
PLC-025	Panel not in polling list	
PLC-026	PLC connection timeout	A timeout occurred after sending a request to the PLC.
PLC-027	Memory type incorrect	
PLC-028	PLC failed to respond	The PLC failed to respond after sending a request to the PLC.
PLC-495	Omron Ethernet Error	An error code specific to Omron Ethernet with a Value of XXXX has been returned from the PLC. See the explanation for error code PLC-495 proceeding the Omron CS/CJ FINS Ethernet error code tables.
PLC-496	Error code 0xaaaaaaaaa returned from PLC	Allen-Bradley EtherNET/IP specific. Encapsulation Error. See the explanation for error code PLC-496 proceeding the Allen-Bradley EtherNet/IP error code tables.
PLC-497	Error code 0xaaaaaaaaa returned from PLC	Allen-Bradley EtherNET/IP specific. CIP Error. See the explanation for error code PLC-497 proceeding the Allen-Bradley EtherNet/IP error code tables.
PLC-498	Error code 0xaaaaaaaaa returned from PLC	Allen-Bradley EtherNET/IP specific. Service Packet Error. See the explanation for error code PLC-498 proceeding the Allen-Bradley EtherNet/IP error code tables.
PLC-499	Error code XXXX returned from PLC	An error code with a value of XXXX has been returned from the PLC. See the explanation for error code PLC-499 below for <i>Direct</i> LOGIC and proceeding each set of PLC error code tables that use this error code.
PLC-500	Cannot write to Serial Port	Data cannot write to the Serial port. Data was sent to the PLC via the Serial Port. If this error shows on the Panel, it indicates a Hardware Problem.
PLC-700	Not enough buffer memory	There was an error while allocating memory for the read buffer. When this error is displayed, a memory leak may have occurred.
PLC-701	Access to inaccessible PLC memory	Request to inaccessible memory from the HMI layer to the PLC protocol layer. This error is an indication that there is a problem in the HMI layer.
PLC-702	Cannot access by different function code	A Read/Write/SetBit request has been sent to an invalid memory area. This error is an indication that there is a problem in the HMI layer.
PLC-703	Write request to PLC Read Only Memory	A PLC Write request was made to the PLC's Read-Only memory area. This error is an indication that there is a problem in the HMI layer or the PLC protocol layer.

DirectLOGIC – Panel Error Code PLC-499 Explanation

The PLC-499 error code is used to show any errors that are generated by the connected PLC. The PLC-499 error message includes a four digit hexadecimal value embedded in the message. This value can be looked up in the specific PLC's error tables to determine the cause of the error. The possible PLC generated error codes for the *DirectLOGIC* communication protocol is represented by a hexadecimal value as shown in the following message example.

DirectLOGIC Error Code PLC-499 Message Example:



Panel error code PLC-499 showing a hexadecimal value of 0003 indicates an "Illegal data value dependent upon the request." PLC error.

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DirectLOGIC K-Sequence Protocol – PLC Error Code Table

The following table lists the errors that can be generated by the *DirectLOGIC* PLC when using the K-Sequence protocol.

PLC Error Codes for <i>DirectLOGIC</i> – K-Sequence	
Panel Error Code PLC-499 Hex Value	Description
01F8	Error setting value.
020D	Error in key mode.
021C	Password protected.



Note: The following errors can be generated from the designated PLC, are monitored by the *C-more* touch panel, and displayed on the touch panel's screen as a hexadecimal value in panel error code PLC-499 message, if active. Please refer to the PLC manufacturer's documentation for additional information.

DirectLOGIC DirectNET Protocol – PLC Error Codes

Only errors as listed in the Touch Panel Error Code Table shown on page A-3 can occur when using the *DirectLOGIC DirectNET* protocol, there are no PLC generated errors.

DirectLOGIC error code tables continued on the next page.

DirectLOGIC Modbus (Koyo) Protocol – PLC Error Code Table

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The following table lists the errors that can be generated by the *DirectLOGIC* PLC when using the Modbus (Koyo) protocol.

PLC Error Codes for <i>DirectLOGIC</i> – Modbus (Koyo)	
Panel Error Code PLC-499 Hex Value	Description
0x1	The function code is unknown by the server.
0x2	Dependent upon the request.
0x3	Illegal data value dependent upon the request.
0x4	The server failed during the execution.



Note: The following errors can be generated from the designated PLC, are monitored by the C-more touch panel, and displayed on the touch panel's screen as a hexadecimal value in panel error code PLC-499 message, if active. Please refer to the PLC manufacturer's documentation for additional information.

Modbus RTU Protocol – PLC Error Code Table

The following table lists the errors that can be generated by the *DirectLOGIC* PLC when using the Modbus RTU protocol.

PLC Error Codes for Modbus RTU	
Panel Error Code PLC-499 Hex Value	Description
0x1	The function code is unknown to the server.
0x2	Dependent upon the request.
0x3	Illegal data value dependent upon the request.
0x4	The server failed during the execution.



Note: The following errors can be generated from the designated PLC, are monitored by the C-more touch panel, and displayed on the touch panel's screen as a hexadecimal value in panel error code PLC-499 message, if active. Please refer to the PLC manufacturer's documentation for additional information.

Modbus TCP/IP Protocol – PLC Error Code Table

The following table lists the errors that can be generated by the *DirectLOGIC* PLC when using the Modbus TCP/IP protocol.

PLC Error Codes for Modbus TCP/IP	
Panel Error Code PLC-499 Hex Value	Description
0x1	The function code is unknown to the server.
0x2	Dependent upon the request.
0x3	Illegal data value dependent upon the request.
0x4	The server failed during the execution.



Note: The following errors can be generated from the designated PLC, are monitored by the C-more touch panel, and displayed on the touch panel's screen as a hexadecimal value in panel error code PLC-499 message, if active. Please refer to the PLC manufacturer's documentation for additional information.

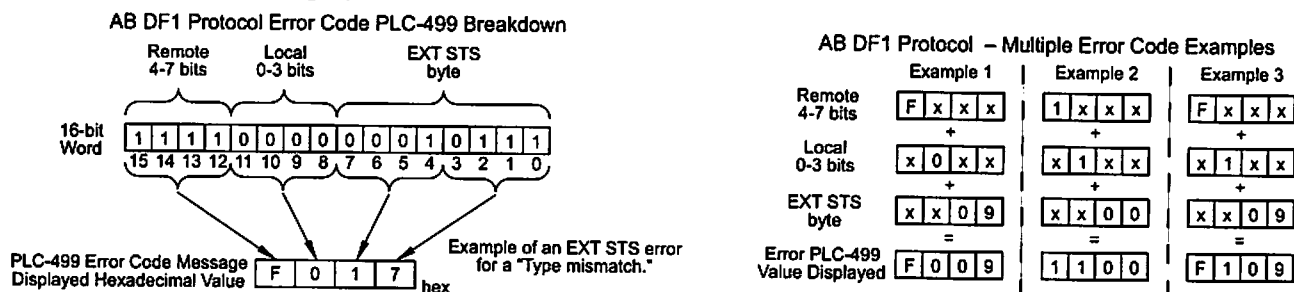
DirectLOGIC ECOM Protocol – PLC Error Codes

Only errors as listed in the Touch Panel Error Code Table shown on page A-3 can occur when using the *Direct*LOGIC ECOM protocol, there are no PLC generated errors.

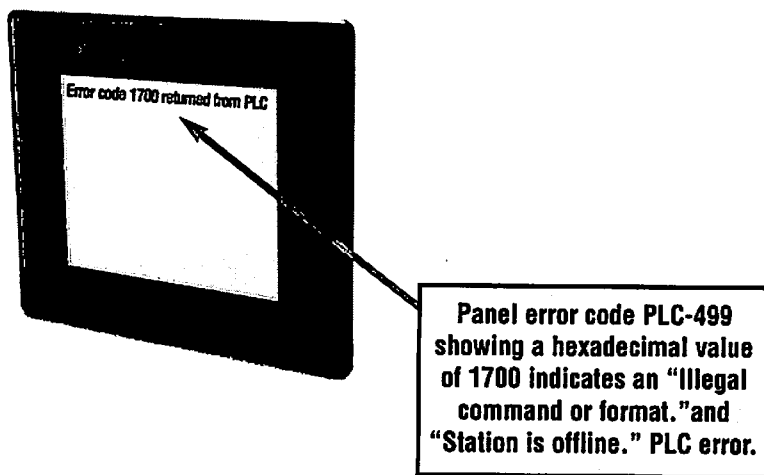
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Allen-Bradley – Panel Error Code PLC-499 Explanation

The PLC-499 error code is used to show any errors that are generated by the connected PLC. The PLC-499 error message includes a four digit hexadecimal value embedded in the message. This value can be looked up in the specific PLC's error tables to determine the cause of the error. The possible PLC generated error codes for the Allen-Bradley DF1 communication protocol is represented by a hexadecimal value as shown in the following message example. Please note that the error code is broken down into three sections. It is possible for more than one type of PLC error to be displayed in this value.



Allen-Bradley Error Code PLC-499 Message Example:



Allen-Bradley DF1 Protocol – PLC Error Code Tables

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The following PLC error code tables cover possible errors that are detected by the panel from Allen-Bradley PLCs using the DF1 protocol. This includes full and half duplex communications for the MicroLogix 1000, 1100, 1200 & 1500, SLC 5/03, /04, /05, ControlLogix, CompactLogix and FlexLogix, and full duplex communications for the PLC5.



Note: The following errors can be generated from the designated PLC, are monitored by the C-more touch panel, and displayed on the touch panel's screen as a hexadecimal value in panel error code PLC-499 message, if active. Please refer to the PLC manufacturer's documentation for additional information.

PLC Errors for Allen-Bradley DF1 Protocol, Local STS Errors (0-3 bits)	
Panel Error Code PLC-499 Hex Value	Description
0x0	Success; no error.
0x1	DST node is out of buffer space.
0x2	Cannot guarantee delivery; link layer. (The remote node specified does not ACK command.)
0x3	Duplicate token holder detected.
0x4	Local port is disconnected.
0x5	Application layer timed out waiting for response.
0x6	Duplicate node detected.
0x7	Station is offline.
0x8	Hardware fault.

PLC Errors for Allen-Bradley DF1 Protocol, Remote STS Errors (4-7 bits)	
Panel Error Code PLC-499 Hex Value	Description
0x0	Success; no error.
0x10	Illegal command or format.
0x20	Host has a problem and will not communicate.
0x30	Remote node host is missing, disconnected, or shut down.
0x40	Host could not complete function due to hardware fault.
0x50	Addressing problem or memory protect rungs.
0x60	Function not allowed due to command protection selection.
0x70	Processor is in Program Mode.
0x80	Compatibility mode file missing or communication zone problem.
0x90	Remote node cannot buffer command.
0xA0	Wait ACK (1775 KA buffer full).
0xB0	Remote node problem due to download.
0xC0	Wait ACK (1775 KA buffer full).
0xD0	not used
0xE0	not used
0xF0	Error code in the EXT STS byte. See the error code table on the next page.

(PLC generated error codes for the Allen-Bradley DF1 protocol continued on the next page.)

Allen-Bradley DF1 Protocol – PLC Error Code Tables (cont'd)

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PLC Errors for Allen-Bradley DF1 Protocol, EXT STS Command Code for F0 Command	
Panel Error Code PLC-499 Hex Value	Description
0x0	not used
0x1	A field has an illegal value.
0x2	Fewer levels specified in address than minimum for any address.
0x3	More levels specified in address than system supports.
0x4	Symbol not found.
0x5	Symbol is of improper format.
0x6	Address does not point to something usable.
0x7	File is wrong size.
0x8	Cannot complete request; situation has changed since start of the command.
0x9	Data or file size is too large.
0xA	Transaction size plus word address is too large.
0xB	Access denied; improper privilege.
0xC	Condition cannot be generated; resource is not available.
0xD	Condition already exists; resource is readily available.
0xE	Command cannot be executed.
0xF	Histogram overflow.
0x10	No access.
0x11	Illegal data type.
0x12	Invalid parameter or invalid data.
0x13	Address reference exists to deleted area.
0x14	Command execution failure for unknown reason; possible PLC 3 histogram overflow.
0x15	Data conversion error.
0x16	Scanner not able to communicate with 1771 rack adapter.
0x17	Type mismatch.
0x18	1771 module response was not valid.
0x19	Duplicated label.
0x22	Remote rack fault.
0x23	Timeout.
0x24	Unknown error.
0x1A	File is open; another node owns it.
0x1B	Another node is the program owner.
0x1C	Reserved
0x1D	Reserved
0x1E	Data table element protection violation.
0x1F	Temporary internal problem.

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Allen-Bradley DH485 Protocol – PLC Error Code Tables

The following PLC error code tables cover possible errors that are detected by the panel from Allen-Bradley PLCs using the DH485 protocol. This includes all MicroLogix and SLC500 PLCs, and any communication connection using an Allen-Bradley AIC device using the DH485 protocol.



Note: The following errors can be generated from the designated PLC, are monitored by the C-more touch panel, and displayed on the touch panel's screen as a hexadecimal value in panel error code PLC-499 message, if active. Please refer to the PLC manufacturer's documentation for additional information.

PLC Errors for Allen-Bradley DH485 Protocol, Local STS Errors (0-3 bits)	
Panel Error Code PLC-499 Hex Value	Description
0x0	Success; no error.
0x1	DST node is out of buffer space.
0x2	Cannot guarantee delivery; link layer. (The remote node specified does not ACK command.)
0x3	Duplicate token holder detected.
0x4	Local port is disconnected.
0x5	Application layer timed out waiting for response.
0x6	Duplicate node detected.
0x7	Station is offline.
0x8	Hardware fault.

PLC Errors for Allen-Bradley DH485 Protocol, Remote STS Errors (4-7 bits)	
Panel Error Code PLC-499 Hex Value	Description
0x0	Success; no error.
0x10	Illegal command or format.
0x20	Host has a problem and will not communicate.
0x30	Remote node host is missing, disconnected, or shut down.
0x40	Host could not complete function due to hardware fault.
0x50	Addressing problem or memory protect rungs.
0x60	Function not allowed due to command protection selection.
0x70	Processor is in Program Mode.
0x80	Compatibility mode file missing or communication zone problem.
0x90	Remote node cannot buffer command.
0xA0	Wait ACK (1775 KA buffer full).
0xB0	Remote node problem due to download.
0xC0	Wait ACK (1775 KA buffer full).
0xD0	not used
0xE0	not used
0xF0	Error code in the EXT STS byte. See the error code table on the next page.

(PLC generated error codes for the Allen-Bradley DH485 protocol continued on the next page.)

Allen-Bradley DH485 Protocol – PLC Error Code Tables (cont'd)

PLC Errors for Allen-Bradley DH485 Protocol, EXT STS Command Code for FD Command	
Panel Error Code PLC-499 Hex Value	Description
0x7	Insufficient memory module size (0000h is returned).
0xB	Access denied; privilege violation.
0xC	Resource not available or cannot do.
0xE	CMD cannot be executed.
0x12	Invalid parameter.
0x14	Failure during processing.
0x19	Duplicate label.
0x1A	File open by another node + owner's local node address, 1 byte.
0x1B	Program owned by another node + program owner's local node address, 1 byte.

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Allen-Bradley EtherNet/IP Protocol–

A Panel Error Code PLC-496, 497 and 498 Explanation

The PLC-499 error code is used to show any errors that are generated by the connected PLC. The PLC-499 error message includes a eight digit hexadecimal value displayed embedded in the message. This value can be looked up in the specific PLC's error tables to determine the cause of the error. The possible PLC generated error codes for the Allen-Bradley EtherNet/IP communication protocol is represented by a hexadecimal value as shown in the following message example.

Allen-Bradley Error Code PLC-496, 497, 498 Message Example:



Panel error code PLC-499 showing a hexadecimal value of 00000065 indicates an "The target received a message of invalid length." PLC error.

Allen-Bradley – EtherNet/IP Protocol – PLC Error Code Tables

ControlLogix, CompactLogix, & FlexLogix

The following PLC error code tables cover possible errors that are detected by the panel from Allen-Bradley PLCs using the EtherNet/IP protocol. This includes all ControlLogix, CompactLogix and FlexLogix PLCs.



Note: The following errors can be generated from the designated PLC, are monitored by the C-more touch panel, and displayed on the touch panel's screen as a hexadecimal value in panel error code PLC-496 message, if active. Please refer to the PLC manufacturer's documentation for additional information.

PLC Errors for Allen-Bradley EtherNet/IP Protocol – Encapsulation Errors (Error code 0xa0000000 returned from the PLC.)	
Panel Error Code PLC-496 Hex Value	Description
0x00000001	The sender issued an invalid or unsupported encapsulation command.
0x00000002	Insufficient memory resources in the receiver to handle the command. You can get this error if the 1761-NET-ENI cannot connect to the PLC serially.
0x00000003	Poorly formed or incorrect data in the data portion of the encapsulation message.
0x00000004 - 0x00000063	Reserved for legacy (Rockwell Automation).
0x00000064	An originator used an invalid session handle when sending an encapsulation message to the target.
0x00000065	The target received a message of invalid length.
0x00000066 - 0x00000068	Reserved for legacy (Rockwell Automation).
0x00000069	Unsupported encapsulation protocol revision.
0x0000006a - 0x0000ffff	Reserved for future expansion.

PLC Errors for Allen-Bradley EtherNet/IP Protocol – CIP Errors (Error code 0xa0000000 returned from the PLC.)	
Panel Error Code PLC-497 Hex Value	Description
0x010100	Connection Manager: Connection in Use or Duplicate Forward Open.
0x010103	Connection Manager: Transport Class and Trigger combination not supported.
0x010106	Connection Manager: Ownership Conflict.
0x010107	Connection Manager: Connection not found at target application.
0x010108	Connection Manager: Invalid connection type (problem with type or priority).
0x010109	Connection Manager: Invalid connection size.
0x010110	Connection Manager: Device not configured.
0x010111	Connection Manager: RPI not supported. Could also be problem with inactivity timeout.
0x010113	Connection Manager: Connection Manager cannot support any more connections.
0x010114	Connection Manager: Either the vendor ID or the Product Code in the key segment did not match the device.
0x010115	Connection Manager: Product Type in the key segment did not match the device.
0x010116	Connection Manager: Major or minor revision information in the key segment did not match the device.

(PLC generated error codes for the Allen-Bradley EtherNet/IP protocol for ControlLogix, CompactLogix, and FlexLogix continued on the next page.)

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Allen-Bradley – EtherNet/IP Protocol – PLC Error Code Tables ControlLogix, CompactLogix, & FlexLogix (cont'd)

PLC Errors for Allen-Bradley EtherNet/IP Protocol – CIP Errors (Error code 0xaaaaaaaa returned from the PLC.)	
Panel Error Code PLC-497 Hex Value	Description
0x010117	Connection Manager: Invalid connection point.
0x010118	Connection Manager: Invalid configuration format.
0x010119	Connection Manager: Connection request fails since there is no controlling connection currently open.
0x01011a	Connection Manager: Target application cannot support any more connections.
0x01011b	Connection Manager: RPI is smaller than the Production Inhibit Time.
0x010203	Connection Manager: Connection cannot be closed since the connection has timed out.
0x010204	Connection Manager: Unconnected Send timed out waiting for a response.
0x010205	Connection Manager: Parameter error in Unconnected send service.
0x010206	Connection Manager: Message too large for Unconnected message service.
0x010207	Connection Manager: Unconnected acknowledge without reply.
0x010301	Connection Manager: No buffer memory available.
0x010302	Connection Manager: Network Bandwidth not available for data.
0x010303	Connection Manager: No Tag filters available.
0x010304	Connection Manager: Not configured to send real-time data.
0x010311	Connection Manager: Port specified in Port segment not available.
0x010312	Connection Manager: Link address specified in port segment not available.
0x010315	Connection Manager: invalid segment type or segment value in path.
0x010316	Connection Manager: Path and Connection not equal in close.
0x010317	Connection Manager: Ether Segment not present or Encoded Value in Network Segment is invalid.
0x010318	Connection Manager: Link address to self invalid.
0x010319	Connection Manager: Resources on Secondary unavailable.
0x01031a	Connection Manager: Connection already established.
0x01031b	Connection Manager: Direct connection already established.
0x01031c	Connection Manager: Miscellaneous.
0x01031d	Connection Manager: Redundant connection mismatch.
0x01031e	Connection Manager: No more consumer resources available in the producing module.
0x01031f	Connection Manager: No connection resources exist for target path.
0x010320 - 0x0107ff	Connection Manager: Vendor specific.
0x020000	Resource unavailable: Connection Manager resources are unavailable to handle service request.
0x030000	Invalid parameter value.
0x040000	Path segment error: The path segment identifier or the segment syntax was not understood by the processing node.
0x050000	Path destination unknown: The path is referencing an object class, instance or structure element that is not known or is not contained in the processing node.
0x060000	Partial transfer: Only part of the expected data was transferred.
0x070000	Connection lost: The messaging connection was lost.

(PLC generated error codes for the Allen-Bradley EtherNet/IP protocol for ControlLogix, CompactLogix, and FlexLogix continued on the next page.)

Allen-Bradley – EtherNet/IP Protocol – PLC Error Code Tables ControlLogix, CompactLogix, & FlexLogix (cont'd)

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PLC Errors for Allen-Bradley EtherNet/IP Protocol – CIP Errors (Error code 0xaaaaaaaa returned from the PLC.)	
Panel Error Code PLC-497 Hex Value	Description
0x080000	Service not supported: The requested service was not implemented or was not defined for this Object Class/Instance.
0x090000	Invalid attribute value: Invalid attribute data detected.
0x0a0000	Attribute list error: An attribute in the Get_Attribute_List or Set_Attribute_List response has a non-zero status.
0x0b0000	Already in requested mode/state: The object is already in the mode/state being requested by the service.
0x0c0000	Object state conflict: The object cannot perform the requested service in its current mode/state.
0x0d0000	Object already exists: The requested instance of object to be created already exists.
0x0e0000	Attribute not settable: A request to modify non-modifiable attribute was received.
0x0f0000	Privilege violation: A permission/privilege check failed.
0x100000	Device state conflict: The device's current mode/state prohibits the execution of the requested service.
0x110000	Reply data too large: The data to be transmitted in the response buffer is larger than the allocated response buffer.
0x120000	Fragmentation of a primitive value: The service specified an operation that is going to fragment a primitive data value. For example, trying to send a 2 byte value to a REAL data type (4 byte).
0x130000	Not enough data: The service did not supply enough data to perform the specified operation.
0x140000	Attribute not supported: The attribute specified in the request is not supported.
0x150000	Too much data: The service supplied more data than was expected.
0x160000	Object does not exist: The object specified does not exist in the device.
0x170000	Service fragmentation sequence not in progress: The fragmentation sequence for this service is not currently active for this data.
0x180000	No stored attribute data: The attribute data of this object was not saved prior to the requested service.
0x190000	Store operation failure: The attribute data of this object was not saved due to a failure during the attempt.
0x1a0000	Routing failure, request packet too large: The service request packet was too large for transmission on a network in the path to the destination.
0x1b0000	Routing failure, response packet too large: The service response packet was too large for transmission on a network in the path from the destination.
0x1c0000	Missing attribute list entry data: The service did not supply an attribute in a list of attributes that was needed by the service to perform the requested behavior.
0x1d0000	Invalid attribute value list: The service is returning the list of attributes supplied with status information for those attributes that were invalid.
0x1e0000	Embedded service error: See Service Packet error list (PLC-498 Error codes) below:
0x1f0000	Vendor specific error: A vendor specific error has been encountered. This occurs when none of the specified errors relate to the error in the device.
0x200000	Invalid parameter: A parameter associated with the request was invalid. This code is used when a parameter does not meet the requirements defined in an Application Object specification.
0x210000	Write-once value or medium already written: An attempt was made to write to a write-once-medium that has already been written or to modify a value that cannot be change once established.
0x220000	Invalid Reply Received: An invalid reply is received (example: service code sent doesn't match service code received.).

(PLC generated error codes for the Allen-Bradley EtherNet/IP protocol for ControlLogix, CompactLogix and FlexLogix continued on the next page.)

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Allen-Bradley – EtherNet/IP Protocol – PLC Error Code Tables ControlLogix, CompactLogix, & FlexLogix (cont'd)

PLC Errors for Allen-Bradley EtherNet/IP Protocol – CIP Errors (Error code 0xa0000000 returned from the PLC.)	
Panel Error Code PLC-497 Hex Value	Description
0x230000	Reserved by CIP for future extensions.
0x240000	Reserved by CIP for future extensions.
0x250000	Key failure in path: The key segment was included as the first segment in the path does not match the destination module. The object specific status shall indicate which part of the key check failed.
0x260000	Path Size Invalid: The size of the path which was sent with the Service Request is either not large enough to allow the Request to be routed to an object or too much routing data was included.
0x270000	Unexpected attribute in list: An attempt was made to set an attribute that is not able to be set at this time.
0x280000	Invalid Member ID: The Member ID specified in the request does not exist in the specified Class/Instance/Attribute.
0x290000	Member not settable: A request to modify a non-modifiable member was received.
0x2a0000	Group 2 only server general failure: This error code may only be reported by DeviceNet group 2 only servers with 4K or less code space and only in place of Service not supported, Attribute not supported and Attribute not settable.
0x2b0000 - 0xc0000	Reserved by CIP for future extensions.
0xd00000 - 0xff0000	Reserved for Object Class and service errors: This range of error codes is to be used to indicate Object Class specific errors. Use of this range should only be used when errors in this table don't accurately reflect the error encountered.

PLC Errors for Allen-Bradley EtherNet/IP Protocol – Service Packet Errors (Error code 0xa0000000 returned from the PLC.)	
Panel Error Code PLC-498 Hex Value	Description
0x040000	This general status codes that the tag name could not be deciphered. This could mean that the tag name was entered incorrectly or does not exist in the PLC.
0x050000	The particular item referenced (usually instance) could not be found.
0x060000	The amount of data requested would not fit into the response buffer. Partial data transfer has occurred.
0x0a0000	An error has occurred trying to process one of the attributes.
0x130000	Not enough command data/parameters were supplied in the command to execute the service requested.
0x1c0000	An insufficient number of attributes were provided compared to the attribute count.

Allen-Bradley – EtherNet/IP Protocol – PLC Error Code Tables

MicroLogix 1100 & SLC 5/05, both via native Ethernet port;

MicroLogix 1000, 1100, 1200, 1500, SLC 5/03/04/05, all via ENI Adapter

The following PLC error code tables cover possible errors that are detected by the panel from Allen-Bradley PLCs using the EtherNet/IP protocol. This includes MicroLogix 1100 & SLC 5/05, both using their native Ethernet port, and MicroLogix 1000, 1100, 1200, 1500, SLC 5/03, 5/04 and 5/05 using an Allen-Bradly ENI Adapter.



Note: The following errors can be generated from the designated PLC, are monitored by the C-more touch panel, and displayed on the touch panel's screen as a hexadecimal value in panel error code PLC-496 message, if active. Please refer to the PLC manufacturer's documentation for additional information.

PLC Errors for Allen-Bradley EtherNet/IP Protocol – Encapsulation Errors (Error code 0xaaaaaaaa returned from the PLC.)	
Panel Error Code PLC-496 Hex Value	Description
0x00000001	The sender issued an invalid or unsupported encapsulation command.
0x00000002	Insufficient memory resources in the receiver to handle the command. You can get this error if the 1761-NET-ENI cannot connect to the PLC serially.
0x00000003	Poorly formed or incorrect data in the data portion of the encapsulation message.
0x00000004 - 0x00000063	Reserved for legacy (Rockwell Automation).
0x00000064	An originator used an invalid session handle when sending an encapsulation message to the target.
0x00000065	The target received a message of invalid length.
0x00000066 - 0x00000068	Reserved for legacy (Rockwell Automation).
0x00000069	Unsupported encapsulation protocol revision.
0x0000006a - 0x0000ffff	Reserved for future expansion.

PLC Errors for Allen-Bradley EtherNet/IP Protocol – CIP Errors (Error code 0xaaaaaaaa returned from the PLC.)	
Panel Error Code PLC-497 Hex Value	Description
0x010100	Connection Manager: Connection in Use or Duplicate Forward Open.
0x010103	Connection Manager: Transport Class and Trigger combination not supported.
0x010106	Connection Manager: Ownership Conflict.
0x010107	Connection Manager: Connection not found at target application.
0x010108	Connection Manager: Invalid connection type (problem with type or priority).
0x010109	Connection Manager: Invalid connection size.
0x010110	Connection Manager: Device not configured.
0x010111	Connection Manager: RPI not supported. Could also be problem with inactivity timeout.

(PLC generated error codes for the Allen-Bradley EtherNet/IP protocol for MicroLogix 1100, SLC 5/05, or ENI Adapter continued on the next page.)

Allen-Bradley – EtherNet/IP Protocol – PLC Error Code Tables

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MicroLogix 1100 & SLC 5/05, both via native Ethernet port;

MicroLogix 1000, 1100, 1200, 1500, SLC 5/03/04/05, all via ENI Adapter

PLC Errors for Allen-Bradley EtherNet/IP Protocol – CIP Errors (Error code 0xaaaaaaaa returned from the PLC.)	
Panel Error Code PLC-497 Hex Value	Description
0x010113	Connection Manager: Connection Manager cannot support any more connections.
0x010114	Connection Manager: Either the vendor ID or the Product Code in the key segment did not match the device.
0x010115	Connection Manager: Product Type in the key segment did not match the device.
0x010116	Connection Manager: Major or minor revision information in the key segment did not match the device.
0x010117	Connection Manager: Invalid connection point.
0x010118	Connection Manager: Invalid configuration format.
0x010119	Connection Manager: Connection request fails since there is no controlling connection currently open.
0x01011a	Connection Manager: Target application cannot support any more connections.
0x01011b	Connection Manager: RPI is smaller than the Production Inhibit Time.
0x010203	Connection Manager: Connection cannot be closed since the connection has timed out.
0x010204	Connection Manager: Unconnected Send timed out waiting for a response.
0x010205	Connection Manager: Parameter error in Unconnected send service.
0x010206	Connection Manager: Message too large for Unconnected message service.
0x010207	Connection Manager: Unconnected acknowledge without reply.
0x010301	Connection Manager: No buffer memory available.
0x010302	Connection Manager: Network Bandwidth not available for data.
0x010303	Connection Manager: No Tag filters available.
0x010304	Connection Manager: Not configured to send real-time data.
0x010311	Connection Manager: Port specified in Port segment not available.
0x010312	Connection Manager: Link address specified in port segment not available.
0x010315	Connection Manager: invalid segment type or segment value in path.
0x010316	Connection Manager: Path and Connection not equal in close.
0x010317	Connection Manager: Ether Segment not present or Encoded Value in Network Segment is invalid.
0x010318	Connection Manager: Link address to self invalid.
0x010319	Connection Manager: Resources on Secondary unavailable.
0x01031a	Connection Manager: Connection already established.
0x01031b	Connection Manager: Direct connection already established.
0x01031c	Connection Manager: Miscellaneous.
0x01031d	Connection Manager: Redundant connection mismatch.
0x01031e	Connection Manager: No more consumer resources available in the producing module.
0x01031f	Connection Manager: No connection resources exist for target path.
0x010320 - 0x0107ff	Connection Manager: Vendor specific.

(PLC generated error codes for the Allen-Bradley EtherNet/IP protocol for MicroLogix 1100, SLC 5/05, or ENI Adapter continued on the next page.)

Allen-Bradley – EtherNet/IP Protocol – PLC Error Code Tables
MicroLogix 1100 & SLC 5/05, both via native Etherent port;
MicroLogix 1000, 1100, 1200, 1500, SLC 5/03/04/05, all via ENI Adapter

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PLC Errors for Allen-Bradley EtherNet/IP Protocol – CIP Errors (Error code 0xaaaaaaaa returned from the PLC.)	
Panel Error Code PLC-497 Hex Value	Description
0x020000	Resource unavailable: Connection Manager resources are unavailable to handle service request.
0x030000	Invalid parameter value.
0x040000	Path segment error: The path segment identifier or the segment syntax was not understood by the processing node.
0x050000	Path destination unknown: The path is referencing an object class, instance or structure element that is not known or is not contained in the processing node.
0x060000	Partial transfer: Only part of the expected data was transferred.
0x070000	Connection lost: The messaging connection was lost.
0x080000	Service not supported: The requested service was not implemented or was not defined for this Object Class/Instance.
0x090000	Invalid attribute value: Invalid attribute data detected.
0x0a0000	Attribute list error: An attribute in the Get_Attribute_List or Set_Attribute_List response has a non-zero status.
0x0b0000	Already in requested mode/state: The object is already in the mode/state being requested by the service.
0x0c0000	Object state conflict: The object cannot perform the requested service in its current mode/state.
0x0d0000	Object already exists: The requested instance of object to be created already exists.
0x0e0000	Attribute not settable: A request to modify non-modifiable attribute was received.
0x0f0000	Privilege violation: A permission/privilege check failed.
0x100000	Device state conflict: The device's current mode/state prohibits the execution of the requested service.
0x110000	Reply data too large: The data to be transmitted in the response buffer is larger than the allocated response buffer.
0x120000	Fragmentation of a primitive value: The service specified an operation that is going to fragment a primitive data value. For example, trying to send a 2 byte value to a REAL data type (4 byte).
0x130000	Not enough data: The service did not supply enough data to perform the specified operation.
0x140000	Attribute not supported: The attribute specified in the request is not supported.
0x150000	Too much data: The service supplied more data than was expected.
0x160000	Object does not exist: The object specified does not exist in the device.
0x170000	Service fragmentation sequence not in progress: The fragmentation sequence for this service is not currently active for this data.
0x180000	No stored attribute data: The attribute data of this object was no saved prior to the requested service.
0x190000	Store operation failure: The attribute data of this object was not saved due to a failure during the attempt.
0x1a0000	Routing failure, request packet too large: The service request packet was too large for transmission on a network in the path to the destination.
0x1b0000	Routing failure, response packet too large: The service reponse packet was too large for transmission on a network in the path from the destination.
0x1c0000	Missing attribute list entry data: The service did not supply an attribute in a list of attributes that was needed by the service to perform the requested behavior.

(PLC generated error codes for the Allen-Bradley EtherNet/IP protocol for MicroLogix 1100, SLC 5/05, or ENI Adapter continued on the next page.)

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Allen-Bradley – EtherNet/IP Protocol – PLC Error Code Tables
MicroLogix 1100 & SLC 5/05, both via native Ethernet port;
MicroLogix 1000, 1100, 1200, 1500, SLC 5/03/04/05, all via ENI Adapter

PLC Errors for Allen-Bradley EtherNet/IP Protocol – CIP Errors (Error code 0xaaaaaaaa returned from the PLC.)	
Panel Error Code PLC-497 Hex Value	Description
0x1d0000	Invalid attribute value list: The service is returning the list of attributes supplied with status information for those attributes that were invalid.
0x1e0000	Embedded service error: See Service Packet error list (PLC-498 Error codes) below:
0x1f0000	Vendor specific error: A vendor specific error has been encountered. This occurs when none of the specified errors relate to the error in the device.
0x200000	Invalid parameter: A parameter associated with the request was invalid. This code is used when a parameter does not meet the requirements defined in an Application Object specification.
0x210000	Write-once value or medium already written: An attempt was made to write to a write-once-medium that has already been written or to modify a value that cannot be change once established.
0x220000	Invalid Reply Received: An invalid reply is received (example: service code sent doesn't match service code received.).
0x230000	Reserved by CIP for future extensions.
0x240000	Reserved by CIP for future extensions.
0x250000	Key failure in path: The key segment was included as the first segment in the path does not match the destination module. The object specific status shall indicate which part of the key check failed.
0x260000	Path Size Invalid: The size of the path which was sent with the Service Request is either not large enough to allow the Request to be routed to an object or too much routing data was included.
0x270000	Unexpected attribute in list: An attempt was made to set an attribute that is not able to be set at this time.
0x280000	Invalid Member ID: The Member ID specified in the request does not exist in the specified Class/Instance/Attribute.
0x290000	Member not settable: A request to modify a non-modifiable member was received.
0x2a0000	Group 2 only server general failure: This error code may only be reported by DeviceNet group 2 only servers with 4K or less code space and only in place of Service not supported, Attribute not supported and Attribute not settable.
0x2b0000 - 0xcf0000	Reserved by CIP for future extensions.
0xd00000 - 0xff0000	Reserved for Object Class and service errors: This range of error codes is to be used to indicate Object Class specific errors. Use of this range should only be used when errors in this table don't accurately reflect the error encountered.

(PLC generated error codes for the Allen-Bradley EtherNet/IP protocol for MicroLogix 1100, SLC 5/05, or ENI Adapter continued on the next page.)

Allen-Bradley – EtherNet/IP Protocol – PLC Error Code Tables

MicroLogix 1100 & SLC 5/05, both via native Ethernet port;

MicroLogix 1000, 1100, 1200, 1500, SLC 5/03/04/05, all via ENI Adapter

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PLC Errors for Allen-Bradley EtherNet/IP Protocol – Service Packet Errors (Error code 0xaaaaaaaa returned from the PLC.)	
Panel Error Code PLC-498 Hex Value	Description
0x010000	DST Node is out of buffer space.
0x020000	Cannot guarantee delivery; link layer (The remote node specified does not ACK command).
0x030000	Duplicate token holder detected.
0x040000	Local port is disconnected.
0x050000	Application layer timed out waiting for response.
0x060000	Duplicate node detected.
0x070000	Station is offline.
0x080000	Hardware fault.
0x100000	Illegal command or format. Typical error received from PLC when addressed requested to the PLC does not exist. Usually occurs if memory map has not been expanded in PLC to the range requested from panel.
0x200000	Host has a problem and will not communicate.
0x300000	Remote node host is missing, disconnected, or shut down.
0x400000	Host could not complete function due to hardware fault.
0x500000	Addressing problem or memory protected rungs.
0x600000	Function not allowed due to command protection selection.
0x700000	Processor is in Program Mode.
0x800000	Compatibility mode file missing or communication zone problem.
0x900000	Remote node cannot buffer command.
0xA00000	Wait ACK (1775 KA buffer full).
0xB00000	Not used.
0xC00000	Not used.
0xD00000	Error code in the EXT STS byte. See the error code table below.
0xE00000	Fewer levels specified in address than minimum for any address.
0xF00300	More levels specified in address than system supports.
0xF00400	Symbol not found.
0xF00500	Symbol is of improper format.
0xF00600	Address does not point to something usable.
0xF00700	File is wrong size.
0xF00800	Cannot complete request, situation has changed since start of the command.
0xF00900	Data or file size is too large.
0xF00900	Transaction size plus word address is too large.
0xF00B00	Access denied; improper privilege. This will occur if data file is set to constant or protected.
0xF00C00	Condition cannot be generated; resource is not available.
0xF00D00	Condition already exists; resource is readily available.

(PLC generated error codes for the Allen-Bradley EtherNet/IP protocol for MicroLogix 1100, SLC 5/05, or ENI Adapter continued on the next page.)

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Allen-Bradley – EtherNet/IP Protocol – PLC Error Code Tables

MicroLogix 1100 & SLC 5/05, both via native Ethernet port; MicroLogix 1000, 1100, 1200, 1500, SLC 5/03/04/05, all via ENI Adapter

PLC Errors for Allen-Bradley EtherNet/IP Protocol – Service Packet Errors (Error code 0xaaaaaaaa returned from the PLC.)	
Panel Error Code PLC-498 Hex Value	Description
0xF00E00	Command cannot be executed.
0xF00F00	Histogram overflow.
0xF01000	No access.
0xF01100	Illegal data type.
0xF01200	Invalid parameter or invalid data.
0xF01300	Address reference exists to deleted area.
0xF01400	Command execution failure for unknown reason; possible histogram overflow.
0xF01500	Data conversion error.
0xF01600	Scanner not able to communicate with 1771 rack adapter.
0xF01700	Type mismatch.
0xF01800	1771 module response was not valid.
0xF01900	Duplicated label.
0xF02200	Remote rack fault.
0xF02300	Timeout.
0xF02400	Unknown error.
0xF01A00	File is open; another node owns it.
0xF01B00	Another node is the program owner.
0xF01C00	Reserved.
0xF01D00	Reserved.
0xF01E00	Data table element protection violation.
0xF01F00	Temporary internal problem.

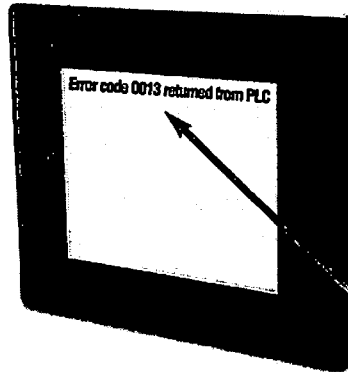
Generic EtherNet IP Protocol – PLC Error Codes

Only errors as listed in the Touch Panel Error Code Table shown on page A-3 can occur when using the Generic Ethernet IP protocol, there are no PLC generated errors.

GE 90-30 – Panel Error Code PLC-499 Explanation

The PLC-499 error code is used to show any errors that are generated by the connected PLC. The PLC-499 error message includes a four digit hexadecimal value embedded in the message. This value can be looked up in the specific PLC's error tables to determine the cause of the error. The possible PLC generated error codes for the GE 90-30 communication protocol is represented by a hexadecimal value as shown in the following message example.

GE 90-30 Error Code PLC-499 Message Example:



Panel error code PLC-499 showing a hexadecimal value of 0013 indicates an "Port configurator error." PLC error.

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GE 90-30 SNPX Protocol – PLC Error Code Tables

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The following table lists the errors that can be generated by the GE 90-30 PLC when using the SNPX protocol.



Note: The following errors can be generated from the designated PLC, are monitored by the C-more touch panel, and displayed on the touch panel's screen as a hexadecimal value in panel error code PLC-499 message, if active. Please refer to the PLC manufacturer's documentation for additional information.

PLC Errors for GE 90-30 SNPX Protocol (Major)	
Panel Error Code PLC-499 Hex Value	Description
No error	Successful completion. (This is the expected completion value in the COMMREQ Status Word.)
0x0002	Insufficient Privilege. For Series 90-70 PLC, the minor error code contains the privilege level required for the service request.
0x0004	Protocol Sequence Error. The CPU has received a message that is out of order.
0x0005	Service Request Error, the minor error code contains the specific error code.
0x0006	Illegal Mailbox Type. Service request mailbox type is either undefined or unexpected.
0x0007	The PLC CPU's Service Request Queue is full. The master should retry later. It is recommended that the master wait a minimum of 10 msec before sending another service request.
0x000A	SNP DOS Driver Error. The minor error code contains the specific error code.
0x000B	Illegal Service Request. The requested service is either not defined or not supported. (This value is returned in lieu of the actual 01h value passed in the SNP error message, to avoid confusion with the normal successful COMMREQ completion.)
0x000C	Local SNP/SNP-X Error. An error occurred within the SNP task in the CMM module in this PLC. This error may occur in either an SNP master or an SNP slave. The minor error code contains the specific error code.
0x000D	Remote SNP Error. An error occurred within the SNP slave task in the CMM module in the remote PLC. The minor error code contains the specific error code.
0x000E	Autodial Error. An error occurred while attempting to send a command string to an attached external modem. The minor error code contains the specific error code.
0x000F	SNP-X slave error. An error occurred within the SNPX task in the remote slave device. The minor error code contains the specific error code.
0x0013	Port configurator error.
0x0050	Problem with sending mail to the slave Service Request task. (Series 90-70 PLC CPUs only)
0x0051	Problem with getting mail from the slave Service Request task. (Series 90-70 PLC CPUs only)
0x0055	Slave SNP task timed out before receiving an SRP response. (Series 90-70 PLC CPUs only)
0x0056	Slave SNP task could not find the requested datagram connection. (Series 90-70 PLC CPUs only)
0x0057	Slave SNP task encountered an error in trying to write the datagram. (Series 90-70 PLC CPUs only)
0x0058	Slave SNP task encountered an error in trying to update the datagram. (Series 90-70 PLC CPUs only)

(PLC generated error codes for the GE 90-30 SNPX protocol continued on the next page.)

GE 90-30 SNPX Protocol – PLC Error Code Tables (cont'd)

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PLC Errors for GE 90-30 SNPX Protocol (Minor-Major) (cont'd)	
Panel Error Code PLC-499 Hex Value	Description
PLC Error 0x010C	WAIT-type COMMREQ is not permitted; must use NOW AIT-type.
PLC Error 0x010E	Not used
PLC Error 0x010F	The service request code in an X-Request message is unsupported or invalid at this time. This error may occur if an SNP-X communication session has not been successfully established at the slave device.
PLC Error 0x020C	COMMREQ command is not supported.
PLC Error 0x020E	The modem command string length exceeds 250 characters.
PLC Error 0x020F	Insufficient privilege level in the slave PLC CPU for the requested SNP-X service. Password protection at PLC CPU may be preventing the requested service.
PLC Error 0x0213	Unsupported COMMREQ. These errors are only generated when there is no protocol currently being run on a port, and the port receives a COMMREQ. (The port may be disabled or an error has occurred in processing a new configuration).
PLC Error 0x030C	SNP communication is not active. Must initiate a new SNP communication by sending an Attach or Long Attach COMMREQ.
PLC Error 0x030E	COMMREQ Data Block Length is too small. Output command string data is missing or incomplete.
PLC Error 0x030F	Invalid slave memory type in X-Request message.
PLC Error 0x0313	Invalid COMMREQ length.
PLC Error 0x040C	SNP slave did not respond to Attach message from master.
PLC Error 0x040E	Serial output timeout. The CMM module was unable to transmit the modem autodial output from the serial port. (May be due to missing CTS signal when the CMM is configured to use hardware flow control.)
PLC Error 0x040F	Invalid slave memory address or range in X-Request message.
PLC Error 0x0413	Invalid COMMREQ status word location.
PLC Error 0x050C	Unable to write SNP Status Word to local PLC memory; may be due to invalid Status Word memory type or address.
PLC Error 0x050E	Response was not received from modem. Check modem and cable.
PLC Error 0x050F	Invalid data length in X-Request message. Data length must be non-zero, and may not exceed decimal 1000 bytes.
PLC Error 0x0513	Invalid COMMREQ data.
PLC Error 0x060C	Master device memory type is not valid in this PLC.
PLC Error 0x060E	Modem responded with BUSY. Modem is unable to complete the requested connection. The remote modem is already in use; retry the connection request at a later time.
PLC Error 0x060F	X-Buffer data length does not match the service request in X-Request message. The X-Buffer message length is obtained from the Next Message Length field in the X-Request message; the length of the data within the buffer message is always the message length.
PLC Error 0x070C	Master device memory address or length is zero.
PLC Error 0x070E	Modem responded with NO CARRIER. Modem is unable to complete the requested connection. Check the local and remote modems and the telephone line.
PLC Error 0x070F	Queue Full indication from Service Request Processor in slave PLC CPU. The slave is temporarily unable to complete the service request. The master should try again later. It is recommended that the master wait at least 10 msec before repeating the X-Request.

(PLC generated error codes for the GE 90-30 SNPX protocol continued on the next page.)

GE 90-30 SNPX Protocol – PLC Error Code Tables (cont'd)

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PLC Errors for GE 90-30 SNPX Protocol (Minor-Major) (cont'd)	
Panel Error Code PLC-499 Hex Value	Description
0x080C	Unable to read or write master device memory locations specified in COMMREQ. Usually caused by invalid memory address for this PLC. SNP message exchange may have taken place.
0x080E	Modem responded with NO DIALTONE. Modem is unable to complete the requested connection. Check the modem connections and the telephone line.
0x080F	Service Request Processor response exceeds 1000 bytes; the SNP-X slave device cannot return the data in an X-Response message. (This error applies to CMM module only.)
0x090C	Master device memory data length exceeds maximum data size of CMM module (2048 bytes). Must use a smaller data length. Use multiple COMMREQs if total data length exceeds this maximum value.
0x090E	Modem responded with ERROR. Modem is unable to complete the requested command. Check the modem command string and modem.
0x0A0C	Slave device memory type is missing or not valid.
0x0A0E	Modem responded with RING, indicating that the modem is being called by another modem. Modem is unable to complete the requested command. Retry the modem command at a later time.
0x0B0C	Slave device memory address is missing or zero.
0x0B0E	An unknown response was received from the modem. Modem is unable to complete the requested command. Check the modem command string and modem. The modem response is expected to be either CONNECT or OK.
0x0C0C	COMMREQ Data Block Length is too small. (When expected COMMREQ length is 6 words or less. An improper length may cause other minor error codes 6-11.)
0x0D0C	Invalid Diagnostic Status Word (DSW) starting word or length.
0x0E0C	Invalid maximum SNP message data size. Must be an even value from 42 to 2048.
0x0F0C	Invalid Privilege Level. Must be 0 through 4 or -1.
0x100C	Invalid Fault Table selector. Must be 1 for I/O Fault Table, or 2 for PLC Fault Table.
0x100F	Unexpected Service Request Processor error. (This error applies to CMM module only; the unexpected SRP error code is saved in the Diagnostic Status Words in the CMM module.)
0x110C	Invalid Fault Table starting index. Must be 1-32 for I/O Fault Table, or 1-16 for PLC.
0x120C	Invalid fault count. Must be 1-32 for I/O Fault Table, or 1-16 for PLC Fault Table.
0x130C	Invalid Set PLC Date/Time mode. Must be 1-4.
0x140C	Invalid Set PLC Date/Time date, time, or day-of-week value.
0x150C	Unable to retrieve master device PLC time/date from PLC CPU.
0x150F	Requested service is not permitted in a Broadcast request. The master must direct the X-Request message to a specific SNP-X slave device.
0x160C	Invalid slave PLC type. Must be 0 for Series 90-70, or 1 for Series 90-30 or Series 90-20.
0x170C	Invalid datagram type. Must be 01h for normal datagram, or 81h (129) for permanent datagram.
0x180C	Missing or too many datagram point formats. Must be 1-32.
0x190C	Invalid datagram point format data.

(PLC generated error codes for the GE 90-30 SNPX protocol continued on the next page.)

GE 90-30 SNPX Protocol – PLC Error Code Tables (cont'd)

PLC Errors for GE 90-30 SNPX Protocol (Minor-Major) (cont'd)	
Panel Error Code PLC-499 Hex Value	Description
0x1A0C	Datagram area size is too small to include data for all specified point formats.
0x1B0C	Invalid number of Control Program Names. Must be 1-8.
0x1C0C	SNP-X Request exceeds maximum data size (1000 bytes). Must use a smaller data length. Use multiple COMMREQs if necessary.
0x1D0C	Invalid SNP-X communication session type. Must be 0 for a single slave device, or 1 for multiple slave devices.
0x1E0C	Illegal destination SNP ID specified for SNP-X slave. Must be 0-7 ASCII characters, plus a terminating null character (00h). The Null SNP ID (eight bytes of 00h) may be used to specify any single device. The Broadcast SNP ID (eight bytes of FFh) may be use to specify all slave devices on the serial link.
0x1F0C	Destination SNP ID does not match SNP-X session type. The Broadcast SNP ID is not permitted in a single-slave SNP-X session. The Null SNP ID is not permitted in a multiple-slave SNP-X session.
0x200C	Inactivity timeout (T3'). The SNP slave has not received any new SNP messages within the configured T3' time interval.
0x200F	Invalid Message Type field in a received X-Request message. The message type of an X-Request message must be 58h = 'X'.
0x210C	A Parity error has occurred on an Attach, Attach Response, or Update Real-time Datagram message. Communications have not been established.
0x210F	Invalid Next Message Type or Next Message Length field in a received X Request message. If this request does not use a buffer (0-2 bytes of data), the Next Message Type must be zero. If this request will be followed with a buffer message (more than 2 byte.), the Next Message Type must be 54h = 'T', and the Next Message Length must specify the length of the X-Buffer message. Valid X-Buffer message lengths are 9-1008 bytes (data length plus 8 bytes).
0x220C	A BCC (Block Check Code) error has occurred on an Attach, Attach Response, or Update Realtime Datagram message. Communications have not been established.
0x220F	Invalid Message Type field in a received X-Buffer message. The message type of an X-Buffer message must be 54h = 'T'.
0x230C	A Framing or Overrun serial error has occurred on an Attach, Attach Response, or Update Realtime Datagram message. Communications have not been established.
0x230F	Invalid Next Message Type field in a received X-Buffer message. Since an X-Buffer message is never followed by another message, the Next Message Type must always be zero.
0x240C	An invalid SNP message type was received when an Attach, Attach Response, or Update Realtime Datagram message was required. Communications have not been established.
0x250C	An invalid next message length value was specified in an Attach, Attach Response, or Update Realtime Datagram message. Communications have not been established.
0x260C	An unexpected SNP message type was received when an Attach, Attach Response, or Update Realtime Datagram was required. Communications have not been established.
0x270C	Another Break was received while SNP slave was waiting for an Attach or Update Realtime Datagram message.
0x280C	An SNP message has been sent and retried the maximum number of times. A maximum of two retries are permitted. A retry is caused by a NAK from from the remote SNP device.
0x290C	A received SNP message has been NAKed the maximum number of two times. The NAKed message may be retransmitted a maximum of two times.

(PLC generated error codes for the GE 90-30 SNPX protocol continued on the next page.)

GE 90-30 SNPX Protocol – PLC Error Code Tables (cont'd)

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PLC Errors for GE 90-30 SNPX Protocol (Minor-Major) (cont'd)	
Panel Error Code PLC-499 Hex Value	Description
0x2A0C	An unknown message was received when an acknowledge (ACK or NAK) was required.
0x2B0C	Sequence Error. An unexpected SNP message type was received.
0x2C0C	Received SNP message contains bad next message length value.
0x2D0C	Acknowledge timeout. An acknowledge (ACK or NAK) was not received within the configured T2 time interval. A slave device may generate this error if the master device has aborted after maximum response NAKs and does not NAK the next response retry.
0x2E0C	Response timeout. The SNP Master did not receive an SNP Response message within the configured T5' time interval.
0x2F0C	Buffer message timeout. An expected Text Buffer or Connection Data message was not received within the configured T5'' time interval.
0x300C	Serial output timeout. The CMM module was unable to transmit a Break, an SNP message, or SNP acknowledge (ACK or NAK) from the serial port. (May be due to missing CTS signal when the CMM module is configured to use hardware flow control.)
0x310C	SNP slave did not receive a response from the Service Request Processor in the PLC CPU.
0x320C	COMMREQ timeout. The COMMREQ did not complete within the configured time interval.
0x330C	An SNP Request or Response was aborted prior to completion due to reception of a Break.
0x340C	PLC backplane communications error
0x350C	Invalid Piggyback Status data memory type or address. Communications have not been established.
0x360C	Invalid SNP Slave SNP ID. Must be a 0-7 ASCII characters, plus a terminating null character (00h). The Null SNP ID (eight bytes of 00h) may be used to specify any single slave device.
0x370C	The SNP master has received a response message containing an unexpected data length. Usually indicates a problem with the remote SNP slave device. May occur when Series 90-70 commands (Task Memory or Program Block Memory Read/Write) are issued to a Series 90-30 slave device.
0x380C	Response code in received SNP-X response message does not match expected value. (Response code must equal the request code +80h.)
0x390C	SNP-X Response message exceeds maximum data size (decimal 1000 bytes). Data in the Response is ignored.
0x400C	A parity error has occurred on an X-Attach Response message when establishing a new SNP-X communication session. Communications have not been established.
0x400D	The requested service is not supported by the SNP slave.
0x400F	Serial output timeout. The slave was unable to transmit an SNP-X message from the serial port. (May be due to missing CTS signal when the CMM module is configured to use hardware flow control.)

(PLC generated error codes for the GE 90-30 SNPX protocol continued on the next page.)

GE 90-30 SNPX Protocol – PLC Error Code Tables (cont'd)

PLC Errors for GE 90-30 SNPX Protocol (Minor-Major) (cont'd)	
Panel Error Code PLC-499 Hex Value	Description
0x410C	A framing or overrun error has occurred on an X-Attach Response message when establishing a new SNP-X communication session. Communications have not been established.
0x410D	SNP slave on CMM module requires PLC CPU privilege level 2 to operate. The SNP slave has rejected a request to change to a higher or lower privilege level.
0x410F	An SNP-X request was aborted prior to completion due to reception of a Break.
0x420C	A BCC (Block Check Code) error has occurred on an X-Attach Response message when establishing a new SNP-X communication session. Communications have not been established.
0x420D	SNP Request or Response message exceeds maximum data length of the CMM module. (Total data length for Mailbox and all following Buffer messages is 2048 bytes.) The master must use a smaller data length. Use multiple requests if total data length exceeds the maximum value.
0x420F	An X-Buffer message was received containing greater than 1000 bytes of data. The data is ignored.
0x430C	An invalid message type was received when an X-Attach Response was required when establishing a new SNP-X communication session. Communications have not been established.
0x430D	Improper Write Datagram message format. Series 90-70 slave devices use a different format for this message than Series 90-30 or Series 90-20 slave devices. The master must use the proper message format for this SNP slave device. (The SNP master in the CMM module sends this message as part of the Establish Datagram COMMREQ command. The datagram has been partially established, but is not usable; the datagram should be cancelled by using the Datagram ID returned by the COMMREQ.)
0x430F	The SNP-X slave did not receive a response from the Service Request Processor in the PLC CPU.
0x440C	An invalid next message type value was detected in an X-Attach Response message when establishing a new SNP-X communication session. Communications have not been established.
0x440D	A datagram error occurred in a Series 90-70 slave device (dual-port error).
0x440F	PLC backplane communications error.
0x450C	An invalid response code was detected in an X-Attach Response message when establishing a new SNP-X communication session. Communications have not been established.
0x460C	An expected X-Attach Response message was not received within the response timeout interval when establishing a new SNP-X communication session. The master has retried the X-Attach message twice without receiving a response. Communications have not been established.
0x500C	A parity error has occurred on an X-Attach Response message when re-establishing an existing SNP-X communication session. Communications have not been established.
0x500F	A parity error has occurred in a received X-Attach message.
0x510C	A framing or overrun error has occurred on an X-Attach Response message when re-establishing an existing SNP-X communication session. Communications have not been established.
0x510F	A framing or overrun error has occurred in a received X-Attach message.
0x520C	A BCC (Block Check Code) error has occurred on an X-Attach Response message when re-establishing an existing SNP-X communication session. Communications have not been established.
0x520F	A BCC (Block Check Code) error has occurred in a received X-Attach message.

(PLC generated error codes for the GE 90-30 SNPX protocol continued on the next page.)

GE 90-30 SNPX Protocol – PLC Error Code Tables (cont'd)

A

PLC Errors for GE 90-30 SNPX Protocol (Minor-Major) (cont'd)	
Panel Error Code PLC-499 Hex Value	Description
0x530C	An invalid message type was received when an X-Attach Response was required when re-establishing an existing SNP-X communication session. Communications have not been established.
0x530F	An invalid Message Type was received when an X-Attach message was required. (For an X-Attach message, the message type must be 58h = 'T'.)
0x540C	An invalid Next Message Type value was detected in an X-Attach Response message when re-establishing an existing SNP-X communication session. Communications have not been established.
0x540F	An invalid Next Message Type value was detected in a received X-Attach message. (For an X-Attach message, the Next Message Length must be zero.)
0x550C	An invalid response code was detected in an X-Attach Response message when re-establishing an existing SNP-X communication session. Communications have not been established.
0x550F	An invalid request code was detected in a received X-Attach message.
0x560C	An expected X-Attach Response message was not received within the response timeout interval when re-establishing an existing SNP-X communication session. The master has retried the X-Attach message twice without receiving a response. Communications have not been established.
0x600C	A parity error has occurred on an X-Response message.
0x600F	A parity error has occurred in a received X-Request message.
0x610C	A framing or overrun error has occurred on an X-Response message.
0x610F	A framing or overrun error has occurred in a received X-Request message.
0x620C	A BCC (Block Check Code) error has occurred on an X-Response message.
0x620F	A BCC (Block Check Code) error has occurred in a received X-Request message.
0x630C	An invalid message type was received when an X-Response message was required.
0x640C	An invalid next message type value was detected in an X-Response message.
0x650C	An invalid response code was detected in an X-Response message.
0x660C	An expected X-Response message was not received within the response time.
0x700C	A parity error has occurred on an Intermediate Response message.
0x700F	A parity error has occurred in a received X-Buffer message.
0x710C	A framing or overrun error has occurred on an Intermediate Response message.
0x710F	A framing or overrun error has occurred in a received X-Buffer message.
0x720C	A BCC (Block Check Code) error has occurred on an Intermediate Response message.
0x720F	A BCC (Block Check Code) error has occurred in a received X-Buffer message.
0x730C	An invalid message type was received when an Intermediate Response message was required.
0x730F	An expected X-Buffer message was not received.
0x740C	An invalid next message type value was detected in an Intermediate Response message.
0x750C	An invalid response code was detected in an Intermediate Response message.
0x760C	An expected Intermediate Response message was not received within the response timeout interval.

(PLC generated error codes for the GE 90-30 SNPX protocol continued on the next page.)

GE 90-30 SNPX Protocol – PLC Error Code Tables (cont'd)

PLC Errors for GE 90-30 SNPX Protocol (Minor-Major) (cont'd)	
Panel Error Code PLC-499 Hex Value	Description
0x8D0A	Bad DOS Version. Must have DOS 2.0, or later, to support the SNP DOS Driver.
0x8E0A	PC Serial port configured for SNP Master driver is not open; no communication can take place.
0x8F0A	Out-of-Sequence SNP message. SNP message type received was not the type expected.
0x900A	Bad SNP BCC encountered. Transmission was aborted after maximum retries due to a bad Block Check Code.
0x910A	Bad SNP communication. Transmission was aborted after maximum retries due to serial errors (that is, parity, overrun, or framing errors).
0x920A	No SNP communication. Either communication has been lost or a communication session has not been established.
0xC105	Invalid block state transition.
0xC205	The OEM key is NULL (inactive).
0xC305	Text length does not match traffic type.
0xC405	Verify with FA Card or EEPROM failed.
0xC505	No task-level Rack/Slot configuration to read or delete.
0xC605	Control Program (CP) tasks exist but requestor not logged into main CP.
0xC705	Passwords are set to inactive and cannot be enabled or disabled.
0xC805	Password(s) already enabled and can not be forced inactive.
0xC905	Login using non-zero buffer size required for block commands.
0xCA05	Device is write-protected.
0xCB05	A comm or write verify error occurred during save or restore.
0xCC05	Data stored on device has been corrupted and is no longer reliable.
0xCD05	Attempt was made to read a device but no data has been stored on it.
0xCE05	Specified device has insufficient memory to handle request.
0xCF05	Specified device is not available in the system (not present).
0xD005	One or more PLC modules configured have unsupported revision.
0xD105	Packet size or total program size does not match input.
0xD205	Invalid write mode parameter.
0xD305	User Program Module (UPM) read or write exceeded block end.
0xD405	Mismatch of configuration checksum.
0xD505	Invalid block name specified in datagram.
0xD605	Total datagram connection memory exceeded.
0xD705	Invalid datagram type specified.
0xD805	Point length not allowed.
0xD905	Transfer type invalid for this Memory Type selector.
0xDA05	Null pointer to data in Memory Type selector.
0xDB05	Invalid Memory Type selector in datagram.
0xDC05	Unable to find connection address.
0xDD05	Unable to locate given datagram connection ID.
0xDE05	Size of datagram connection invalid.
0xDF05	Invalid datagram connection address.

(PLC generated error codes for the GE 90-30 SNPX protocol continued on the next page.)

GE 90-30 SNPX Protocol – PLC Error Code Tables (cont'd)

A

PLC Errors for GE 90-30 SNPX Protocol (Minor-Major) (cont'd)	
Panel Error Code PLC-499 Hex Value	Description
0xE005	Service in process cannot login.
0xE105	No I/O configuration to read or delete.
0xE205	IOS could not delete configuration, or bad type.
0xE305	CPU revision number does not match.
0xE405	Memory Type for this selector does not exist.
0xE505	DOS file area not formatted.
0xE605	CPU model number does not match.
0xE705	Configuration is not valid.
0xE805	No user memory is available to allocate.
0xE905	Memory Type selector not valid in context.
0xEA05	Not logged in to process service request.
0xEB05	Task unable to be deleted.
0xEC05	Task unable to be created.
0xED05	VME bus error encountered.
0xEE05	Could not return block sizes.
0xEF05	Programmer is already attached.
0xF005	Request only valid in stop mode.
0xF105	Request only valid from programmer.
0xF205	Invalid program cannot log in.
0xF305	I/O configuration mismatch.
0xF405	Invalid input parameter in request.
0xF505	Invalid password.
0xF605	Invalid sweep state to set.
0xF705	Required to log in to a task for service.
0xF805	Invalid Task Name referenced.
0xF905	Task address out of range.
0xFA05	Cannot replace I/O module.
0xFB05	Cannot clear I/O configuration.
0xFC05	I/O configuration is invalid.
0xFD05	Unable to perform auto configuration.
0xFE05	No privilege for attempted operation.
0xFF05	Service Request Error has been aborted.

Mitsubishi FX Protocol – PLC Error Codes

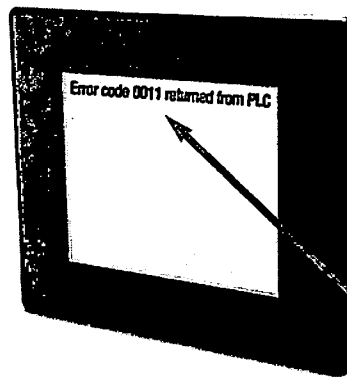
Only errors as listed in the Touch Panel Error Code Table shown on page A-3 can occur when using the Mitsubishi FX protocol, there are no PLC generated errors.

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Omron – Panel Error Code PLC-499 Explanation

The PLC-499 error code is used to show any errors that are generated by the connected PLC. The PLC-499 error message includes a four digit hexadecimal value embedded in the message. This value can be looked up in the specific PLC's error tables to determine the cause of the error. The possible PLC generated error codes for the Omron Host Link and FINS communication protocol is represented by a hexadecimal value as shown in the following message example.

Omron Error Code PLC-499 Message Example:



Panel error code PLC-499 showing a hexadecimal value of 0011 indicates an "Framing error." PLC error when using the Omron Host Link protocol.

Omron Host Link Protocol – PLC Error Code Table

A

The following table lists the errors that can be generated by the Omron PLC when using the Host Link protocol.



Note: The following errors can be generated from the designated PLC, are monitored by the C-more touch panel, and displayed on the touch panel's screen as a hexadecimal value in panel error code PLC-499 message, if active. Please refer to the PLC manufacturer's documentation for additional information.

PLC Error Codes for Omron Host Link	
Panel Error Code PLC-499 Hex Value	Description
0x0000	Normal Completion.
0x0001	Not executable in RUN mode.
0x0002	Not executable in MONITOR mode.
0x0003	Not executable with PROM mounted.
0x0004	Address over (data overflow).
0x000B	Not executable in PROGRAM mode.
0x000C	Not executable in DEBUG mode.
0x000D	Not executable in LOCAL mode.
0x0010	Parity error.
0x0011	Framing error.
0x0012	Overrun.
0x0013	FCS error.
0x0014	Format error (parameter length error).
0x0015	Entry number data error (parameter error, data code error, data length error).
0x0016	Instruction not found.
0x0018	Frame length error.
0x0019	Not executable (due to Un-executable error clear, non-registration of I/O table, etc.).
0x0020	I/O table generation impossible (unrecognized remote I/O unit, channel over, duplication of optical transmitting I/O unit).
0x00A0	Abort due to parity error in transmit data under process.
0x00A1	Abort due to framing error in transmit data under process.
0x00A2	Abort due to overrun in transmit data under process.
0x00A3	Abort due to FCS error in transmit data under process.
0x00A4	Abort due to format error in transmit data under process.
0x00A5	Abort due to frame length error in transmit data under process.
0x00A8	Abort due to entry number data error in transmit data under process.
0x00B0	Un-executable due to program area capacity other than 16k bytes.

Omron FINS Protocol – PLC Error Code Table

The following table lists the errors that can be generated by the Omron PLC when using the FINS protocol.



Note: The following errors can be generated from the designated PLC, are monitored by the C-more touch panel, and displayed on the touch panel's screen as a hexadecimal value in panel error code PLC-499 message, if active. Please refer to the PLC manufacturer's documentation for additional information.

A

PLC Error Codes for Omron FINS	
Panel Error Code PLC-499 Hex Value	Description
0x0000	Normal Completion.
0x0001	Service Canceled.
0x0101	Local Error: Local node not in network.
0x0102	Local Error: Token Timeout.
0x0103	Local Error: Retries Failed.
0x0104	Local Error: Too many send frames.
0x0105	Local Error: Node address range error.
0x0106	Local Error: Node Address Duplication.
0x0201	Destination Node Error: Destination Node not in network.
0x0202	Destination Node Error: Unit Missing.
0x0203	Destination Node Error: Third Node missing.
0x0204	Destination Node Error: Destination Node busy.
0x0205	Destination Node Error: Response Timeout.
0x0301	Controller Error: Communications Controller Error.
0x0302	Controller Error: CPU Unit Error.
0x0303	Controller Error: Controller Error.
0x0304	Controller Error: Unit number Error.
0x0401	Service Unsupported: Undefined Command.
0x0402	Service Unsupported: Not supported by Model/Version.
0x0501	Routing Table Error: Destination address setting error.
0x0502	Routing Table Error: No routing tables.
0x0503	Routing Table Error: Routing table error.
0x0504	Routing Table Error: Too many delays.
0x1001	Command Format Error: Command too long.
0x1002	Command Format Error: Command too short.
0x1003	Command Format Error: Elements/Data don't match.
0x1004	Command Format Error: Command format error.
0x1005	Command Format Error: Header Error.
0x1101	Parameter Error: Area classification missing.
0x1102	Parameter Error: Access Size Error.
0x1103	Parameter Error: Address range error.

(PLC generated error codes for the Omron FINS protocol continued on the next page.)

Omron FINS Protocol – PLC Error Code Table (cont'd)

A

PLC Error Codes for Omron FINS	
Panel Error Code PLC-499 Hex Value	Description
0x1104	Parameter Error: Address range exceeded.
0x1106	Parameter Error: Program Missing.
0x1109	Parameter Error: Relational Error.
0x110A	Parameter Error: Duplicate Data Access.
0x110B	Parameter Error: Response too long.
0x110C	Parameter Error: Parameter Error.
0x2002	Read Not Possible: Protected.
0x2003	Read Not Possible: Table missing.
0x2004	Read Not Possible: Data missing.
0x2005	Read Not Possible: Program missing.
0x2006	Read Not Possible: File missing.
0x2007	Read Not Possible: Data mismatch.
0x2101	Write Not Possible: Read Only.
0x2102	Write Not Possible: Protected - cannot write data link table.
0x2103	Write Not Possible: Cannot register.
0x2105	Write Not Possible: Program missing.
0x2106	Write Not Possible: File missing.
0x2107	Write Not Possible: File name already exists.
0x2108	Write Not Possible: Cannot change.
0x2201	Not executable in current mode: Not possible during execution.
0x2202	Not executable in current mode: Not possible while running.
0x2203	Not executable in current mode: Wrong PLC mode (Program).
0x2204	Not executable in current mode: Wrong PLC mode (Debug).
0x2205	Not executable in current mode: Wrong PLC mode (Monitor).
0x2206	Not executable in current mode: Wrong PLC mode (Run).
0x2207	Not executable in current mode: Specified node not polling node.
0x2208	Not executable in current mode: Step cannot be executed.
0x2301	No such device: File device missing.
0x2302	No such device: Missing memory.
0x2303	No such device: Clock missing.
0x2401	Cannot Start/Stop: Table missing.
0x2502	Unit Error: Memory Error.
0x2503	Unit Error: I/O setting Error.
0x2504	Unit Error: Too many I/O points.
0x2505	Unit Error: CPU bus error.
0x2506	Unit Error: I/O Duplication.

(PLC generated error codes for the Omron FINS protocol continued on the next page.)

Omron FINS Protocol – PLC Error Code Table (cont'd)

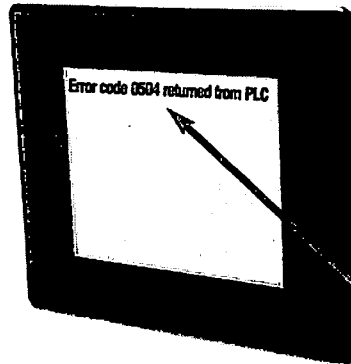
A

PLC Error Codes for Omron FINS	
Panel Error Code PLC-499 Hex Value	Description
0x2507	Unit Error: I/O bus error.
0x2509	Unit Error: SYSMAC BUS/2 error.
0x250A	Unit Error: CPU Bus Unit Error.
0x250D	Unit Error: SYSMAC BUS No. duplication.
0x250F	Unit Error: Memory Error.
0x2510	Unit Error: SYSMAC BUS terminator missing.
0x2601	Command Error: No protection.
0x2602	Command Error: Incorrect password.
0x2604	Command Error: Protected.
0x2605	Command Error: Service already executing.
0x2606	Command Error: Service stopped.
0x2607	Command Error: No execution right.
0x2608	Command Error: Settings not complete.
0x2609	Command Error: Necessary items not set.
0x260A	Command Error: Number already defined.
0x260B	Command Error: Error will not clear.
0x3001	Access Right Error: No access right.
0x4001	Abort: Service aborted.

Omron – Panel Error Code P495 Explanation

A

The PLC-495 error code is used to show any errors that are generated by the connected PLC. The PLC-495 error message includes a four digit hexadecimal value embedded in the message. This value can be looked up in the specific PLC's error tables to determine the cause of the error. The possible PLC generated error codes for the Omron CS/CJ FINS ethernet communication protocol is represented by a hexadecimal value as shown in the following message example.



Panel error code PLC-495 showing a hexadecimal value of 0504 indicates a "Routing table error: Too many relays" PLC error.

Omron CS/CJ FINS Ethernet Protocol – PLC Error Code Table

The following table lists the errors that can be generated by the Omron PLC when using the CS/CJ FINS Ethernet protocol.



Note: The following errors can be generated from the designated PLC, are monitored by the C-more touch panel, and displayed on the touch panel's screen as a hexadecimal value in panel error code PLC-495 message, if active. Please refer to the PLC manufacturer's documentation for additional information.

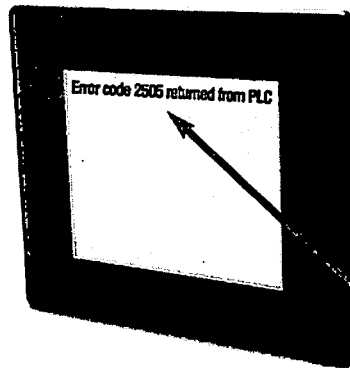
PLC Error Codes for Omron CS/CJ FINS Ethernet	
Panel Error Code PLC-495 Hex Value	Description
0103	Local Error: Send Error from lack of buffer space. Try reducing Ethernet load to the module.
0201	Destination Node Error: IP address of remote node not set correctly.
0202	Destination Node Error: No node with the specified unit address found.
0205	Destination Node Error: Packet corrupted or Response timeout. Try increasing timeout.
0301	Controller Error: Communications controller error.
0302	Controller Error: CPU Unit error. Check error LEDs on PLC. Refer to documentation for that CPU.
0304	Controller Error: Unit number error. Make sure Unit number is not used twice.
0401	Service unsupported: Undefined command.
0501	Routing table error: Destination address setting error. Routing table incorrect.
0502	Routing table error: No routing tables.
0503	Routing table error: Routing table error.
0504	Routing table error: Too many relays.
1001	Command format error: Command too long. Bad packet: check for electrical noise and grounding.
1002	Command format error: Command too short. Bad packet: check for electrical noise and grounding.
1003	Command format error: Elements/data don't match. Bad packet: check for electrical noise and grounding.
1005	Command format error: Header error. This is the error received when station # set in the command does not match the station # of the Ethernet module.
1100	Parameter error: UDP socket number bad.
1101	Parameter error: Address requested does not exist in PLC.
1103	Parameter error: Address area requested in not accessible.
220F	Status error: Duplicate Socket error.
2210	Status error: Specified socket not open.
2305	Environment Error: IP address conversion failed. Only encountered when using routing tables.
2307	Environment Error: IP address conversion set for automatic.
2503	Unit error: I/O setting error.
2505	Unit error: CPU bus error.
250A	Unit error: CPU Bus Unit error.

Siemens – Panel Error Code P499 Explanation

A

The PLC-499 error code is used to show any errors that are generated by the connected PLC. The PLC-499 error message includes a four digit hexadecimal value displayed at the end of the message. This value can be looked up in the specific PLC's error tables to determine the cause of the error. The possible PLC generated error codes for the Siemens PPI communication protocols breakdown into a four digit hexadecimal value as shown in the following message example.

Siemens Error Code PLC-499 Message Example:



Panel error code PLC-499 showing a hexadecimal value of 2505 indicates an "Unit error: CPU bus error." PLC error.

Siemens PPI Protocol – PLC Error Code Table

A

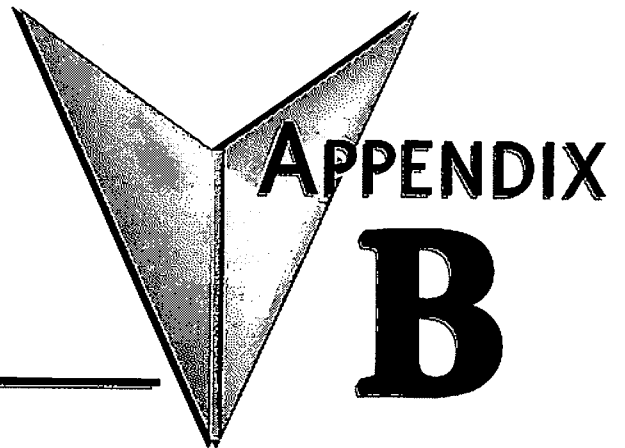
PLC PDU Header Errors for S7-200 PPI	
Panel Error Code PLC-499 Hex Value	Description
0x0001	Hardware Fault.
0x0003	Object access not allowed: Occurs when access to Timer and Counter data type is set to Signed Integer and not BCD.
0x0004	Context not supported.
0x0005	Address out of range: Occurs when requesting an address within a Data Block that does not exist or is out of range.
0x0006	Address out of range.
0x0007	Write Data size mismatch.
0x000A	Object does not exist: Occurs when trying to request a Data Block that does not exist.
0x8000	Function being used.
0x8001	Action is not allowed in current mode.
0x8101	Hardware fault.
0x8103	Access not allowed.
0x8104	Function not supported.
0x8105	Address invalid.
0x8106	Data Type not supported.
0x8107	Data Type is not consistent with size.
0x810A	Object does not exist.
0x8500	PDU Size is incorrect.
0x8702	Address is invalid.
0xD201	Block name syntax error.
0xD202	Error with function parameter.
0xD203	Error with block type.
0xD204	No linked block.
0xD205	Object already exists.
0xD206	Object already exists.
0xD207	Block already used in EPROM.
0xD209	Block does not exist.
0xD20E	No Block does not exist.
0xD210	Block number incorrect.

Siemens ISO over TCP Protocol – PLC Error Code Table

A

PLC PDU Header Errors for S7-300 Ethernet	
Panel Error Code PLC-499 Hex Value	Description
0x0001	Hardware Fault.
0x0003	Object access not allowed: Occurs when access to Timer and Counter data type is set to Signed Integer and not BCD.
0x0004	Context not supported.
0x0005	Address out of range: Occurs when requesting an address within a Data Block that does not exist or is out of range.
0x0006	Address out of range.
0x0007	Write Data size mismatch.
0x000A	Object does not exist: Occurs when trying to request a Data Block that does not exist.
0x8000	Function being used.
0x8001	Action is not allowed in current mode.
0x8101	Hardware fault.
0x8103	Access not allowed.
0x8104	Function not supported.
0x8105	Address invalid.
0x8106	Data Type not supported.
0x8107	Data Type is not consistent with size.
0x810A	Object does not exist.
0x8500	PDU Size is incorrect.
0x8702	Address is invalid.
0xD201	Block name syntax error.
0xD202	Error with function parameter.
0xD203	Error with block type.
0xD204	No linked block.
0xD205	Object already exists.
0xD206	Object already exists.
0xD207	Block already used in EPROM.
0xD209	Block does not exist.
0xD20E	No Block does not exist.
0xD210	Block number incorrect.

TOUCH PANEL RUNTIME ERRORS



In This Appendix...

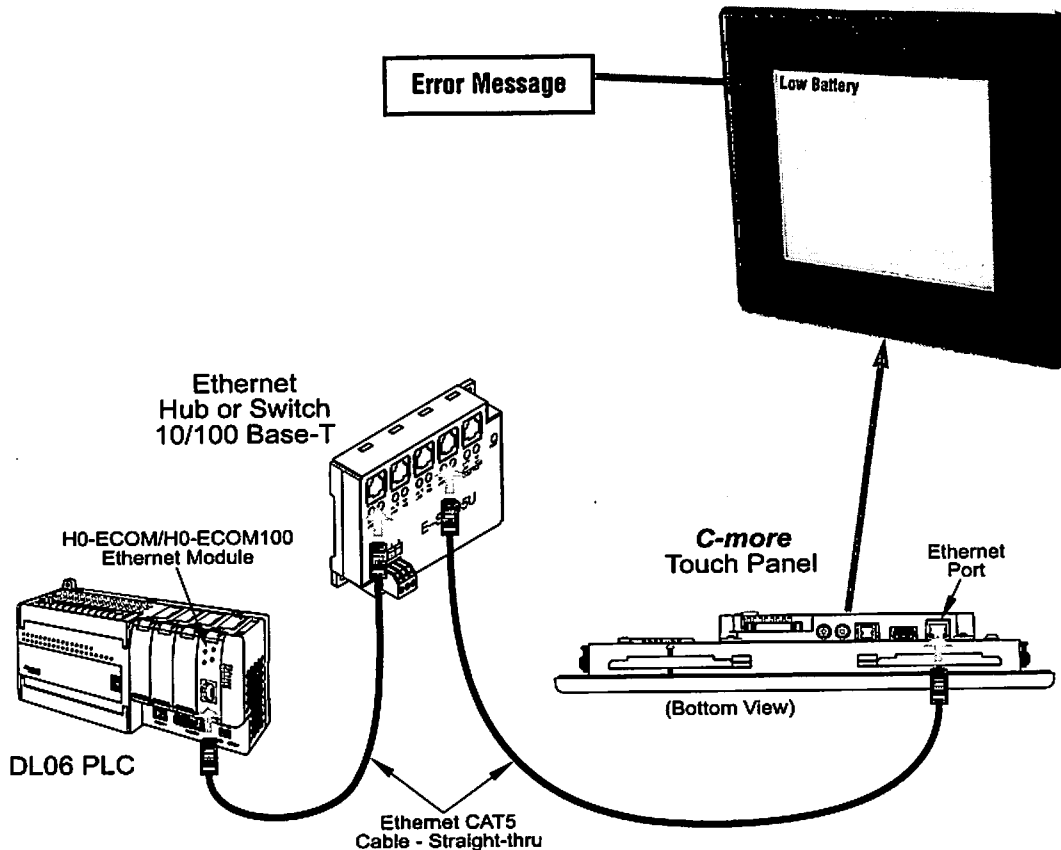
IntroductionB-2
Runtime ErrorsB-3

Introduction

The *C-more* touch panels have diagnostics built-in to the operating system that monitor various runtime functions that will display an error message on the panel's display indicating that a particular error has occurred and what the error represents. The Error Message(s) is displayed in the upper left area of the display screen. The Runtime Errors are also logged into the panel's Error log under the Information tab in the panel's System Setup Screens. The Error Log Code, such as RTE-031, is how the error is identified in the error log. See Chapter 5: System Setup Screens for additional details. The tables that follow show the possible Runtime Errors and include the error message, log error code, tag error code value, cause, etc.

The user can include in their touch panel project the use of this diagnostic information by using the system tag name `SYS ERR ERRORCODE` to control displayed screens, operator messages, etc., and also communicate error information to the PLC or controlling device. If a runtime error occurs, the `SYS ERR ERRORCODE` system tag will contain the numeric value shown under the Tag Code Error Value. For example, if a Low Battery runtime error is indicated, then the screen display will show Low Battery and the `SYS ERR ERRORCODE` system tag will contain the value 2031. The value of the last runtime error detected will remain in the `SYS ERR ERRORCODE`.

If you have difficulty determining the cause of the error, refer to Chapter 8: Troubleshooting for additional help or contact our technical support group at 770-844-4200



Runtime Errors

If there is more than one Runtime Error, then the Error Message displayed at the top of the panel's screen will display for 3 seconds, then be off for 2 seconds. The next Error Message will display for the same time increments, continue through any other active runtime error messages, and then start over. When only one Runtime Error is active, then that message will continuously be displayed until it is no longer active.

B

No.	Error Log Code	Error Message Located at upper left of screen	Error Message Tag	Tag Error Code Value	System Screen Info > Error	Cause
Log Error						
1	RTE-001	Log Failed. Not enough Memory Space in %Device%	SYS ERR ERRORCODE	2001	MM/DD/YY HH/MM/SS Error Code RTE-001	The size of the destination memory is not large enough to store the data.
2	RTE-002	Log Failed. %Device% cannot be found	SYS ERR ERRORCODE	2002	MM/DD/YY HH/MM/SS Error Code RTE-002	No device available or the device is defective.
3	RTE-003	Log Failed. Can not write file - %file%	SYS ERR ERRORCODE	2003	MM/DD/YY HH/MM/SS Error Code RTE-003	Logging the data has failed due to a problem such as the memory write protect is enabled.
4	RTE-004	Log cache memory is full	SYS ERR ERRORCODE	2004	MM/DD/YY HH/MM/SS Error Code RTE-004	The data log buffer in the SRAM memory is full.
Screen Capture						
1	RTE-011	Capture Failed. Not enough Memory Space in %Device%	SYS ERR ERRORCODE	2011	MM/DD/YY HH/MM/SS Error Code RTE-011	The size of the destination memory is not large enough to store the data.
2	RTE-012	Capture Failed. %Device% cannot be found	SYS ERR ERRORCODE	2012	MM/DD/YY HH/MM/SS Error Code RTE-012	No device available or the device is defective.
3	RTE-013	Capture Failed. Can not write file - %file%	SYS ERR ERRORCODE	2013	MM/DD/YY HH/MM/SS Error Code RTE-013	Logging the data has failed due to a problem such as the memory write protect is enabled.
Table continued on next page.						

Runtime Errors (cont'd)

B

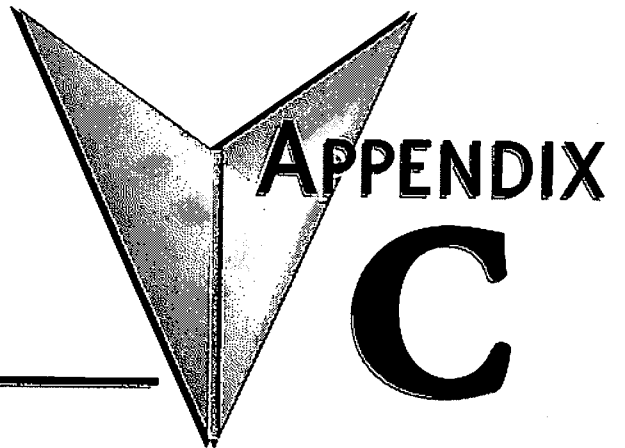
No.	Error Log Code	Error Message Located at upper left of screen	Error Message Tag	Tag Error Code Value	System Screen Info > Error	Cause
Handshake						
1	RTE-021	Handshake Timeout Error	SYS ERR ERRORCODE	2021	MM/DD/YY HH/MM/SS Error Code RTE-021	A communications timeout occurred when either a Recipe or Numeric Entry Object, in which Notification and Handshake signals are used, failed to complete the responses.
Battery						
1	RTE-031	Low Battery	SYS ERR ERRORCODE	2031	MM/DD/YY HH/MM/SS Error Code RTE-031	The panel's backup battery voltage level has fallen below 1.8 VDC and should be replaced.
e-mail						
1	RTE-041	E-mail Connection Error %Address%	SYS ERR ERRORCODE	2041	MM/DD/YY HH/MM/SS Error Code RTE-041	An incorrect SMTP address has been entered into the Touch Panel Network dialog screen.
2	RTE-042	Send E-mail Error %Address%	SYS ERR ERRORCODE	2042	MM/DD/YY HH/MM/SS Error Code RTE-042	An incorrect email address has been entered into the Address Book.
Send FTP						
1	RTE-051	FTP Connection Error %Address%&%ID%	SYS ERR ERRORCODE	2051	MM/DD/YY HH/MM/SS Error Code RTE-051	An incorrect FTP Service has been assigned into the Touch Panel Network dialog screen.
2	RTE-052	Send FTP Error %Address%&%ID%	SYS ERR ERRORCODE	2052	MM/DD/YY HH/MM/SS Error Code RTE-052	Permission to write to the FTP folder has not been authorized. The FTP site may require a user ID and password.
Sound						
1	RTE-081	Sound Failed. Not enough Memory	SYS ERR ERRORCODE	2081	MM/DD/YY HH/MM/SS Error Code RTE-081	The sound file failed to play due to insufficient memory.
Conflict						
1	RTE-091	IP Address Conflict - Corrcet IP Address and Power Cycle	SYS ERR ERRORCODE	2091	MM/DD/YY HH/MM/SS Error Code RTE-091	Conflict of IP Address

Runtime Errors (cont'd)

B

No.	Error Log Code	Error Message Located at upper left of screen	Error Message Tag	Tag Error Code Value	System Screen Info > Error	Cause
Multiple Recipe						
1	RTE-101	Record doesn't exist	SYS ERR ERRORCODE	2101	MM/DD/YY HH/MM/SS Error Code RTE-101	The recipe file or data doesn't exist.
2	RTE-102	File cannot open	SYS ERR ERRORCODE	2102	MM/DD/YY HH/MM/SS Error Code RTE-102	The recipe file cannot be opened.
3	RTE-103	E-mail Connection Error %Address%	SYS ERR ERRORCODE	2103	MM/DD/YY HH/MM/SS Error Code RTE-103	Abnormality is found in the numeric character data of the recipe file.
4	RTE-104	Send E-mail Error %Address%	SYS ERR ERRORCODE	2104	MM/DD/YY HH/MM/SS Error Code RTE-104	Abnormality is found in the Tag data of the recipe file.
5	RTE-105	Recipe - Index (%Row%) error	SYS ERR ERRORCODE	2105	MM/DD/YY HH/MM/SS Error Code RTE-105	Recipe was operated by the record number outside the range.
6	RTE-106	Not enough buffer memory	SYS ERR ERRORCODE	2106	MM/DD/YY HH/MM/SS Error Code RTE-106	Memory allocation error
7	RTE-107	File cannot write	SYS ERR ERRORCODE	2107	MM/DD/YY HH/MM/SS Error Code RTE-107	There was an error trying to write the recipe file.
8	RTE-108	Wrong file format	SYS ERR ERRORCODE	2108	MM/DD/YY HH/MM/SS Error Code RTE-108	The recipe file format is incorrect.
9	RTE-109	Not enough Memory Space in %Device%	SYS ERR ERRORCODE	2109	MM/DD/YY HH/MM/SS Error Code RTE-109	Insufficient storage space on media.
Action						
1	RTE-121	Action Overflows	SYS ERR ERRORCODE	2121	MM/DD/YY HH/MM/SS Error Code RTE-121	The number of actions executed in the event exceeded the maximum number.
SRAM Error						
1	RTE-500	SRAM Check Sum Error	SYS ERR ERRORCODE	2500	MM/DD/YY HH/MM/SS Error Code RTE-500	Memory in Panel has been Corrupted by Power Loss, etc.

MOUNTING CLIPS PRIOR APRIL 2006



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EA7-T15C	C-11

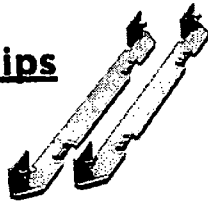
Introduction

The mounting clips supplied with *C-more* touch panels after April 2006 are slightly different than the original clips. Appendix C: Mounting Clips Prior April 2006 has been included in the Hardware User Manual for the end user to have a reference to the drawings and information pertaining to the original mounting clips. The enclosure mounting thickness range and screw torque range has remained the same for each type of touch panel. The basic physical construction and use of the mounting clips remains the same, as does the various touch panel cutout dimensions.

The 6" touch panels use two long style mounting clips. The new 6" mounting clips have been redesigned to increase rigidity and also the screw position height has been increased to allow easier placement in the touch panel slots on thicker enclosures.

The 8"-15" touch panels, depending on the panel's size, use either 6 or 8 smaller style mounting clips. The new 8"-15" mounting clips have been made shorter in height to allow easier installation. Their rigidity remains the same.

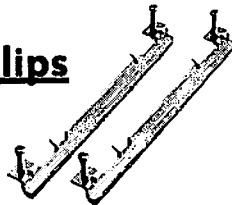
Original
6" Mounting Clips



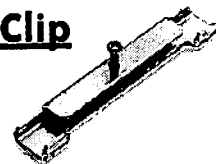
Original
8-15" Mounting Clip



Newer
6" Mounting Clips

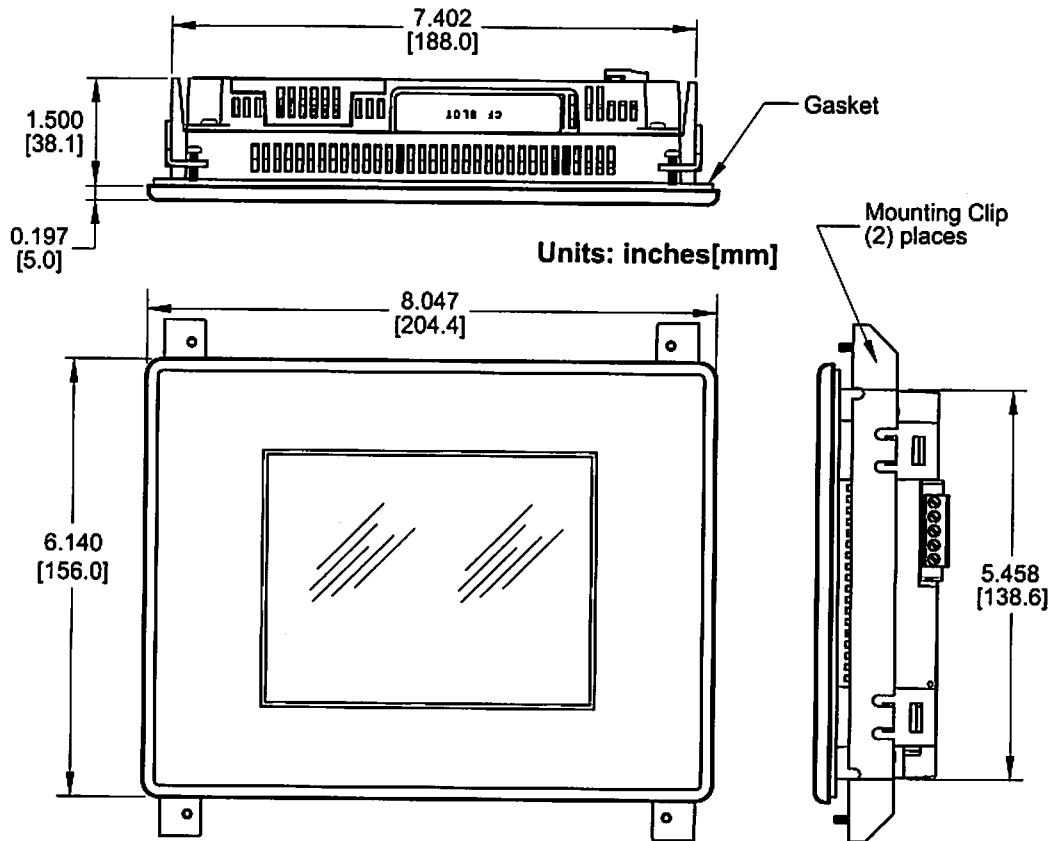


Newer
8-15" Mounting Clip

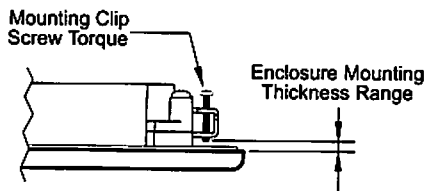


EA7-S6M-R, S6C-R, S6M, S6C and T6C Original Mounting Clips

Dimensions:



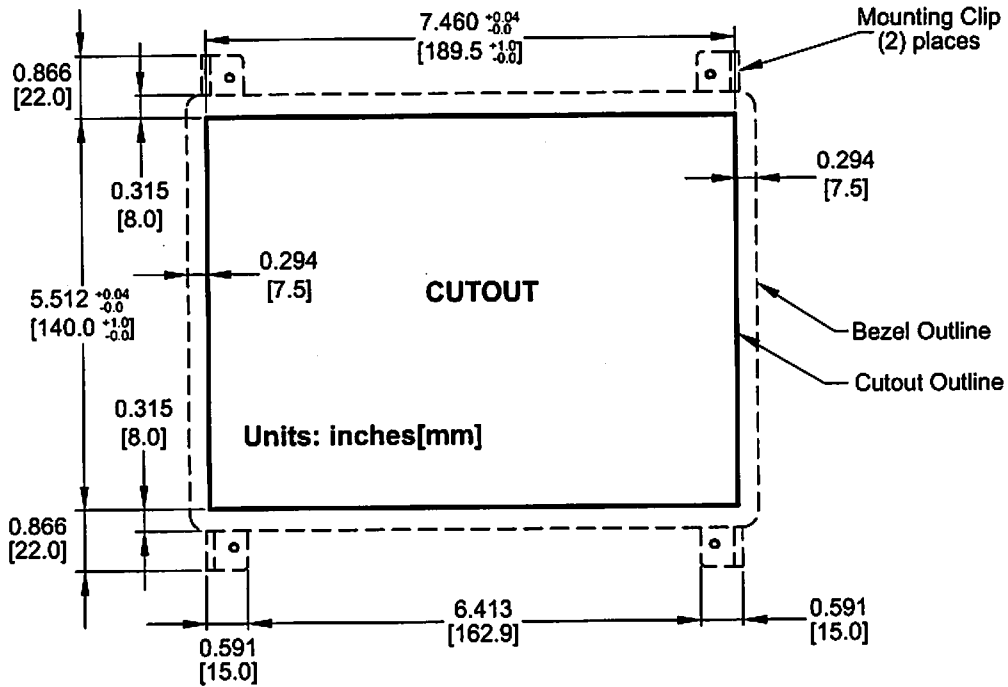
Enclosure Mounting Thickness Ranges and Mounting Clip Screw Torque



Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
6" – lower mounting clip position	0.039 - 0.24 inch [1 - 6 mm]	35 ~ 50 oz-in [0.25 ~ 0.35 Nm]
6" – upper mounting clip position	0.20 - 0.63 inch [5 - 16 mm]	35 ~ 50 oz-in [0.25 ~ 0.35 Nm]

EA7-S6M-R, S6C-R, S6M, S6C and T6C Original Mounting Clips

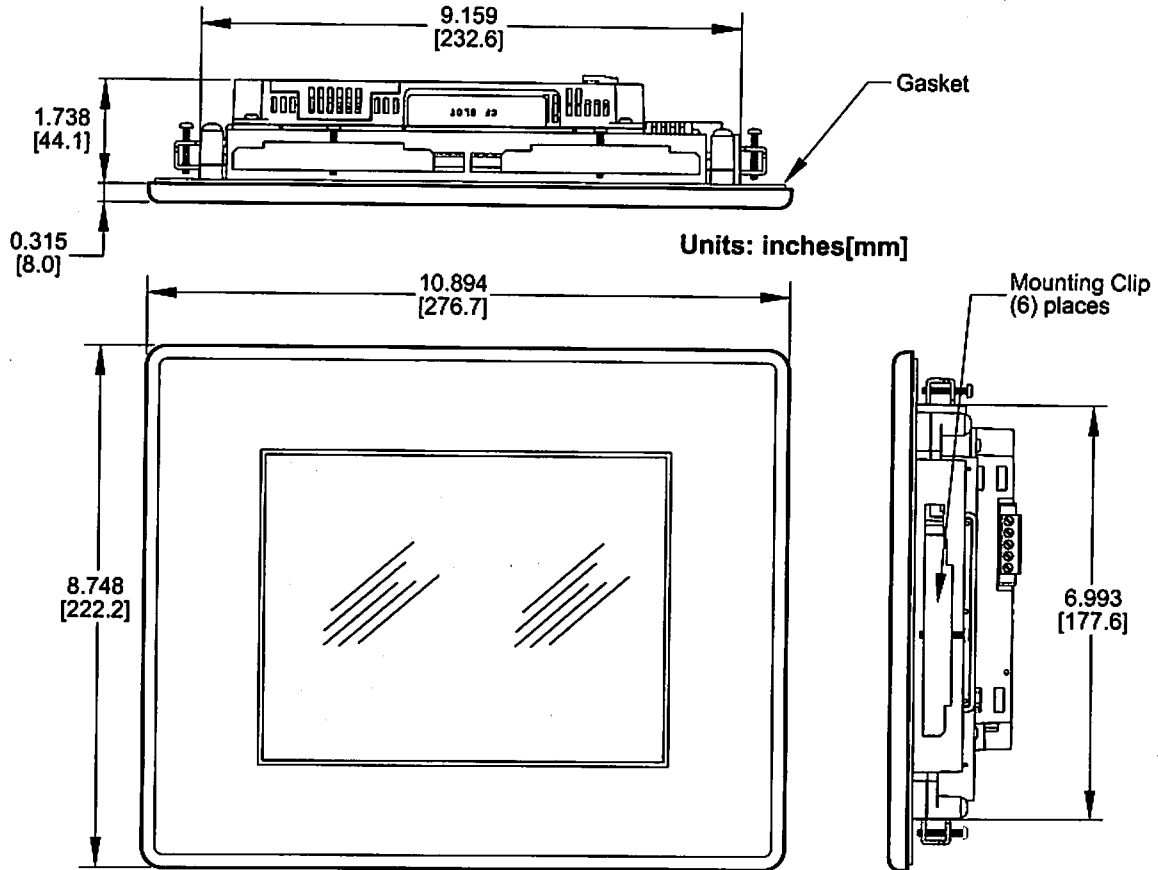
Cutout Dimensions:



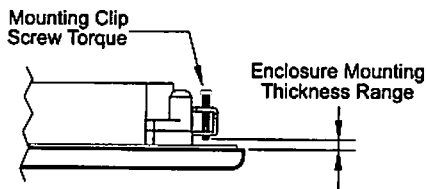
EA7-T8C

Original Mounting Clips

Dimensions:



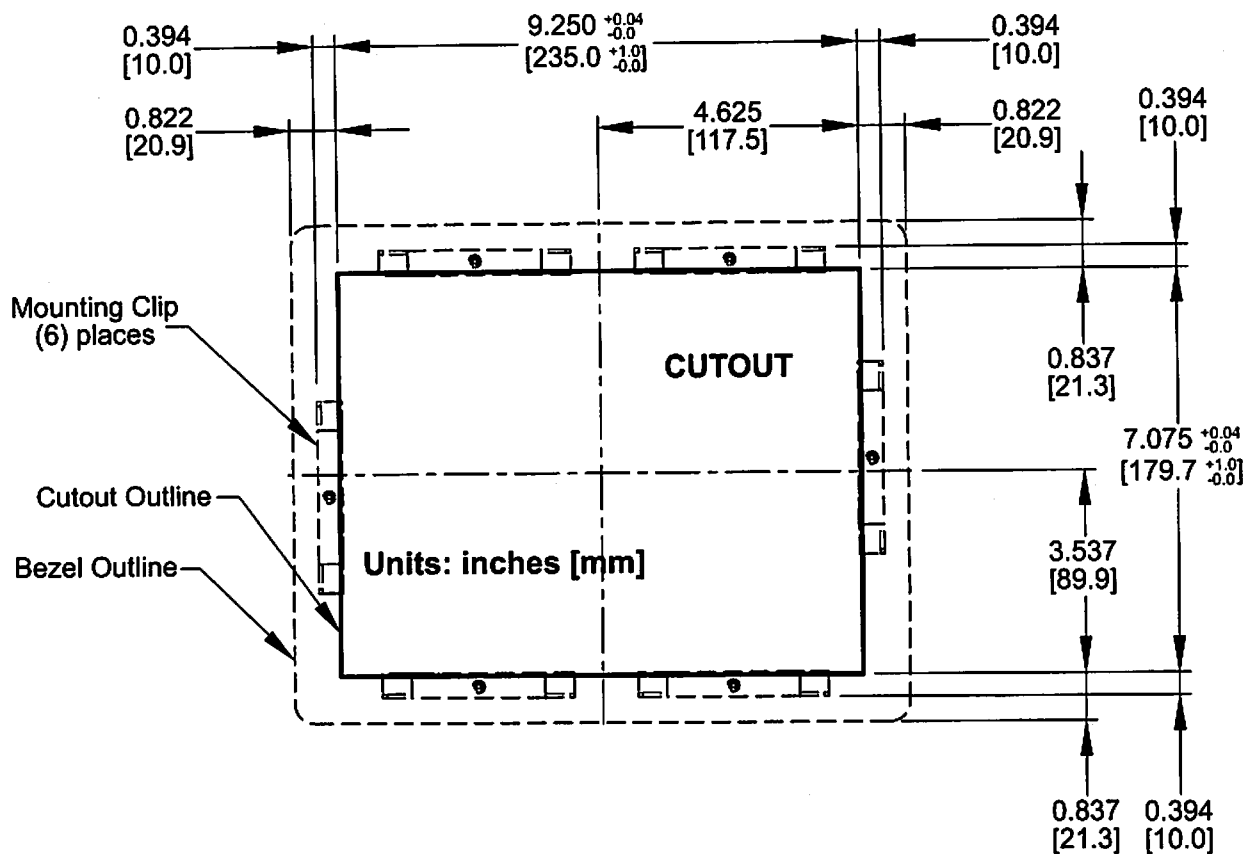
Enclosure Mounting Thickness Ranges and Mounting Clip Screw Torque



Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
8", 10", 12" & 15"	0.039 - 0.20 inch [1 - 5 mm]	42 ~ 57 oz-in [0.3 ~ 0.4 Nm]

EA7-T8C Original Mounting Clips

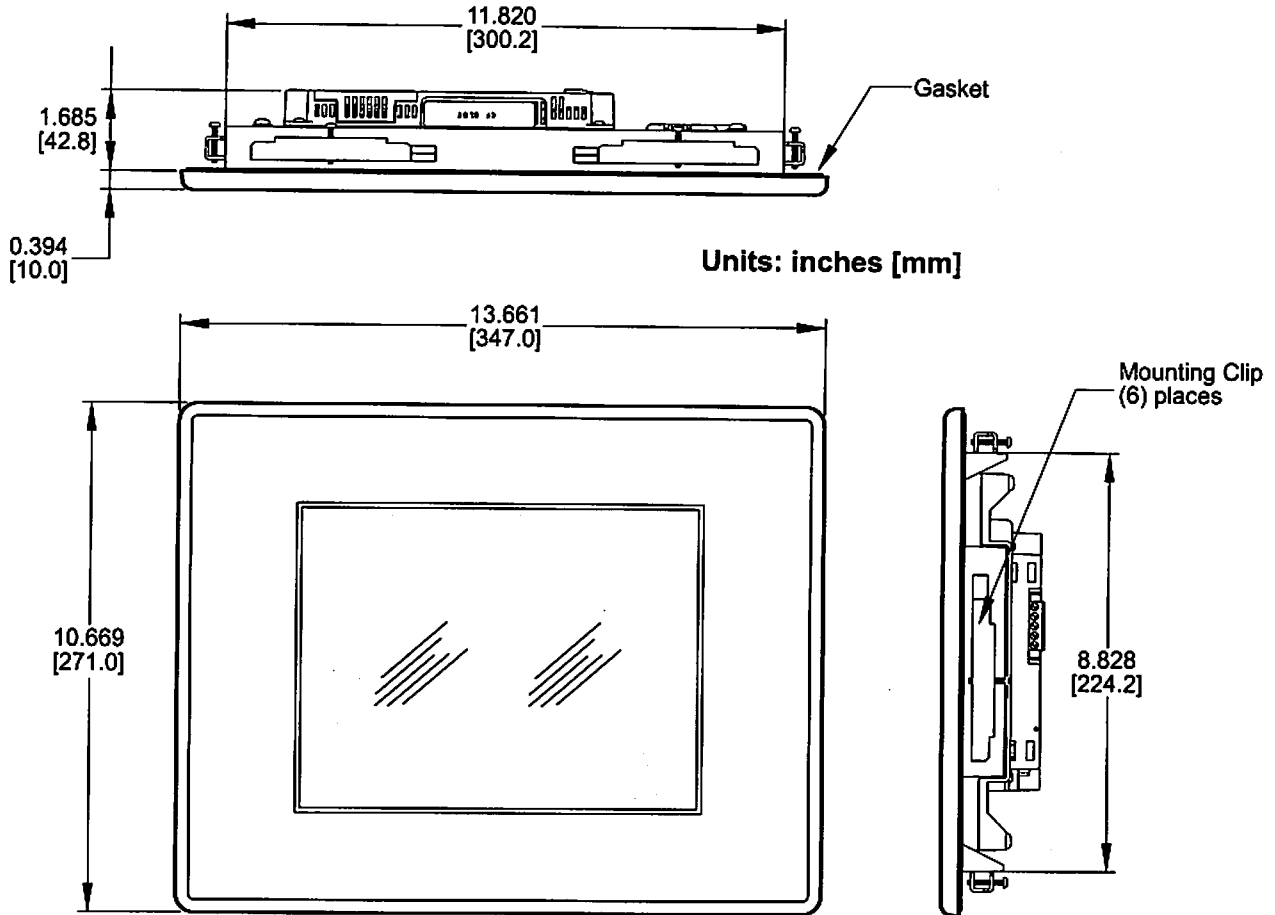
Cutout Dimensions:



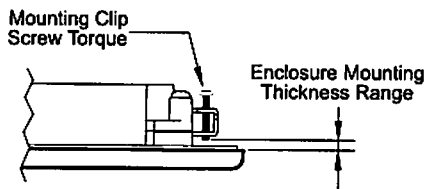
EA7-T10C

Original Mounting Clips

Dimensions:



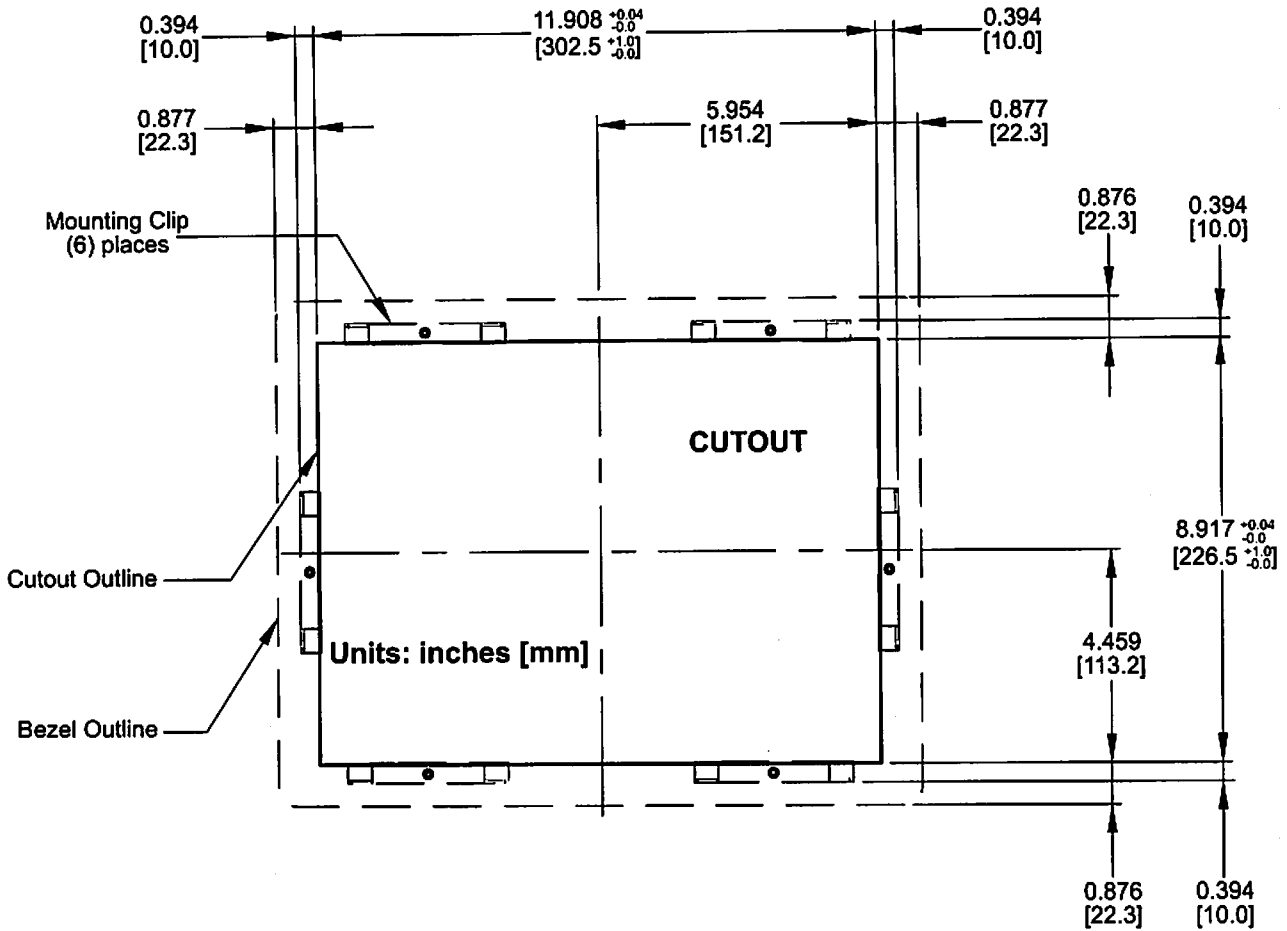
Enclosure Mounting Thickness Ranges and Mounting Clip Screw Torque



Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
8", 10", 12" & 15"	0.039 - 0.20 inch [1 - 5 mm]	42 ~ 57 oz-in [0.3 ~ 0.4 Nm]

EA7-T10C Original Mounting Clips

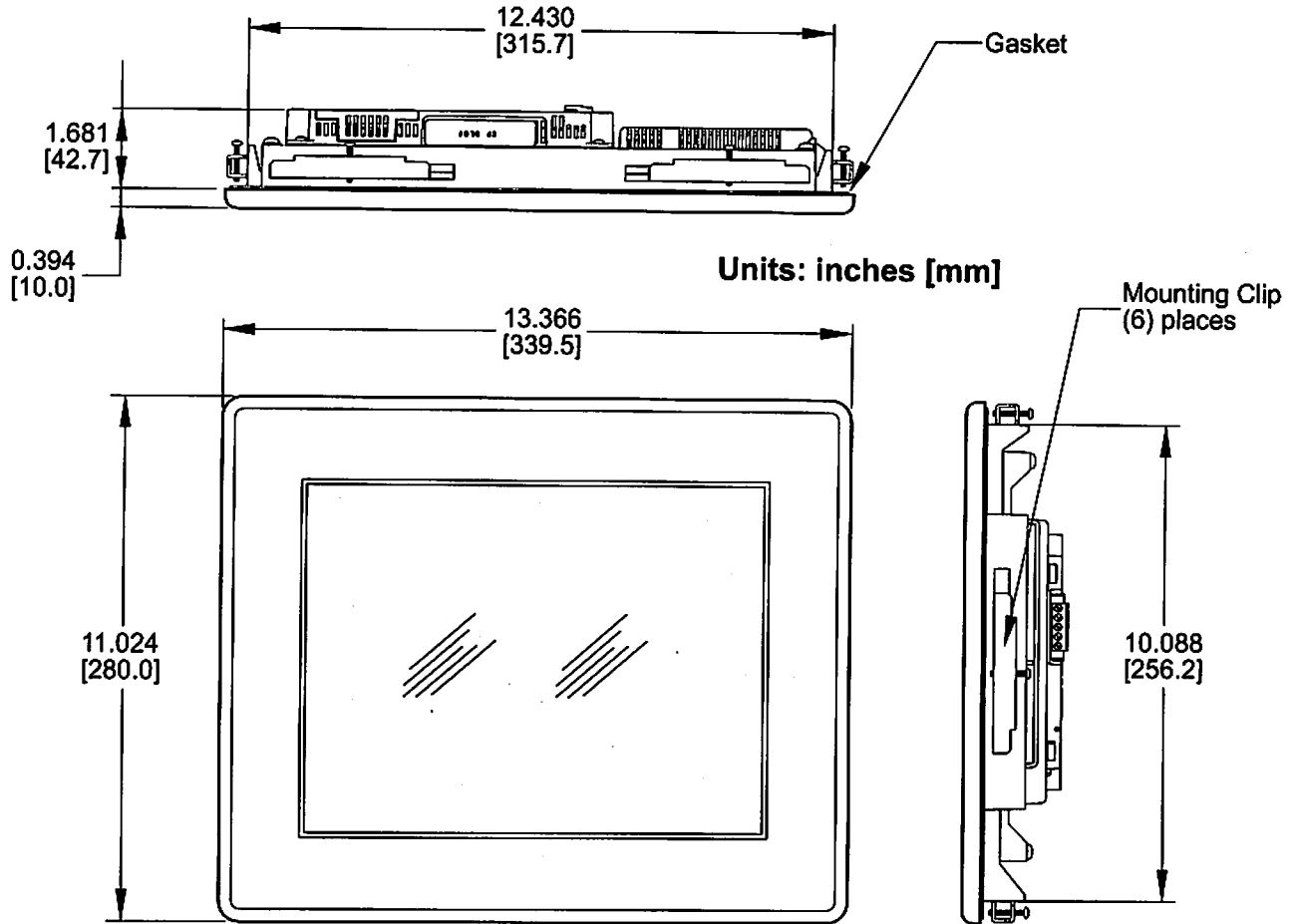
Cutout Dimensions:



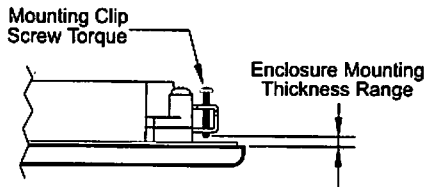
EA7-T12C

Original Mounting Clips

Dimensions:



Enclosure Mounting Thickness Ranges and Mounting Clip Screw Torque

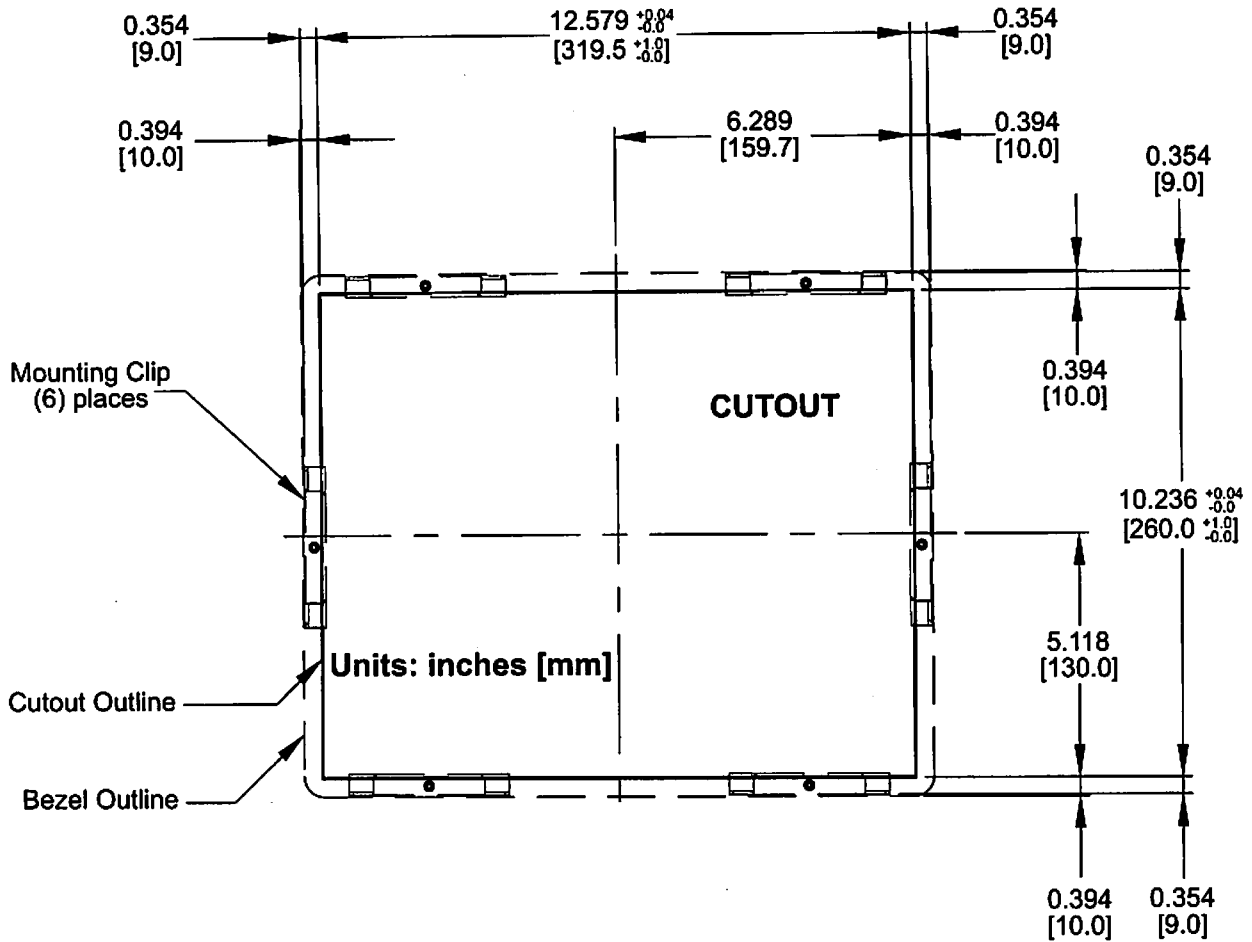


Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
8", 10", 12" & 15"	0.039 - 0.20 inch [1 - 5 mm]	42 ~ 57 oz-in [0.3 ~ 0.4 Nm]

EA7-T12C

Original Mounting Clips

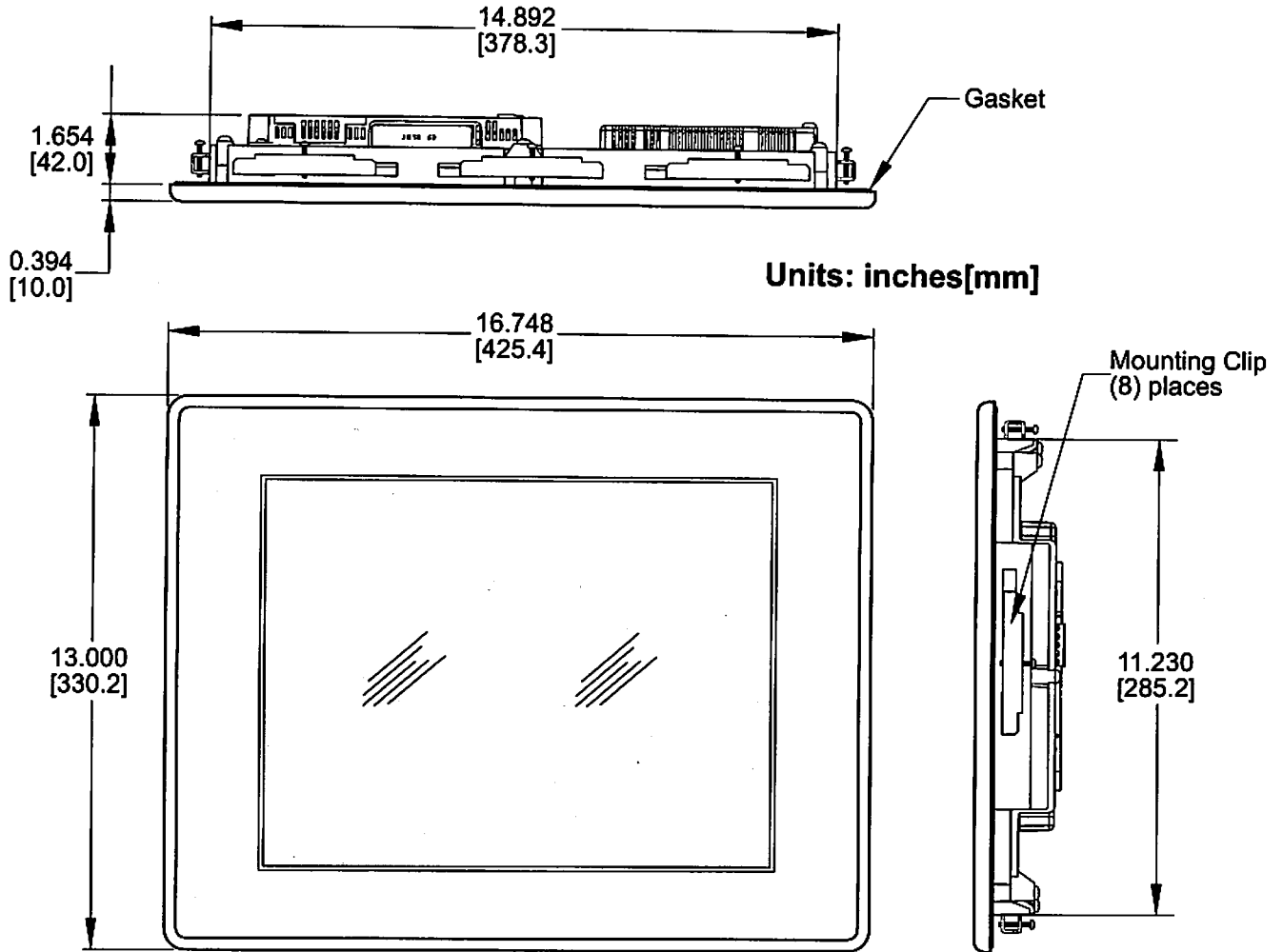
Cutout Dimensions:



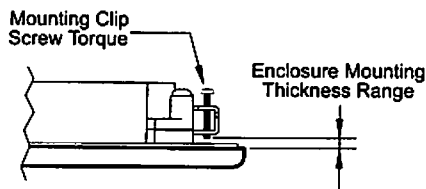
EA7-T15C

Original Mounting Clips

Dimensions:



Enclosure Mounting Thickness Ranges and Mounting Clip Screw Torque

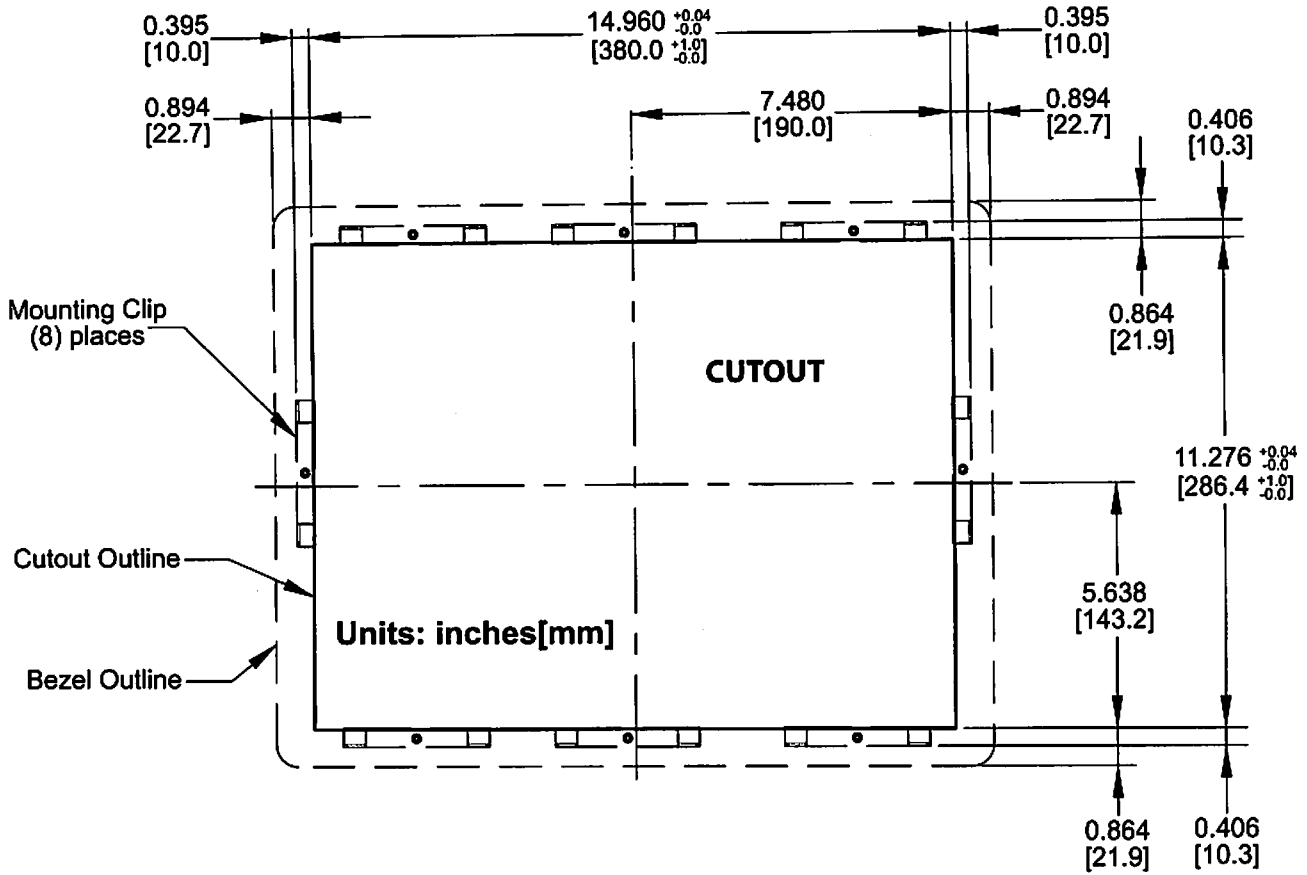


Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
8", 10", 12" & 15"	0.039 - 0.20 inch [1 - 5 mm]	42 ~ 57 oz-in [0.3 ~ 0.4 Nm]

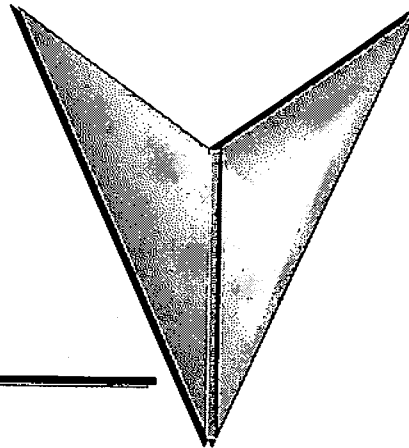
EA7-T15C

Original Mounting Clips

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Hardware User Manual

EA-USER-M

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HARDWARE USER MANUAL

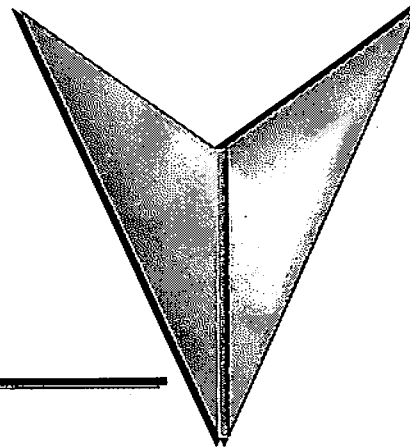


Please include the Manual Number and the Manual Issue, both shown below, when communicating with Technical Support regarding this publication.

Manual Number: EA-USER-M
Issue: 2nd Edition Rev. A
Issue Date: 07/08

Publication History		
Issue	Date	Description of Changes
First Edition	11/05	Original
Rev. A	01/06	Added chapters and content.
Rev. B	04/06	Added chapters 7-9 and appendix B.
Rev. C	08/07	Added AB EtherNet/IP, minor corrections, and content added.
Second Edition	02/08	Added Recipe backup/restore, Omron Ethernet & Siemens
Rev. A	07/08	Added Mitsubishi drivers, minor corrections.

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GETTING STARTED



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Introduction

The Purpose of this Manual

Thank you for purchasing our *C-more*® Touch Panel family of products. This manual describes AutomationDirect.com's *C-more* Touch Panels, their specifications, included components, available accessories and provides you with important information for installation, connectivity and setup. The manual shows you how install, wire and use the products. It also helps you understand how to interface the panels to other devices in a control system.

This user manual contains important information for personnel who will install the touch panels and accessories, and for the personnel who will be programming the panel. If you understand control systems that make use of operating interfaces such as the *C-more* touch panels, our user manuals will provide all the information you need to get, and keep your system up and running.

Supplemental Manuals

If you are familiar with industrial control type devices, you may be able to get up and running with just the aide of the Quick Start Guide that is included with each touch panel. You can also refer to the On-line help that is available in the *C-more* programming software for more information about programming the panel. The accessories include data sheets that will help with installing the accessories.

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Conventions Used




When you see the “notepad” icon in the left-hand margin, the paragraph to its immediate right will be a special note. The word **NOTE:** in boldface will mark the beginning of the text.



When you see the “exclamation mark” icon in the left-hand margin, the paragraph to its immediate right will be a warning. This information could prevent injury, loss of property, or even death (in extreme cases). The word **WARNING:** in boldface will mark the beginning of the text.

Key Topics for Each Chapter

The beginning of each chapter will list the key topics that can be found in that chapter.

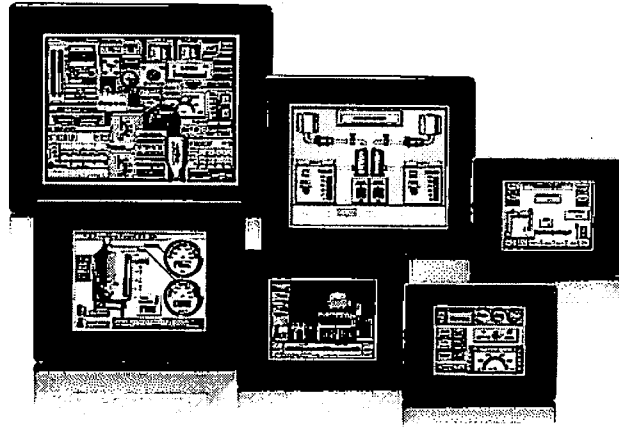
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Mounting Clips – New Style



NOTE: *C-more* touch panels shipped prior to approximately April 2006 had a slightly different mounting clip design. All of the drawings and illustrations in this issue of the Hardware User Manual are shown with the newer design. **Appendix C: Mounting Clips Prior April 2006** contains drawings and illustrations of the original designed mounting clips for your reference.

Product Overview

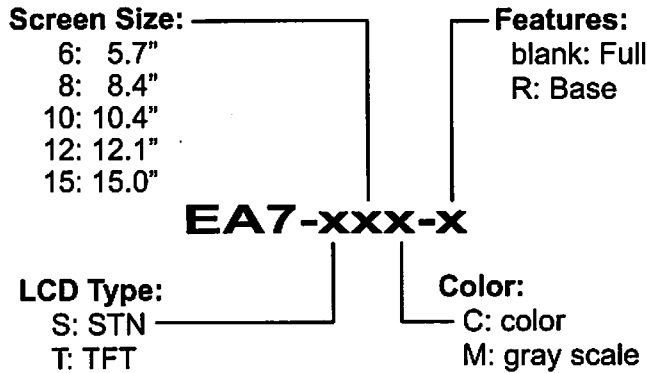


Some of the features designed into the product to provide excellent hardware and software are listed below.

- Analog touch screen (no touch cell boundaries)
- Plenty of memory and methods to get data in/out of the panel
- Overlapping active devices on the touch screen
- 65,536 colors for enhanced graphics on 6" (TFT), 8", 10", 12" and 15" panels (256 colors on 6" STN panels)
- Screen resolutions up to 1024 X 768 pixels
- Built-in project simulation; test on PC while developing
- Serial RS232, RS422/485 and Ethernet 10/100Base-T communications (Ethernet available on full feature units only.)
- Programming via USB or Ethernet (Ethernet available on full feature units only.)
- Optional AC/DC power adapter (EA-AC)
- User replaceable bulbs on 8", 10", 12" and 15" panels
- Animation of bitmaps and objects
- 4,000 built-in symbols, classic fonts: 6x8, 8x16, 8x32, 8x64, 16x16, 16x32, 16x64, 32x16, 32x32, 32x64, and Windows fonts
- PID face plate, trending, alarming and a recipe database
- Event Manager to trigger actions based on assigned state changes, schedules, PLC tag names, etc. setup in a database environment. The event can also trigger a sound byte, initiate a screen capture, send a data file (FTP), send an E-mail, etc.
- Select unique background screens for each created screen
- Trend Data logging
- Built-in FTP client/server, E-mail client, and Web server
- Audio output port - stereo, requires amplifier and speaker(s)

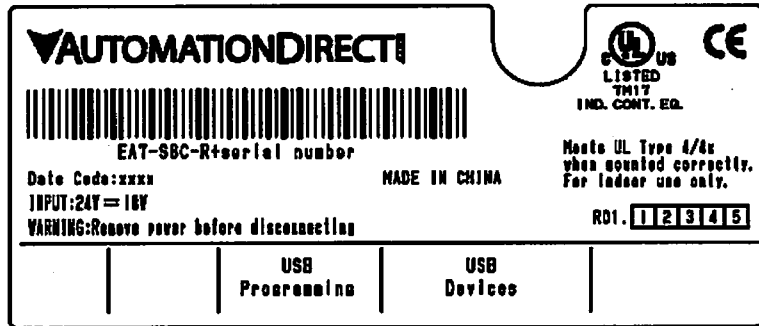
Part Number Key – Touch Panels

The *C-more* touch panel part numbers consist of the following key:

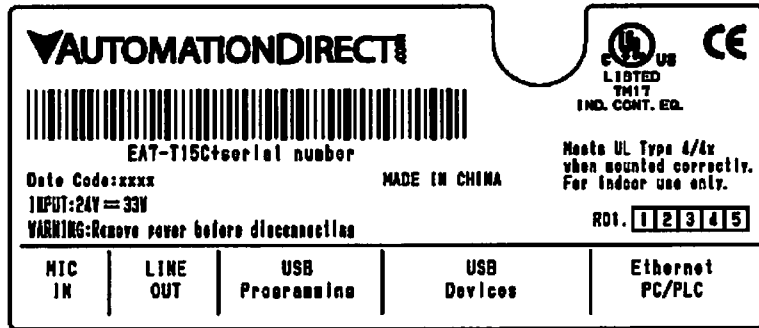


Product label examples:

EA7-S6C-R



EA7-T15C



Serial Number and Date Code formats:

Serial Number = [Part Number]+[YYMDDFNNN]

Date Code = **YYMF**

- YY:** Year (05–99 --- e.g. 05 = 2005)
- M:** Month (1–9, X, Y, Z --- e.g. X = Oct.)
- DD:** Day (1–31)
- F:** Manufacturing Site (0–9, A–Z)
- NNN:** Sequence number for the date listed (000–999)

EZTouch Conversion and Mounting

C-more panels are a drop-in replacement for EZTouch panels from *AutomationDirect*. They fit the same panel cutout*. The *C-more* software will convert your legacy EZTouch project (created with EZTouch Edit ver. 3.1a) automatically with no changes to the project required.** Just open your old EZTouch project in the new *C-more* Programming Software, connect the USB cable, and click "Send to Panel". The conversion is automatic and you will benefit immediately from:

- A better looking display
- A brighter screen
- Longer backlight bulb life
- Wider temperature tolerance
- A two year warranty



Note: EZTouch projects most have been created with EZTouch Edit software version 3.1a to assure proper project conversion.

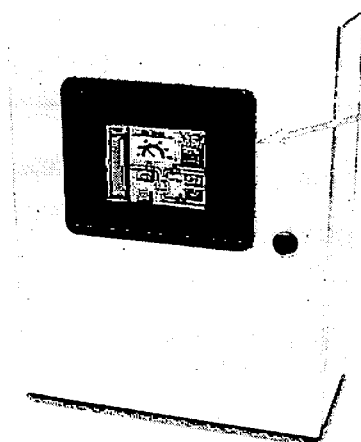
Now, there are hundreds of new features you may want to take advantage of, but it's nice to know that you can be up and running your existing EZTouch project in just a few minutes.

C-more accepts the same PLC communications and networking cables that you are using with EZTouch. The 24 VDC power connections accept the same DC wiring that you used for EZTouch, and now there is a removable terminal block connector. Only the programming cable is different - you no longer have to buy a proprietary serial cable to program your touch panel. *C-more* uses a standard USB cable or an Ethernet (CAT5) connection for programming.

* If you have an old 6" non-slim bezel EZTouch panel you will need our 6" Adapter Plate, part number EA-6-ADPTR, see the chapter on accessories.



** Some things to keep in mind when switching to *C-more*:




- 1.) The project conversion utility is a great feature. However the user must take full responsibility in ensuring the conversion works to their satisfaction.
- 2.) *C-more* does not support: FDA approval, DH+, ModBus+, Profibus, DeviceNet, Siemens MPI




Example of a C-more 6" touch panel mounted into an existing EZTouch non-slim bezel cutout using the C-more 6" adapter plate.

EZTouch Touch Panel Cross Reference to C-more

EZTouch		C-more*	
EZTouch 6", grayscale STN (0-45 °C)		C-more 6" Adapter	
		C-more 6", grayscale STN (0-50 °C)	
EZ-S6M-R	Requires: EA-6-ADPTR		EA7-S6M-R
EZ-S6M-RS			
EZ-S6M-F	Requires: EA-6-ADPTR		EA7-S6M (includes Ethernet)
EZ-S6M-FS			

EZTouch		C-more*	
EZTouch 6", 128 Color STN (0-45 °C)		C-more 6" Adapter	
		C-more 6", 256 Color STN or 65,536 Color TFT (0-50 °C)	
EZ-S6C-K	Requires: EA-6-ADPTR		EA7-S6C-R
EZ-S6C-KS			
EZ-S6C-F	Requires: EA-6-ADPTR		EA7-S6C (256 Color STN; includes Ethernet)
EZ-S6C-FS			
EZ-S6C-FST			EA7-T6C (65,536 Color TFT; includes Ethernet)

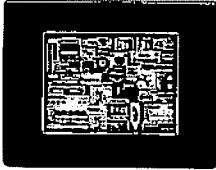
EZTouch		C-more*	
EZTouch 8", 128 Color STN (0-40 °C)		C-more 8" Adapter	
		C-more 8", 65,536 Color TFT (0-50 °C)	
EZ-S8C-F			EA7-T8C (includes Ethernet)
EZ-S8C-FS			
EZ-S8C-FST			

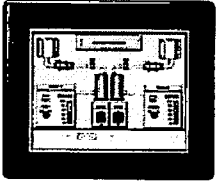


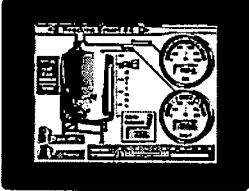
*Note: All C-more touch panels are NEMA 4/4X, IP-65 (When mounted correctly, for indoor use only), non-FDA.

1

EZTouch Touch Panel Cross Reference to C-more (cont'd)

EZTouch	C-more*
EZTouch 10", 128 Color TFT (0-50 °C)	C-more 10", 65,536 Color TFT (0-50 °C)
EZ-S10C-F	 <p>EA7-T10C (includes Ethernet)</p>
EZ-S10C-FS	
EZ-S10C-FST	
EZ-S10T-FSE	

EZTouch	C-more*
No 12" EZTouch available	C-more 12", 65,536 Color TFT (0-50 °C)
	 <p>EA7-T12C (includes Ethernet)</p>

EZTouch	C-more*
EZTouch 15", 128 Color TFT (0-45 °C)	C-more 15", 65,536 Color TFT (0-50 °C)
EZ-S15C-FS	 <p>EA7-T15C (includes Ethernet)</p>
EZ-S15C-FST	
EZ-S15C-FSE	



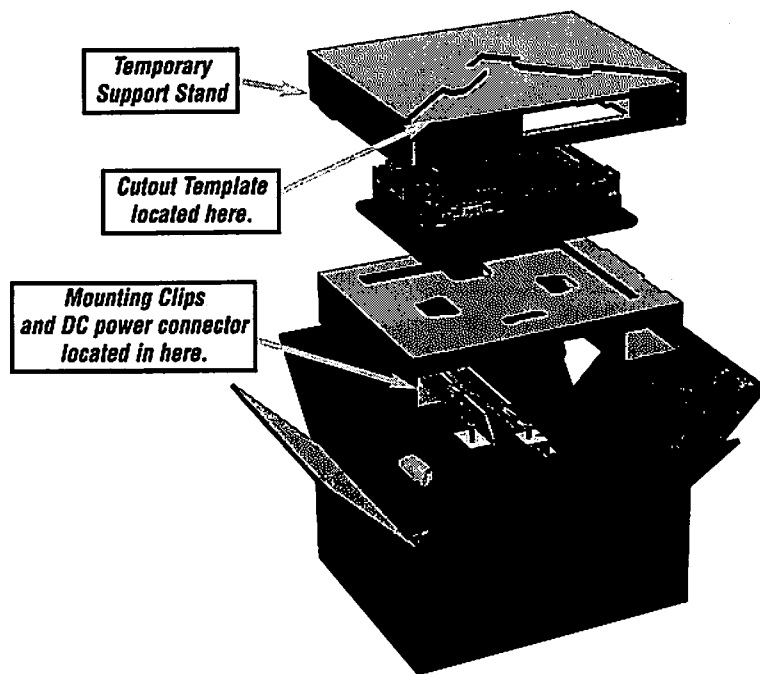
*Note: All C-more touch panels are NEMA 4/4X, IP-65 (When mounted correctly, for indoor use only), non-FDA.

Quick Start Steps

Step 1 – Unpack and Inspect

a.) Unpack the *C-more* Touch Panel from its shipping carton. Included in the carton are the following:

- *C-more* Touch Panel
- cutout template
- mounting clips
- temporary support stand
- DC power connector
- gasket
- Quick Start Guide, p/n EA-QSG



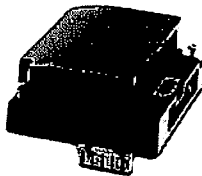
b.) Unpack any accessories that have been ordered, such as: AC/DC Power Adapter, Expansion Assembly, CompactFlash memory, programming cable, communications cable, etc.

c.) Inspect all equipment for completeness. If anything is missing or damaged, immediately call the *AutomationDirect*® returns department @ 1-800-633-0405.

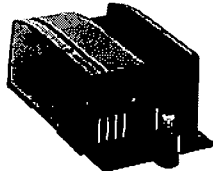
Shipping Carton Contents

Optional Accessories

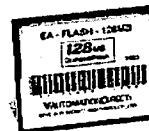
AC Power Adapter
EA-AC



Expansion Assembly
EA-EXP-OPT



128 MB Compact Flash
EA-FLASH-128MB



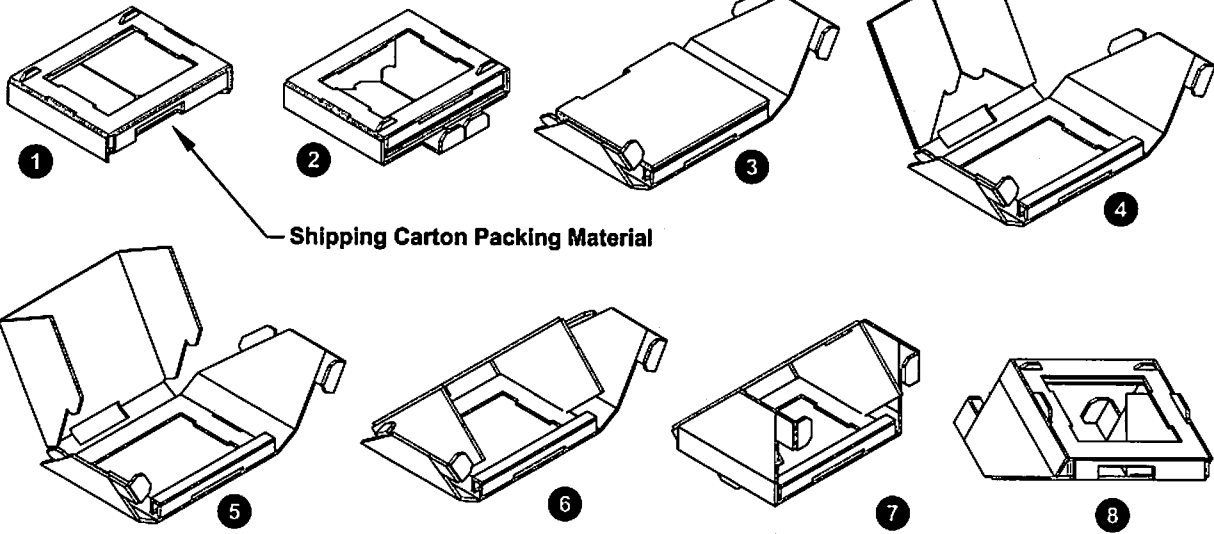
2GB USB Pen Drive
SDCZ4-2048-A10



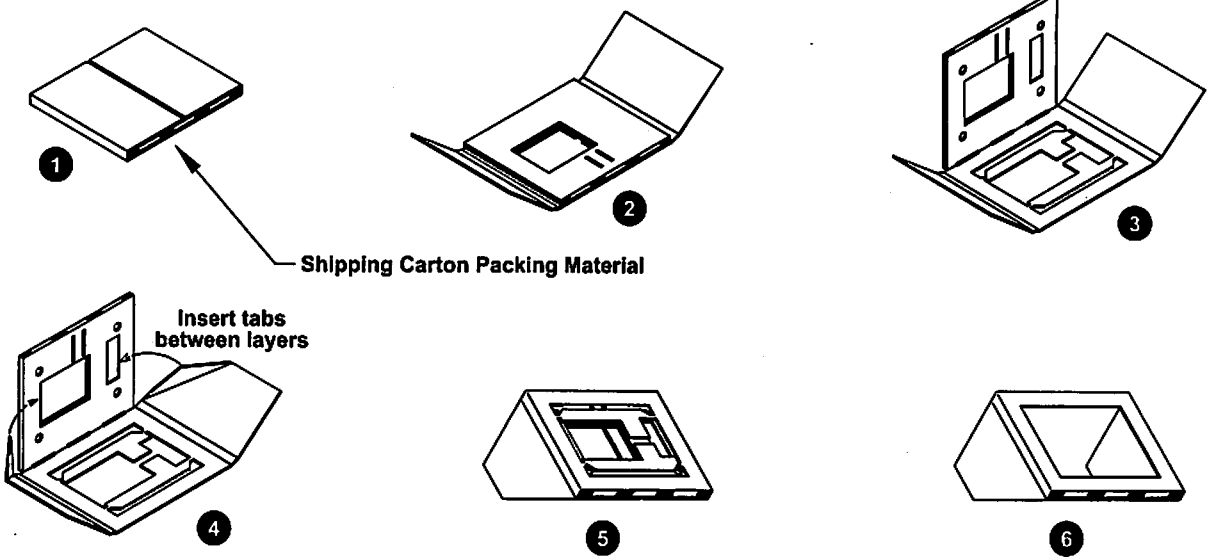
Step 2 – Assemble Temporary Support Stand

1

6" & 8" Touch Panel – Temporary Stand



10", 12" & 15" Touch Panel – Temporary Stand

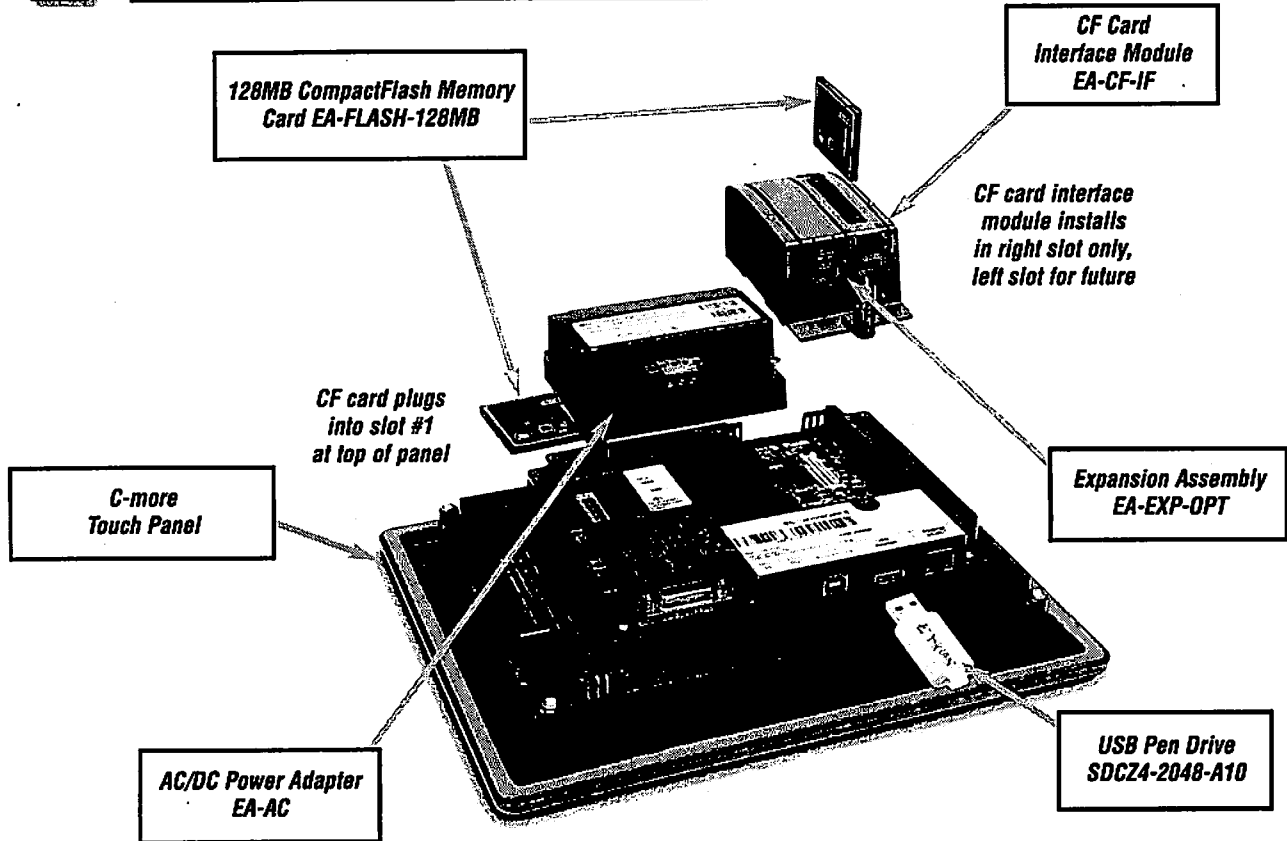


NOTE: See Chapter 4: Installation and Wiring for C-more touch panel installation information including cutout dimensions and mounting clearances.

Step 3 – Install Optional Hardware Accessories



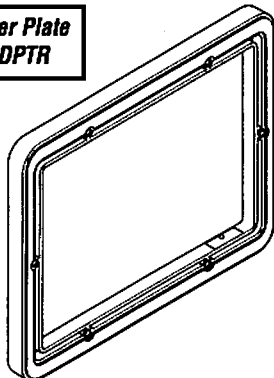
NOTE: CompactFlash memory card designations – *CF Slot #1* is at the top of the panel and *CF Slot #2* is the CF Card Interface Module, p/n EA-CF-IF.



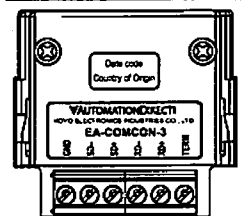
NOTE: The C-more 6" touch panels will fit into the existing cutout of any EZTouch 6" slim bezel panel. Use the C-more 6" Adapter Plate, p/n EA-6-ADPTR, to install C-more 6" panels into existing cutouts of EZTouch 6" non-slim (rounded bezel) panels.

Optional Accessories

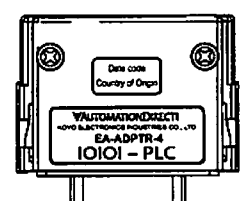
6" Adapter Plate EA-6-ADPTR



15-pin Terminal Block Adapter EA-COMCON-3

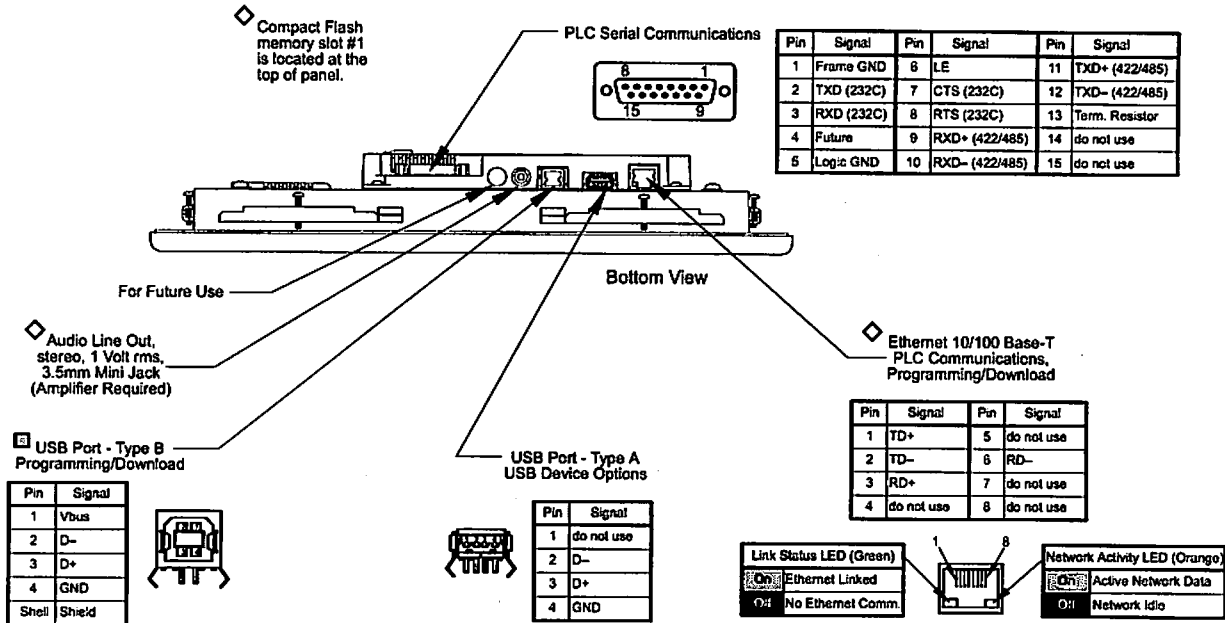


15-pin 90 Degree Comm. Port Adapter EA-ADPTR-4



Step 4 – Become Familiar with Available Communication Ports

1



◆ Note: Device is not available on Base Feature touch panels, part numbers EA7-S6M-R and EA7-S6C-R.

■ Note: Use USB Programming Cable, p/n USB-CBL-AB15.

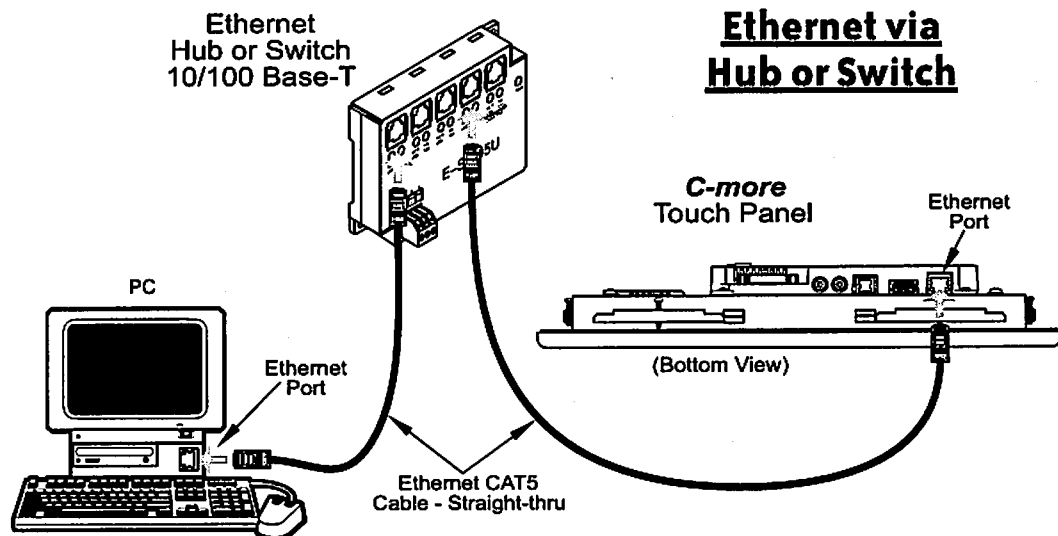
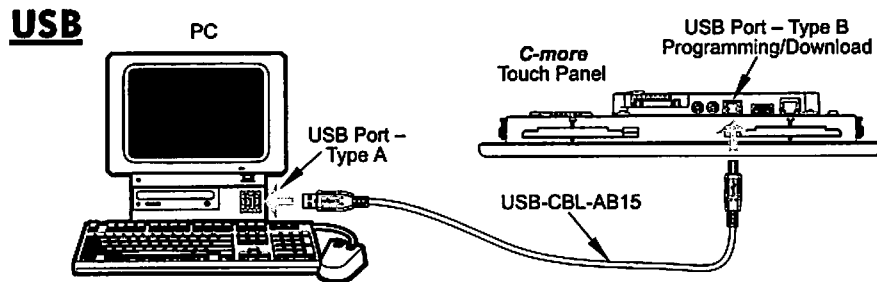


Note: See Chapter 2: Specifications and Chapter 6: PLC Communications for additional details on the available communication ports, protocols and cables.

Step 5 – Connect Touch Panel to Computer

- Connect a USB Programming Cable, p/n USB-CBL-AB15, from an USB type A port on the PC to the USB type B programming port on the *C-more* touch panel
- or connect the *C-more* touch panel and PC together via an Ethernet hub or switch, and CAT5 Ethernet cables (full feature panels only)
- or use an Ethernet crossover cable directly between the *C-more* touch panel Ethernet port and the PC Ethernet port (full feature panels only)

1

**Ethernet via Crossover Cable**

PC

Ethernet Port

Ethernet CAT5 Cable - Crossover

C-more Touch Panel

Ethernet Port

(Bottom View)

1

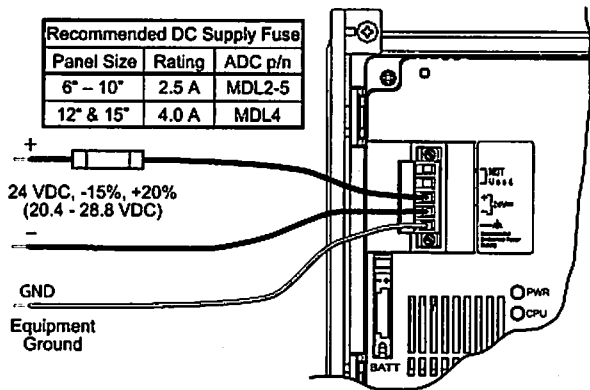
Step 6 – Provide Power to the Touch Panel

- Connect a dedicated 24 VDC (20.4 - 28.8 VDC) switching power supply rated at a minimum of 1.5 A to the DC connector on the rear of the *C-more* touch panel, include wiring the ground terminal to a proper equipment ground
- or install a *C-more* AC/DC Power Adapter, EA-AC, to the rear of the touch panel and connect an AC voltage source of 100-240 VAC, 50/60Hertz, to its AC connector (see note below)
- then turn on the power source and check the LED status indicators on the rear of the *C-more* touch panel for proper indication



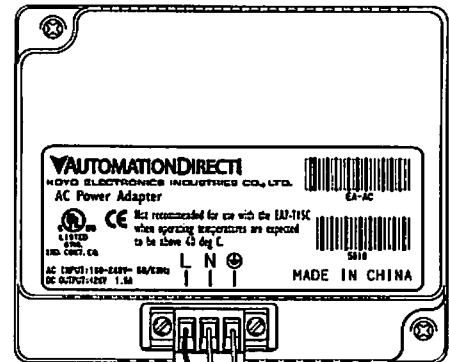
NOTE: The AC/DC Power Adapter, EA-AC, is for *C-more* touch panels only. The adapter is powered from a 100-240 VAC, 50/60 Hertz power source. The adapter provides 24 VDC @ 1.5 A. Power Fault features help protect data being logged to CompactFlash during power failures. The *C-more* panel must have firmware version 1.21 Build 6.18E or higher for proper operation.

DC Wiring



WARNING: The AC/DC Power Adapter is not recommended for use with the EA7-T15C touch panel when operating temperatures are expected to exceed 40 °C [104 °F].

AC Wiring

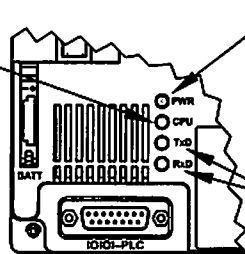


Recommended AC Supply Fuse
3.0 A time delay, ADC p/n MDL3

100 - 240 VAC
50/60 Hz

C-more LED Status Indicators

CPU Status LED (Green, Orange & Red)	
Off	Power Off
Green	Normal – CPU Run State
Blinking Red	Memory Error
Blinking Orange	Operating System not found
Blinking	LCD Backlight Failure
Blinking	Power Loss Detection



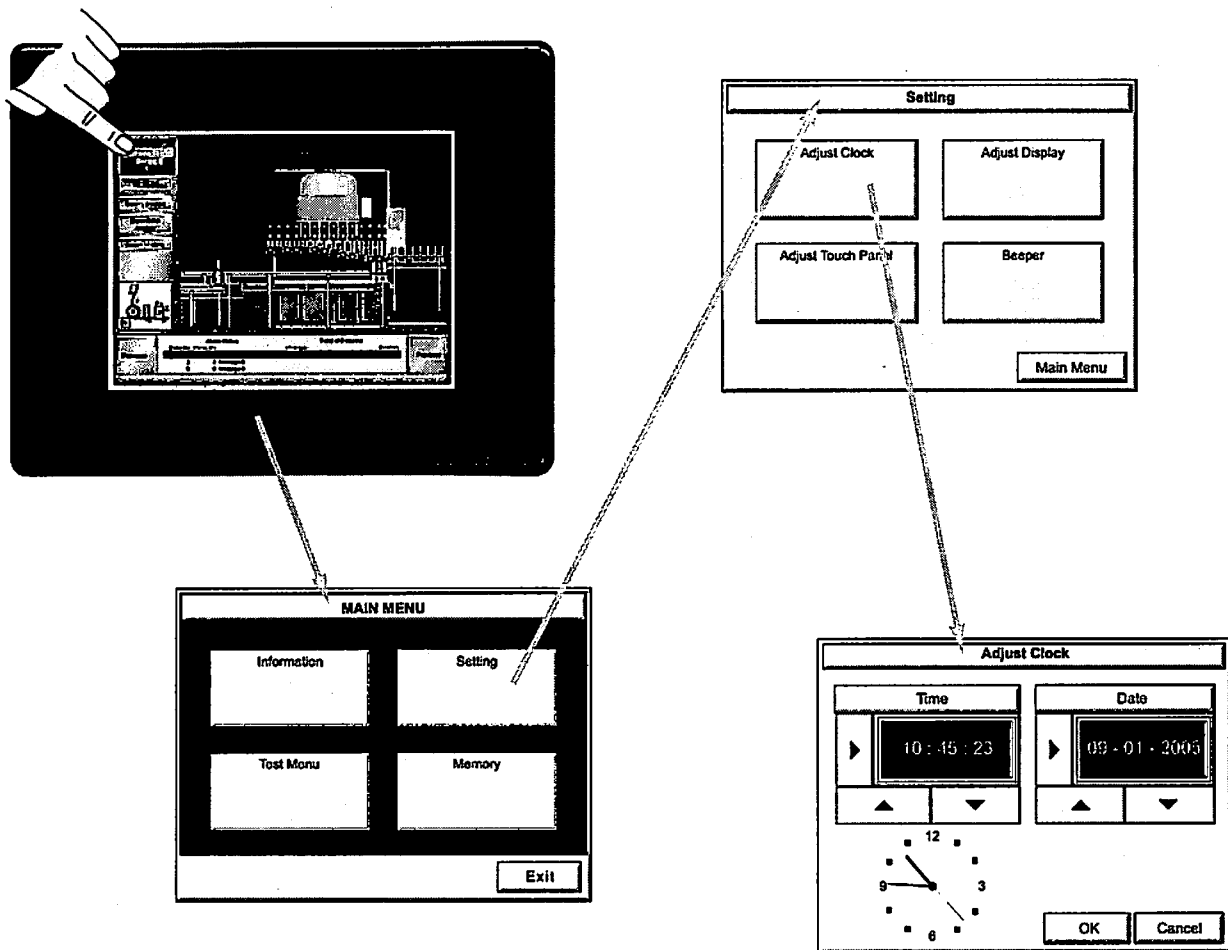
Rear View

Power LED (Green)	
On	Power On
Off	Power Off

Serial TxD/RxD LED (Green)	
On	Comm. is active
Off	No communication

Step 7 – Access the Touch Panel Setup Screens

- Access the Main Menu of the touch panel System Setup Screens by pressing the extreme upper left corner of the panel display area for three (3) seconds as shown below.
- Adjust the time and date for the panel by pressing the Setting button on the Main Menu, then press the Adjust Clock button on the Setting screen.
- Use the right pointing arrows for the time or date display to select the unit to change. Use the up and down arrows to increment or decrement the value for the selected unit.
- Press OK when done to accept the changes to the time and date that is retained in the touch panel's battery backed memory, or press Cancel to exit the Adjust Clock setup screen without making any changes.
- Press the Main Menu button on the Setting screen and then the Exit button on the Main Menu screen to return to the application screen.



Note: When using an Ethernet connection, by default the panel is set for DHCP IP addressing. If it can not find a DHCP server, the panel will automatically assign an IP address. The IP address can be changed by the user from the programming software or by accessing the IP address setting screen as shown on page 5-19 and detailed on page 5-25. See Chapter 5 - System Setup Screens for details on other setup screen settings and functions.

Step 8 – Choose Touch Panel to PLC Protocol & Cables

1

PLC Compatibility Table			
PLC Family	Model	Protocols	
DirectLOGIC	DL05/DL06	all	K-Sequence
			<i>Direct</i> NET
		Modbus (Koyo addressing)	
		H0-ECOM/H0-ECOM100	<i>Direct</i> LOGIC Ethernet
	DL105	all	K-Sequence
	DL205	D2-230	K-Sequence
		D2-240	K-Sequence
			<i>Direct</i> NET
		D2-250/D2-250-1/D2-260	K-Sequence
			<i>Direct</i> NET
			Modbus (Koyo addressing)
		D2-240/D2-250-1/D2-260 Using DCM	<i>Direct</i> NET
			Modbus (Koyo addressing)
		H2-ECOM/H2-ECOM100	<i>Direct</i> LOGIC Ethernet
	DL305	D3-330/330P (Requires the use of a Data Communications Unit)	<i>Direct</i> NET
		D3-340	<i>Direct</i> NET
		D3-350	K-Sequence
			<i>Direct</i> NET
			Modbus (Koyo addressing)
	D3-350 DCM	<i>Direct</i> NET	
		Modbus (Koyo addressing)	
	DL405	D4-430	K-Sequence
			<i>Direct</i> NET
		D4-440	K-Sequence
			<i>Direct</i> NET
		D4-450	K-Sequence
			<i>Direct</i> NET
			Modbus (Koyo addressing)
	All with DCM	<i>Direct</i> NET	
		Modbus (Koyo addressing)	
	H4-ECOM/H4-ECOM100	<i>Direct</i> LOGIC Ethernet	
	H2-WinPLC (Think & Do) Live V5.2 or later and Studio any version	Think & Do Modbus RTU (serial port)	
	H2-WinPLC (Think & Do) Live V5.5.1 or later and Studio V7.2.1 or later	Think & Do Modbus TCP/IP (Ethernet port)	

PLC Compatibility Table continued on the next page.

Step 8 – Choose Touch Panel to PLC Protocol & Cables (cont'd)

PLC Compatibility Table (cont'd)		
PLC Family	Model	Protocols
Allen-Bradley	MicroLogix 1000, 1100, 1200, 1500, SLC 5-01/02/03, PLC5	DH485/AIC/AIC+
	MicroLogix 1000, 1100, 1200 and 1500	DF1 Half Duplex; DF1 Full Duplex
	SLC 5-03/04/05	
	ControlLogix™, CompactLogix™, FlexLogix™	
	PLC-5	DF1 Full Duplex
	ControlLogix, CompactLogix, FlexLogix - Tag Based	DF1 Half Duplex; DF1 Full Duplex
	ControlLogix, CompactLogix, FlexLogix - Generic I/O Messaging	EtherNet/IP Server
	ControlLogix, CompactLogix, FlexLogix - Tag Based	EtherNet/IP Client
	MicroLogix 1100 & SLC 5/05, both via native Ethernet port	
	MicroLogix 1000, 1100, 1200, 1500, SLC 5-03/04/05, all via ENI adapter	
Modbus TCP/IP	Modbus TCP/IP devices	Modbus TCP/IP
GE	90/30, 90/70, Micro 90, VersaMax Micro	SNPX
Mitsubishi	FX Series	FX Direct
	Q02, Q02H, Q06H, Q12H, Q25H	Q CPU
	Q, QnA Serial	QnA Serial
	Q, QnA Ethernet	QnA Ethernet
Omron	C200 Adapter, C500	Host Link
	CJ1/CS1 Serial	FINS
	CJ1/CS1 Ethernet	
Modicon	984 CPU, Quantum 113 CPU, AEG Modicon Micro Series 110 CPU: 311-xx, 411-xx, 512-xx, 612-xx	Modbus RTU
Siemens	S7-200 CPU, RS-485 Serial	PPI
	S7-300, Ethernet	Ethernet ISO over TCP

Step 8 – Choose Cables continued on next page.

Step 8 – Choose Touch Panel to PLC Protocol & Cables (cont'd)

1

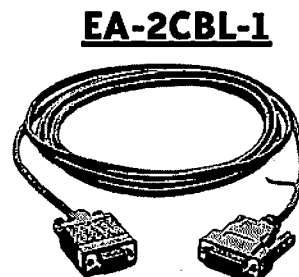
Purchased Cable Description	Cable Part Number
DirectLOGIC PLC RJ-12 port, DL05, DL06, DL105, DL205, D3-350, D4-450 & H2-WINPLC (RS-232C)	EA-2CBL
DirectLOGIC (VGA Style) 15-pin port, DL06, D2-250 (250-1), D2-260 (RS-232C)	EA-2CBL-1
DirectLOGIC PLC RJ-11 port, D3-340 (RS-232C)	EA-3CBL
DirectLOGIC DL405 PLC 15-pin D-sub port, DL405 (RS-232C)	EA-4CBL-1
DirectLOGIC PLC 25-pin D-sub port, DL405, D3-350, DL305 DCU and all DCM's (RS-232C)	EA-4CBL-2
Allen-Bradley MicroLogix 1000, 1100, 1200 & 1500 (RS-232C)	EA-MLOGIX-CBL
Allen-Bradley SLC 5-03/04/05, ControlLogix, CompactLogix, FlexLogix DF1 port (RS-232C)	EA-SLC-232-CBL
Allen-Bradley PLC-5 DF1 port (RS-232C)	EA-PLC5-232-CBL
Allen-Bradley MicroLogix, SLC 5-01/02/03, PLC5 DH485 port (RS-232C)	EA-DH485-CBL
GE 90/30, 90/70, Micro 90, VersaMax Micro 15-pin D-sub port (RS-422A)	EA-90-30-CBL
MITSUBISHI FX Series 25-pin port (RS-422A)	EA-MITSU-CBL
MITSUBISHI FX Series 8-pin mini-DIN (RS-422A)	EA-MITSU-CBL-1
OMRON Host Link (C200 Adapter, C500) (RS-232C)	EA-OMRON-CBL



NOTE 1: The above list of pre-made communications cables may be purchased. See **Chapter 6: PLC Communications** for wiring diagrams of additional user constructed cables. Chapter 6 also includes wiring diagrams for the pre-made cables.

NOTE 2: EZTouch serial PLC communication cables are compatible with C-more touch panels.

Pre-made cable examples

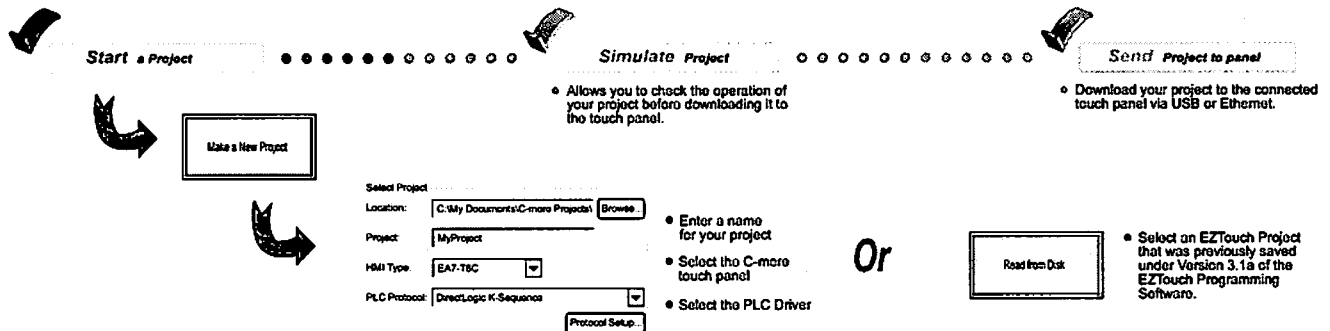
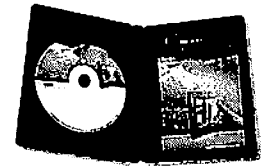


Step 9 – Install the Programming Software and Develop a Project

Following are the minimum system requirements for running *C-more* Programming Software, p/n EA-PGMSW, on a PC:

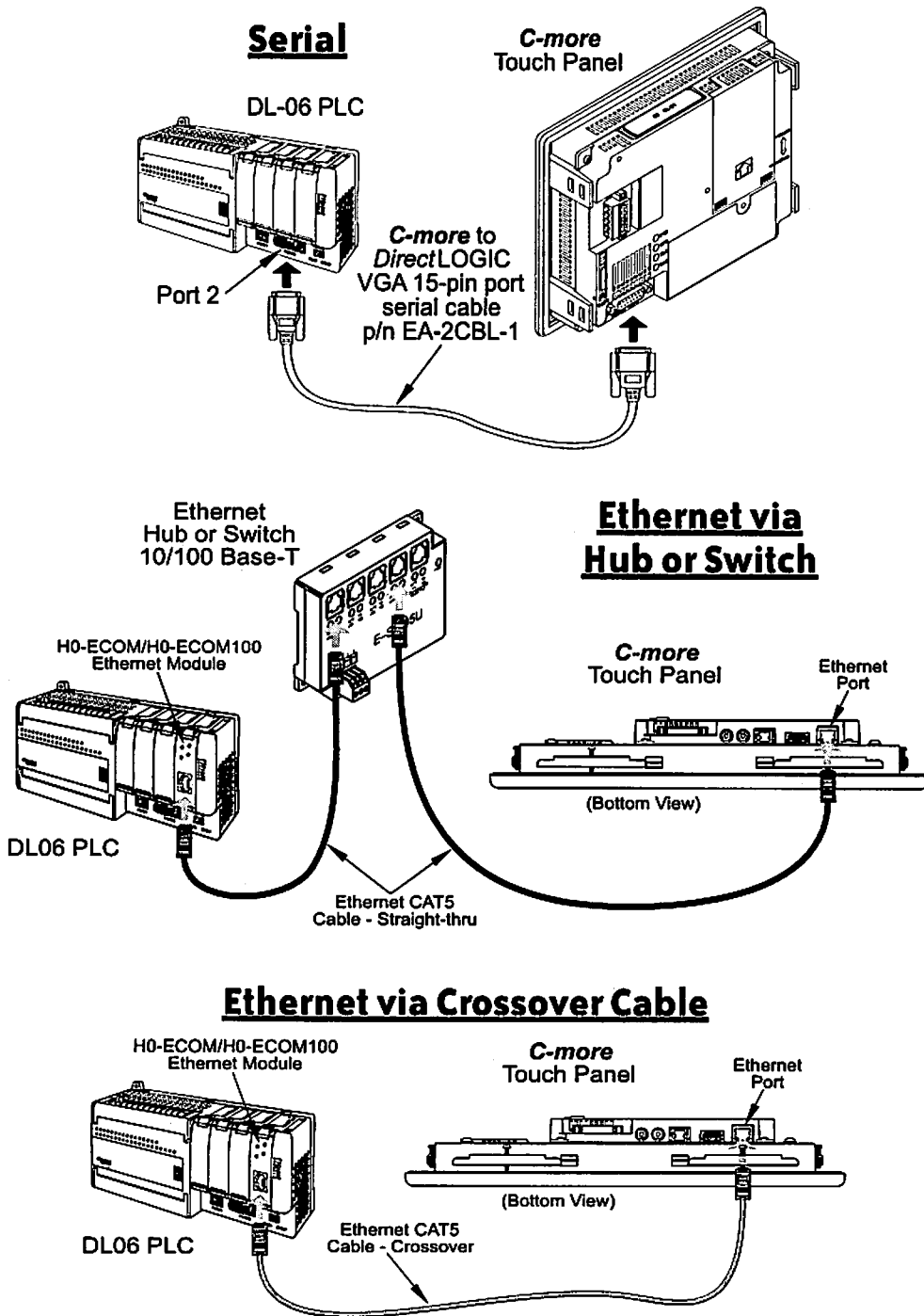
- Personal Computer with a 333 MHz or higher processor (CPU) clock speed recommended; Intel® Pentium/Celeron family, or AMD® K6/Athlon/Duron family, or compatible processor recommended
- Keyboard and Mouse or compatible pointing device
- Super VGA color video adapter and monitor with at least 800 x 600 pixels resolution (1024 x 768 pixels recommended), 64K color minimum
- 300 MB free hard-disk space
- 128 MB free RAM (512 MB recommended)
- CD-ROM or DVD drive for installing software from the CD
- USB type A port or Ethernet 10/100 Mbps port for project transfer from software to touch panel (Ethernet port not available on -R models)
- Operating System - Windows® XP Home / Professional Edition or Windows® 2000 with Service Pack 4. (To check your computer system information, go to the Start Menu – All Programs and select Accessories, then System Tools, and finally System Information.)

Insert the supplied CD-ROM into the PC's CD-ROM drive and follow the instructions. If you need assistance during the software installation, please refer to the supplied Software Installation Guide or call the AutomationDirect Technical Support team @ 770-844-4200.



Step 10 – Connect Touch Panel to PLC

- Connect the serial communications cable between the *C-more* touch panel and the PLC
- or connect the *C-more* touch panel and PLC together via an Ethernet hub or switch, and CAT5 Ethernet cables (full feature panels only)
- or use an Ethernet crossover cable directly between the *C-more* Ethernet port and the PLC Ethernet port (full feature panels only)



SPECIFICATIONS



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Available Models

The *C-more*[®] Operator Interface is the next generation of touch panel brought to you by *AutomationDirect*. It has been designed to display and interchange graphical data from a PLC by merely viewing or touching the screen.

The *C-more* Touch Panel is available in a variety of models to suit your application. Refer to the following tables for a list of part numbers, descriptions and options available.

Part Number	Description	User Memory	CF Card Option	USB Device	Ethernet
EA7-S6M-R	6-inch <i>C-more</i> grayscale STN touch panel (5.7 inch viewable screen), 15 shades of gray, 320 x 240 pixel QVGA screen resolution, 333 MHz CPU, 24 VDC (20.4-28.8 VDC operating range), NEMA 4/4X, IP-65 (when mounted correctly; for indoor use only), non-replaceable backlight, 50,000 hour half-life. *Base Model: Built-in USB only, no Ethernet or CompactFlash support.	10 MB	No	Yes	No
EA7-S6C-R	6-inch <i>C-more</i> color STN touch panel (5.7 inch viewable screen), 256 colors, 320 x 240 pixel QVGA screen resolution, 333 MHz CPU, 24 VDC (20.4-28.8 VDC operating range), NEMA 4/4X, IP-65 (when mounted correctly; for indoor use only), non-replaceable backlight, 50,000 hour half-life. *Base Model: Built-in USB only, no Ethernet or CompactFlash support.	10 MB	No	Yes	No
EA7-S6M	6-inch <i>C-more</i> grayscale STN touch panel (5.7 inch viewable screen), 15 shades of gray, 320 x 240 pixel QVGA screen resolution, 333 MHz CPU, 24 VDC (20.4-28.8 VDC operating range), NEMA 4/4X, IP-65 (when mounted correctly; for indoor use only), non-replaceable backlight, 50,000 hour half-life. Built-in Ethernet and USB; supports CompactFlash.	10MB	Yes	Yes	Yes
EA7-S6C	6-inch <i>C-more</i> color STN touch panel (5.7 inch viewable screen), 256 colors, 320 x 240 pixel QVGA screen resolution, 333 MHz CPU, 24 VDC (20.4-28.8 VDC operating range), NEMA 4/4X, IP-65 (when mounted correctly; for indoor use only), non-replaceable backlight, 50,000 hour half-life. Built-in Ethernet and USB; supports CompactFlash.	10 MB	Yes	Yes	Yes
EA7-T6C	6-inch <i>C-more</i> color TFT touch panel (5.7 inch viewable screen), 64K colors, 320 x 240 pixel QVGA screen resolution, 333 MHz CPU, 24 VDC (20.4-28.8 VDC operating range), NEMA 4/4X, IP-65 (when mounted correctly; for indoor use only), non-replaceable backlight, 50,000 hour half-life. Built-in Ethernet and USB; supports CompactFlash.	10 MB	Yes	Yes	Yes

Table continued on the next page.

Available Models (cont'd)

Part Number	Description	User Memory	CF Card Option	USB Device	Ethernet
EA7-T8C	8-inch <i>C-more</i> color TFT touch panel (8.4 inch viewable screen), 64K colors, 640 x 480 pixel VGA screen resolution, 400 MHz CPU, 24 VDC (20.4-28.8 VDC operating range), NEMA 4/4X, IP-65 (when mounted correctly; for indoor use only), user replaceable backlight, 50,000 hour half-life. Built-in Ethernet and USB; supports CompactFlash.	10 MB	Yes	Yes	Yes
EA7-T10C	10-inch <i>C-more</i> color TFT touch panel (10.4 inch viewable screen), 64K colors, 640 x 480 pixel VGA screen resolution, 400 MHz CPU, 24 VDC (20.4-28.8 VDC operating range), NEMA 4/4X, IP-65 (when mounted correctly; for indoor use only), user replaceable backlight, 50,000 hour half-life. Built-in Ethernet and USB; supports CompactFlash.	10 MB	Yes	Yes	Yes
EA7-T12C	12-inch <i>C-more</i> color TFT touch panel (12.1 inch viewable screen), 64K colors, 800 x 600 pixel SVGA screen resolution, 400 MHz CPU, 24 VDC (20.4-28.8 VDC operating range), NEMA 4/4X, IP-65 (when mounted correctly; for indoor use only), user replaceable backlight, 50,000 hour half-life. Built-in Ethernet and USB; supports CompactFlash.	40 MB	Yes	Yes	Yes
EA7-T15C	15-inch <i>C-more</i> color TFT touch panel (15.0 inch viewable screen), 64K colors, 1024 x 768 XGA screen resolution, 400 MHz CPU, 24V DC (20.4-28.8 VDC operating range), NEMA 4/4X, IP-65 (when mounted correctly; for indoor use only), user replaceable backlight, 50,000 hour half-life. Built-in Ethernet and USB; supports CompactFlash.	40 MB	Yes	Yes	Yes

2

Model Specifications

The following tables on the next four pages provide details to the Specifications of each available model. The specification tables are separated into the following groups:

- 6" Base Feature Models, EA7-S6M-R and EA7-S6C-R
- 6" Full Feature Models, EA7-S6M, EA7-S6C and EA7-T6C
- 8" & 10" Full Feature Models, EA7-T8C and EA7-T10C
- 12" & 15" Full Feature Models, EA7-T12C & EA7-T15C

The following note applies to the Backlight Average Lifetime of 50,000 hours shown in the following four tables:



Note: The backlight average lifetime is defined as the average usage time it takes before the brightness becomes 50% of the initial brightness. The lifetime of the backlight depends on the ambient temperature. The lifetime will decrease under low or high temperature usage.

6" Base Feature Models

2

Specification	Model	6" STN grayscale w/ base features	6" STN color w/ base features
Part Number		EA7-S6M-R	EA7-S6C-R
Display Actual Size and Type		5.7" STN grayscale	5.7" STN color
Color Scale		15 shades of gray	256 colors
Display Viewing Area		4.54" x 3.4" [115.2 mm x 86.4 mm]	
Screen Pixels		320 x 240 (QVGA)	
Display Brightness		150 cd/m ² (NITS)	200 cd/m ² (NITS)
LCD Panel Dot Pitch		0.36 mm x 0.36 mm	
Backlight Average Lifetime		Approximately 50,000 hours (See note at bottom of page 2-3.)	
Backlight User Replaceable		No	
Touch Panel Type		Analog resistive (10-bit resolution, 1024 x 1024 touch area)	
CPU Type		32-Bit RISC CPU (333 MHz)	
Battery		Replaceable battery – ADC Part # D2-BAT-1 (Manufacturer Part # CR2354)	
System Memory		SDRAM 32 MBytes	
System Flash Memory		FLASH 32 MBytes	
Backup Memory (SRAM)		Control data backup memory (SRAM) 256 KBytes	
Logging Data Memory		USB Pen Drive p/n SDCZ4-2048-A10 (Optional)	
Number of Screens		Up to 999 – limited by project memory (10 MBytes)	
Realtime Clock		Built into panel (PLC clock is still accessible if available)	
Calendar – Month/Day/Year		Yes - battery backup	
Screen Saver		Yes, backlight turns off after a 30–1500 minute adjustable time, or can be disabled	
Serial PLC Interface		Serial PLC Port: RS-232C/422/485 15-Pin D-sub (female)	
USB Port – Type B		Download/Program – USB Port – type B	
USB Port – Type A		Port for USB device options – type A	
Ethernet Port		not available	
Audio Line Out		not available	
CF Card – Slot #1		not available	
Expansion Assembly (p/n EA-EXP-OPT)		not available	
Supply Power		24 VDC, -15%, +20% (20.4–28.8 VDC operating range, minimum of 1.5 A) (Use the AC/DC Power Adapter, EA-AC, to power the touch panel from a 100-240 VAC, 50/60 Hz. power source.)	
Power Consumption		9 W @ 24 VDC	10 W @ 24 VDC
Recommended DC Supply Fuse		2.5 A time delay, ADC p/n MDL2-5	
Operating Temperature		0 to 50 °C (32 to 122 °F)	
Storage Temperature		-20 to +60 °C (-4 to +140 °F)	
Humidity		10–85% RH (non-condensing)	
Noise Immunity		Noise voltage: 1000 Vp-p, Pulse width: 1 μs, Rise time: 1 ns	
Withstand Voltage		1000 VDC for 1 minute, between DC power supply input terminal and safety ground	
Insulation Resistance		Over 20 MΩ between DC power supply input terminal and safety ground	
Vibration		IEC61131-2 compliant, 10–57 Hz: 0.075 mm amplitude, 57–150 Hz 1.0 G: 10 sweep cycles per axis on each of 3 mutually perpendicular axes	
Shock		15 G peak, 11 ms duration, 2 shocks per axis, on 3 mutually perpendicular axes	
Enclosure		NEMA 4/4X, IP-65 (When mounted correctly. For indoor use only.)	
Agency Approvals		UL, cUL, CE	
Dimensions		6.140" x 8.047" x 1.697" [156.0 mm x 204.4 mm x 43.1 mm]	
Weight		1.46 lb. [660 g]	1.39 lb. [630 g]

6" Full Feature Models

2

Specification	Model	6" STN grayscale w/full features	6" STN color w/full features	6" TFT color w/full features
Part Number		EA7-S6M	EA7-S6C	EA7-T6C
Display Actual Size and Type		5.7" STN grayscale	5.7" STN color	5.7" TFT color
Color Scale		15 shades of gray	256 colors	65,536 colors
Display Viewing Area		4.54" x 3.4" [115.2 mm x 86.4 mm]		
Screen Pixels		320 x 240 (QVGA)		
Display Brightness		150 cd/m ² (NITS)	200 cd/m ² (NITS)	270 cd/m ² (NITS)
LCD Panel Dot Pitch		0.36 mm x 0.36 mm		
Backlight Average Lifetime		Approximately 50,000 hours (See note at bottom of page 2-3.)		
Backlight User Replaceable		No		
Touch Panel Type		Analog resistive (10-bit resolution, 1024 x 1024 touch area)		
CPU Type		32-Bit RISC CPU (333 MHz)		
Battery		Replaceable battery – ADC Part # D2-BAT-1 (Manufacturer Part # CR2354)		
System Memory		SDRAM 32 MBytes		
System Flash Memory		FLASH 32 MBytes		
Backup Memory (SRAM)		Control data backup memory (SRAM) 256 KBytes		
Logging Data Memory		CompactFlash Memory Card p/n EA-FLASH-128MB, industrial grade, high speed (Optional) or USB Pen Drive p/n SDCZ4-2048-A10 (Optional)		
Number of Screens		Up to 999 – limited by project memory (10 MBytes)		
Realtime Clock		Built into panel (PLC clock is still accessible if available)		
Calendar – Month/Day/Year		Yes - battery backup		
Screen Saver		Yes, backlight turns off after a 30–1500 minute adjustable time, or can be disabled		
Serial PLC Interface		Serial PLC Port: RS-232C/422/485 15-Pin D-sub (female)		
USB Port – Type B		Download/Program – USB Port – type B		
USB Port – Type A		Port for USB device options – type A		
Ethernet Port		Ethernet 10/100 Base-T		
Audio Line Out		Audio Line Out, 1 volt rms, stereo – requires amplifier and speaker(s)		
CF Card – Slot #1		Optional: CompactFlash Card p/n EA-FLASH-32MB, slot #1 located on top side of touch panel.		
Expansion Assembly (p/n EA-EXP-OPT)		Optional: Use the CF Card Adapter p/n EA-CF-IF in the right slot of the expansion assembly for installing CF card - Slot #2. The left slot of the expansion assembly is for future options.		
Supply Power		24 VDC, -15%, +20% (20.4–28.8 VDC operating range, minimum of 1.5 A) (Use the AC/DC Power Adapter, EA-AC, to power the touch panel from a 100-240 VAC, 50/60 Hz. power source.)		
Power Consumption		10 W @ 24 VDC	11 W @ 24 VDC	13 W @ 24 VDC
Recommended DC Supply Fuse		2.5 A time delay, ADC p/n MDL2-5		
Operating Temperature		0 to 50 °C (32 to 122 °F)		
Storage Temperature		–20 to +60 °C (–4 to +140 °F)		
Humidity		10–85% RH (non-condensing)		
Noise Immunity		Noise voltage: 1000 Vp-p, Pulse width: 1 µs, Rise time: 1 ns		
Withstand Voltage		1000 VDC for 1 minute, between DC power supply input terminal and safety ground		
Insulation Resistance		Over 20 MΩ between DC power supply input terminal and safety ground		
Vibration		IEC61131-2 compliant, 10–57 Hz: 0.075 mm amplitude, 57–150 Hz 1.0 G: 10 sweep cycles per axis on each of 3 mutually perpendicular axes		
Shock		15 G peak, 11 ms duration, 2 shocks per axis, on 3 mutually perpendicular axes		
Enclosure		NEMA 4/4X, IP-65 (When mounted correctly. For indoor use only.)		
Agency Approvals		UL, cUL, CE		
Dimensions		6.140" x 8.047" x 1.697" [156.0 mm x 204.4 mm x 43.1 mm]		
Weight		1.50 lb. [680 g]	1.43 lb. [650 g]	1.52 lb. [690 g]

8" and 10" Full Feature Models

2

Specifications	Model	8" TFT color w/ full features	10" TFT color w/ full features
Part Number		EA7-T8C	EA7-T10C
Display Actual Size and Type		8.4" TFT color	10.4" TFT color
Color Scale		65,536 colors	
Display Viewing Area		6.73" x 5.05" [170.9 mm x 128.2 mm]	8.31" x 6.24" [211.2 mm x 158.4 mm]
Screen Pixels		640 x 480 (VGA)	
Display Brightness		300 cd/m ² (NITS)	270 cd/m ² (NITS)
LCD Panel Dot Pitch		0.267 mm x 0.267 mm	0.33 mm x 0.33 mm
Backlight Average Lifetime		Approximately 50,000 hours (See note at bottom of page 2-3.)	
Backlight User Replaceable		Yes - Part No. EA-xx-BULB, xx = panel size	
Touch Panel Type		Analog resistive (10-bit resolution, 1024 x 1024 touch area)	
CPU Type		32-Bit RISC CPU (400 MHz)	
Battery		Replaceable battery – ADC Part # D2-BAT-1 (Manufacturer Part # CR2354)	
System Memory		SDRAM 32 MBytes	
System Flash Memory		FLASH 32 MBytes	
Backup Memory (SRAM)		Control data backup memory (SRAM) 256 KBytes	
Logging Data Memory		CompactFlash Memory Card p/n EA-FLASH-128MB, industrial grade, high speed (Optional) or USB Pen Drive p/n SDCZ4-2048-A10 (Optional)	
Number of Screens		Up to 999 – limited by project memory (10 MBytes)	
Realtime Clock		Built into panel (PLC clock is still accessible if available)	
Calendar – Month/Day/Year		Yes - battery backup	
Screen Saver		Yes, backlight turns off after a 30–1500 minute adjustable time, or can be disabled	
Serial PLC Interface		Serial PLC Port: RS-232C/422/485 15-Pin D-sub (female)	
USB Port – Type B		Download/Program – USB Port – type B	
USB Port – Type A		Port for USB device options – type A	
Ethernet Port		Ethernet 10/100 Base-T	
Audio Line Out		Audio Line Out, 1 volt rms, stereo – requires amplifier and speaker(s)	
CF Card – Slot #1		Optional: CompactFlash Card p/n EA-FLASH-32MB, slot #1 located on top side of touch panel.	
Expansion Assembly (p/n EA-EXP-OPT)		Optional: Use the CF Card Adapter p/n EA-CF-IF in the right slot of the expansion assembly for installing CF card - Slot #2. The left slot of the expansion assembly is for future options.	
Supply Power		24 VDC, -15%, +20% (20.4–28.8 VDC operating range, minimum of 1.5 A) (Use the AC/DC Power Adapter, EA-AC, to power the touch panel from a 100-240 VAC, 50/60 Hz. power source.)	
Power Consumption		15 W @ 24 VDC	17 W @ 24 VDC
Recommended DC Supply Fuse		2.5 A time delay, ADC p/n MDL2-5	
Operating Temperature		0 to 50 °C (32 to 122 °F)	
Storage Temperature		–20 to +60 °C (–4 to +140 °F)	
Humidity		10–85% RH (non-condensing)	
Noise Immunity		Noise voltage: 1000 Vp-p, Pulse width: 1 µs, Rise time: 1 ns	
Withstand Voltage		1000 VDC for 1 minute, between DC power supply input terminal and safety ground	
Insulation Resistance		Over 20 MΩ between DC power supply input terminal and safety ground	
Vibration		IEC61131-2 compliant, 10–57 Hz: 0.075 mm amplitude, 57–150 Hz 1.0 G: 10 sweep cycles per axis on each of 3 mutually perpendicular axes	
Shock		15 G peak, 11 ms duration, 2 shocks per axis, on 3 mutually perpendicular axes	
Enclosure		NEMA 4/4X, IP-65 (When mounted correctly. For indoor use only.)	
Agency Approvals		UL, cUL, CE	
Dimensions		8.748" x 10.894" x 2.053" [222.2 mm x 276.7 mm x 52.1 mm]	10.669" x 13.661" x 2.079" [271.0 x 347.0 x 52.8 mm]
Weight		2.60 lb. [1,180 g]	3.55 lb. [1,610 g]

12" and 15" Full Feature Models

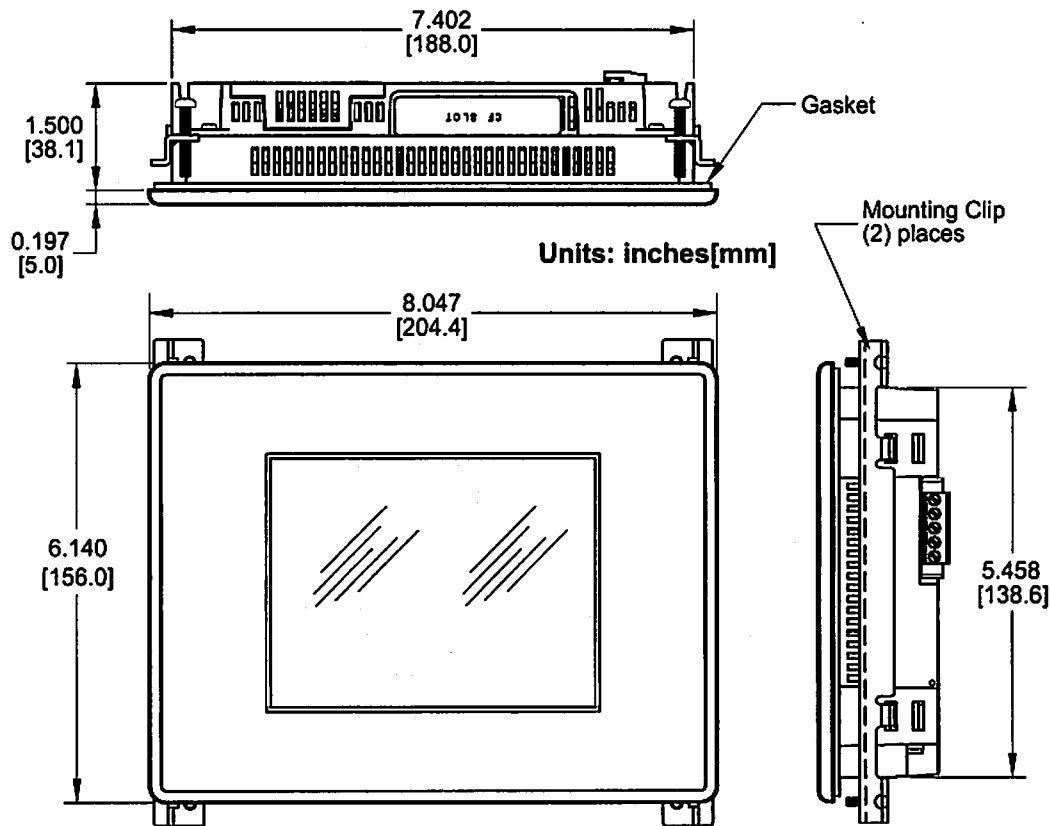
2

Specifications	Model	12" TFT color w/full features	15" TFT color w/full features
Part Number	EA7-T12C		EA7-T15C
Display Actual Size and Type	12.1" TFT color		15.0" TFT color
Color Scale	65,536 Colors		
Display Viewing Area	9.47" x 7.62" [240.6 mm x 184.5 mm]		11.97" x 8.98" [304.1 mm x 228.1 mm]
Screen Pixels	800 x 600 (SVGA)		1024 x 768 (XGA)
Display Brightness	260 cd/m ² (NITS)		220 cd/m ² (NITS)
LCD Panel Dot Pitch	0.267 mm x 0.267 mm		0.297 mm x 0.297 mm
Backlight Average Lifetime	Approximately 50,000 hours (See note at bottom of page 2-3.)		
Backlight User Replaceable	Yes - Part No. EA-xx-BULB, xx = panel size		
Touch Panel Type	Analog resistive (12-bit resolution, 4096 x 4096 touch area)		
CPU Type	32-Bit RISC CPU (400 MHz) Plus Graphic Accelerator Chip		
Battery	Replaceable battery – ADC Part # D2-BAT-1 (Manufacturer Part # CR2354)		
System Memory	SDRAM 64 MBytes		
System Flash Memory	FLASH 64 MBytes		
Backup Memory (SRAM)	Control data backup memory (SRAM) 256 KBytes		
Logging Data Memory	CompactFlash Memory Card p/n EA-FLASH-128MB, industrial grade, high speed (Optional) or USB Pen Drive p/n SDCZ4-2048-A10 (Optional)		
Number of Screens	Up to 999 – limited by project memory (40 MBytes)		
Realtime Clock	Built into panel (PLC clock is still accessible if available)		
Calendar – Month/Day/Year	Yes - battery backup		
Screen Saver	Yes, backlight turns off after a 30–1500 minute adjustable time, or can be disabled		
Serial PLC Interface	Serial PLC Port: RS-232C/422/485 15-Pin D-sub (female)		
USB Port – Type B	Download/Program – USB Port – type B		
USB Port – Type A	Port for USB device options – type A		
Ethernet Port	Ethernet 10/100 Base-T		
Audio Line Out	Audio Line Out, 1 volt rms, stereo – requires amplifier and speaker(s)		
CF Card – Slot #1	Optional: CompactFlash Card p/n EA-FLASH-32MB, slot #1 located on top side of touch panel.		
Expansion Assembly (p/n EA-EXP-OPT)	Optional: Use the CF Card Adapter p/n EA-CF-IF in the right slot of the expansion assembly for installing CF card - Slot #2. The left slot of the expansion assembly is for future options.		
Supply Power	24 VDC, -15%, +20% (20.4–28.8 VDC operating range, minimum of 1.5 A) (Use the AC/DC Power Adapter, EA-AC, to power the touch panel from a 100-240 VAC, 50/60 Hz. power source.)		
Power Consumption	20 W @ 24 VDC		33 W @ 24 VDC
Recommended DC Supply Fuse	4.0 A time delay, ADC MDL4		
Operating Temperature	0 to 50 °C (32 to 122 °F)		
Storage Temperature	–20 to +60 °C (–4 to +140 °F)		
Humidity	10–85% RH (non-condensing)		
Noise Immunity	Noise voltage: 1000 Vp-p, Pulse width: 1 µs, Rise time: 1 ns		
Withstand Voltage	1000 VDC for 1 minute, between DC power supply input terminal and safety ground		
Insulation Resistance	Over 20 MΩ between DC power supply input terminal and safety ground		
Vibration	IEC61131-2 compliant, 10–57 Hz: 0.075 mm amplitude, 57–150 Hz 1.0 G: 10 sweep cycles per axis on each of 3 mutually perpendicular axes		
Shock	15 G peak, 11 ms duration, 2 shocks per axis, on 3 mutually perpendicular axes		
Enclosure	NEMA 4/4X, IP-65 (When mounted correctly. For indoor use only.)		
Agency Approvals	UL, cUL, CE		
Dimensions	11.024" x 13.336" x 2.075" [280.0 x 339.5 x 52.7 mm]		13.000" x 16.748" x 1.0481" [330.2 x 425.4 x 54.0 mm]
Weight	4.59 lb. [2,080 g]		7.01 lb. [3,180 g]

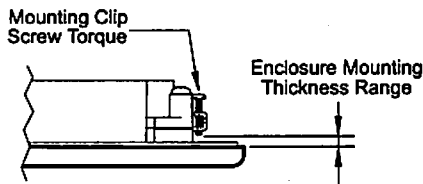
EA7-S6M-R, S6C-R, S6M, S6C and T6C

Dimensions:

All the necessary mounting hardware is provided with the touch panel. Use the two (2) mounting clips and screws to secure the touch panel to the cabinet or enclosure surface. A template is provided for marking the cutout dimensions on the mounting surface.



Enclosure Mounting Thickness Ranges and Mounting Clip Screw Torque

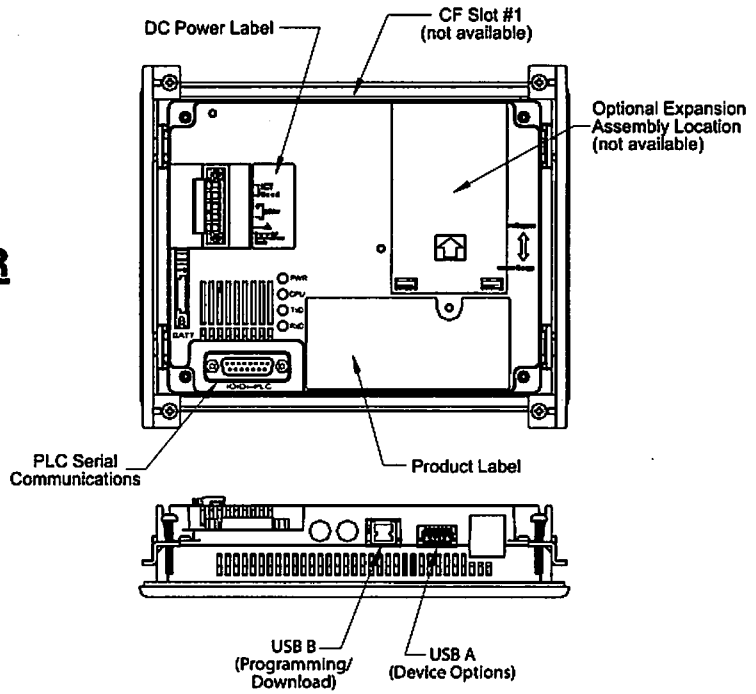


Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
6" – lower mounting clip position	0.039 - 0.24 inch [1 - 6 mm]	35 ~ 50 oz-in [0.25 ~ 0.35 Nm]
6" – upper mounting clip position	0.20 - 0.63 inch [5 - 16 mm]	35 ~ 50 oz-in [0.25 ~ 0.35 Nm]

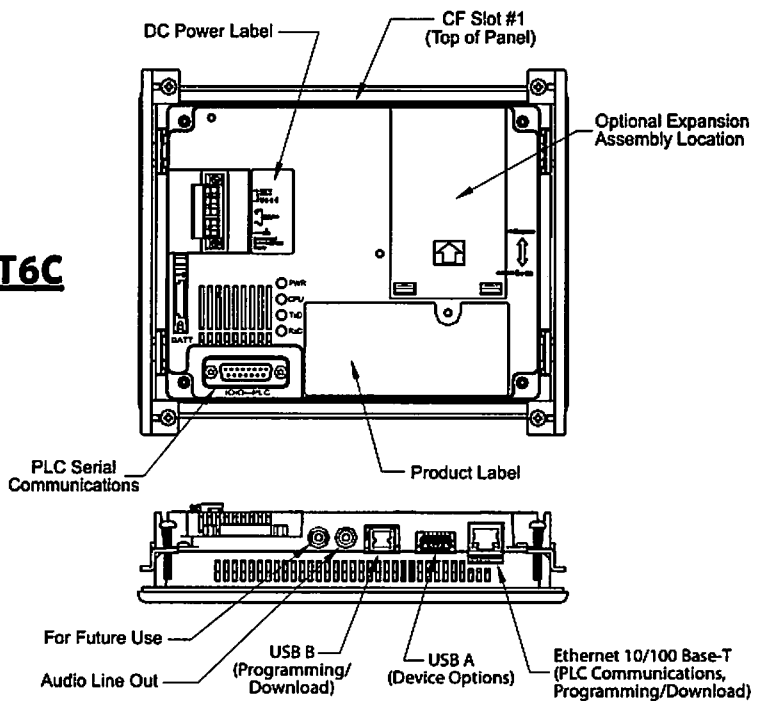
EA7-S6M-R, S6C-R, S6M, S6C and T6C

Ports & Memory Expansion:

Base Feature Model EA7-S6M-R & EA7-S6C-R



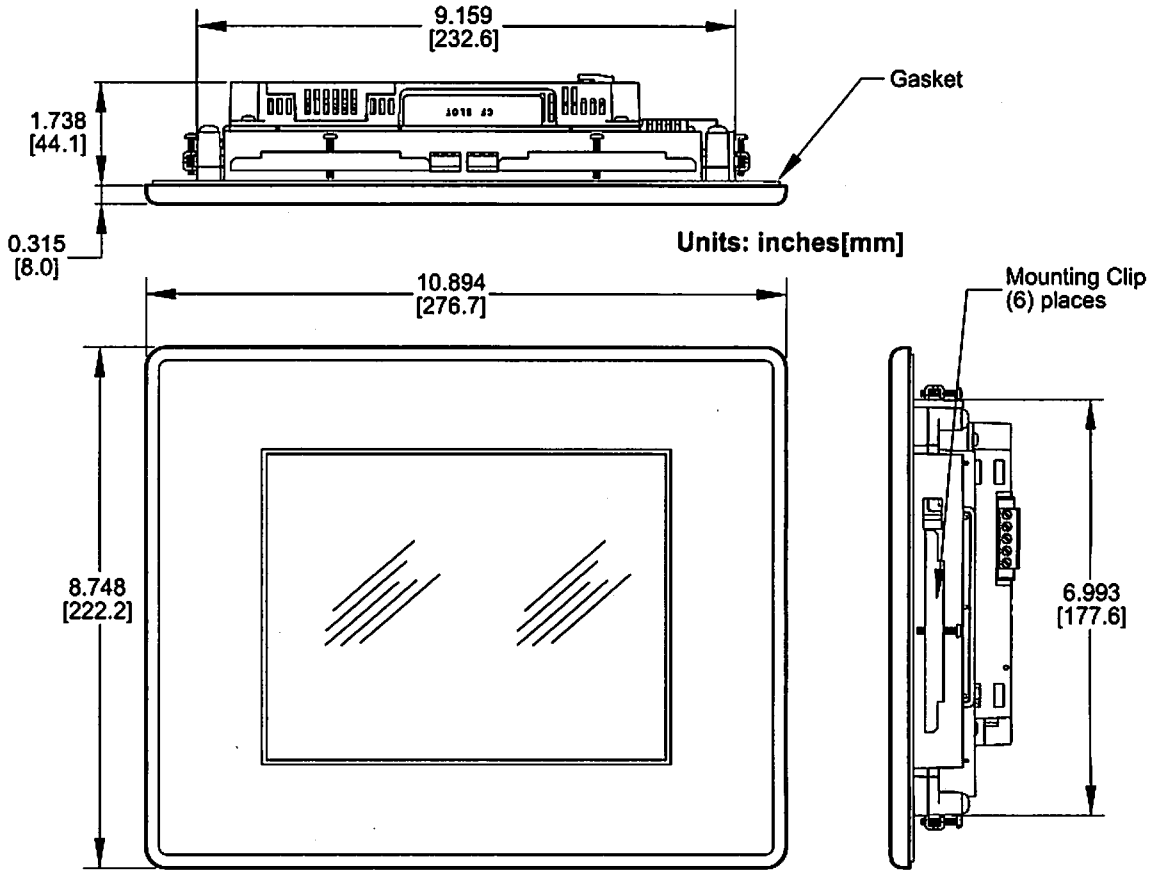
Full Feature Model EA7-S6M, EA7-S6C & EA7-T6C



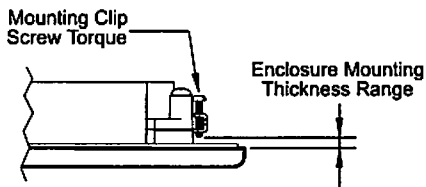
EA7-T8C

Dimensions:

All the necessary mounting hardware is provided with the touch panel. Use the six (6) mounting clips and screws to secure the touch panel to the cabinet or enclosure surface. A template is provided for marking the cutout dimensions on the mounting surface.



Enclosure Mounting Thickness Ranges and Mounting Clip Screw Torque



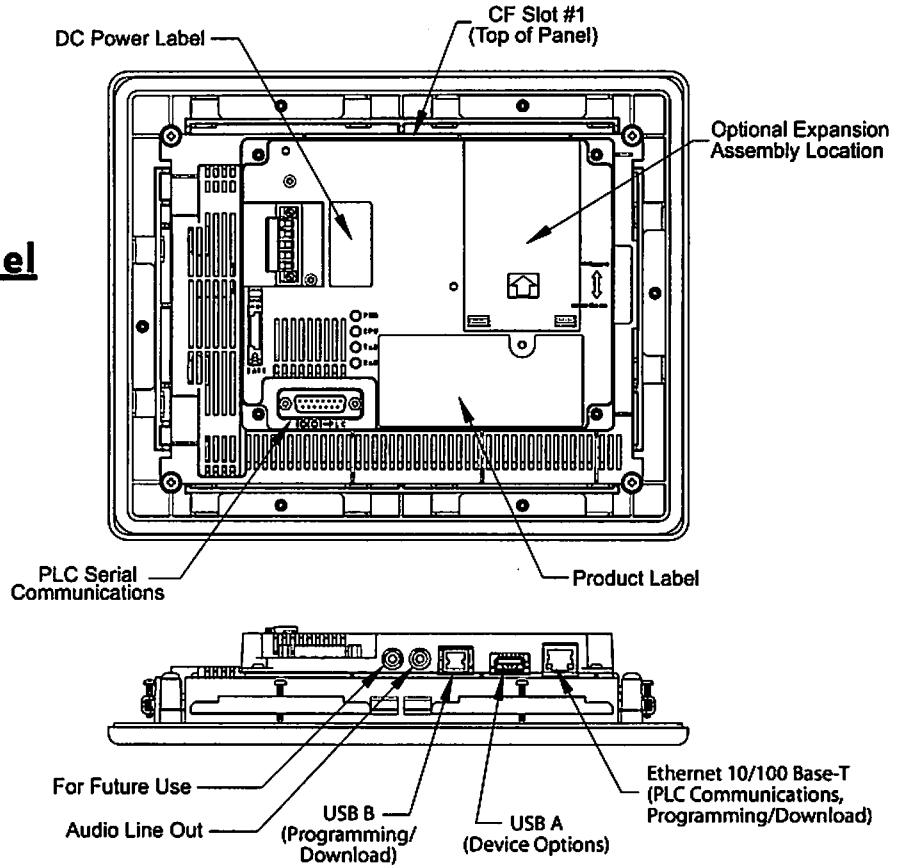
Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
8", 10", 12" & 15"	0.039 - 0.20 inch [1 - 5 mm]	42 ~ 57 oz-in [0.3 ~ 0.4 Nm]

EA7-T8C

Ports & Memory Expansion:

2

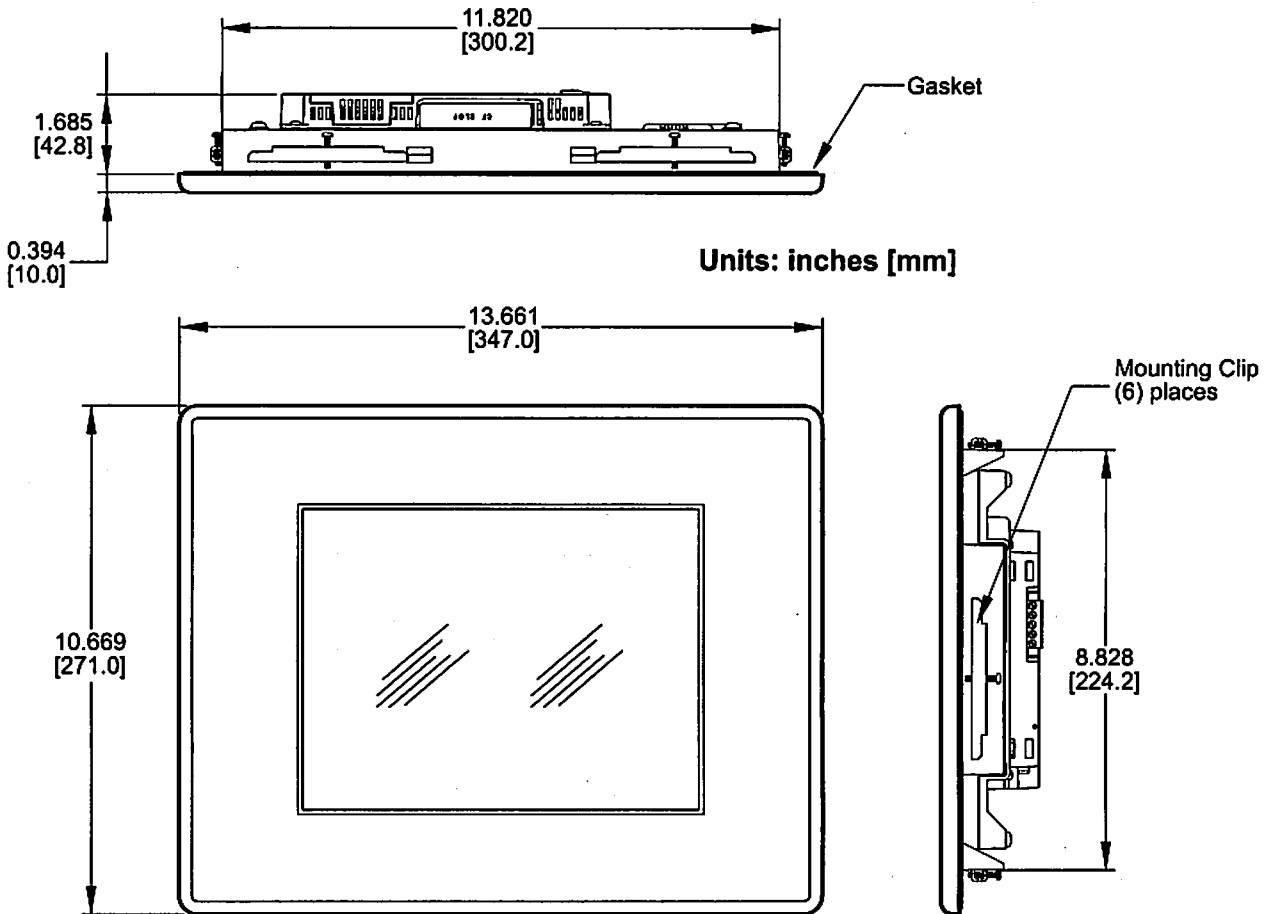
Full Feature Model EA7-T8C



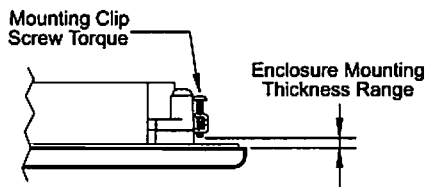
EA7-T10C

Dimensions:

All the necessary mounting hardware is provided with the touch panel. Use the six (6) mounting clips and screws to secure the touch panel to the cabinet or enclosure surface. A template is provided for marking the cutout dimensions on the mounting surface.



Enclosure Mounting Thickness Ranges and Mounting Clip Screw Torque



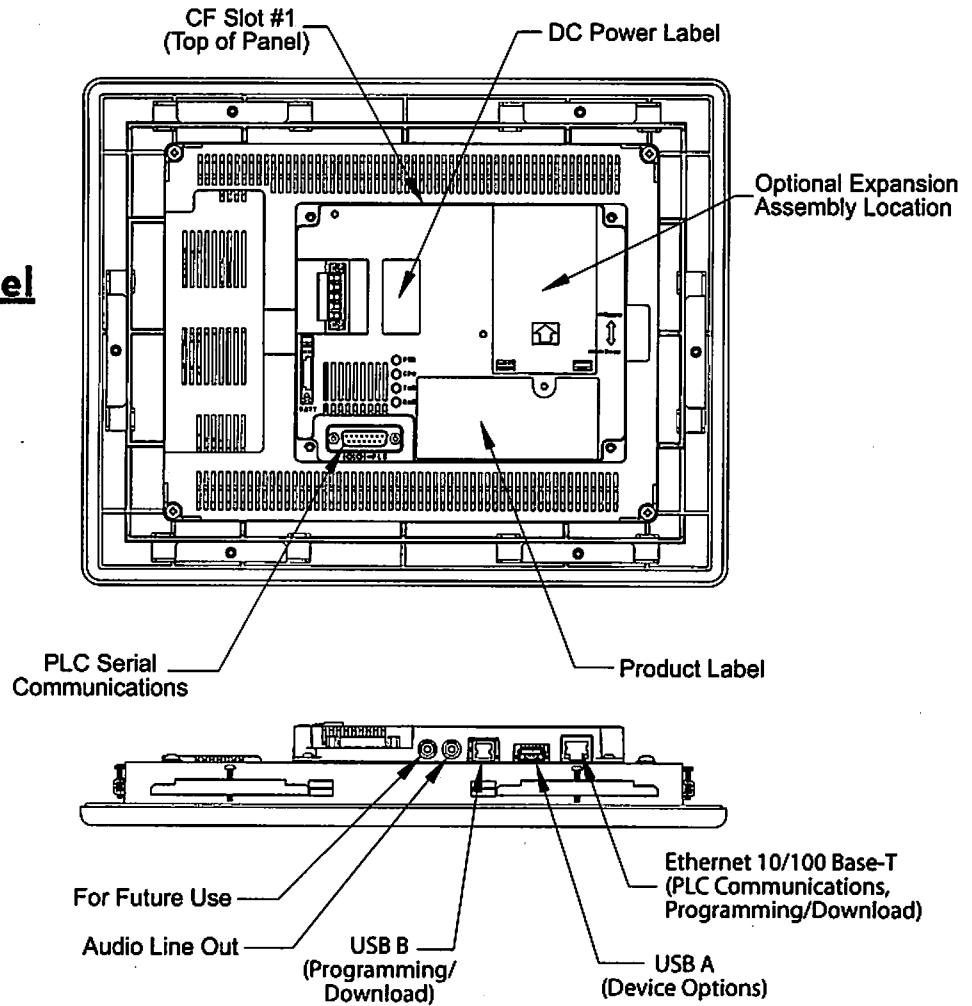
Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
8", 10", 12" & 15"	0.039 - 0.20 inch [1 - 5 mm]	42 ~ 57 oz-in [0.3 ~ 0.4 Nm]

EA7-T10C

Ports & Memory Expansion:

2

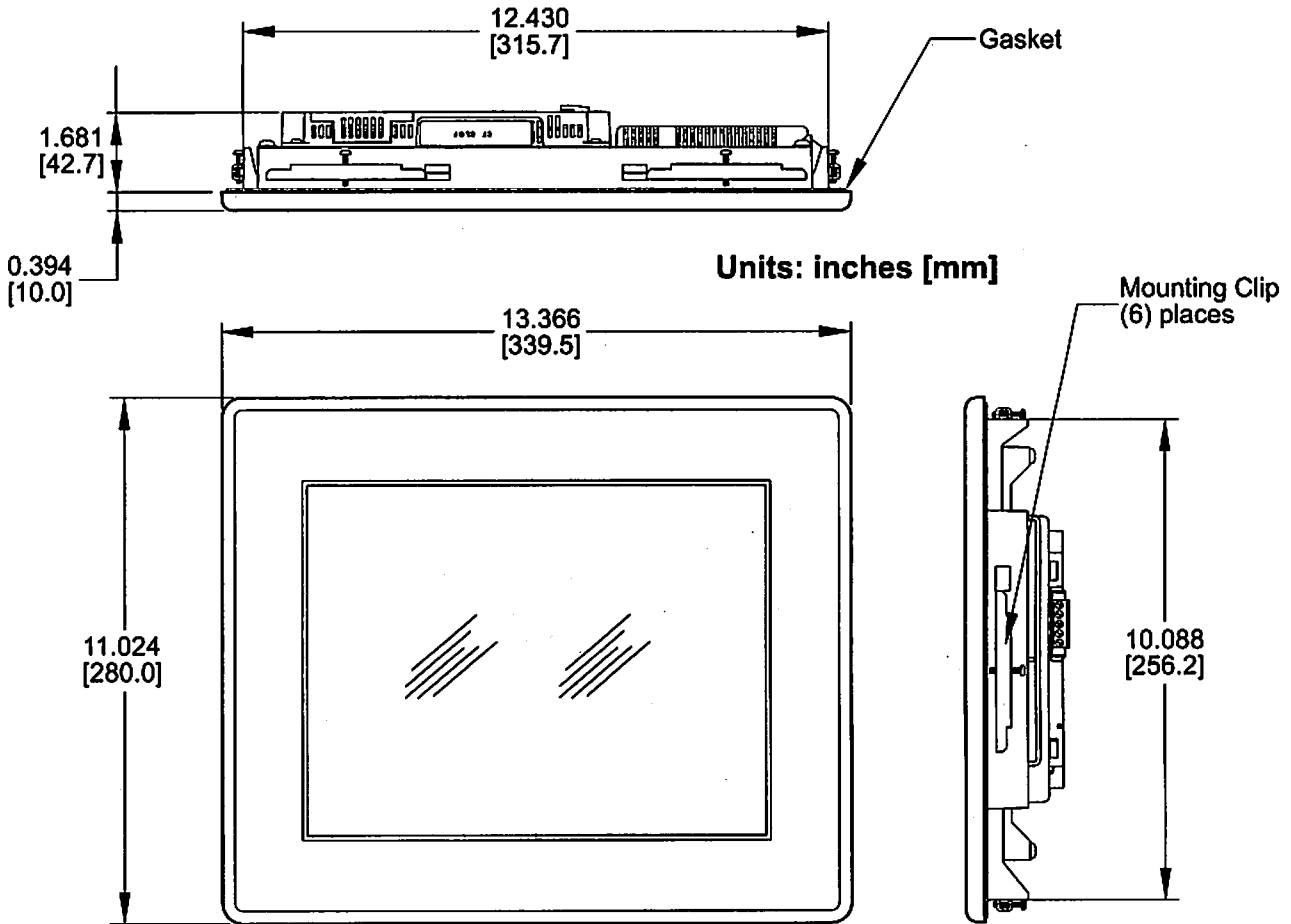
Full Feature Model
EA7-T10C



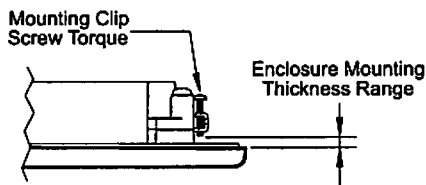
EA7-T12C

Dimensions:

All the necessary mounting hardware is provided with the touch panel. Use the six (6) mounting clips and screws to secure the touch panel to the cabinet or enclosure surface. A template is provided for marking the cutout dimensions on the mounting surface.



Enclosure Mounting Thickness Ranges and Mounting Clip Screw Torque



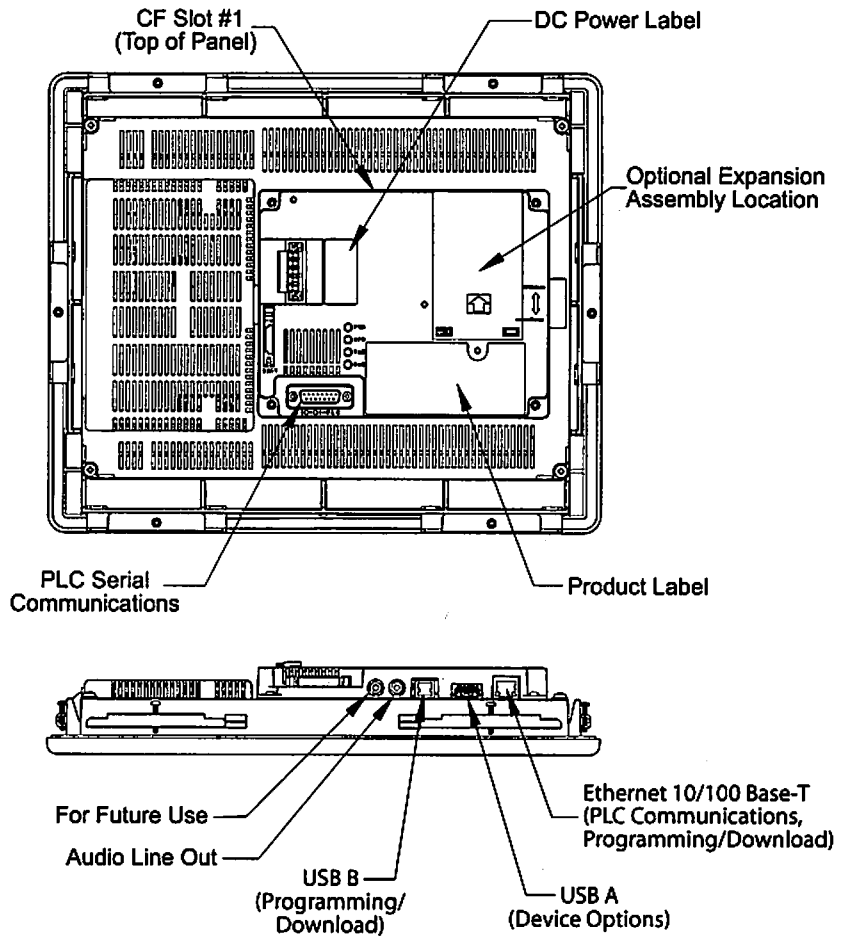
Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
8", 10", 12" & 15"	0.039 - 0.20 inch [1 - 5 mm]	42 ~ 57 oz-in [0.3 ~ 0.4 Nm]

EA7-T12C

Ports & Memory Expansion:

2

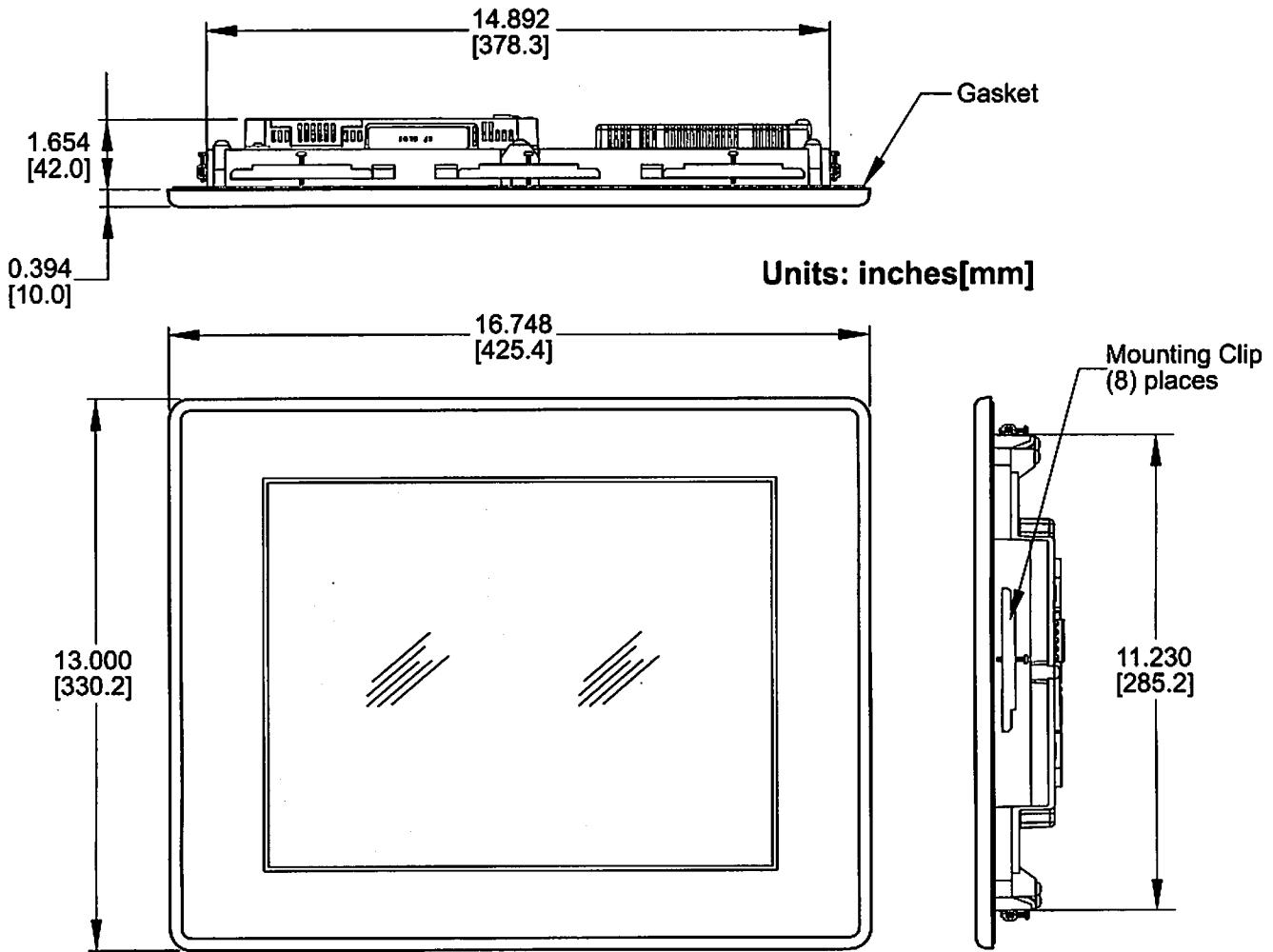
Full Feature Model
EA7-T12C



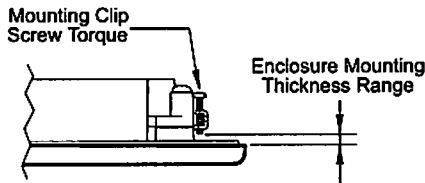
EA7-T15C

Dimensions:

All the necessary mounting hardware is provided with the touch panel. Use the eight (8) mounting clips and screws to secure the touch panel to the cabinet or enclosure surface. A template is provided for marking the cutout dimensions on the mounting surface.



Enclosure Mounting Thickness Ranges and Mounting Clip Screw Torque



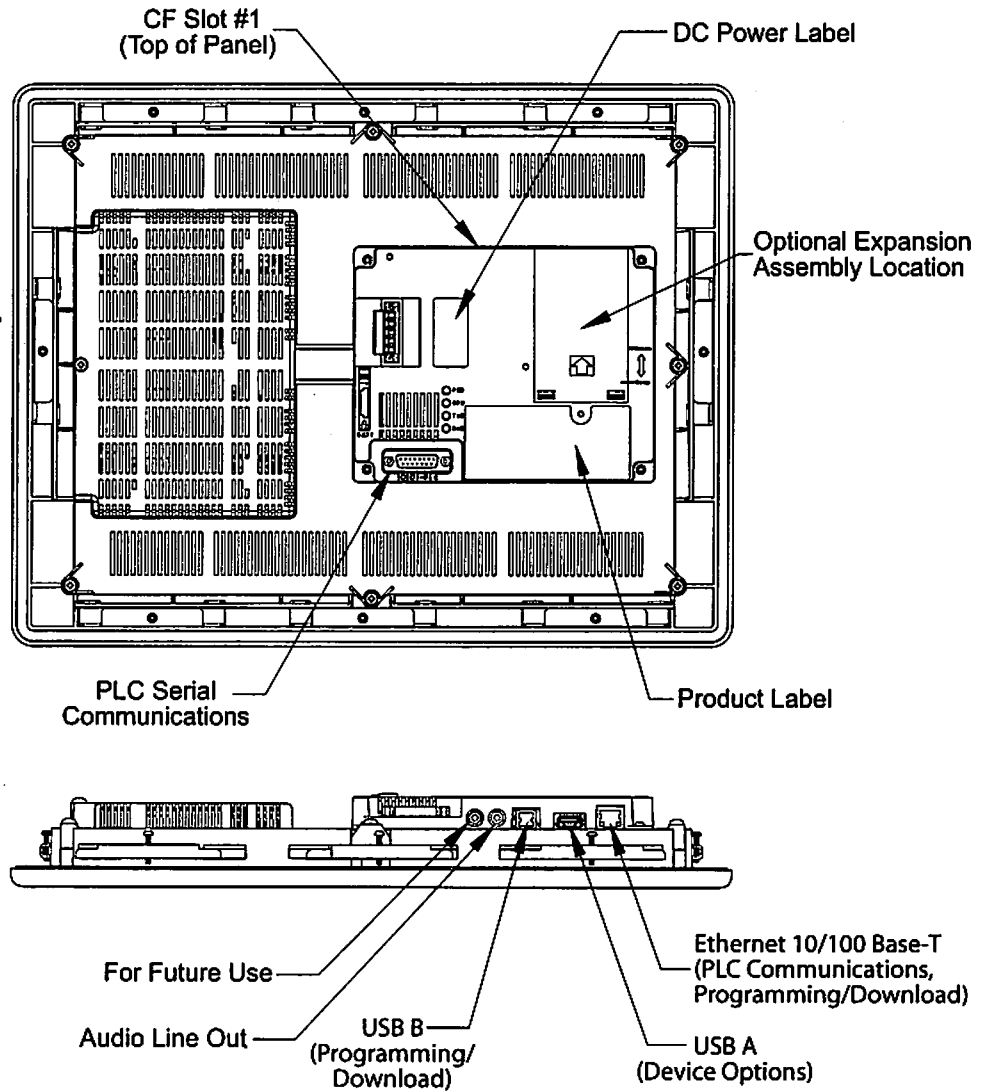
Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
8", 10", 12" & 15"	0.039 - 0.20 inch [1 - 5 mm]	42 ~ 57 oz-in [0.3 ~ 0.4 Nm]

EA7-T15C

Ports & Memory Expansion:

2

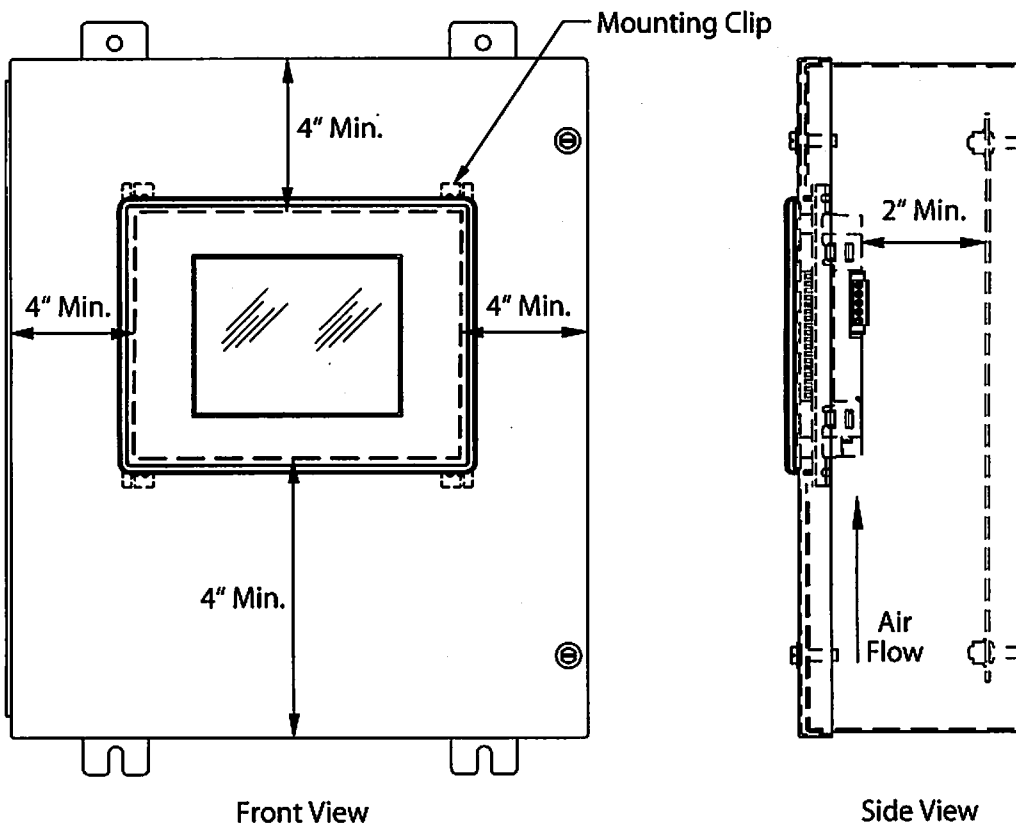
Full Feature Model
EA7-T15C



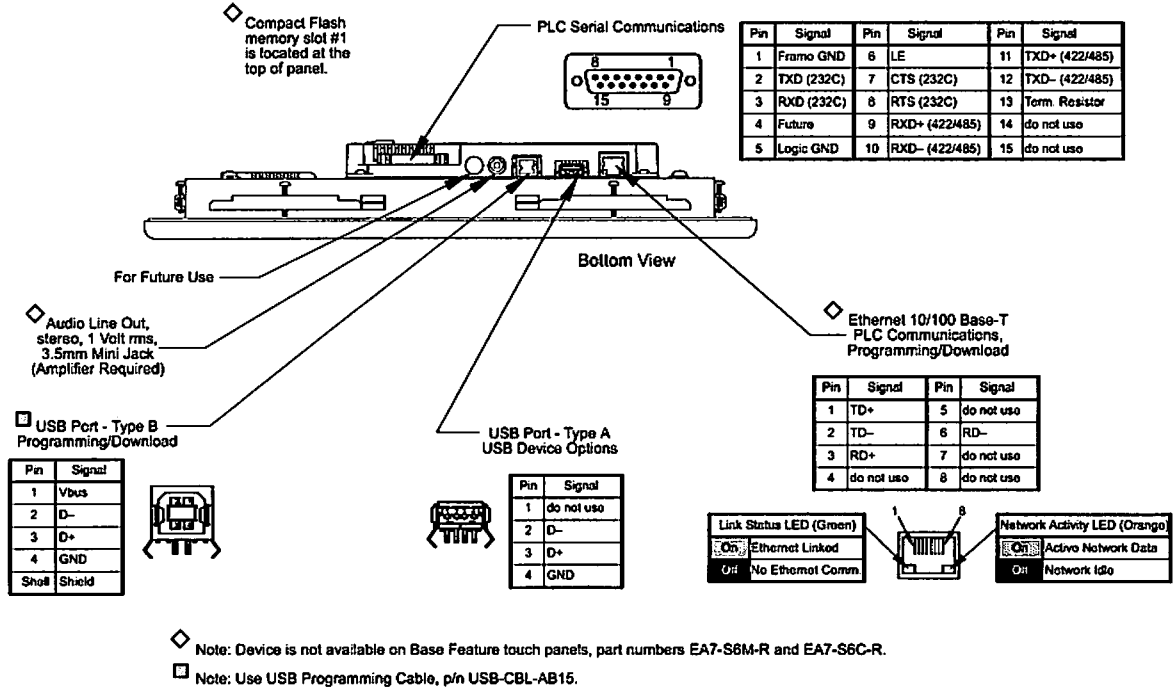
Mounting Clearances

The following drawing shows the mounting clearances for the *C-more* touch panel. There should be a minimum of 4 inches of space between all sides of the panel and the nearest object or obstruction and at least 2 inches between the rear of the panel and the nearest object or obstruction.

Note: Make sure the touch panel is mounted on a vertical surface to allow convection air flow for proper cooling.



Communications Ports



Ethernet Port

The Ethernet port can be used several ways: for programming the panel (downloading a project), for PLC communication, and for the advanced features, such as sending e-mail, FTP access, and allowing the panel to act as a web-server.

The Ethernet connector is an RJ-45 Module jack type. It has a green and an orange LED.

- The orange LED indicates the Ethernet communication status. It illuminates when there is data activity on the network.
- The green LED indicates link status and illuminates when a link is established.

Ethernet connections to PLCs:

- Direct LOGIC Ethernet
- Modbus TCP/IP
- Allen-Bradley EtherNet/IP™ Server - Generic I/O Messaging (ControlLogix™, CompactLogix™, and FlexLogix™)
- Allen-Bradley EtherNet/IP Client - Tag Based (ControlLogix, CompactLogix, and FlexLogix)
- Allen-Bradley EtherNet/IP Client - MicroLogix 1100 & SLC 5/05, both via native Ethernet port
- Allen-Bradley EtherNet/IP Client - MicroLogix 1000, 1100, 1200, 1500, SLC 5-03/04/05, all via ENI Adapter
- Entivity Modbus TCP/IP
- Omron Ethernet FINS
- Siemens Ethernet ISO over TCP

Note: The base panels (-R part numbers) do not include an Ethernet port, and do not have these capabilities.

Communications Ports (cont'd)

USB Port B

Program *C-more* via the USB programming port. It's fast and easy, with no baud rate settings, parity, or stop bits to worry about. We stock standard USB cables for your convenience, such as part no. USB-CBL-AB15. USB Port B can be used to upload or download projects to and from a PC (personnel computer).

USB Port A

The Universal Serial Bus (USB) type A port is a standard feature for all models and can be used to connect various USB HID (Human Input Device) devices to the panel, such as:

- USB pen drives, (such as ADC p/n SDCZ4-2048-A10)
- USB keyboards
- USB barcode scanners
- USB card scanners

C-more can log data to the USB pen drive as well as load projects to the panel from the pen drive. You can also back up project files and panel firmware.

Sound Interface (Audio Line Out)

When attached to an amplifier and speaker(s), *C-more* can play warning sounds, or pre-recorded messages such as: "conveyor is jammed". *C-more* supports WAV type files. The output is stereo. See the next page for the WAV file specifications. Various "Objects" in the *C-more* programming software support sounds. Sound files are stored in the sound library. See the *C-more* programming software help support for additional details.

PLC Port

The PLC port is an RS-232C, RS-422A or RS-485A female 15-pin D-sub connector. Use this port for serial connections to PLCs. The port supports the following PLC protocols:

- All *AutomationDirect.com* *Direct*LOGIC PLCs:
 - Direct*LOGIC K-sequence
 - Direct*NET
 - Modbus (Koyo Addressing)
- Allen Bradley:
 - DF1 Full & Half Duplex
 - DF1 Full & Half Duplex - Tag Based
 - PLC5 DF1
 - DH485
- Modbus RTU
- Entivity Modbus RTU
- GE SNPX (90/30, 90/70, Micro 90, VersaMax Micro)
- Omron:
 - Host Link (C200 Adapter, C500)
 - FINS (CJ1, CS1)
- Mitsubishi Melsec FX
- Siemens PPI (S7-200 CPU)

Audio WAV File Specifications

The *C-more* Audio Line Out port supports the following WAV file specifications:

Bit Rate: 44 Kbps

Audio Sample Size: 8 bit or 16 bit

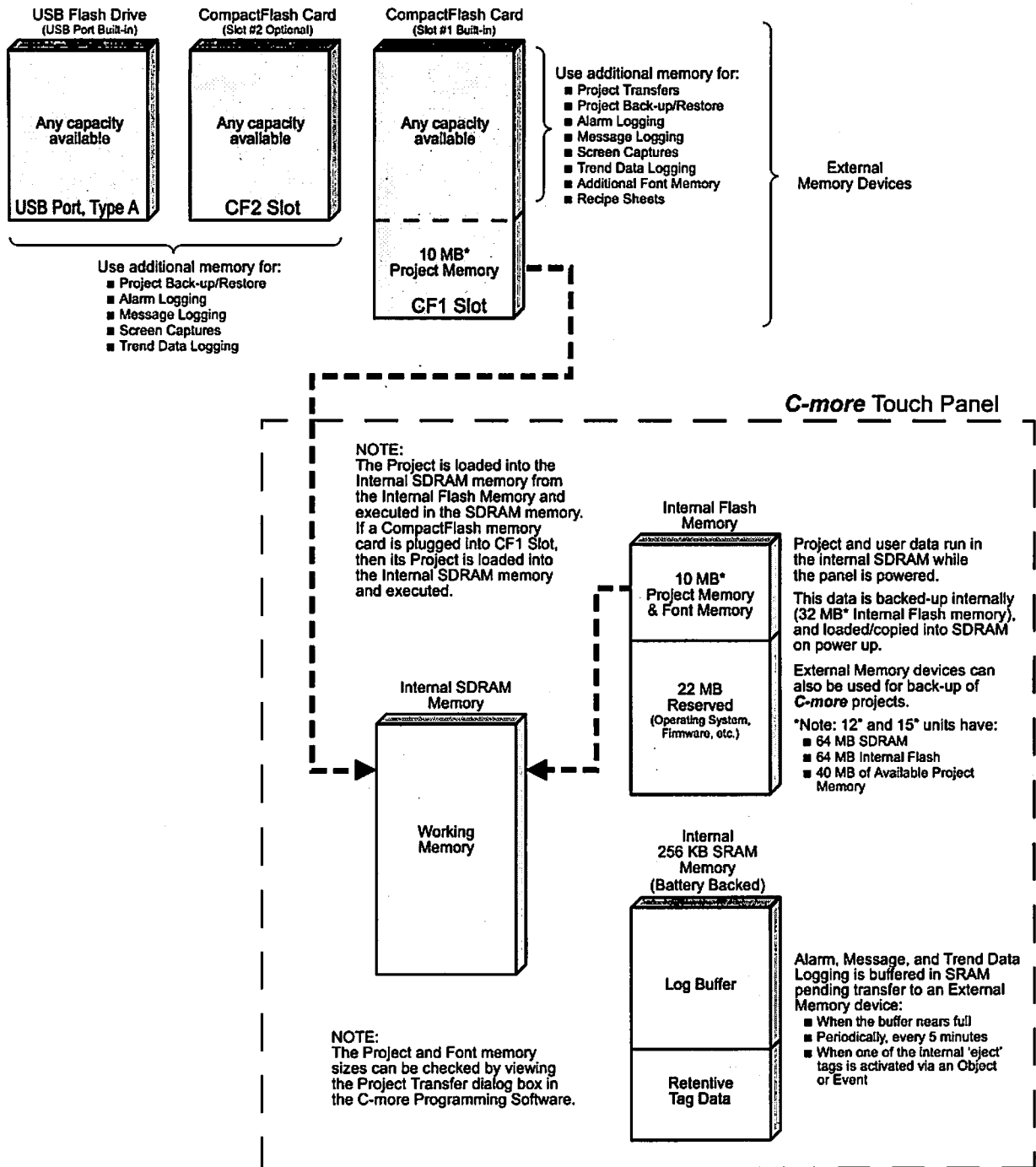
Number of Channels: 2 channel, 3.5 mm mini jack stereo output (amplifier required)

Audio Format: WAVE_FORMAT_1M08 11.025 kHz, mono, 8-bit
WAVE_FORMAT_1M16 11.025 kHz, mono, 16-bit
WAVE_FORMAT_1S08 11.025 kHz, stereo, 8-bit
WAVE_FORMAT_1S16 11.025 kHz, stereo, 16-bit
WAVE_FORMAT_2M08 22.05 kHz, mono, 8-bit
WAVE_FORMAT_2M16 22.05 kHz, mono, 16-bit
WAVE_FORMAT_2S08 22.05 kHz, stereo, 8-bit
WAVE_FORMAT_2S16 22.05 kHz, stereo, 16-bit
WAVE_FORMAT_4M08 44.1 kHz, mono, 8-bit
WAVE_FORMAT_4M16 44.1 kHz, mono, 16-bit
WAVE_FORMAT_4S08 44.1 kHz, stereo, 8-bit
WAVE_FORMAT_4S16 44.1 kHz, stereo, 16-bit

Memory Organization

The following diagram outlines the relationships between the internal memory of the panel and any external memory device. It also shows how the various memory areas can be used for different functions. The 6", 8" and 10" panels have a project area of 10 MB, while the 12" and 15" panels have a 40 MB project area.

2



Handling External Memory Devices

Consider the following to prevent data error risk when utilizing data logging.

- Do not turn off power to the *C-more* touch panel at any time the external memory device is being accessed.
- Do not remove any external memory device when the device is being accessed by the touch panel.



Note: A system tag, such as **SYS %device% WriteStatus** can be used to detect when the external memory device is being accessed. See the *C-more* programming software on-line help for additional information on **System Tag Names**.

- If a CompactFlash memory card is plugged into the CF1 slot while the panel is running, the project will continue to run from the project that is currently in the internal SDRAM. If power is cycled and there is a good project stored on the CompactFlash, then that project will be loaded into the internal SDRAM and ran.
- Be sure to backup the memory device at regular intervals.
- A CompactFlash memory card plugged into the CF1 slot that includes a project that is being run cannot be used for backup.
- If you suspect the memory device is bad, you may want to use a PC to re-format the device, or use a known good memory device.



Note: The *C-more* touch panel requires that all external memory devices be formatted with a **FAT32** file system.

- The number of times the memory device can be written to is limited, approximately 300,000 times. Consequently, frequent writing at short intervals may shorten the service life of the memory device. Try to use as long as possible sampling times for logging data to reduce the amount of times the memory device is accessed.

Power Loss Detection and Power Retention Period

It is important to have an understanding of how the touch panel handles power loss as it applies to data logging and retentive name tag data. The C-more touch panel system CPU will receive a power loss interrupt signal when the incoming DC voltage level drops below 19.2 VDC. If using the optional AC/DC Power Adapter, EA-AC, then an interrupt signal will occur when the incoming AC voltage level drops below 58 VAC (+/- 5%). When power loss is detected, the backlight will turn off immediately to allow extending the power retention period. Any logging to either CompactFlash memory or an USB pen drive will also stop. This will allow time to complete writing any data to the internal 256 KB SRAM. The 256 KB SRAM along with CPU Date/Time registers are battery backed.

Because the 24 VDC power retention time period is very short, only data backup to the internal 256 KB SRAM memory buffer can occur. When power is restored, the contents of the SRAM will be written to the selected memory storage device.

Data Logging Function and Logging Media

Considering the power retention period and the CF card write performance, the EA-FLASH-128MB memory card is recommended to minimize data loss. It is also recommended to further reduce the risk of losing data, a uninterruptible power supply (UPS) should be used to provide power to the touch panel.

Data Logging - Memory Device Full

The following explains what occurs when logging data from an object, such as Line Trending, and the memory device becomes full. The memory device can be a USB pen drive plugged into the USB port, or a CompactFlash memory card plugged into location CF1 or CF2.

The answer is when the memory device that is being used for logging is full, the panel will stop writing to the log and a RTE-001 Runtime Error will be displayed on the screen. The displayed error message will read "Log Failed. Not enough Memory Space in %Device%". (%Device% can be USB, CF1, or CF2.) The data logging object will continue to execute.

The user can monitor the System Tag "SYS %DEVICE% FreeMemory" with the Event Manager, and display a message to the operator to warn when the memory device is close to full.

The user can also use a Pushbutton object with the tag "SYS Copy Log to %Device%" to copy ALL logs on ALL other devices to %Device% and therefore save the current data.

For example, if the application is logging to CF1 and CF2, the user can monitor "SYS CF1 FreeMemory" and "SYS CF2 FreeMemory" in the Event Manager. When the value of either gets below a set value in the Event Manager, then the Event Manger can issue an Alarm, send an email, etc. The operator can then insert a USB pen drive into the panel's USB port, and press a pushbutton that is configured with System Tag "SYS Copy Log to USB". This action will copy all of the logged data to the USB pen drive from both CF1 and CF2. The operator can then use the System Setup Screen's Memory selection to clear both CompactFlash CF1 and CF2.

This example can work with different combinations of the memory devices, but the preferred method is using a USB pen drive because it is the easiest device to insert and remove.

Chemical Compatibility

The *C-more* touch panels are comprised of three different materials that may be exposed to outside elements. The panel's screen has a polyester (PET) surface. The bezel uses ABS plastic materials and the panel's gasket is a silicone rubber material. The following tables are provided to make you aware of the general compatibility between chemicals that may be present in your work environment and the various materials used in the manufacture of the panel. Use the table to determine those chemicals that are safe to use around your *C-more* touch panel and those that may harm it. The tables are made up of specifications provided by the manufacturer of the listed material. The tables rate these chemicals as either Excellent, Good, Not Recommended, or Not Usable. Because the ratings are for ideal conditions at room temperature, consider all factors when evaluating your application. Areas left blank have not been tested by the manufacturer and therefore information of compatibility is not available.

The values in [brackets] represent the chemical's density at room temperature, 20 °C.

Chemicals	Screen Sheet – PET [Density %, Temperature °C]	6" Bezel – ABS [Density %, Temperature °C]	8"-15" Bezel – ABS [Density %, Temperature °C]	Gasket – Silicone [Density %, Temperature °C]
Acetaldehyde		Not Recommended	Not Usable	
Acetic Acid		[10, 20 °C] Excellent		
		[10, 20 °C] Excellent		
	[Glacial] Excellent	[50, 20 °C] Not Usable		
		[50-70, 20 °C] Not Usable		
		[100, 20 °C] Not Usable		
Acetic anhydride		Not Recommended		
Acetone	Excellent	Not Usable	Not Usable	
Acetophenone		Not Usable	Not Usable	
Acetylene		Excellent		
Acrylonitrile		Not Recommended	Not Usable	
Alcohol - Butyl Ether				Excellent
Alcohol - Ethanol				Excellent
Alcohol - Isopropyl				Excellent
Alums NH3, Cr, K		Excellent		
Aluminum acetate		Excellent		
Aluminum bromide		Good		
Aluminum chloride		Good		
Aluminum nitrate		Excellent		
Aluminum sulfate		Excellent		
Ammonia [anhydrous] (10%)		Good		Good

Table continued at top of next page.

Chemical Compatibility (cont'd)

2

Chemicals	Screen Sheet – PET [Density %, Temperature °C]	6" Bezel – ABS [Density %, Temperature °C]	8"–15" Bezel – ABS [Density %, Temperature °C]	Gasket – Silicone [Density %, Temperature °C]
Ammonia gas [cold]		Good		
Ammonia liquid		Good		
Ammonia water		[12%] Not Usable		
		[28%] Not Usable		
Ammonium carbonate		Excellent		
Ammonium chloride		Excellent		
Ammonium hydroxide [ammonia water]		Excellent		
Ammonium nitrate		Excellent		
Ammonium persulfate		Excellent		
Ammonium phosphate		Excellent		
Ammonium sulfate		Excellent		
Amyl acetate		Not Usable		
Amyl alcohol		Good		
Aniline dyes		Not Recommended		
Animal oil [lard]		Good		
Aqua regia		Not Usable		
Arsenic acid		Not Recommended		
Asphalt		Excellent		
Barium chloride		Excellent		
Barium hydroxide		Excellent		
Barium sulfate		Excellent		
Barium sulfide		Excellent		
Beer		Excellent	Good	
Beet sugar liquors		Excellent		
Benzaldehyde		Not Recommended	Not Usable	
Benzene [Benzol]		Not Recommended	Not Usable	
Benzene	Excellent		Not Usable	
Benzine		Not Usable		Not Usable
Benzyl alcohol		Not Recommended	Not Usable	
Benzyl benzoate		Not Usable	Not Usable	
Benzyl chloride		Not Usable	Not Usable	
Borax		Excellent		
Boric acid		Good		

Table continued at top of next page.

Chemical Compatibility (cont'd)

Chemicals	Screen Sheet – PET [Density %, Temperature °C]	6" Bezel – ABS [Density %, Temperature °C]	8"-15" Bezel – ABS [Density %, Temperature °C]	Gasket – Silicone [Density %, Temperature °C]
Bromine		Not Usable		
Butane		Excellent		
Butter		Good		
Butyl acetate		Not Usable		
Butyl acrylate		Not Usable		
Butyl alcohol [Butanol]		Good	Good	
Calcium acetate		Excellent		
Calcium bisulfite		Good		
Calcium chloride		Excellent		
Calcium hydroxide		Excellent		
Calcium hypochlorite		[20,RT] Excellent		
Calcium nitrate		Excellent		
Calcium sulfide		Excellent		
Cane sugar liquors		Excellent	Good	
Carbon dioxide		Excellent		
Carbon disulfide		Not Usable		
Carbonic acid		Good		
Carbon tetrachloride	Excellent	Not Usable	Not Usable	
Castor oil		Not Recommended	Not Usable	
China wood [tung] oil		Excellent	Not Usable	
Chlorine gas [dry]		Not Usable		
Chlorine gas [wet]		Not Usable		
Chlorine liquid		Not Usable		
Chlorinated solvents		Not Usable	Not Usable	
Chloroacetic acid		Not Usable	Not Usable	
Chloroacetone		Not Usable	Not Usable	
Chloroform	Excellent	Not Usable	Not Usable	
Chlorophenol	Not Usable		Not Usable	
Chlorosulfonic acid		Not Usable	Not Usable	
Chlorotoluene		Not Usable	Not Usable	

Table continued at top of next page.

Chemical Compatibility (cont'd)

Chemicals	Screen Sheet – PET [Density %, Temperature °C]	6" Bezel – ABS [Density %, Temperature °C]	8"-15" Bezel – ABS [Density %, Temperature °C]	Gasket – Silicone [Density %, Temperature °C]
Chromic acid		[2, 70 °C] Not Usable	[2, 70 °C] Not Usable	
		[5, 70 °C] Not Usable	[5, 70 °C] Not Usable	
		[10, 70 °C] Not Usable	[10, 70 °C] Not Usable	
		[25, 70 °C] Not Usable	[25, 70 °C] Not Usable	
Citric acid		Good		
Cocoonut oil		Good	Not Usable	
Copper chloride		Excellent		
Copper cyanide		Excellent		
Copper sulfate		Excellent		
Corn oil		Good	Not Usable	
Cottonseed oil		Good	Not Usable	
Creosol		Not Usable	Not Usable	
Cyclohexane		Good	Not Usable	
Cyclohexanol		Good	Not Usable	
Cyclohexanone		Not Usable	Not Usable	
Developing solutions [Hypos]		Excellent		
Dibutyl phthalate [DBP]		Not Usable	Not Usable	
Dichlorobenzene		Not Usable	Not Usable	
Diethylene glycol		Good	Not Usable	
Diethyl ether		Not Usable	Not Usable	
Disopropyl ketone		Not Usable	Not Usable	
Dimethyl aniline		Not Usable	Not Usable	
Dimethyl formamide		Not Usable	Not Usable	
Dioxane		Not Usable	Not Usable	
Dipentene		Not Usable	Not Usable	
Epichlorohydrine		Not Usable	Not Usable	
Ethyl acetate	Excellent	Not Usable	Not Usable	
Ethyl acetoacetate		Not Usable	Not Usable	
Ethyl acrylate		Not Usable	Not Usable	
Ethyl alcohol		Not Recommended	Good	
Ethyl benzene		Not Usable	Not Usable	
Ethyl chloride		Not Usable	Not Usable	
Ethylene chlorohydrin		Not Usable	Not Usable	

Table continued at top of next page.

Chemical Compatibility (cont'd)

Chemicals	Screen Sheet – PET [Density %, Temperature °C]	6" Bezel – ABS [Density %, Temperature °C]	8"-15" Bezel – ABS [Density %, Temperature °C]	Gasket – Silicone [Density %, Temperature °C]
Ethylene diamine		Not Usable	Not Usable	
Ethylene dichloride		Not Usable	Not Usable	
Ethylene glycol		Excellent	Good	
Ethylene oxide		Not Usable	Not Usable	
Fatty acid		Good	Not Usable	
Ferric chloride		Excellent		
Ferric nitrate		Excellent		
Ferric sulfate		Excellent		
Fluorboric acid		Not Recommended		
Fluorobenzene		Not Usable	Not Usable	
Fluosilicic acid		Not Recommended		
Formaldehyde		[40, 20 °C] Good	[40, 20 °C] Not Usable	
		[25, 20 °C] Excellent		
		[50, 20 °C] Good		
		[90, 20 °C] Not Recommended		
Freon	[45°C] Excellent			
Freon 11		Not Recommended		
Freon 12		Good		
Freon 113		Not Usable		
Freon 114		Not Recommended		
Fuel oil		Good		
Gasoline		Not Recommended	Not Usable	
Gelatin		Excellent	Good	
Glauber's salt		Excellent		
Glue		Excellent		
Glycerin		Excellent	Good	
Grease		Excellent	Good	
Hexane		Not Recommended	Not Usable	
Hexyl alcohol		Good	Not Usable	
Hydrobromic acid		[20, 20 °C] Not Usable		
		[20-70, 20 °C] Not Usable		
		[37, 20 °C] Not Usable		

Table continued at top of next page.

Chemical Compatibility (cont'd)

2

Chemicals	Screen Sheet – PET [Density %, Temperature °C]	6" Bezel – ABS [Density %, Temperature °C]	8"-15" Bezel – ABS [Density %, Temperature °C]	Gasket – Silicone [Density %, Temperature °C]
Hydrochloric acid	[18%] Excellent	[10, 20 °C] Excellent	[10, 20 °C] Good	Good
	[35%] Good	[20, 20 °C] Good		
		[20-80, 20 °C] Not Recommended		
		[38, 20 °C] Not Recommended		
Hydrocyanic acid		Excellent		
Hydrofluoric acid		[10, 20 °C] Excellent		
		[20, 20 °C] Excellent		
		[40, 20 °C] Good		
Hydrofluoric acid anhydrous		Not Usable		
Hydrogen		Excellent		
Hydrogen peroxide		[5, 20 °C] Not Recommended		
		[5-50, 20 °C] Not Recommended		
		[30, 20 °C] Not Usable		
Hydrogen sulfide		Excellent		
Hydroquinone		Not Recommended		
Hypochlorous acid		Not Recommended		
Isobutyl alcohol		Good	Good	
Isopropyl acetate		Not Usable	Not Usable	
Isopropyl alcohol		Good	Good	
JP fuels (1-6)		Good	Not Usable	
Kerosene		Good	Not Usable	
Lacquer		Not Usable		
Lactic acid		Excellent		
Lard		Excellent		
Lead acetate		Excellent		
Lead nitrate		Good		
Lead sulfamate		Good		
Linoleic acid		Excellent		
Linseed oil		Excellent	Not Usable	
Liquified petroleum gas [LPG]		Excellent		
Lubricating oil		Excellent		
Lye solution		Excellent		

Table continued at top of next page.

Chemical Compatibility (cont'd)

Chemicals	Screen Sheet – PET [Density %, Temperature °C]	6" Bezel – ABS [Density %, Temperature °C]	8"-15" Bezel – ABS [Density %, Temperature °C]	Gasket – Silicone [Density %, Temperature °C]
Magnesium chloride		Excellent		
Magnesium hydroxide		Excellent		
Magnesium sulfate		Excellent		
Maleic acid		Excellent		
Mercuric chloride		Excellent		
MEK	Good			
Mercury		Excellent		
Metacresol	Not Usable			
Methyl acetate		Not Usable	Not Usable	
Methyl alcohol	Excellent	Not Recommended	Not Usable	
Methyl Benzoate	Not Usable			
Methyl chloride		Not Usable	Not Usable	
Methyl ethyl ketone [MEK]		Not Usable	Not Usable	
Methyl isobutyl ketone [MIBK]		Not Usable	Not Usable	
Methyl methacrylate		Not Usable	Not Usable	
Methyl dichloride		Not Usable	Not Usable	
Methyl Salicylate	Not Usable			
Milk		Excellent		
Mineral oil		Not Usable		Excellent
Monochlorobenzene	Not Usable	Not Usable	Not Usable	
Naptha		Good		
Napthalene		Excellent		
Napthenic acid		Good		
Natural gas		Excellent		
Natural oil				Excellent
Nickel acetate		Excellent		
Nickel chloride		Excellent		
Nickel sulfate		Excellent		
Nitric acid	[20%] Good	[10, 20 °C] Good	[10, 20 °C] Good	
		[10-70, 20 °C] Not Usable	[10-70, 20 °C] Not Usable	
		[30, 20 °C] Not Usable	[30, 20 °C] Not Usable	
	[30%] Not Usable	[30-70, 20 °C] Not Usable	[30-70, 20 °C] Not Usable	
		[61.3, 20 °C] Not Usable	[61.3, 20 °C] Not Usable	
		[Vapor, 20 °C] Not Usable	[Vapor, 20 °C] Not Usable	

Table continued at top of next page.

Chemical Compatibility (cont'd)

Chemicals	Screen Sheet – PET [Density %, Temperature °C]	6" Bezel – ABS [Density %, Temperature °C]	8"-15" Bezel – ABS [Density %, Temperature °C]	Gasket – Silicone [Density %, Temperature °C]
Nitrobenzene	Not Usable	Not Usable	Not Usable	
Nitroethane		Not Usable	Not Usable	
Nitromethane		Not Usable	Not Usable	
Nitropropane		Not Usable	Not Usable	
Nitrogen		Excellent	Good	
Octyl alcohol		Good		
Oleic acid		Excellent	Not Usable	
Olive oil		Excellent	Not Usable	
Oxalic acid		Excellent		
Oxygen		Excellent		
Ozone		Not Recommended		
Palmitic acid		Excellent		
Perchloroethylene		Not Usable	Not Usable	
Petroleum		Excellent	Not Usable	
Phenol	Not Usable	Not Usable	Not Usable	
Phosphoric acid		[50, 20 °C] Good		
		[50-70, 20 °C] Not Usable		
		[75, 20 °C] Not Usable		
Pickling solution		[Sulfuric acid 20% + nitric acid 4%] Good		
		[Sulfuric acid 40% + nitric acid 15%] Not Recommended		
Pine oil		Good		
Potassium chloride		Excellent		
Potassium cyanide		Excellent		
Potassium dichromate		[10, 20 °C] Excellent		
Potassium hydroxide	[10%] Not Usable	Excellent		
Potassium nitrate		Excellent		
Potassium permangante		[5, 20 °C] Excellent		
Potassium sulfate		Excellent		
Propane		Excellent		
Propyl acetate		Not Usable	Not Usable	
Propyl alcohol		Good	Good	

Table continued at top of next page.

Chemical Compatibility (cont'd)

Chemicals	Screen Sheet – PET [Density %, Temperature °C]	6" Bezel – ABS [Density %, Temperature °C]	8"-15" Bezel – ABS [Density %, Temperature °C]	Gasket – Silicone [Density %, Temperature °C]
Salt water		Excellent	Good	
Silicone oils		Good	Good	
Silver nitrate		Excellent		
Skydrol 500		Not Usable		
Skydrol 7000		Not Usable		Not Usable
Soap solutions		Excellent		
Soda ash		Excellent		
Sodium bicarbonate		Excellent		
Sodium bisulfate		Good		
Sodium borate		Excellent		
Sodium carbonate	[10%] Excellent			
Sodium chloride		Excellent	Good	
Sodium cyanide		Excellent		
Sodium hydroxide	[10%] Not Usable	[10, 20 °C] Excellent		
		[30, 20 °C] Excellent		
		[30-70, 20 °C] Not Usable		
Sodium hydrochlorite		[5, 20 °C] Excellent		
		[5-70, 20 °C] Not Usable		
Sodium metaphosphate		Excellent		
Sodium nitrate		Excellent		
Sodium perborate		Excellent		
Sodium peroxide		Not Usable		
Sodium phosphate		Excellent		
Sodium thiosulfate		Excellent		
Sodium sulfate [Glauber's salt]		Good		
Sodium sulfite		Excellent		
Soybean oil		Excellent		
Stannic chloride		Good		
Steam		[below 150 degrees] Not Usable		
Steam		[above 150 degrees] Not Usable		
Stearic acid		Excellent		
Styrene		Not Recommended		
Sucrose solutions		Excellent		

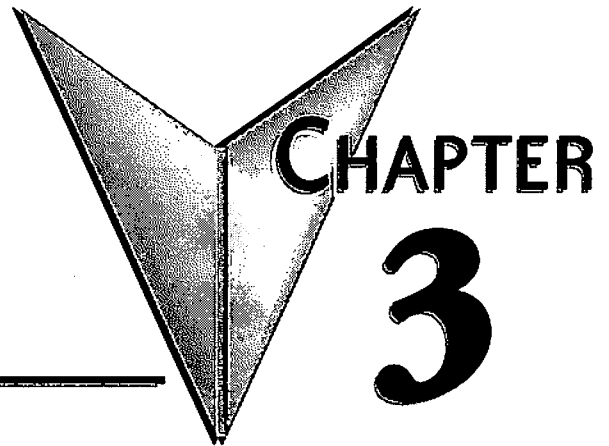
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Chemical Compatibility (cont'd)

2

Chemicals	Screen Sheet – PET [Density %, Temperature °C]	6" Bezel – ABS [Density %, Temperature °C]	8"-15" Bezel – ABS [Density %, Temperature °C]	Gasket – Silicone [Density %, Temperature °C]
Sulfur		Excellent		
Sulfur dioxide		Good		
Sulfuric acid	[40%] Excellent	[10, 20 °C] Excellent	[10, 20 °C] Good	Not Usable
		[10-70, 20 °C] Not Usable		
	[60%] Excellent	[30, 20 °C] Excellent		
		[30-70, 20 °C] Not Recommended		
[70%] Not Usable	[98, 20 °C] Not Usable			
	[Vapor, 20 °C] Not Usable			
Sulphurous acid		[10, 20 °C] Good		
Tannic acid		Good		
Tar		Not Recommended		
Tartaric acid		Excellent		
Terpineol		Not Recommended		
Tetrachloroethane	Good	Not Usable		
Tetraethyl lead		Good	Not Usable	
Tetralin	Not Usable			
Tetrahydrofuran		Not Usable	Not Usable	Not Usable
Thionyl chloride		Not Usable	Not Usable	
Toluene	Excellent	Not Usable	Not Usable	Not Usable
Trichloroethylene [Trichlene]		Not Usable	Not Usable	
Triethanol amine		Good	Not Usable	
Turpentine oil		Good	Not Usable	
Vegetable oil		Good	Not Usable	
Vinegar		Excellent	Good	
Water		Excellent	Good	
Whiskey		Excellent		
Xylene	Excellent	Not Usable	Not Usable	
Zeolites		Excellent		
Zinc acetate		Excellent		
Zinc chloride		Excellent		
Zinc sulfate		Excellent		

ACCESSORIES



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Accessories

3

Part Number	Description	Part Number	Description
EA-AC	The AC/DC Power Adapter, EA-AC, is for <i>C-more</i> touch panels only, and is powered from a 100-240 VAC, 50/60 Hertz power source. The adapter provides 24 VDC @ 1.5 A. Power Fault features help protect data being logged to CompactFlash during power failures. The <i>C-more</i> panel must have firmware version 1.21 Build 6.18E or higher for proper operation.	EA-6-COV2	Non Glare 6 Inch Screen Cover, protective overlay used to protect the touch screen while helping to reduce the glare from external light sources. (pk of 3)
EA-EXP-OPT	Expansion Assembly, is used to allow installation of the optional CF Card Interface Module for CF card use and also provides a slot for future option modules.	EA-8-COV2	Non Glare 8 Inch Screen Cover, protective overlay used to protect the touch screen while helping to reduce the glare from external light sources. (pk of 3)
EA-CF-IF	CF Card Interface Module, is used with the Expansion Assembly to allow use of CF cards, such as the CompactFlash Memory, p/n EA-FLASH-128MB.	EA-10-COV2	Non Glare 10-Inch Screen Cover, protective overlay used to protect the touch screen while helping to reduce the glare from external light sources. (pk of 3)
EA-FLASH-128MB	128 MB CompactFlash Memory Card Option, industrial grade, high speed memory for non-volatile storage.	EA-12-COV2	Non Glare 12-Inch Screen Cover, protective overlay used to protect the touch screen while helping to reduce the glare from external light sources. (pk of 3)
EA-6-ADPTR	6 Inch Adapter Plate, allows C-more 6" touch panels to be mounted into EZTouch 6" non-slim bezel cutouts without having to make alterations. NEMA 4/4X.	EA-15-COV2	Non Glare 15-Inch Screen Cover, protective overlay used to protect the touch screen while helping to reduce the glare from external light sources. (pk of 3)
EA-ADPTR-4	D-SUB 15-pin 90 degree PLC serial communication port adapter to allow a PLC communication cable to be plugged in at a 90 degree angle to reduce panel depth requirements.	SDCZ4-2048-A10	USB Pen Drive, 2GB, SanDisk Cruzer micro Pen Drive. Compatible with Windows 98SE, ME, 2000, XP and Mac OS 9.1.x+, OS X 10.1.2+ Certified Windows XP and Mac OS X. Contains Unit, sleeve and protective cap, lanyard and keychain loop. Recommended for use with the <i>C-more</i> Operator Touch Panels.
EA-COMCON-3	D-SUB 15-pin to 6-terminal PLC serial communication port adapter to allow wire terminal connections for RS-422/485 PLC communication cable.		



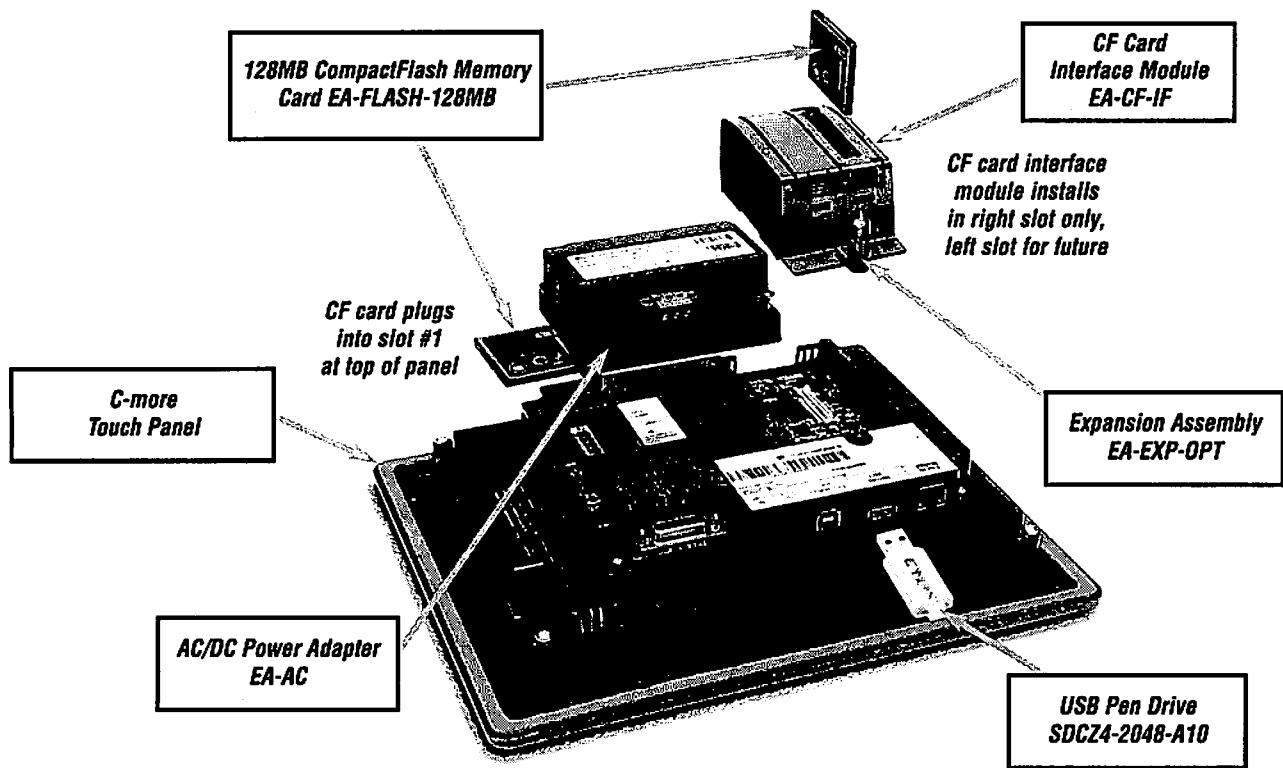
WARNING: Do NOT use EZTouch RAM or Flash memory cards with the *C-more* touch panels.



Accessories Overview

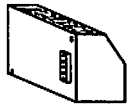


NOTE: CompactFlash memory card designations – CF Slot #1 is at the top of the panel and CF Slot #2 is the CF Card Interface Module, EA-CF-IF.

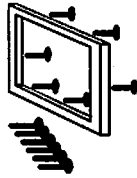


NOTE: Refer to the individual product data sheets that are included with the accessories for additional information.

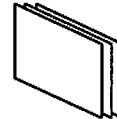
Accessories at a glance:



AC/DC Power Adapter:
EA-AC



6 inch Adapter Plate:
EA-6-ADPTR
(Used to retrofit new
C-more 6" touch panel
into existing EZTouch
non-slim panel cutout.)



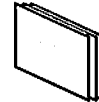
Non glare 15 inch screen cover:
EA-15-COV2
(pk of 3)



Expansion Assembly:
EA-EXP-OPT



D-SUB 15 pin 90 degree
Comm Port Adapter:
EA-ADPTR-4



Non glare 12 inch screen cover:
EA-12-COV2
(pk of 3)



CF Card Interface Module:
EA-CF-IF



D-SUB 15 pin to
Terminal Block Adapter:
EA-COMCON-3



Non glare 10 inch screen cover:
EA-10-COV2
(pk of 3)



128 MB CompactFlash
Memory Card:
EA-FLASH-128MB



USB Pen Drive,
2 GB:
SDCZ4-2048-A10



Non glare 8 inch screen cover:
EA-8-COV2
(pk of 3)



Non glare 6 inch screen cover:
EA-6-COV2
(pk of 3)



WARNING

To minimize the risk of potential safety problems, you should follow all applicable local and national codes that regulate the installation and operation of your equipment. These codes vary from area to area and it is your responsibility to determine which codes should be followed, and to verify that the equipment, installation, and operation are in compliance with the latest revision of these codes.

Equipment damage or serious injury to personnel can result from the failure to follow all applicable codes and standards. We do not guarantee the products described in this publication are suitable for your particular application, nor do we assume any responsibility for your product design, installation, or operation.

If you have any questions concerning the installation or operation of this equipment, or if you need additional information, please call us at 770-844-4200.

This publication is based on information that was available at the time it was printed. At *Automationdirect.com*[®] we constantly strive to improve our products and services, so we reserve the right to make changes to the products and/or publications at any time without notice and without obligation. This publication may also discuss features that may not be available in certain revisions of the product.

AC/DC Power Adapter

The optional *C-more* AC/DC Power Adapter can be used to power the *C-more* touch panels from a 100-240 VAC, 50/60 Hertz, voltage source. The adapter provides 24 VDC @ 1.5 A to the touch panel's DC power connector and can be conveniently secured to the touch panel with two captive screws. The adapter provides a power loss signal to the touch panel that can be used to track power outages. This signal also allows the touch panel by way of a timed sequence to stop writing data to CompactFlash memory devices providing a controlled shutdown for increased data logging reliability.

3

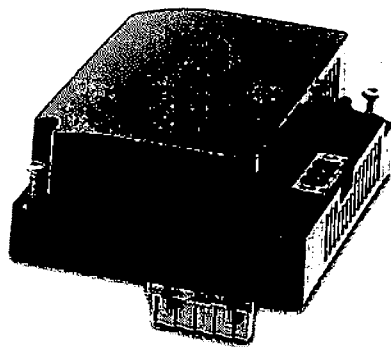


WARNING: The AC/DC Power Adapter is not recommended for use with the EA7-T15C touch panel when operating temperatures are expected to exceed 40 °C [104 °F].

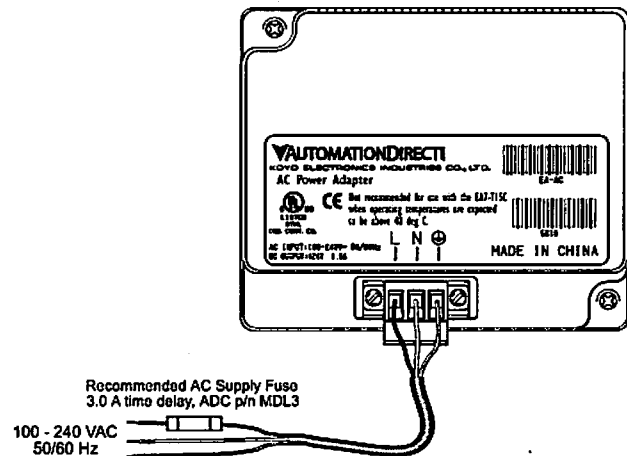


NOTE: 1.) The AC/DC Power Adapter, EA-AC, is for *C-more* touch panels only, and is powered from a 100-240 VAC, 50/60 Hertz power source. The adapter provides 24 VDC @ 1.5 A.
2.) Power Fault features help protect data being logged to CompactFlash during power failures. The *C-more* panel must have firmware version 1.21 Build 6.18E or higher for proper operation.

Part No. EA-AC



AC/DC Power Adapter Wiring



AC/DC Power Adapter Specifications

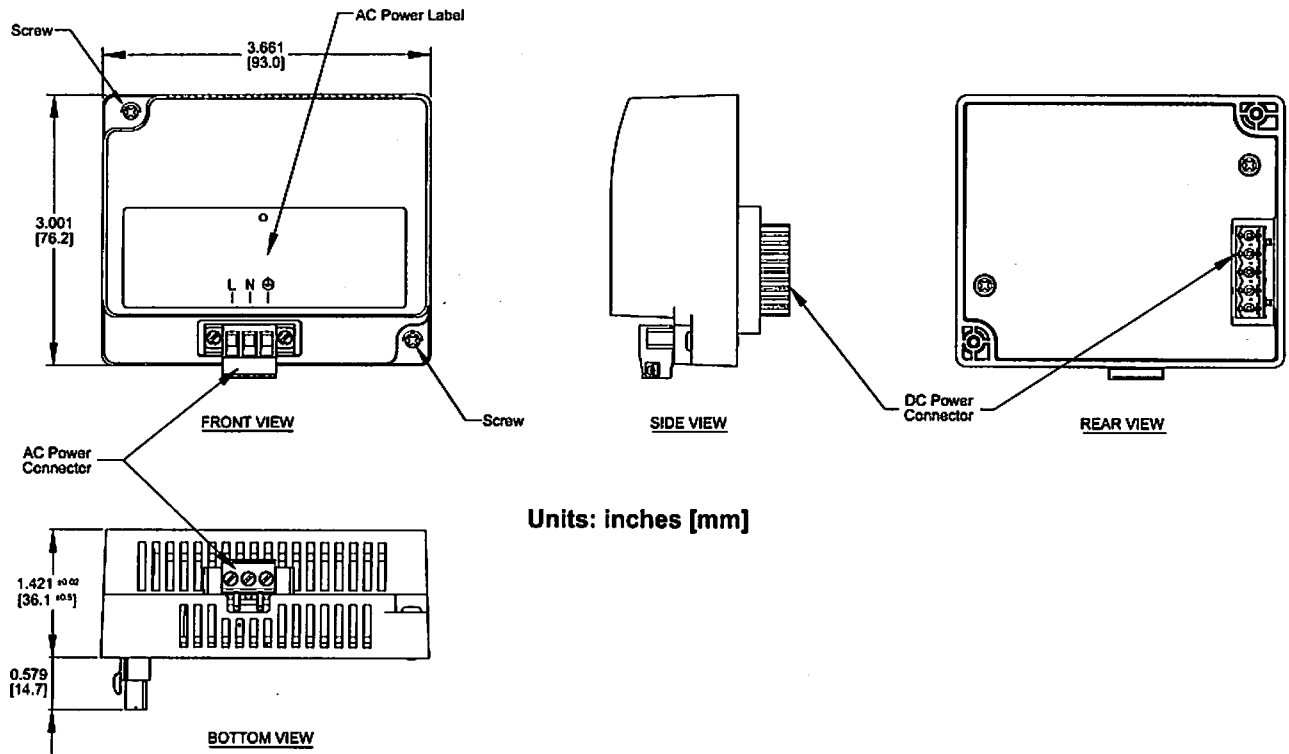
AC/DC Power Adapter Specifications	
Part Number	EA-AC
Input Voltage & frequency	100-240 VAC; 50/60 Hertz
Voltage Range	85-264 VAC w/ Under Voltage and Over Voltage Shutdown
Permissible Momentary Power Failure	Within 40 ms, see explanation in the Note below.
Input Power	68 VA or less
Operating Temperature Range	0 °C to 50 °C [32 to 122 °F] (For the EA7-T15C touch panel, maximum temperature is 40° C, [104 °F] when using the AC/DC Power Adapter.)
Storage Temperature Range	-20 to 60 °C [-4 to 140 °F]
Operating & Storage Humidity	10-85% RH (non-condensing)
Noise Immunity	1000 VAC p-p (Pulse width 1 µs, rise time: 1 ns) With proper ground connection on AC terminal block.
Hi-pot	1000 VAC, 1 minute With proper ground connection on AC terminal block.
Insulation Resistance	500 VDC, 10 M ohm or above With proper ground connection on AC terminal block.
Vibration	Compliant with IEC61131-2
Shock	Pulse shape: Sine half wave, Peak acceleration: 147 m/s ² (15 G), X, Y, Z: 3 directions, 2 times each
Thermal Protection	140 °C [284 °F], with autorecovery
Short Circuit Protection	85 VAC: 2.6 A, 100 VAC: 2.8 A, 264 VAC: 3.9 A
Static Electricity Discharge Resistance	Compliant with IEC61000-4-2, Contact: 4 kV, Air: 8 kV
Agency Approvals	UL508, cUL, CE, EMC EN61132-2
Environment	No corrosive gas or conductive dust
Grounding	Ground resistance: less than 100 ohm
Dimensions - inches [mm]	3.00" (H) x 3.66" (W) x 1.42" (D) [76.2 mm x 93.0 mm x 36.1 mm] (Excluding DC Power Connector.)
Weight	6.13 oz. [175 g]
Cooling Method	Natural convection when installed on vertically mounted touch panel.
Included Parts	AC Power Connector, Data Sheet Insert
Removable AC Power Connector	EA-AC-CON or DECA Switchlab MC101-508-03G Secure with (2) captive M2.5 screws, torque to 70 oz-in [0.5 Nm]
Output Voltage and Ripple	21.6 - 26.4 VDC, Ripple < 100 mV p-p
Output Current	Maximum 1.5 A
Inrush Current	For 100 VAC: 15 A, 3 ms or less For 240 VAC: 20 A, 3 ms or less
Power Fail Detection Voltage	58 VAC ±5%
Recommended AC Supply Fuse	3.0 A time delay, ADC p/n MDL3
Mounting to Touch Panel	Secure with (2) spring loaded captive M3-20 screws, torque to 50 oz-in [0.35 Nm]



NOTE: Permissible momentary power failure: The **C-more** touch panel will turn off the LCD backlight instantly when the power failure is detected (less than 58 VAC +/- 5%) for extending the Power Retention Period that enables the CPU to run longer. The backlight turns on automatically when the power returns to the **C-more** operating voltage.

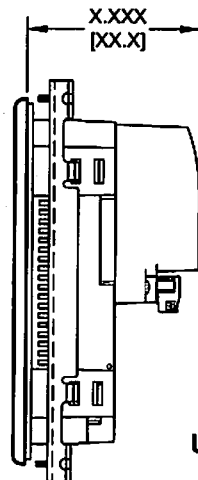
AC/DC Power Adapter Dimensions

Dimensions



3

Panel Depth with AC/DC Power Adapter Installed



- EA7-S6M-R = 2.921 [74.2]
- EA7-S6C-R = 2.921 [74.2]
- EA7-S6M = 2.921 [74.2]
- EA7-S6C = 2.921 [74.2]
- EA7-T6C = 2.921 [74.2]
- EA7-T8C = 3.157 [80.2]
- EA7-T10C = 3.106 [78.9]
- EA7-T12C = 3.102 [78.8]
- EA7-T15C = 3.075 [78.1]

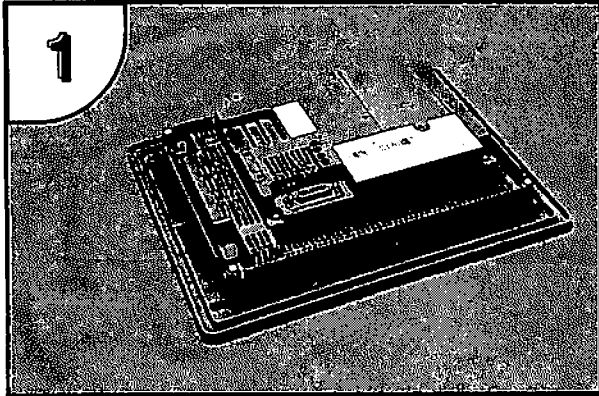
Units: inches[mm]

AC/DC Power Adapter Installation

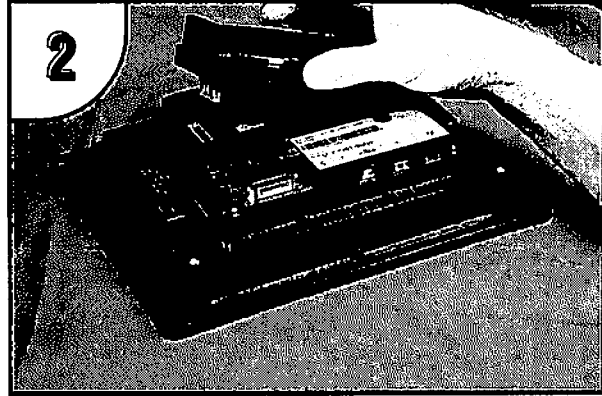


WARNING: This procedure should only be performed by qualified personnel who are experienced in working with electronic equipment. Take the necessary steps to prevent damage that may be caused by static electricity discharge. Disconnect input power to the touch panel before proceeding.

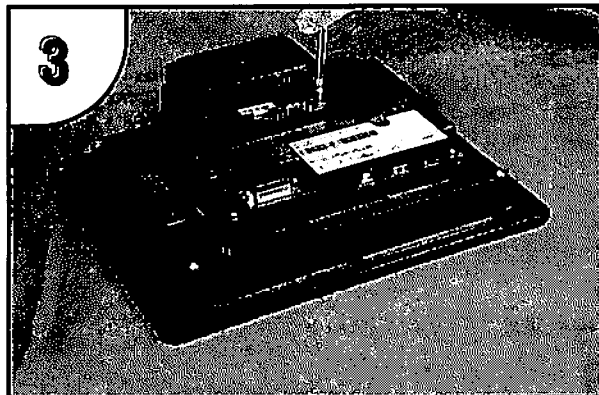
3



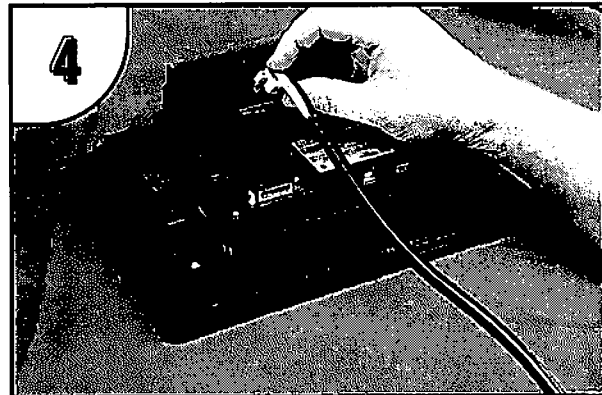
1
Preparation: Place the touch panel face down on a lint-free soft surface to prevent scratching the display screen if not already installed in a control cabinet. Remove the DC power connector if it is installed.



2
Insert the AC/DC Power Adapter into the touch panel's 5-position DC power connector.



3
Secure the AC/DC Power Adapter to the touch panel by tightening the two (2) spring loaded captive M3-20 screws to a torque of 50 oz-in [0.35 Nm].

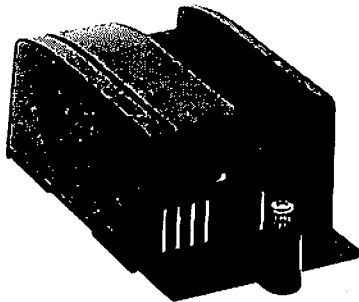


4
Plug the wired 3-pin AC Power Connector into its mating connector on the adapter and secure in place by tightening the two (2) captive M2.5 screws to a torque of 70 oz-in [0.5 Nm]. (Wiring details shown on page 3-5.)

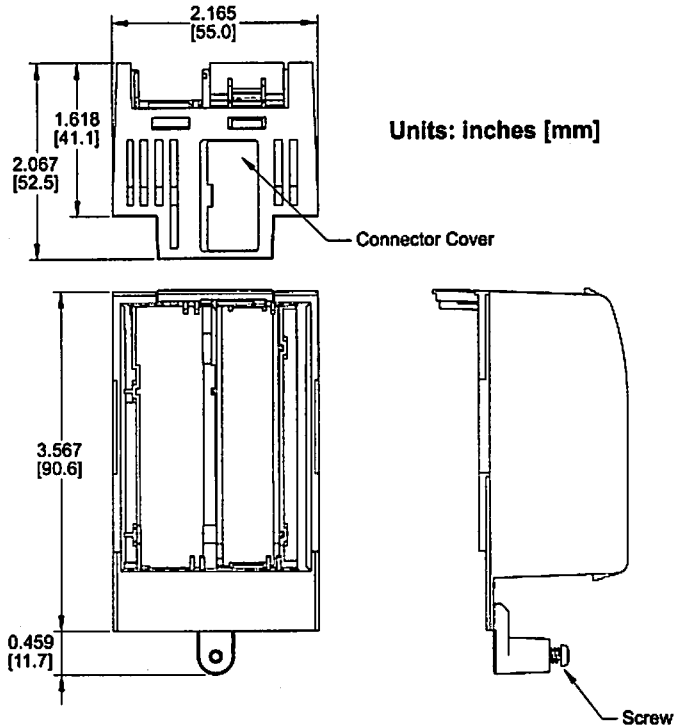
Expansion Assembly

The *C-more* Expansion Assembly is used to allow installation of the optional CF Card Interface Module for CF card use and also provides a slot for future option modules.

Part No. EA-EXP-OPT

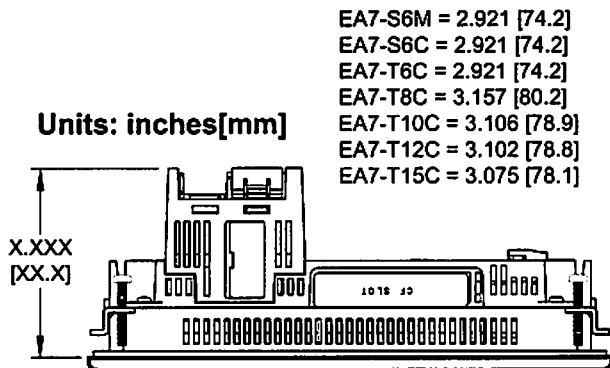


Expansion Assembly Dimensions

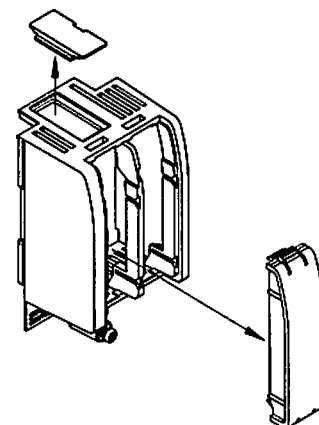


3

Panel Depth with Expansion Assembly Installed



Expansion Assembly Details

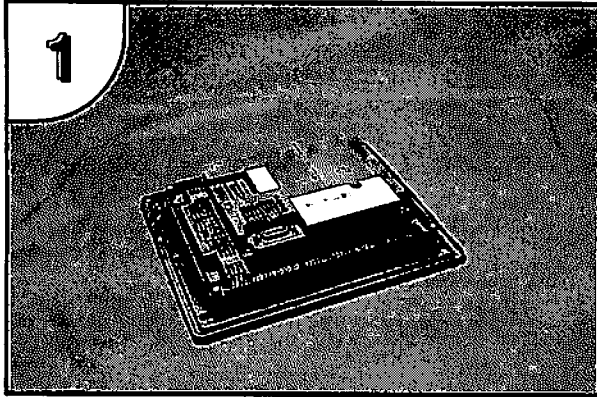


Expansion Assembly Installation

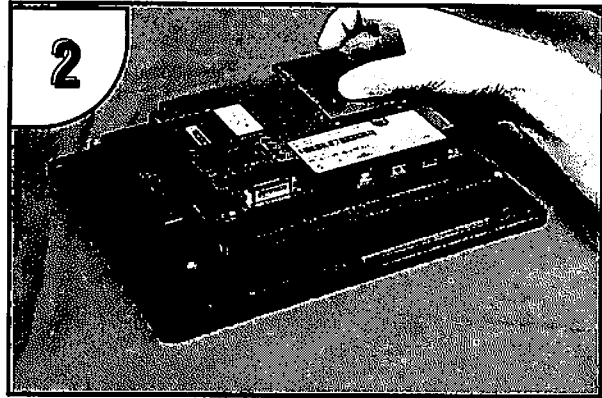


WARNING: This procedure should only be performed by qualified personnel who are experienced in working with electronic equipment. Disconnect input power to the touch panel before proceeding.

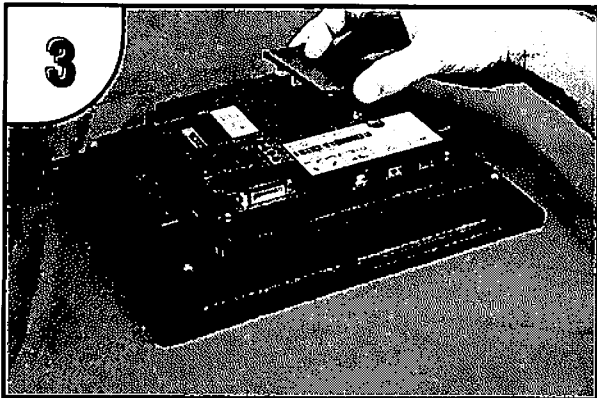
3



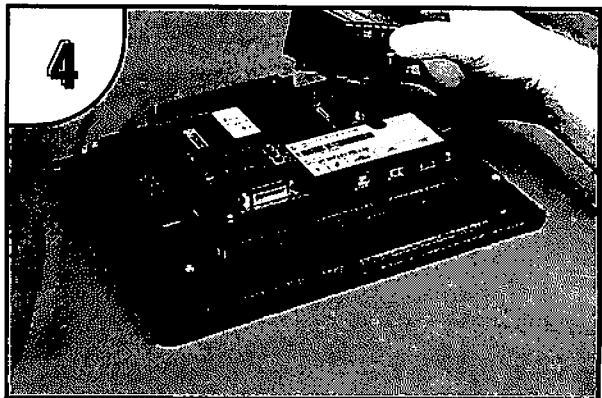
1
Preparation: Place the touch panel face down on a lint-free soft surface to prevent scratching the display screen if not already installed in a control cabinet.



2
Remove expansion area cover by pressing down on the left and right line markings and at the same time, slide the cover in the direction of the embossed arrow.

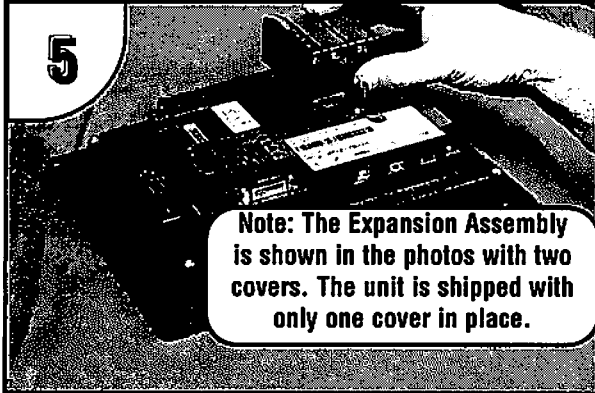


3
The cover will stop at the "Remove" position indicated by a tic mark on the cover lining up with the "Remove" tic mark on the panel. At this position, lift the cover up.

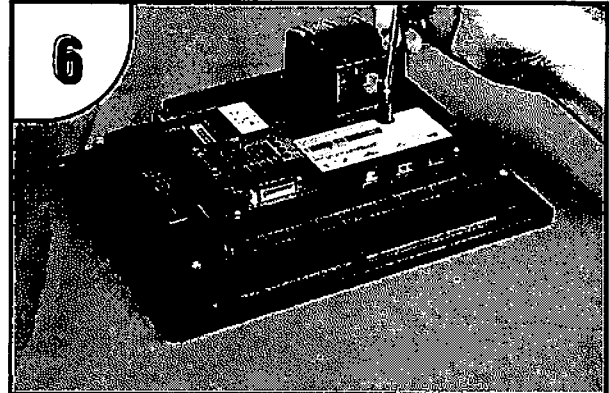


4
Position the expansion assembly over the opening so that the tic mark to the right of the fastening screw lines up with the "Remove" tic mark.

Expansion Assembly Installation (cont'd)



Slide the expansion assembly in a downward direction until the tic marks at the home position line up.



Secure the Expansion Assembly to the touch panel by tightening the spring loaded captive M3-20 screw to a torque of 50 oz-in [0.35 Nm].

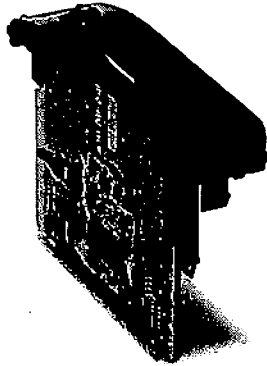
3

CF Card Interface Module

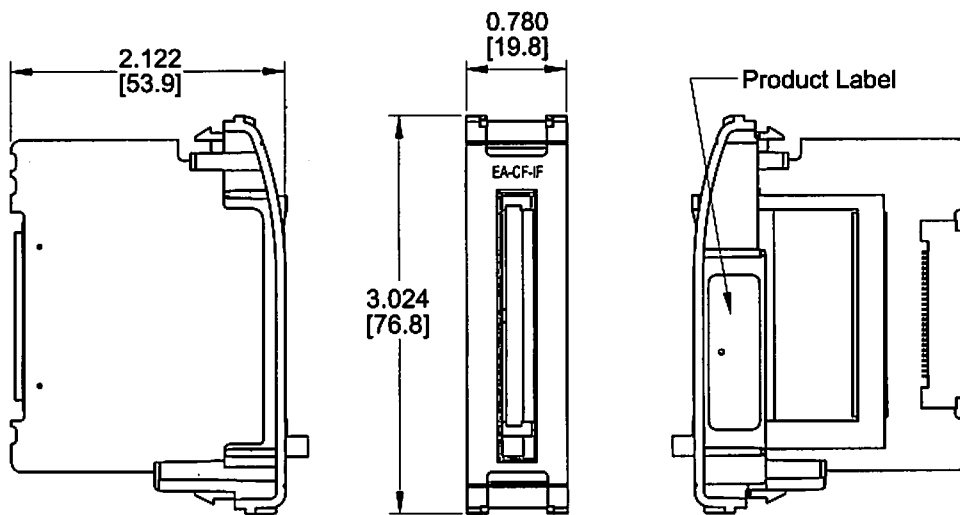
The *C-more* CF Card Interface Module is used with the Expansion Assembly to allow use of CompactFlash™ cards, such as the CompactFlash Memory, EA-FLASH-128MB.

Part No. EA-CF-IF

3



CF Card Interface Module Dimensions



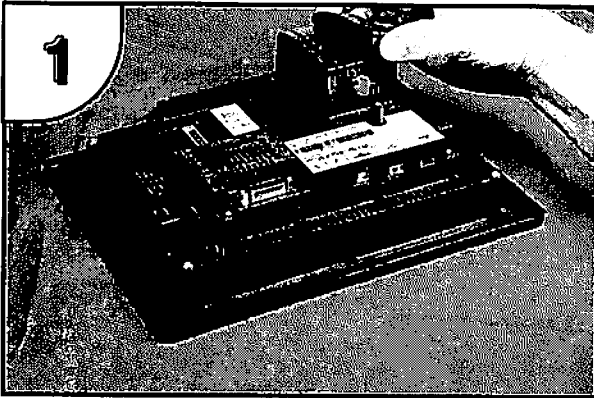
Units: inches [mm]

CF Card Interface Module Installation

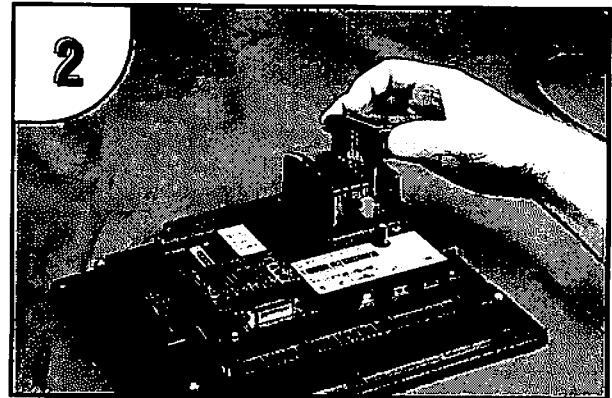


WARNING: The CF Card Interface Module is designed to be installed in the right hand side slot of the Expansion Assembly only. This procedure should only be performed by qualified personnel who are experienced in working with electronic equipment. Take the necessary steps to prevent damage that may be caused by static electricity discharge. Disconnect input power to the touch panel before proceeding.

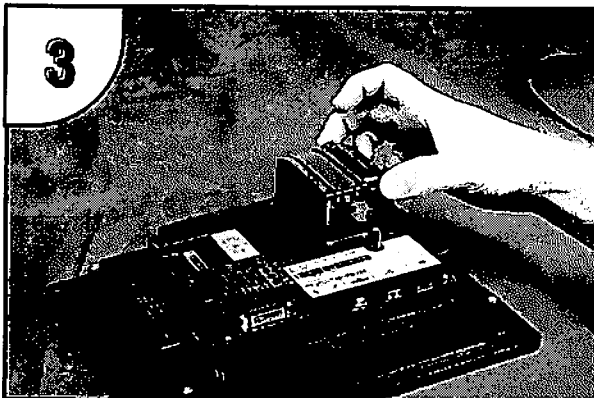
3



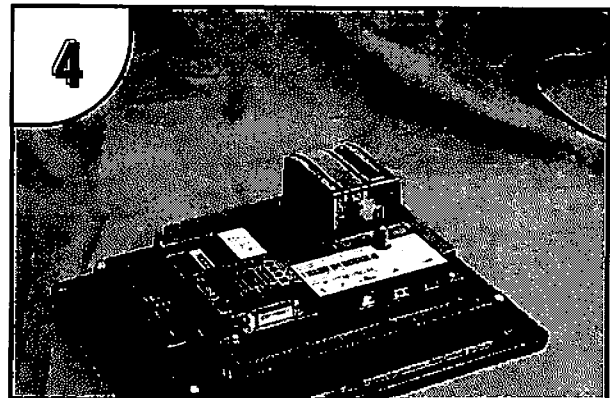
Preparation: Place the touch panel face down on a lint-free soft surface to prevent scratching the display screen if not already installed in a control cabinet. Again, make sure the input power is disconnected. Remove the right hand side protective slot cover, if it is installed, by squeezing the pinch tabs and lifting the cover off.



Install the CF Card Interface Module, p/n EA-CF-IF, into the right hand side slot by carefully aligning the female connector of the interface module with the male connector on the touch panel. There are PCB guides at the top and bottom of the slot to accept the edge of the Interface Module's printed circuit board. It is also helpful to preset the locking tabs of the Interface Module so they are swung inward, top and bottom.



Continue to slide the interface module into the slot until the front of the module is flush with the front of the Expansion Assembly. Press on the front of the Interface Module until the locking tabs snap into place.



The above photo shows the CF Card Interface Module fully installed. To remove the Interface Module in the future, pry out on the top and bottom locking tabs at the same time and the module will release from the connector. Lift the module from the slot. The Interface Module should only be removed from the slot with input power disconnected.

128 MB CompactFlash Memory

EA-FLASH-128MB is a 128MB high speed industrial grade CompactFlash™ memory card for non-volatile storage. Its 85 °C operating temperature makes it perfect for data logging in industrial applications (recommended for *C-more* touch panels).

3

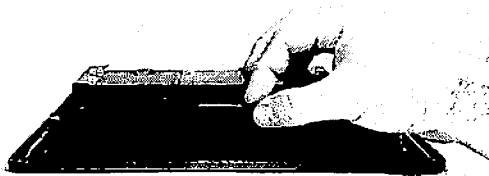
Part No. EA-FLASH-128MB



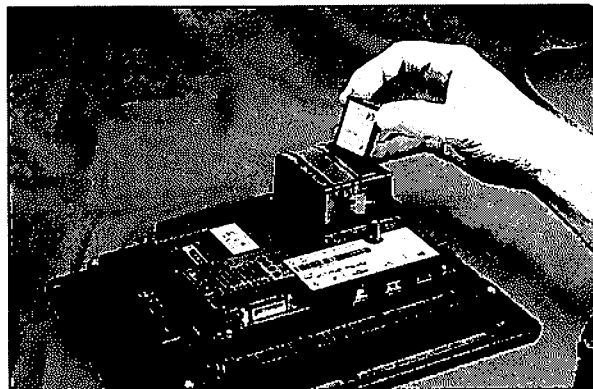
Specifications/Features:

- CompactFlash™ Compatibility
- Interface transfer speed: 16.6 MB/second
- W/E Endurance: 100,000 cycles ($T_a = 40^{\circ}\text{C}$ to 85°C); 300,000 cycles ($T_a = 0^{\circ}\text{C}$ to 70°C)

CF Slot #1 Location



CF Slot #2 Location



CompactFlash Memory Card Installation

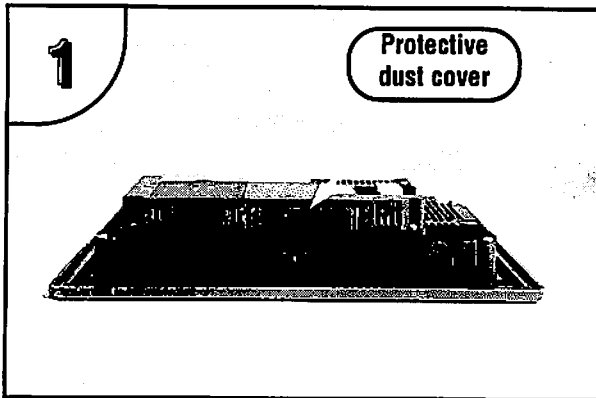


WARNING: Take the necessary steps to prevent damage that may be caused by static electricity discharge. Disconnect input power to the touch panel before proceeding.

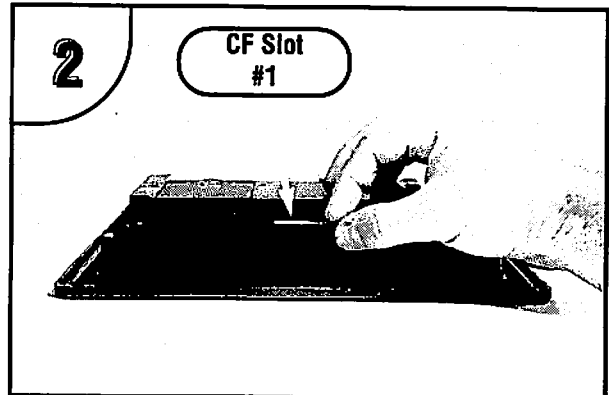
Preparation: If the touch panel is not already installed into a control cabinet, then in a clean environment, place the panel face down on a lint-free soft surface to prevent scratching the front of the panel.

CF Card Installed in CF Slot #1:

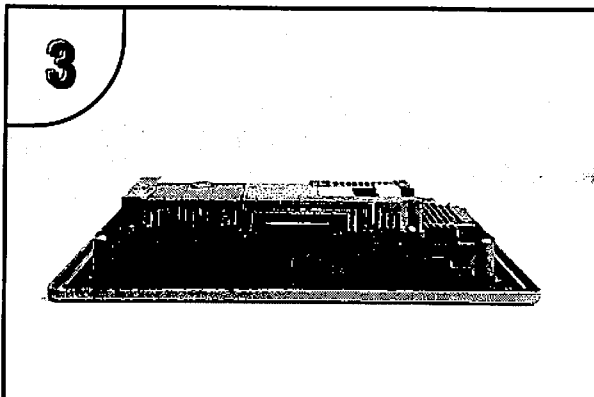
3



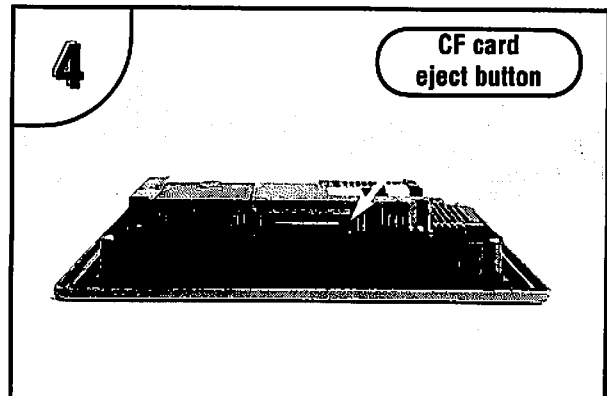
Remove the protective dust cover from the CF Slot #1 at the top of the touch panel by prying up on one edge. Discard the dust cover or store it for future use when a CF card is not being used.



Orientate the CompactFlash memory card so that the front label is facing the back of the panel and the CF card connector faces into the slot. There are guides on each side of the slot that will match the guides on the CF card. The CF card can only be inserted one way.



Gently press the CF card into the slot until it stops. You should feel a slight resistance as the CF card connector mates with the slot's connector. The CF card should be flush with the slot's opening. The dust cover can then be re-installed.



To remove the CF card from the CF Slot #1, press in on the eject button to the right of the CF card. This will cause the CF card to be partially ejected from the slot allowing removal.



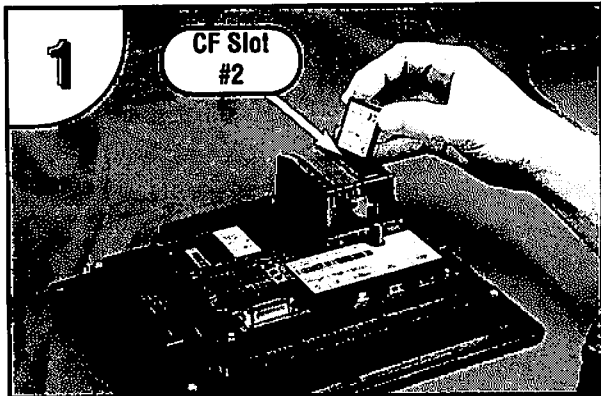
WARNING: Do NOT use EZTouch RAM or Flash memory cards with the *C-more* touch panels.



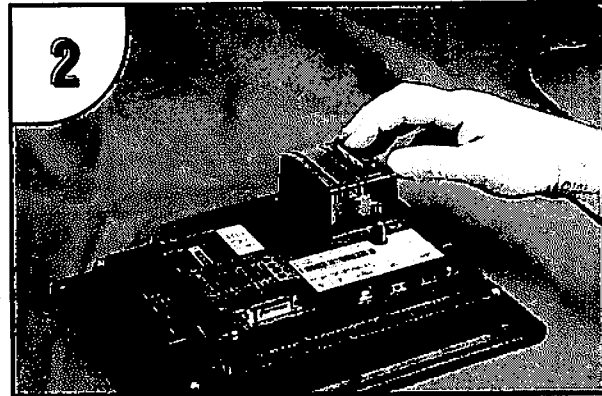
CompactFlash Memory Card Installation (cont'd)

3 CF Card Installed in CF Slot #2:

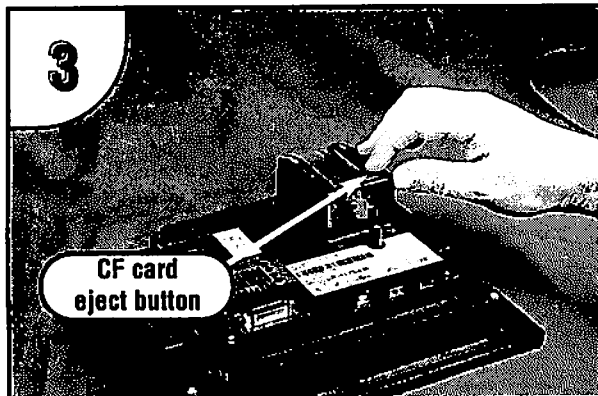
Preparation: Disconnect input power and all other connections, then remove the touch panel from the control cabinet. In a clean environment, place the panel face down on a lint-free soft surface to prevent scratching the front of the panel.



Orientate the CompactFlash memory card so that the front label is facing the power supply connector and the CF card connector faces into the slot. There are guides on each side of the slot that will match the guides on the CF card. The CF card can only be inserted one way.



Gently press the CF card into the slot until it stops. You should feel a slight resistance as the CF card connector mates with the slot's connector. The CF card should be flush with the slot's opening.



To remove the CF card from the CF Slot #2, press in on the eject button at the bottom of the CF card. This will cause the CF card to be partially ejected from the slot allowing removal.



WARNING: Do NOT use EZTouch RAM or Flash memory cards with the *C-more* touch panels.



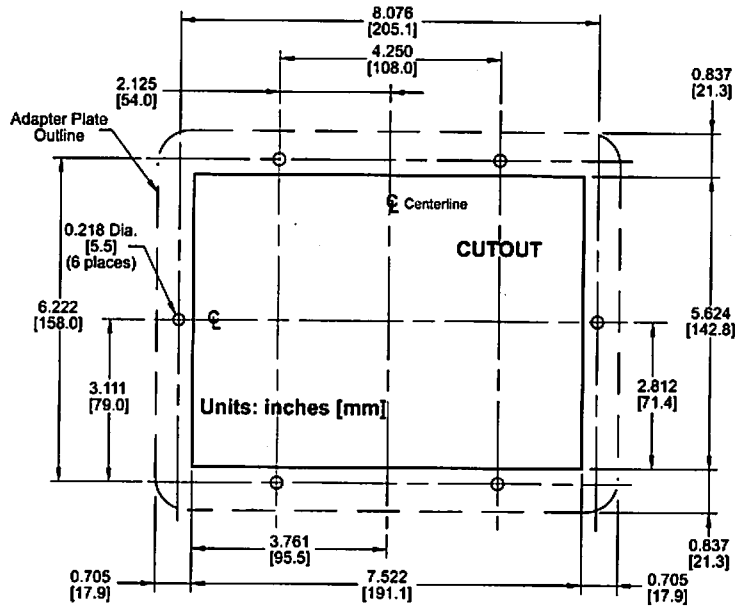
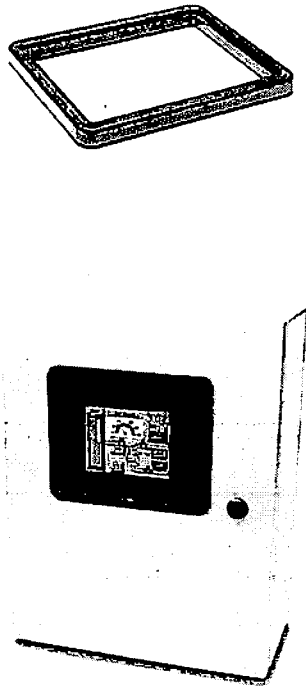
6" Adapter Plate

The adapter plate has been designed to simplify the retrofit of a new *C-more* 6" touch panel into an existing cabinet cutout for an EZTouch 6" non-slim touch panel, such as *AutomationDirect* part number EZ-S6C-K, EZ-S6C-F, EZ-S6M-R or EZ-S6M-F. The new *C-more* 6" touch panel will directly mount into the existing cutout opening for any EZTouch 6" slim touch panel.

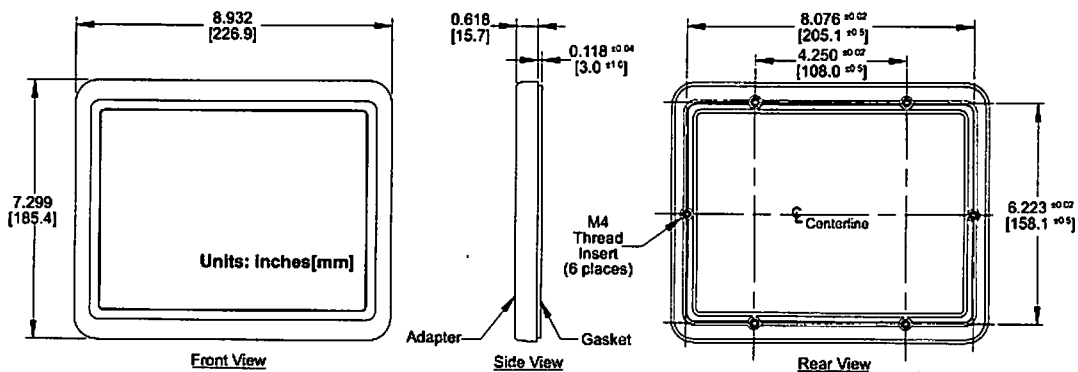
Part No. EA-6-ADPTR

6" Adapter Plate Cutout Dimensions

3



6" Adapter Plate Dimensions



6" Adapter Plate Installation

The adapter plate has been designed to simplify the retrofit of a new *C-more* 6" touch panel into an existing cabinet cutout for an EZTouch 6" non-slim touch panel, such as our part number EZ-S6C-K, EZ-S6C-F, EZ-S6M-R or EZ-S6M-F. The new *C-more* 6" touch panel will directly mount into the existing cutout opening for any EZTouch 6" slim touch panel.

Two sets of mounting screws are provided with the adapter plate. Set A contains six M4 metric screws by 8mm in length for a control cabinet thickness range of 0.02-0.118" [0.5-3mm]. Set B contains six M4 metric screws by 10mm in length for a control cabinet thickness range of 0.118-0.197" [3-5mm]. Mounting screw torque: 100 oz-in [0.7 Nm].

The two DIN mounting clips that secure the *C-more* 6" touch panel to the adapter plate are provided with the touch panel. The adapter plate has an integral sealing gasket and the touch panel includes a gasket to seal the panel to the adapter.

Use of the adapter plate will maintain the NEMA 4/4X (indoor) rating of the *C-more* touch panel.

Dimensions for the cutout with mounting hole locations and an assembly diagram are shown in this chapter.

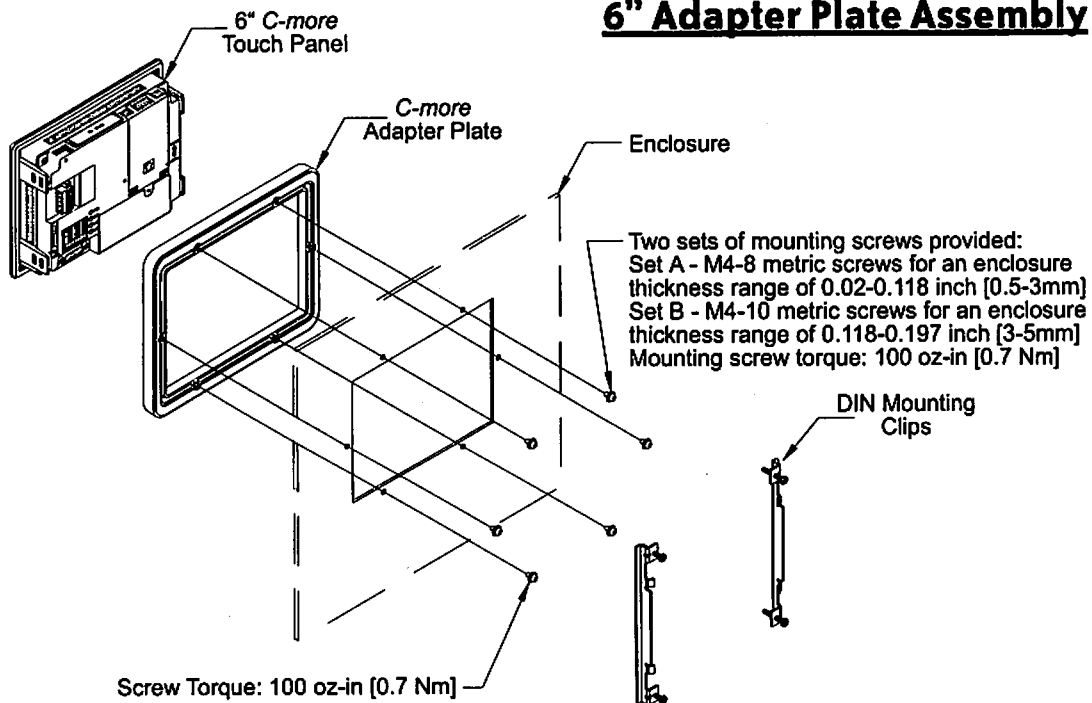
Preparation: Confirm the existing cutout with the dimensions shown on the previous page when using the adapter plate to replace an existing EZTouch 6" non-slim touch panel with a new *C-more* 6" touch panel.

3



WARNING: Mount the adapter plate and touch panel on a vertical surface to allow proper cooling.

6" Adapter Plate Assembly

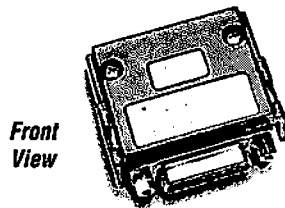
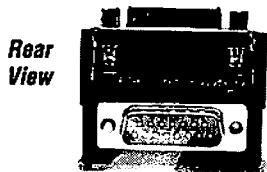


D-SUB 15-pin 90 degree Comm Port Adapter

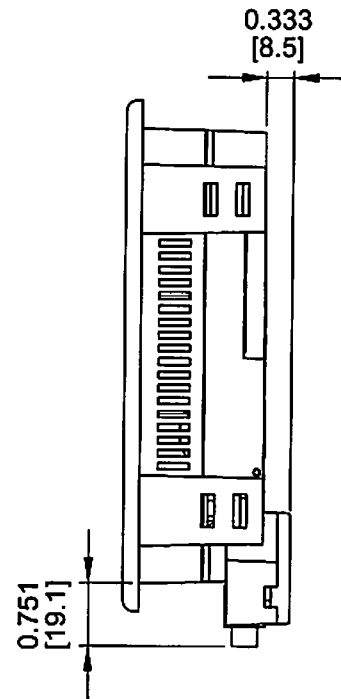
The EA-ADPTR-4 adapter is plugged into the 15-pin serial port on the rear of the panel to allow a PLC communication cable to be plugged in at a 90 degree angle to reduce panel depth requirements. UL Recognized.

Part No. EA-ADPTR-4

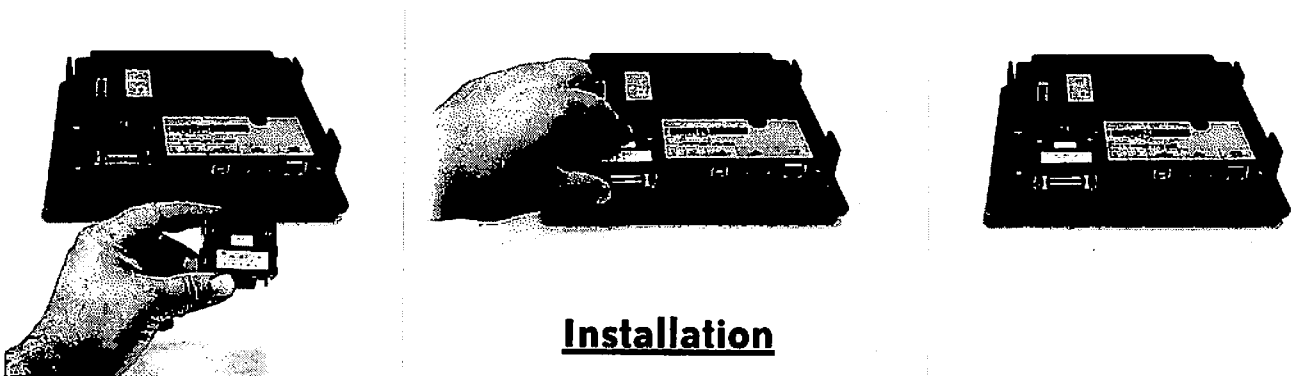
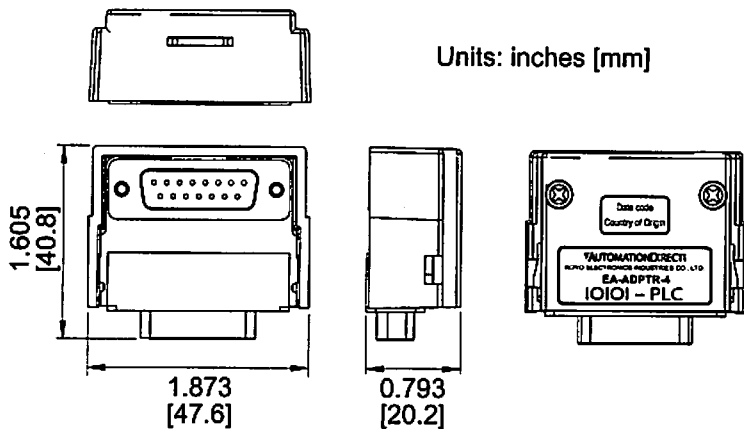
3



Panel Dimensions with Connector Installed



Comm Port Adapter Dimensions



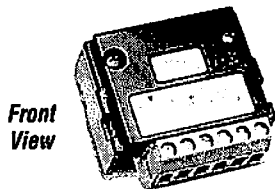
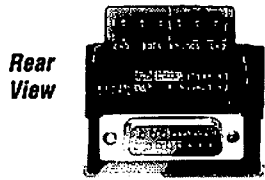
Installation

D-SUB 15-pin to Terminal Block Adapter

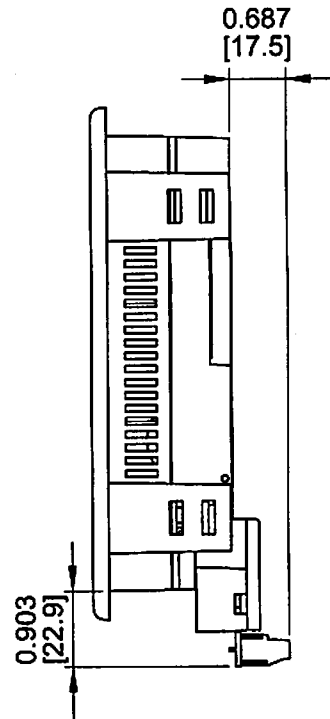
The EA-COMCON-3 adapter is plugged into the 15-pin serial port on the rear of the panel to allow wire terminal connections for RS-422/485 PLC communication cable. UL Recognized.

Part No. EA-COMCON-3

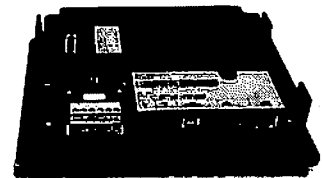
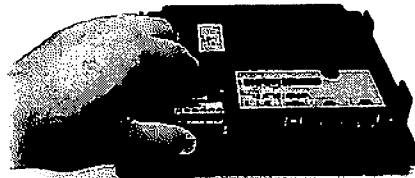
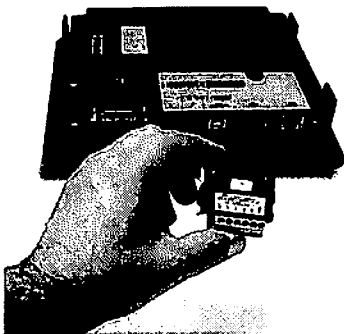
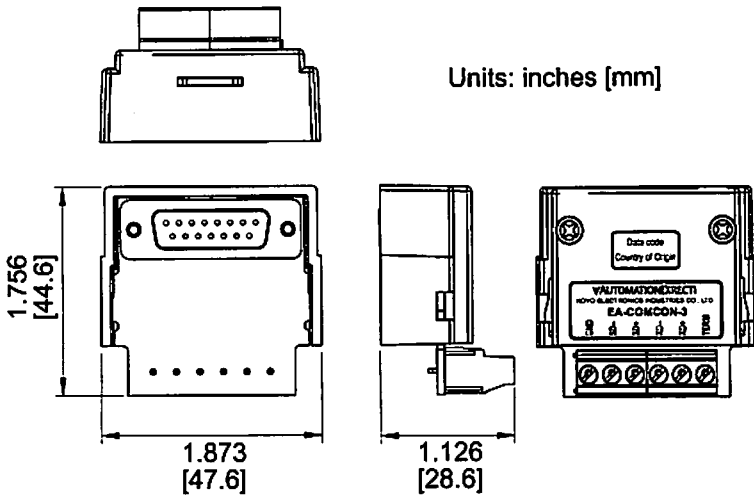
3



Panel Dimensions with Connector Installed



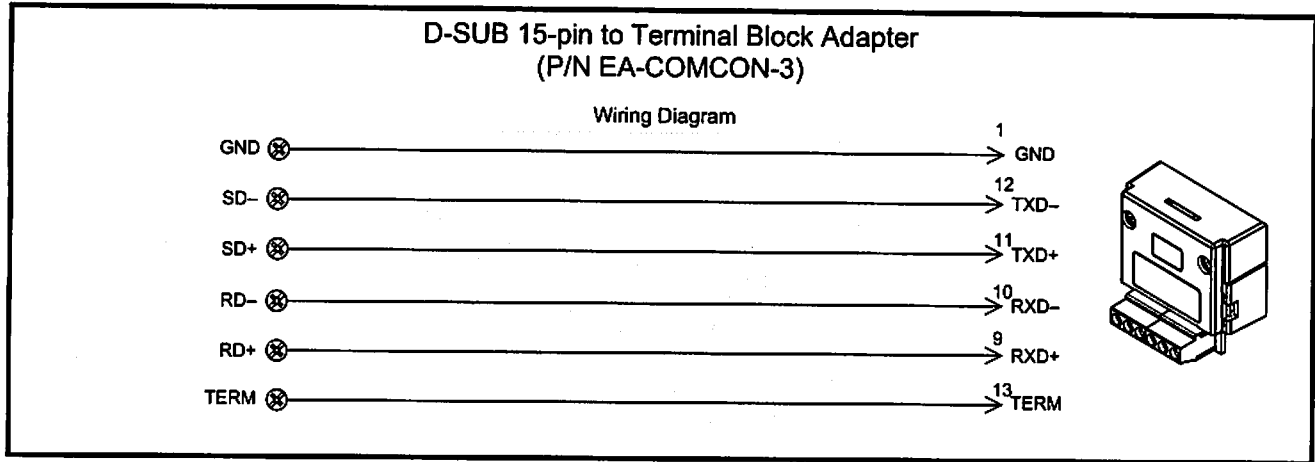
Terminal Block Adapter Dimensions



Installation

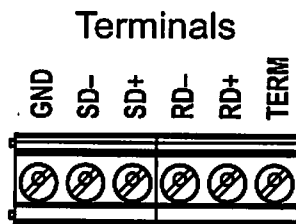
D-SUB 15-pin to Terminal Block Adapter (cont'd)

Terminal Block Adapter Wiring Diagram



3

Terminal Block Adapter Terminal Designations



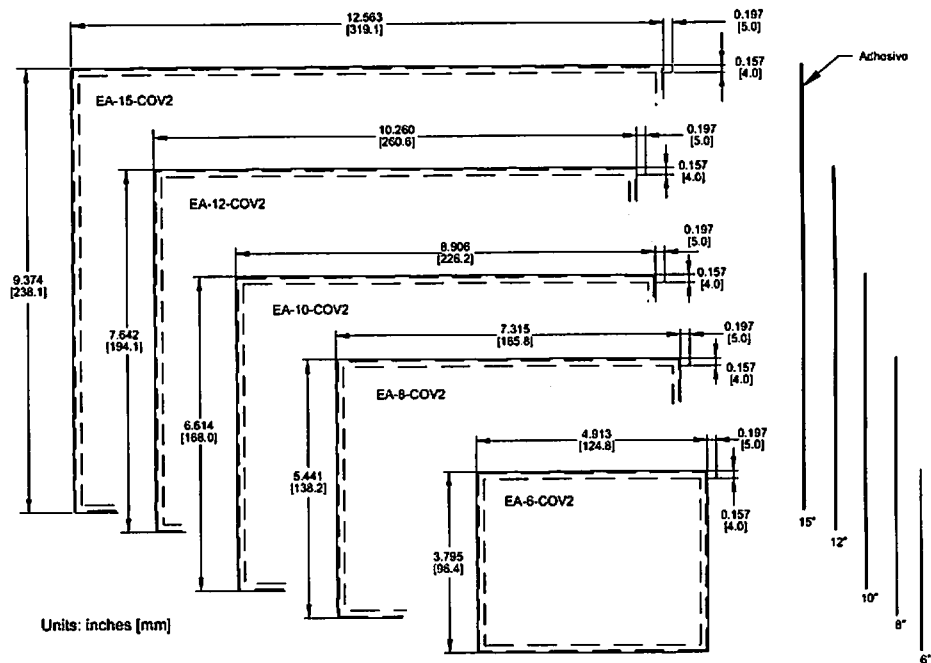
Non-glare Screen Covers

Non Glare 6 Inch Screen Cover, protective overlay used to protect the touch screen while helping to reduce the glare from external light sources. (pk of 3)

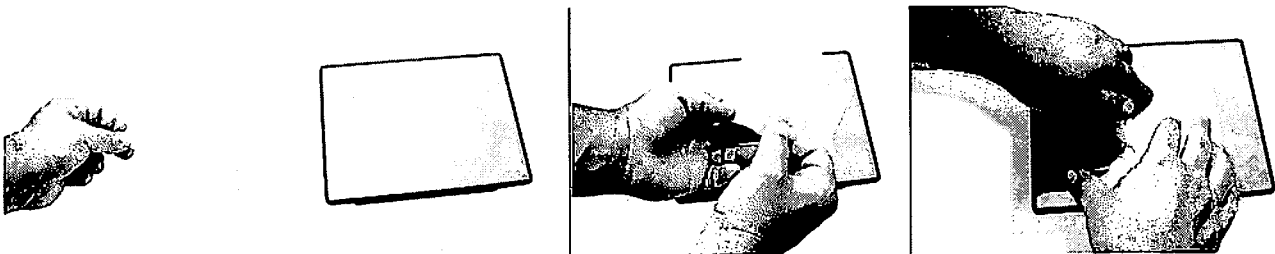
Part No. EA-6-COV2, EA-8-COV2, EA-10-COV2, EA-12-COV2 & EA-15-COV2

3

Screen Cover Dimensions



Installation



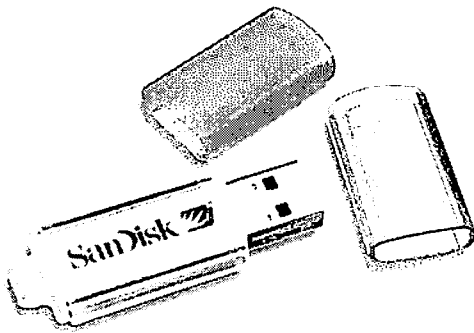
NOTE: The protective cover ships with a thin protective sheet on the face of the cover that needs to be carefully removed. If your panel is not clear, the protective sheet may not have been removed.

USB Pen Drive

The SanDisk Cruzer Micro is an extremely small 2 GB USB Flash Drive (UFD) that connects to a USB port. Users can easily store their logging data, project data, key documents and images on a Cruzer Micro and transfer them to another computer with a USB port.

Includes software for data encryption (CruzerLock 2)*, and trial version for back-up (PocketCache)*, and Outlook synchronization (CruzerSync)*.

Part No. SDCZ4-2048-A10



Specifications/Features:

- Dimensions: 7.9mm x 18.95mm x 52.2mm (H x W x L)
- Stylish, metal casing with changeable colored skins and caps **
- Includes CruzerLock 2 for data security*, and trial versions of PocketCache (back-up)* and CruzerSync (Outlook & My Documents folder synchronization) software*
- Hi-Speed USB 2.0 certified (backwards compatible with all USB 1.1 ports)
- Compatible with Windows 98SE, ME, 2000, XP and Mac OS 9.1.x+, OS X v10.1.2+
- Certified Windows XP and Mac OS X

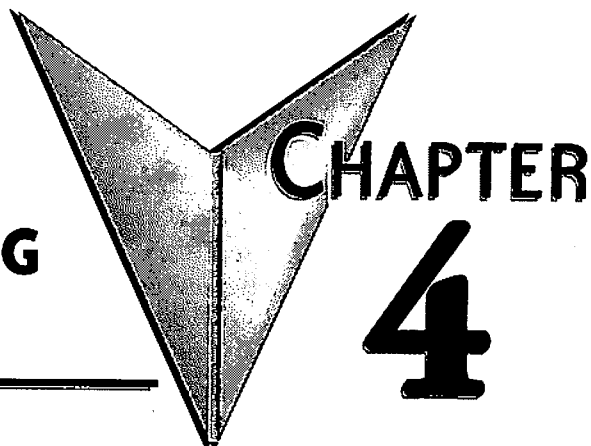
Cruzer Micro Package Contents:

- Cruzer Micro Skins (with clear skin and cap)
- 2 additional colored skins w/matching caps **
- Lanyard
- Quick Start Guide

* For Windows only

** Available for new version of Cruzer Micro with Skins only

INSTALLATION & WIRING



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Safety Guidelines



NOTE: Products with CE marks perform their required functions safely and adhere to relevant standards as specified by CE directives provided they are used according to their intended purpose and that the instructions in this manual are adhered to. The protection provided by the equipment may be impaired if this equipment is used in a manner not specified in this manual. A listing of our international affiliates is available on our Web site: <http://www.automationdirect.com>

4



WARNING: Providing a safe operating environment for personnel and equipment is your responsibility and should be your primary goal during system planning and installation. Automation systems can fail and may result in situations that can cause serious injury to personnel or damage to equipment. Do not rely on the automation system alone to provide a safe operating environment. You should use external electromechanical devices, such as relays or limit switches, that are independent of the PLC application to provide protection for any part of the system that may cause personal injury or damage. Every automation application is different, so there may be special requirements for your particular application. Make sure you follow all national, state, and local government requirements for the proper installation and use of your equipment.

Plan for Safety

The best way to provide a safe operating environment is to make personnel and equipment safety part of the planning process. You should examine *every* aspect of the system to determine which areas are critical to operator or machine safety. If you are not familiar with control system installation practices, or your company does not have established installation guidelines, you should obtain additional information from the following sources.

- NEMA — The National Electrical Manufacturers Association, located in Washington, D.C. publishes many different documents that discuss standards for industrial control systems. You can order these publications directly from NEMA. Some of these include:
 - ICS 1, General Standards for Industrial Control and Systems*
 - ICS 3, Industrial Systems*
 - ICS 6, Enclosures for Industrial Control Systems*
- NEC — The National Electrical Code provides regulations concerning the installation and use of various types of electrical equipment. Copies of the NEC Handbook can often be obtained from your local electrical equipment distributor or your local library.
- Local and State Agencies — many local governments and state governments have additional requirements above and beyond those described in the NEC Handbook. Check with your local Electrical Inspector or Fire Marshall office for information.

Introduction

The installation and wiring of the *C-more*[®] touch panels requires selecting an appropriate location for the touch panel, laying out the cutout dimensions on the surface of the control cabinet that the panel will be mounted through, securing the touch panel with the provided mounting clips, tightening the screws to the appropriate torque rating to assure the gasket is sealing correctly, and finally connecting the appropriate power source to the touch panel.



WARNING: *C-more* touch panels need to be mounted on a vertical surface to ensure proper cooling of the panel and its components.



Note: Each *C-more* touch panel is provided with a cutout template to make marking the proper cutout size on the surface of the control cabinet that the panel will be mounted through a simple task.

The *C-more* 6" touch panels include two mounting clips. The clips can be viewed as a long metal bracket with two screws in each clip. The 6" panel clips can be fitted to the touch panel at two different depth locations that allow the 6" panel to be mounted through a wide range of enclosure thicknesses. The 8" through 12" touch panels include six mounting clips while the 15" touch panel includes eight. The 8" through 15" panel mounting clips are all the same. They are fitted to the touch panel by inserting two tabs into mating wide slots around the panel and then sliding the clip into a narrower slot to secure it in place. There is one screw on each clip that needs tightening to secure the panel in place.

Any *C-more* touch panel can be mounted directly through the existing cutout of a same size EZTouch slim touch panel. There is a simple solution for the need to replace an EZTouch 6" non-slim (rounded bezel) touch panel as explained in the following note.

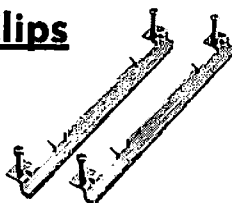


NOTE: The *C-more* 6" touch panels will fit into the existing cutout of any EZTouch 6" slim bezel panel. Use the *C-more* 6" Adapter Plate, EA-6-ADPTR, to install *C-more* 6" panels into existing cutouts of EZTouch 6" non-slim (rounded bezel) panels. The adapter plate gasket is included.

This chapter only covers the proper mounting of the touch panel and connecting power. Once power is applied to the touch panel, the user will want to read Chapter 5 on the System Setup Screens in order to set the internal time and date for the panel, check the information menu to make sure the panel is the correct unit for the application and is the latest version, set communication port parameters that may be required, become familiar with the touch panel test features, and check memory options.

The next step will be to select the appropriate PLC protocol and communications cable as described in Chapter 6.

6" Mounting Clips



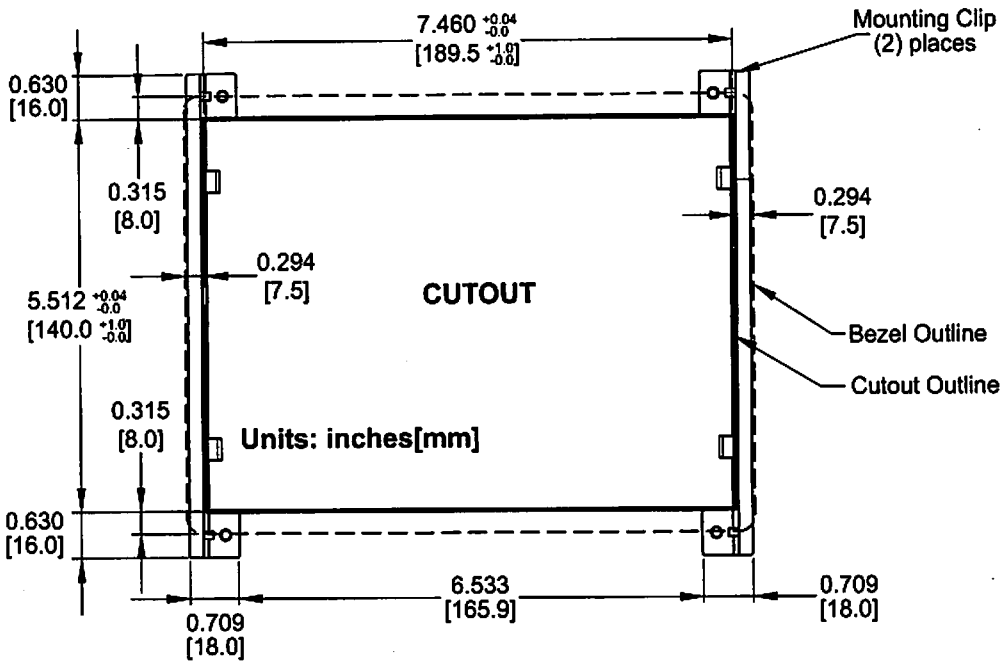
8-15" Mounting Clip



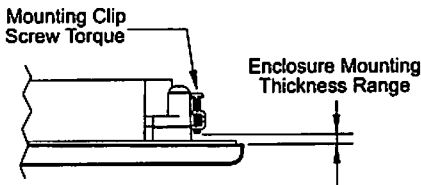
EA7-S6M-R, S6C-R, S6M, S6C and T6C – Cutout Dimensions

The *C-more* 6" touch panels are mounted into a cutout through the control cabinet and secured with two (2) mounting clips. The mounting clips are provided with the touch panel. There is a set of four (4) rectangular holes (slots) on each side of the touch panel's short dimension that the two tabs on each mounting clip will match. You will need to select either the upper or lower set of holes depending on your control cabinet's material thickness. The table below shows the different thickness ranges. The mounting clips are held in place, and pull the front bezel of the panel tight to the mounting surface, by tightening the screws into the rear of the control cabinet. The screws need to be tightened to the torque rating shown in the table below so that the gasket is compressed to form the proper seal between the panel and cabinet surface.

Note: Mount the touch panel on a vertical surface to allow convection air flow for proper cooling.



Enclosure Mounting Thickness Ranges and Mounting Clip Screw Torque



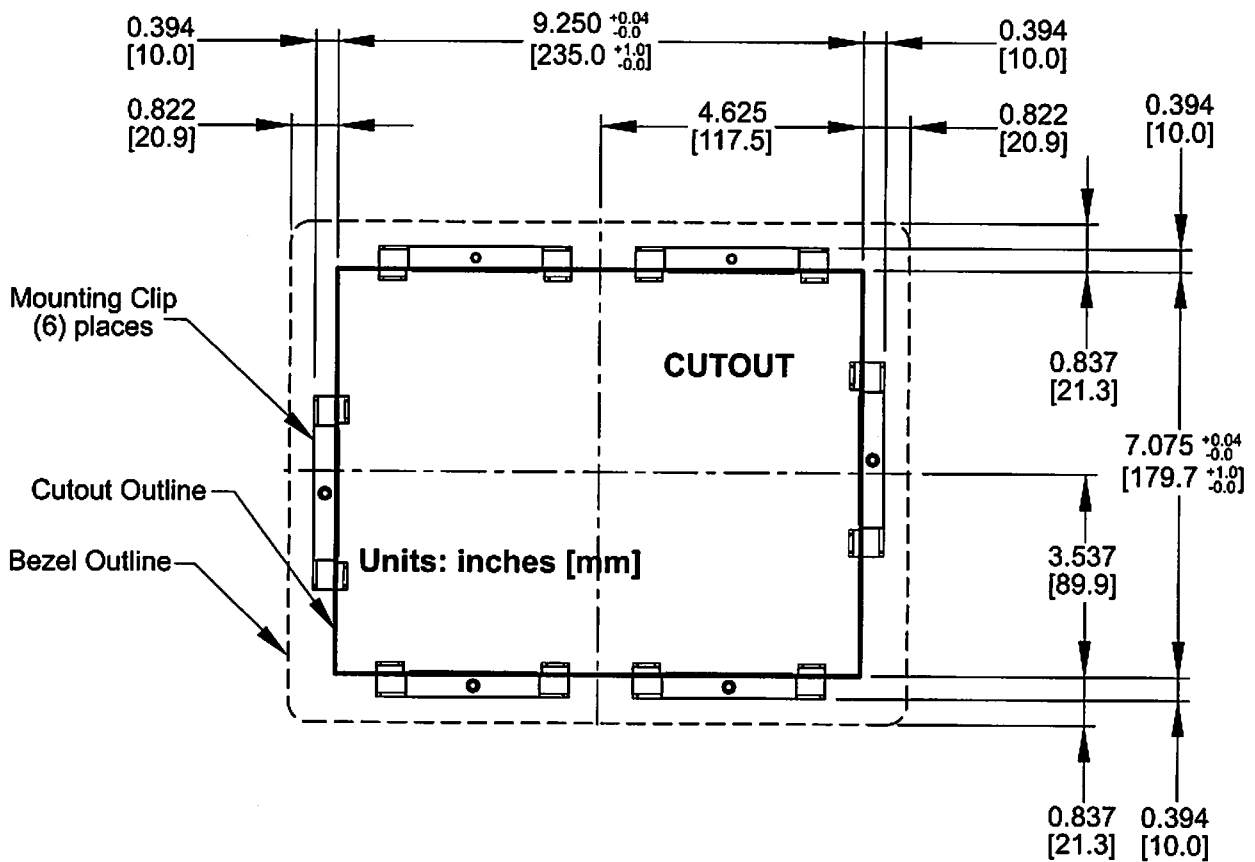
Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
6" – lower mounting clip position	0.039 - 0.24 inch [1 - 6 mm]	35 ~ 50 oz-in [0.25 ~ 0.35 Nm]
6" – upper mounting clip position	0.20 - 0.63 inch [5 - 16 mm]	35 ~ 50 oz-in [0.25 ~ 0.35 Nm]

EA7-T8C – Cutout Dimensions

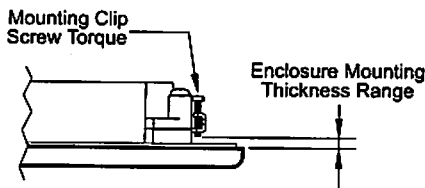
The *C-more* 8" touch panels are mounted into a cutout through the control cabinet and secured with six (6) mounting clips. The mounting clips are provided with the touch panel. The mounting clips will insert into a series of slots around the rear perimeter of the touch panel. Each clip has two tabs that will mate to two slots, using the larger rectangular holes. The mounting clips are held in place by sliding the clip toward the smaller rectangular holes. The screw of each mounting clip needs to be tightened to the torque rating shown in the table below so that the gasket is compressed to form the proper seal between the panel and cabinet surface.



Note: Mount the touch panel on a vertical surface to allow convection air flow for proper cooling.



Enclosure Mounting Thickness Ranges and Mounting Clip Screw Torque

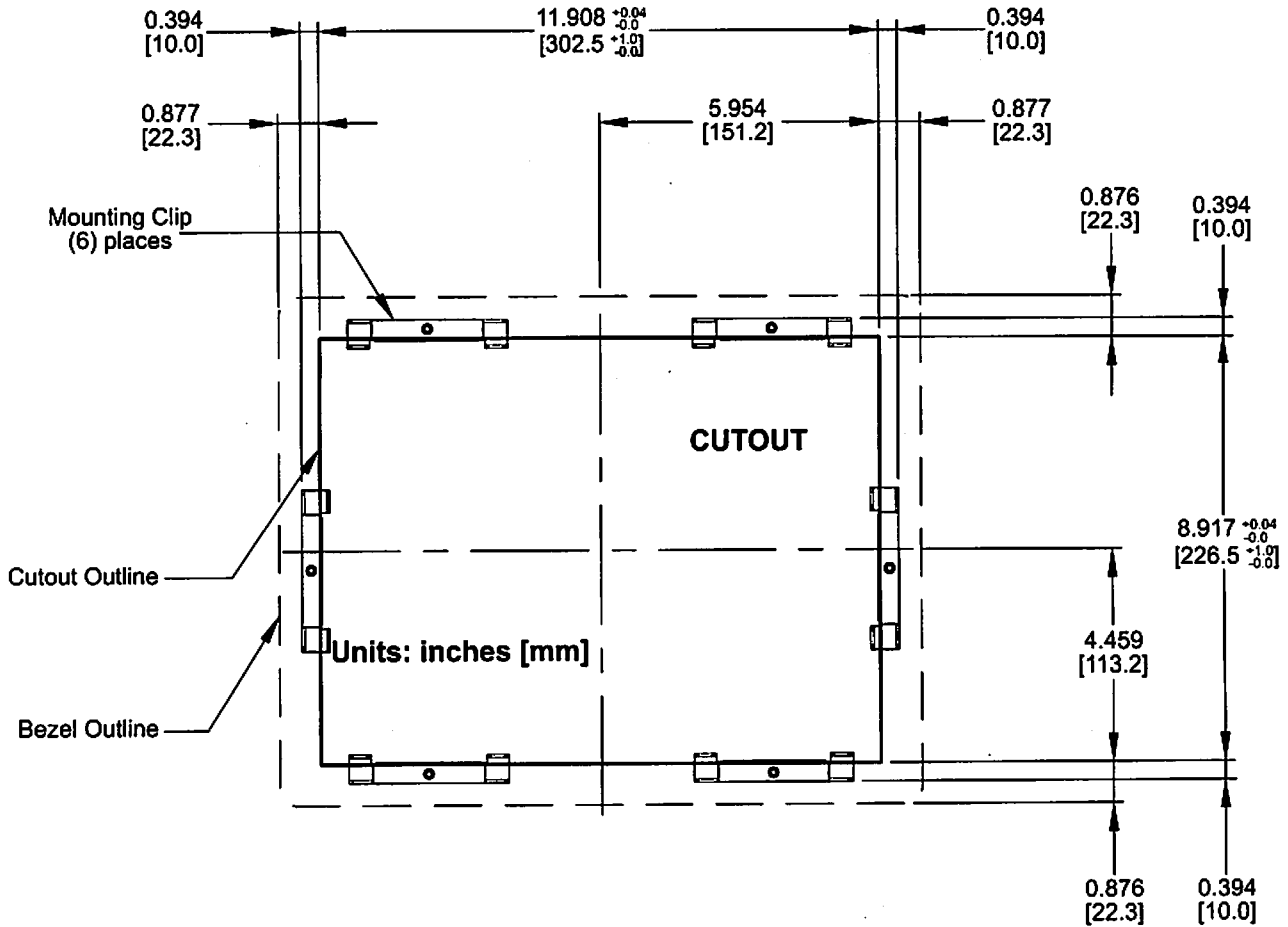


Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
8", 10", 12" & 15"	0.039 - 0.20 inch [1 - 5 mm]	42 ~ 57 oz-in [0.3 ~ 0.4 Nm]

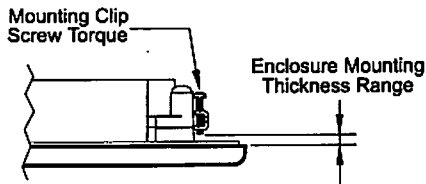
EA7-T10C – Cutout Dimensions

The *C-more* 10" touch panels are mounted into a cutout through the control cabinet and secured with six (6) mounting clips. The mounting clips are provided with the touch panel. The mounting clips will insert into a series of slots around the rear perimeter of the touch panel. Each clip has two tabs that will mate to two slots, using the larger rectangular holes. The mounting clips are held in place by sliding the clip toward the smaller rectangular holes. The screw of each mounting clip needs to be tightened to the torque rating shown in the table below so that the gasket is compressed to form the proper seal between the panel and cabinet surface.

Note: Mount the touch panel on a vertical surface to allow convection air flow for proper cooling.



Enclosure Mounting Thickness Ranges and Mounting Clip Screw Torque



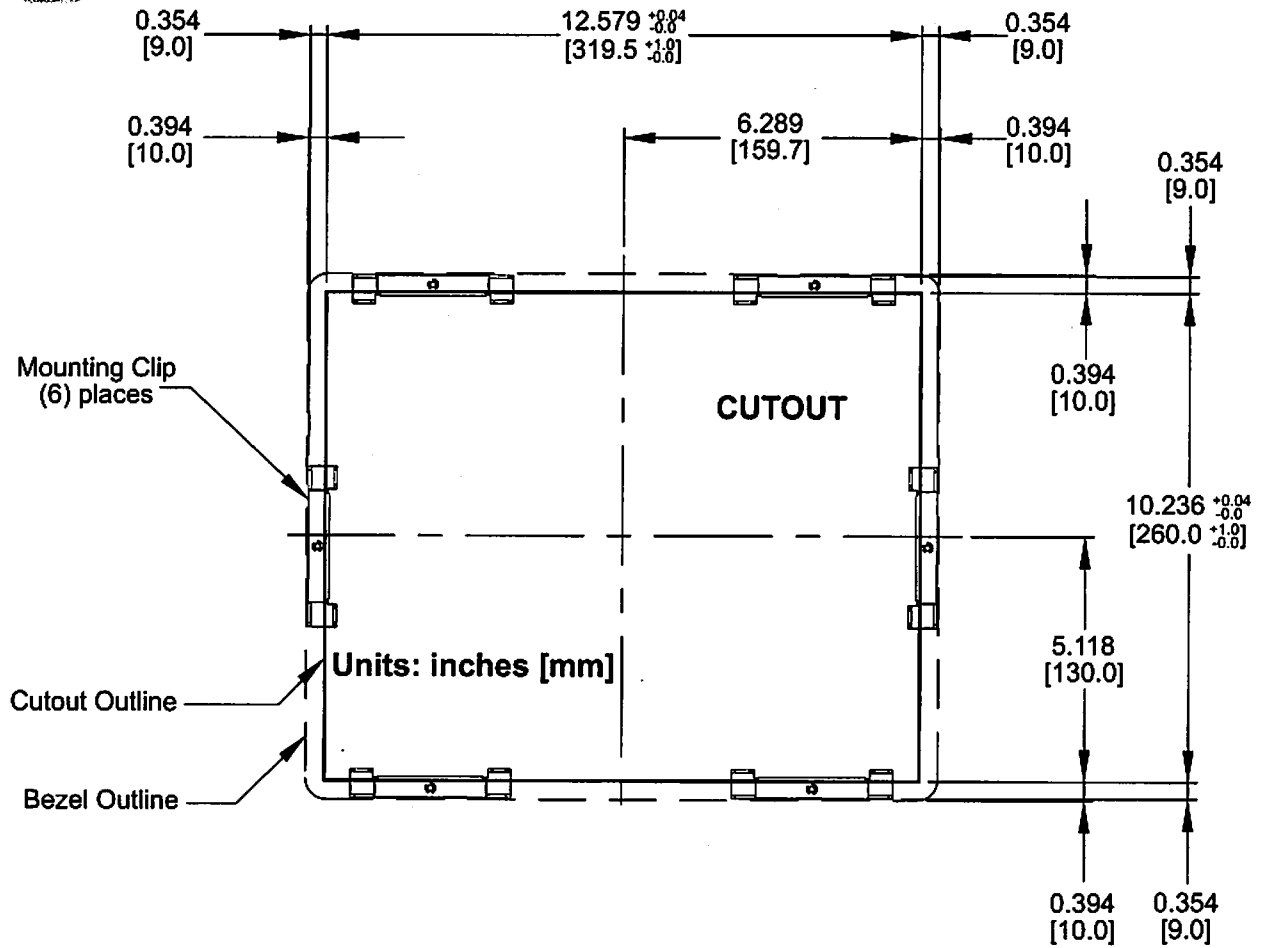
Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
8", 10", 12" & 15"	0.039 - 0.20 inch [1 - 5 mm]	42 ~ 57 oz-in [0.3 ~ 0.4 Nm]

EA7-T12C – Cutout Dimensions

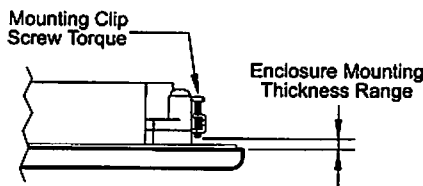
The *C-more* 12" touch panels are mounted into a cutout through the control cabinet and secured with six (6) mounting clips. The mounting clips are provided with the touch panel. The mounting clips will insert into a series of slots around the rear perimeter of the touch panel. Each clip has two tabs that will mate to two slots, using the larger rectangular holes. The mounting clips are held in place by sliding the clip toward the smaller rectangular holes. The screw of each mounting clip needs to be tightened to the torque rating shown in the table below so that the gasket is compressed to form the proper seal between the panel and cabinet surface.



Note: Mount the touch panel on a vertical surface to allow convection air flow for proper cooling.



Enclosure Mounting Thickness Ranges and Mounting Clip Screw Torque

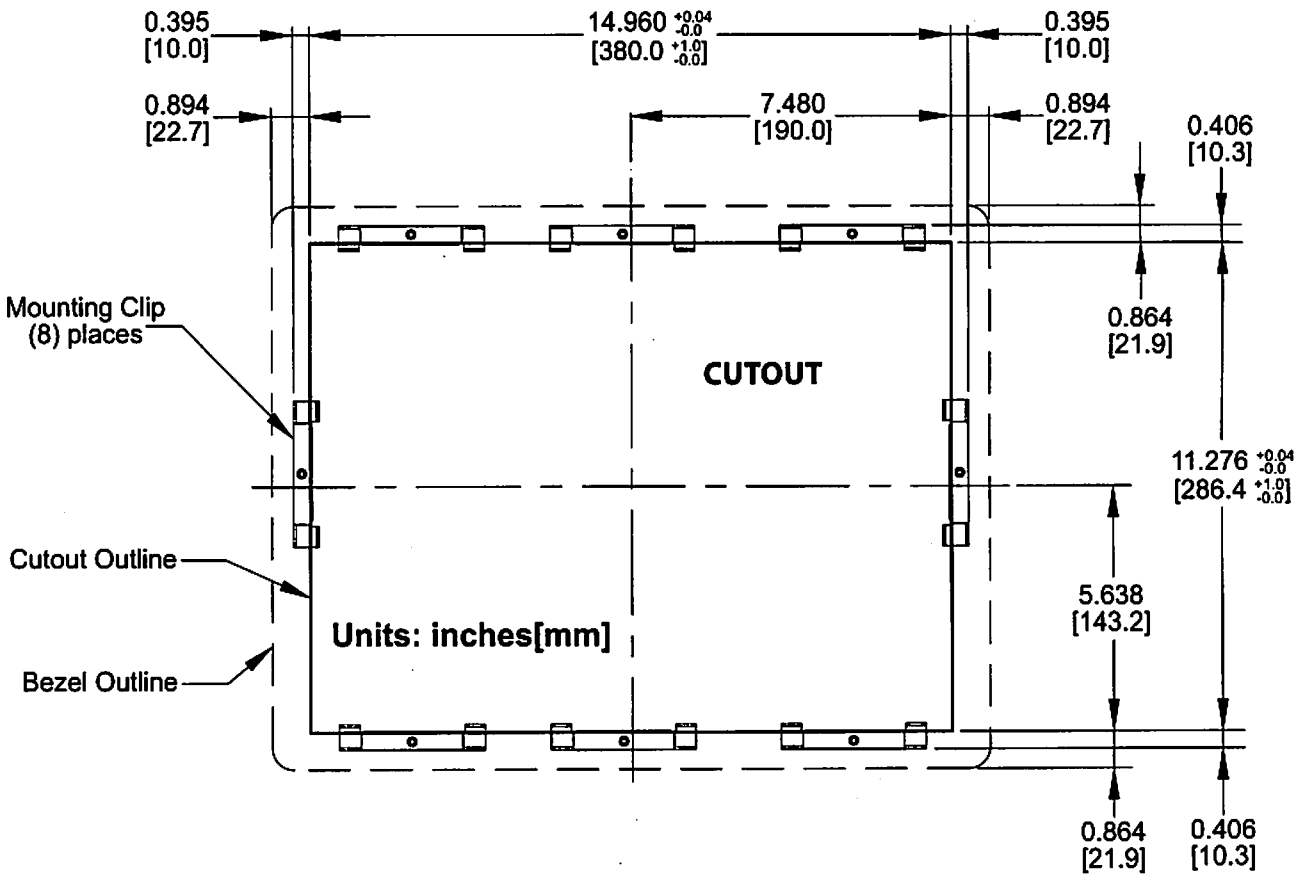


Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
8", 10", 12" & 15"	0.039 - 0.20 inch [1 - 5 mm]	42 ~ 57 oz-in [0.3 ~ 0.4 Nm]

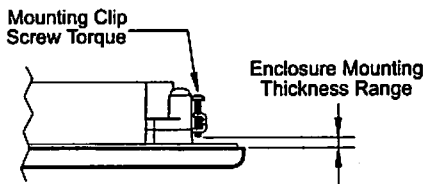
EA7-T15C – Cutout Dimensions

The *C-more* 15" touch panels are mounted into a cutout through the control cabinet and secured with eight (8) mounting clips. The mounting clips are provided with the touch panel. The mounting clips will insert into a series of slots around the rear perimeter of the touch panel. Each clip has two tabs that will mate to two slots, using the larger rectangular holes. The mounting clips are held in place by sliding the clip toward the smaller rectangular holes. The screw of each mounting clip needs to be tightened to the torque rating shown in the table below so that the gasket is compressed to form the proper seal between the panel and cabinet surface.

Note: Mount the touch panel on a vertical surface to allow convection air flow for proper cooling.



Enclosure Mounting Thickness Ranges and Mounting Clip Screw Torque

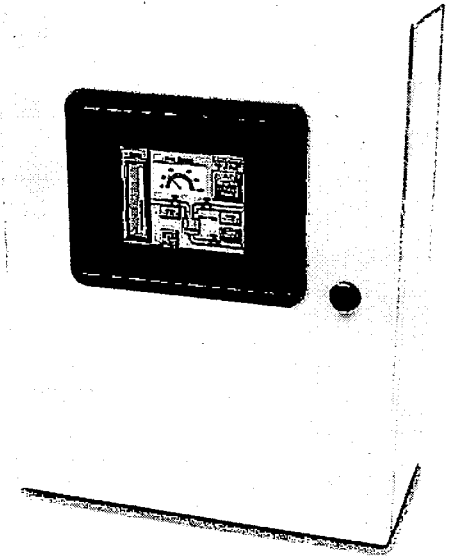
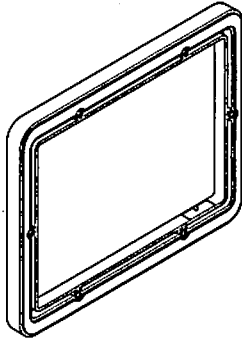


Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
8", 10", 12" & 15"	0.039 - 0.20 inch [1 - 5 mm]	42 ~ 57 oz-in [0.3 ~ 0.4 Nm]

6" Adapter Plate

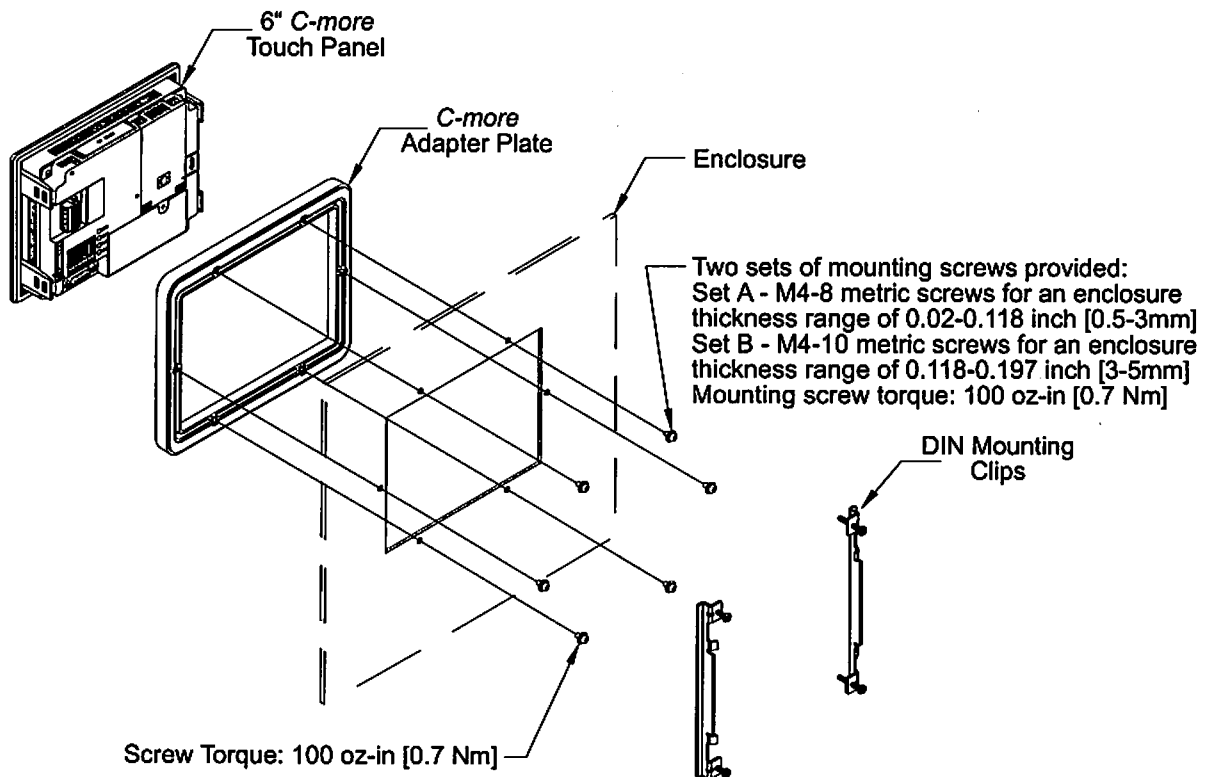
Use the *C-more* 6" Adapter Plate, p/n EA-6-ADPTR, to install a *C-more* 6" touch panel into the existing cutout of an EZTouch 6" non-slim (rounded bezel) touch panel. Gasket and mounting hardware is included.

Part No. EA-6-ADPTR



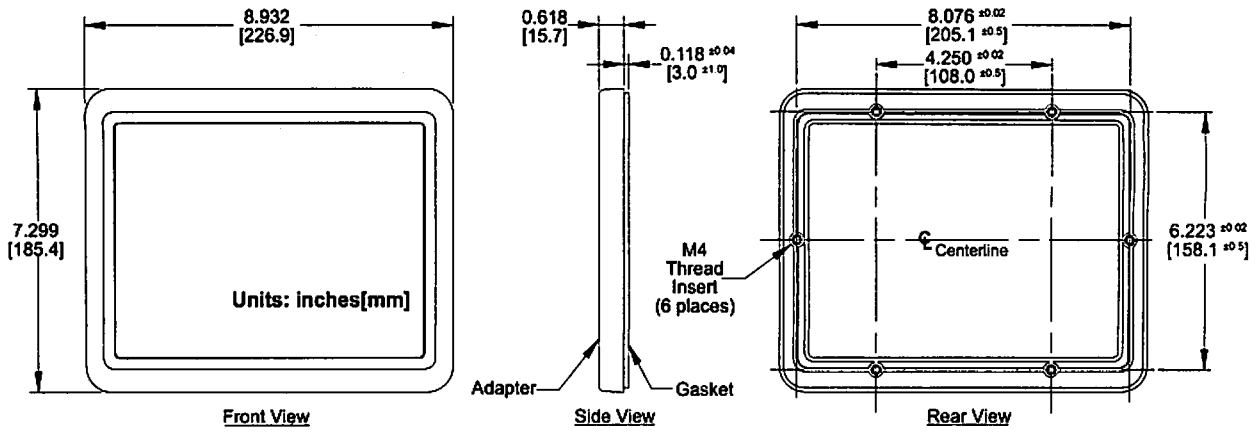
4

6" Adapter Plate Assembly

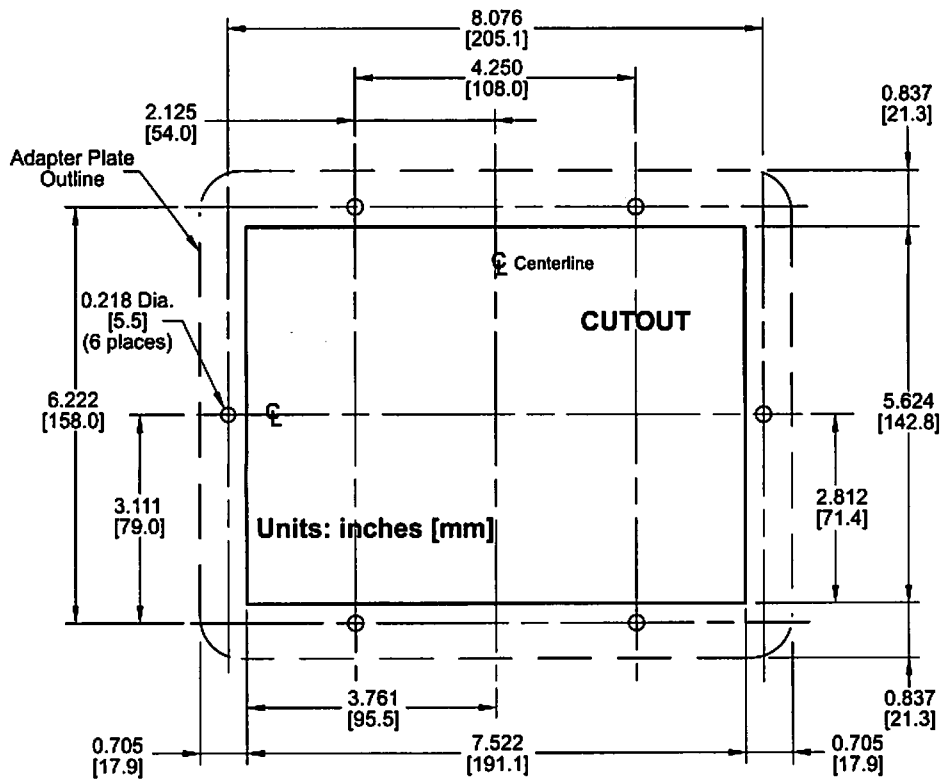


6" Adapter Plate (cont'd)

6" Adapter Plate Dimensions



6" Adapter Plate Cutout Dimensions

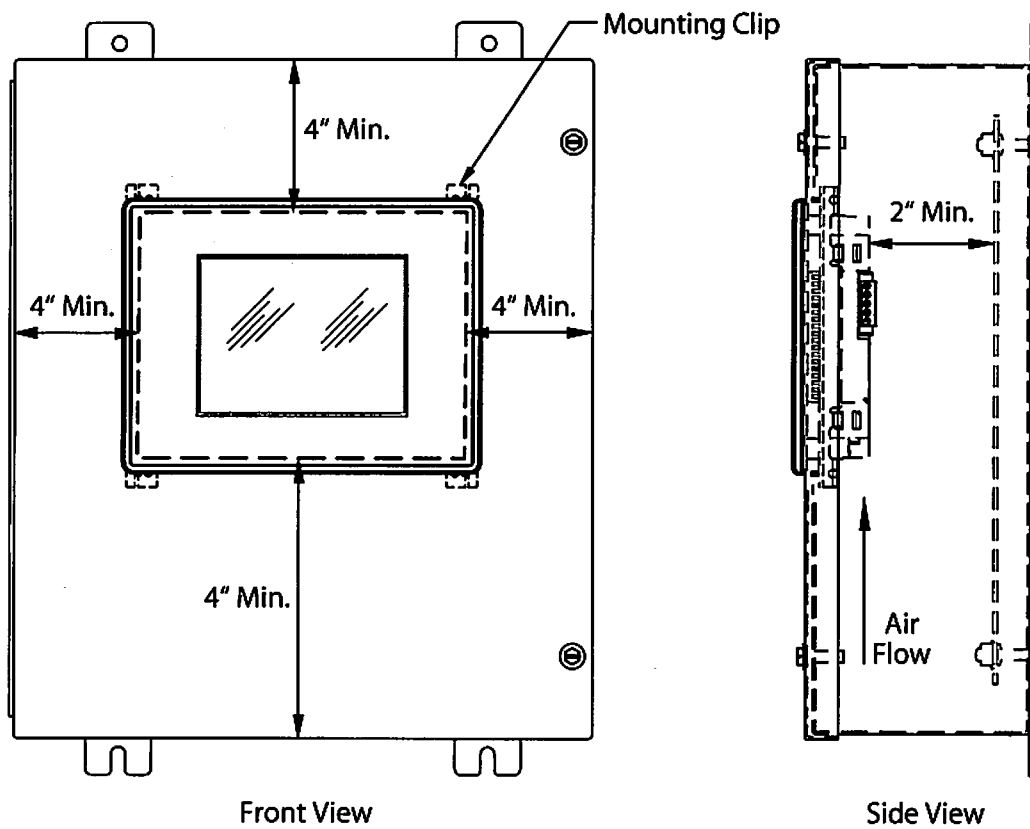


Mounting Clearances

The following drawing shows the mounting clearances for the *C-more* touch panel. There should be a minimum of 4 inches of space between all sides of the panel and the nearest object or obstruction and at least 2 inches between the rear of the panel and the nearest object or obstruction.



Note: Make sure the touch panel is mounted on a vertical surface to allow convection air flow for proper cooling.



Wiring Guidelines



WARNING: To minimize the risk of potential safety problems, you should follow all applicable local and national codes that regulate the installation and operation of your equipment. These codes vary from area to area and it is your responsibility to determine which codes should be followed, and to verify that the equipment, installation, and operation are in compliance with the latest revision of these codes.

Equipment damage or serious injury to personnel can result from the failure to follow all applicable codes and standards. We do not guarantee the products described in this publication are suitable for your particular application, nor do we assume any responsibility for your product design, installation, or operation.

If you have any questions concerning the installation or operation of this equipment, or if you need additional information, please call us at 1-800-633-0405 or 770-844-4200.

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Agency Approvals

Some applications require agency approvals for particular components. The *C-more* touch panel agency approvals are listed below:

- UL (Underwriters' Laboratories, Inc.)
- CUL (Canadian Underwriters' Laboratories, Inc.)
- CE (European Economic Union)

Marine Use

American Bureau of Shipping (ABS) certification requires flame-retarding insulation as per 4-8-3/5.3.6(a). ABS will accept Navy low smoke cables, cable qualified to NEC "Plenum rated" (fire resistant level 4), or other similar flammability resistant rated cables. Use cable specifications for your system that meet a recognized flame retardant standard (i.e. UL, IEEE, etc.), including evidence of cable test certification (i.e. tests certificate, UL file number, etc.).



NOTE: Wiring needs to be "low smoke" per the above paragraph. Teflon coated wire is also recommended.

Wiring Guidelines (cont'd)

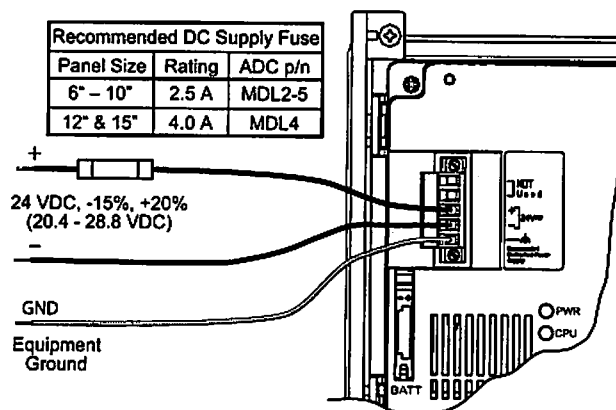
Providing Power to the Touch Panel

- Connect a dedicated 24 VDC (20.4 - 28.8 VDC) switching power supply rated for a minimum of 1.5 A to the DC connector on the rear of the *C-more* touch panel. Connect the ground terminal to a proper equipment ground.
- or install a *C-more* AC/DC Power Adapter (EA-AC) to the rear of the touch panel and connect an AC voltage source of 100-240 VAC, 50/60Hertz, to its AC connector.
- then turn on the power source and check the LED status indicators on the rear of the *C-more* touch panel for proper operation. See the LED Status Indicator diagram on the next page for reference.

4

DC Wiring Diagram

DC Wiring



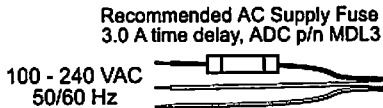
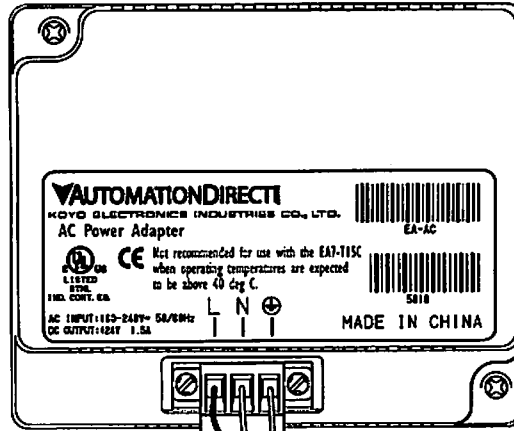
Recommended DC Power Supply:
AutomationDirect Part No. PS24-050D

Wiring Guidelines (cont'd)

AC Wiring Diagram

AC Wiring

AC/DC Power Adapter EA-AC



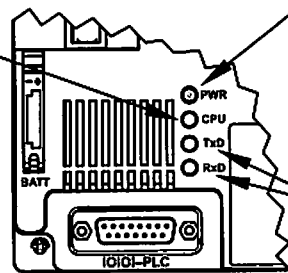
WARNING: The AC/DC Power Adapter is not recommended for use with the EA7-T15C touch panel when operating temperatures are expected to exceed 40 °C [104 °F].



Note: Power Fault features help protect data being logged to CompactFlash during power failures. The C-more panel must have firmware version 1.21 Build 6.18E or higher for proper operation.

C-more LED Status Indicators

CPU Status LED (Green, Orange & Red)	
Off	Power Off
Green	Normal – CPU Run State
Blinking Red	Memory Error
Blinking Red	Operating System not found
Blinking Orange	LCD Backlight Failure
Blinking	Power Loss Detection

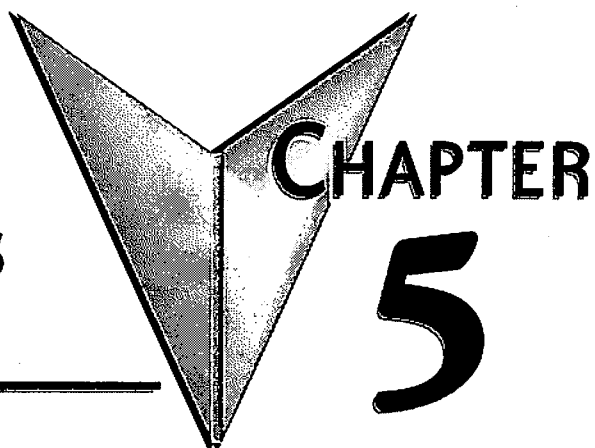


Rear View

Power LED (Green)	
On	Power On
Off	Power Off

Serial TxD/RxD LED (Green)	
On	Comm. is active
Off	No communication

SYSTEM SETUP SCREENS



In This Chapter...

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Memory Menu5-35

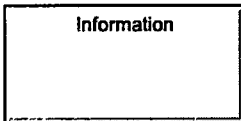
Introduction

The *C-more* touch panels include a series of built-in System Setup Screens that allow the user to view detailed information about the panel, adjust certain features, configure communications, test various functions of the touch panel, backup & restore system, recipe, log and project memory, clear memory, and reset all values and conditions back to the original factory defaults.

The following is presented to give the user a detailed step by step look at 1.) how to access the System Setup Screens, 2.) what adjustments and features are available, 3.) when and why the feature may need to be adjusted or used, and 4.) how to adjust and/or interrupt the features.

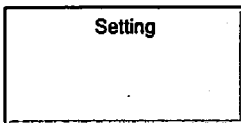
The System Setup Screens from the Main Menu are split into four different categories to make it simple for the user to select the area for viewing information, making adjustments, testing the touch panel or working with the internal and/or external memory options. The four Main Menu selections are:

Information



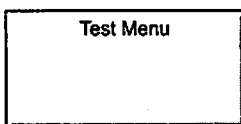
Here you will find detailed information in regards to the touch panel model, the panel's name, version information for the hardware, boot loader and firmware, clock source, battery status and beeper status. Also available are details on the panel's internal memory and the status of any external memory devices, such as CompactFlash memory and USB pen drives. Communication port details are also available in this area, as well as an error log to help in trouble-shooting the system.

Setting



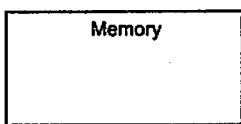
This is the area for 1.) making adjustments to the internal clock, 2.) adjusting the brightness and contrast of the display (There are some differences of what can be adjusted between the STN and TFT type displays, see details later in this chapter.), 3.) adjusting (calibrating) the touch panel, 4.) enabling or disabling the internal beeper, and 5.) the IP Address of the touch panel can also be configured from this menu area. Access to the IP Address Setting screen is covered later in this chapter.

Test Menu



From this sub menu, the user can 1.) test the touch panel, 2.) test the display, 3.) test the communication ports, and 4.) test both the internal beeper or the audio line output, if a speaker with an amplifier is connected. A WAV sound file is system provided for the audio line output test.

Memory

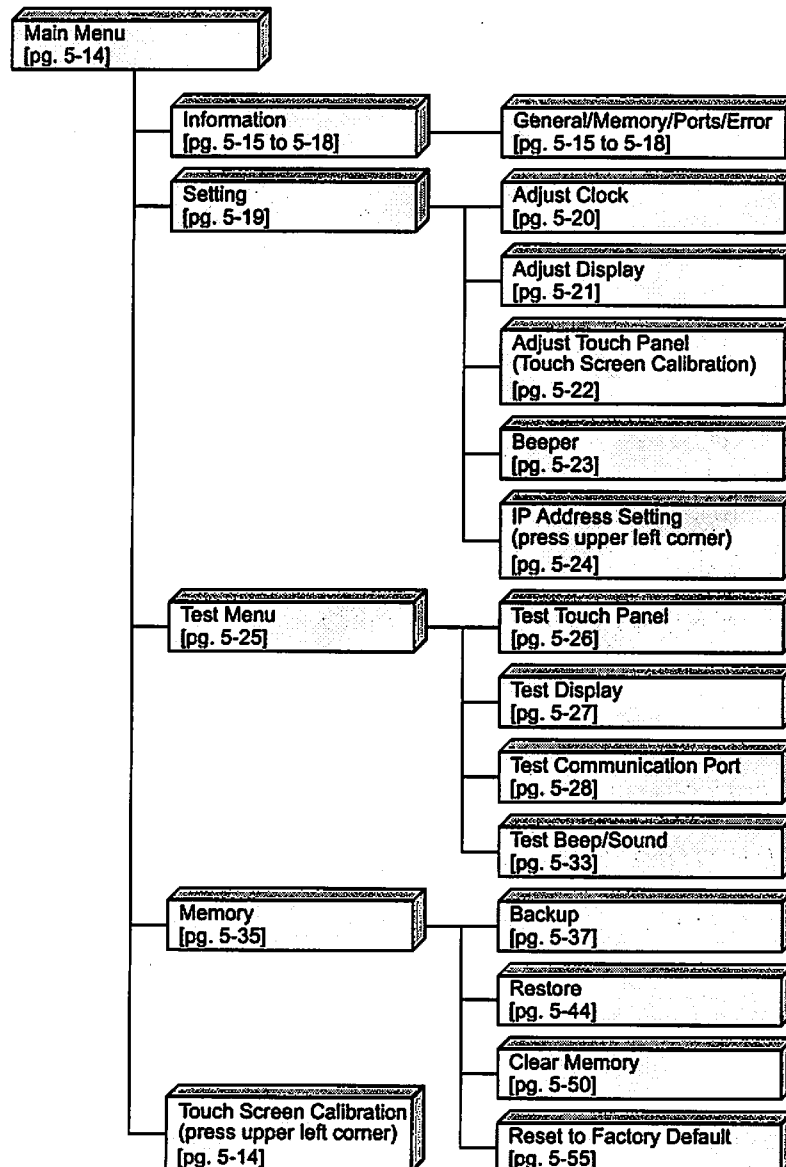


Select the Memory menu item to either backup or restore your project, log data, recipe data and/or system memory. Selections can be made to backup to optional CompactFlash memory or USB pen drive memory. The menu selections also give the user the ability to clear the memory, and there is also a selection to reset all of the touch panel settings back to the original factory defaults.

Chapter Organization

The System Setup Screens chapter is organized in the following order:

- 1.) Accessing the system setup screens with no project loaded will take the user directly to the Main Menu – page 5-4.
- 2.) Accessing the system setup screens with a project loaded will first take the user to a dialog box warning the user that the panel will stop running and waits for an acknowledgement – page 5-5.
 - a.) If a password is not enabled, the user is taken directly to the Main Menu after the warning message is acknowledged – page 5-6.
 - b.) If a password is enabled, then the Enter Security Code keypad is presented after the warning message is acknowledged – page 5-6.
- 3.) How to enable a password in the *C-more* Programming software is explained – page 5-7.
- 4.) System Setup Screens organized as shown in the following flowchart:

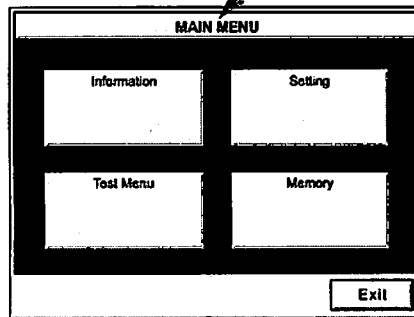
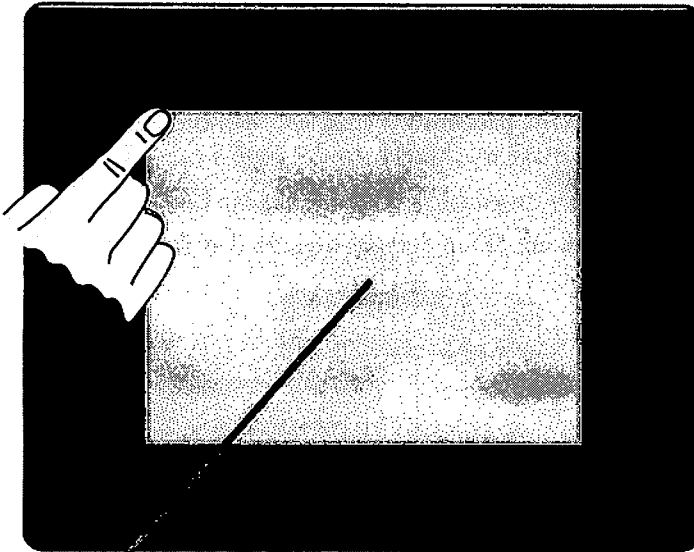


Accessing the System Setup Screens (no project loaded)

To access the Main Menu of the touch panel System Setup Screens prior to downloading a project, press the extreme upper left corner of the panel display area for 3 seconds as shown below. The Main Menu will then be displayed as shown below.

5

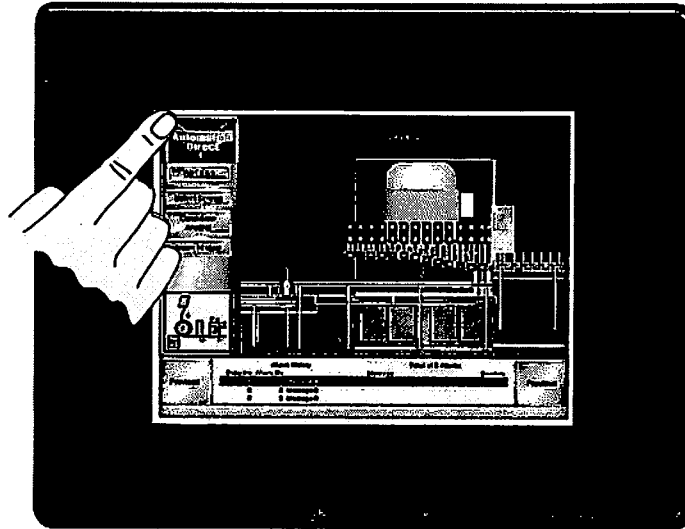
Press in the extreme upper left corner for 3 seconds to bring up the System Setup Screens' Main Menu.



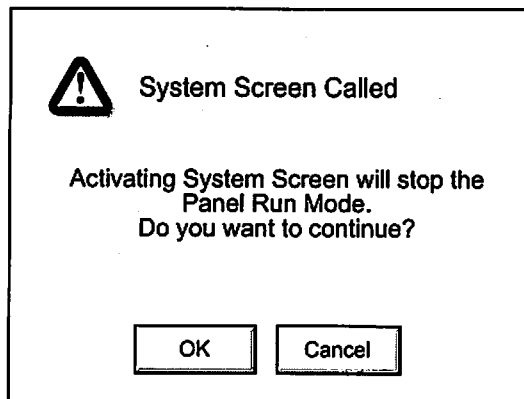
NOTE: The ability to directly activate the **Main Menu** of the **System Setup Screens** by pressing the upper left corner of the touch panel for 3 seconds will only occur when there is no project loaded into the memory of the panel. Refer to the next section on accessing the **System Setup Screens** with a project loaded for procedure details and recommendations.

Accessing the System Setup Screens (with project loaded)

To access the Main Menu of the touch panel System Setup Screens with a project loaded into memory, press the upper left corner of the panel display area for 3 seconds as shown below.



The following WARNING dialog box will appear on the touch screen.



Dialog Box Actions:

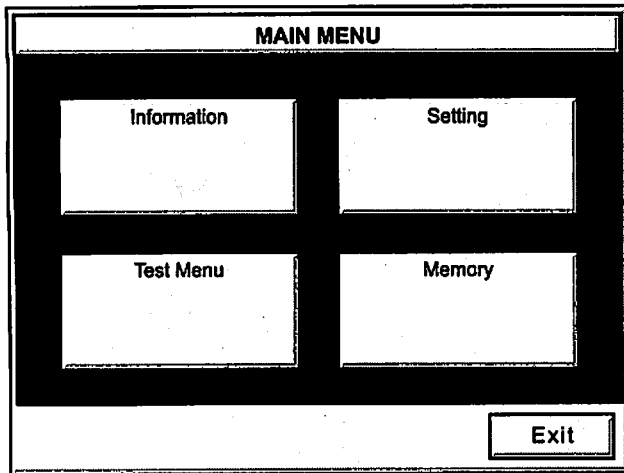
- Pressing OK will display the system setup screen. See the WARNING below!
- Pressing Cancel will take you back to the project screen.
- Communications with the PLC is active while the Warning is displayed.
- The dialog box will close if no action is taken for 60 seconds.
- The dialog box will not display if the touch panel does not have a project loaded.
- The dialog box will not display if the System Screen password is enabled.



WARNING: Pressing OK at this point will STOP the PLC driver and therefore all communications between the touch panel and PLC will cease. It is strongly recommended that the password system tag "SYS SYSTEMSCREENPW" be enabled to add a safeguard step in accessing the system setup screens. See the next section for a quick overview for setting the System Tags in the Event Manager Database.

System Setup Screens (no password enabled)

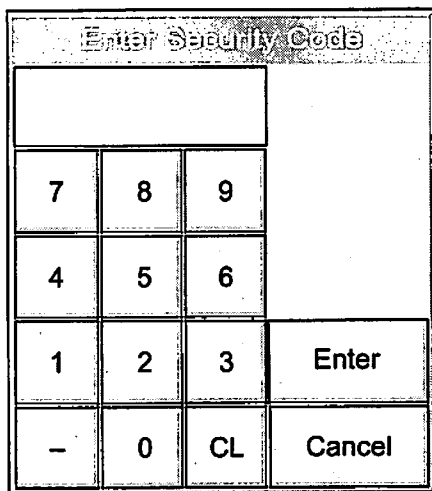
If no password is enabled for the system setup screens, then pressing the OK button in the Warning dialog box will bring up the Main Menu as shown below. You can then proceed to the other system setup screens.



System Setup Screens (password enabled)

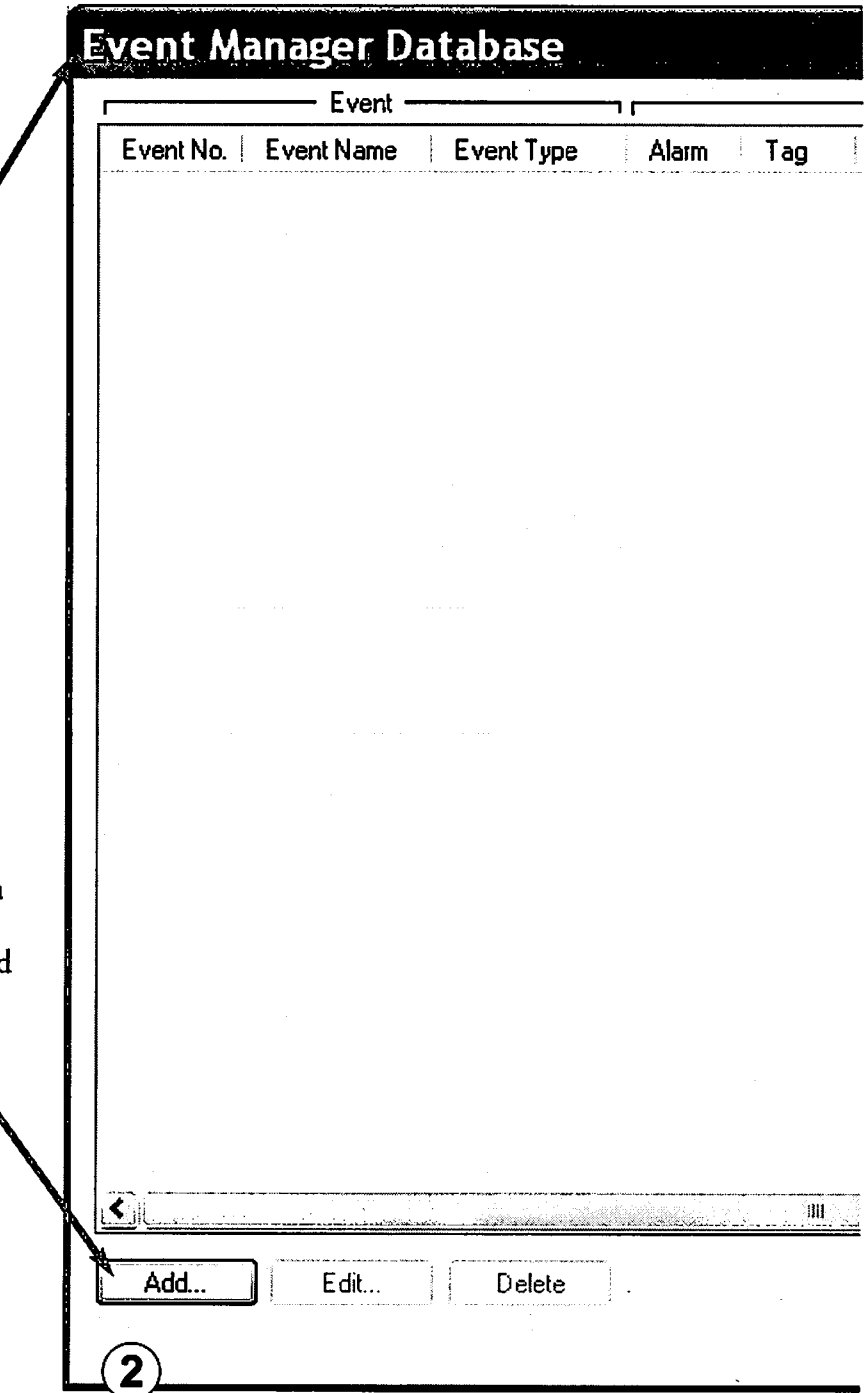
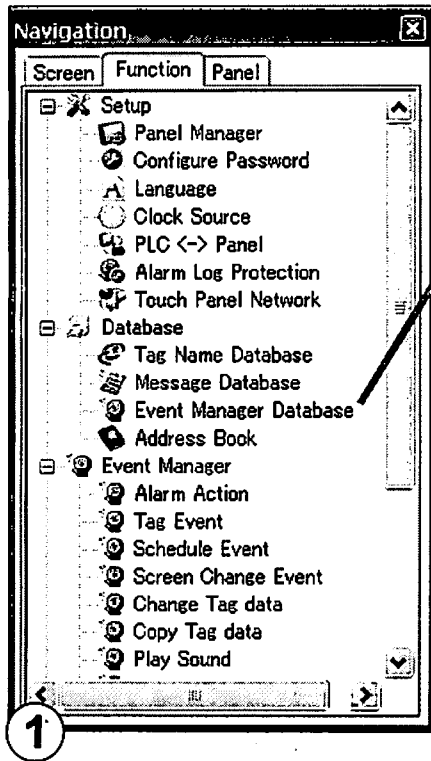


NOTE: If the password system tag **SYS SYSTEMSCREENPW** is enabled, procedure described on the next page, then the **Enter Security Code** keypad shown below will be displayed. Entering the correct password code will then bring up the **Main Menu** system setup screen. If the wrong password code is entered, the keypad clear from its display the value entered and will stay present until the correct value is entered or the **Cancel** key is pressed.



System Setup Screens – Enable Password in Software

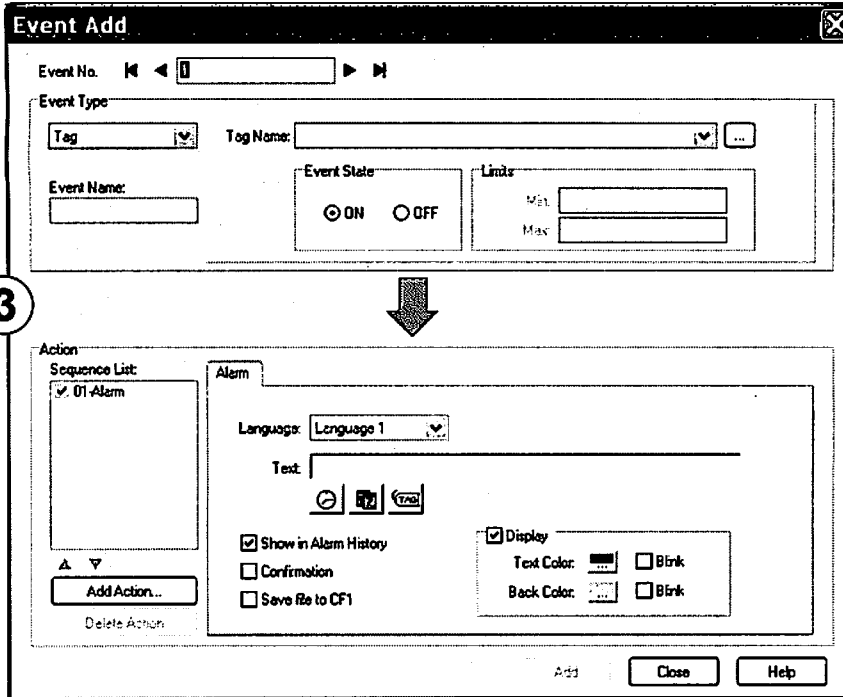
Under the C-more Programming Software's Navigation window, select the Function tab, then select the Event Manager's Database function to display the Event Manager Database shown below:



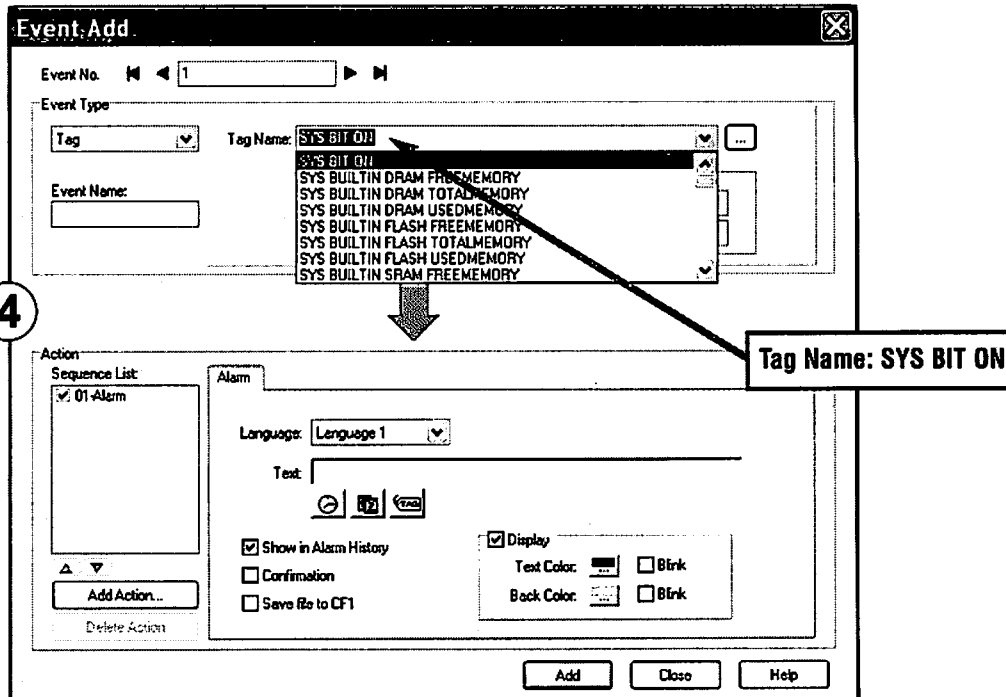
Click on the Add button to add an event to the database that will be used to enable the System Screen Password.

System Setup Screens – Enable Password (cont'd)

The Event Add dialog box will be displayed as shown next:



Click on the Tag Name: pull down menu and select the internal System Bit On (SYS BIT ON) tag as shown. This will force the tag event type to be continuously active.



System Setup Screens – Enable Password (cont'd)

Use the Event Name: text box to document the event as “System Screen PW” for record keeping. This is optional.

In the Action box, click once on the displayed 01-Alarm under the Sequence List: so that 01-Alarm is highlighted. Then click the Delete Action button to remove the 01-Alarm.

5

Event Add

Event No. 1

Event Type

Tag: Tag Name: SYS BIT ON

Event Name: System Screen PW

Event State: ON OFF

Limits: Min: Max:

Sequence List

- 01-Alarm

Language: Language 1

Text:

Show in Alarm History

Confirmation

Sequence to CF1

Display

Text Color: Blink

Back Color: Blink

Add Action... Delete Action

Add Close Help

Event Name:

Delete Action

6

Event Add

Event No. 1

Event Type

Tag: Tag Name: SYS BIT ON

Event Name: System Screen PW

Event State: ON OFF

Limits: Min: Max:

Sequence List

Add Action... Delete Action

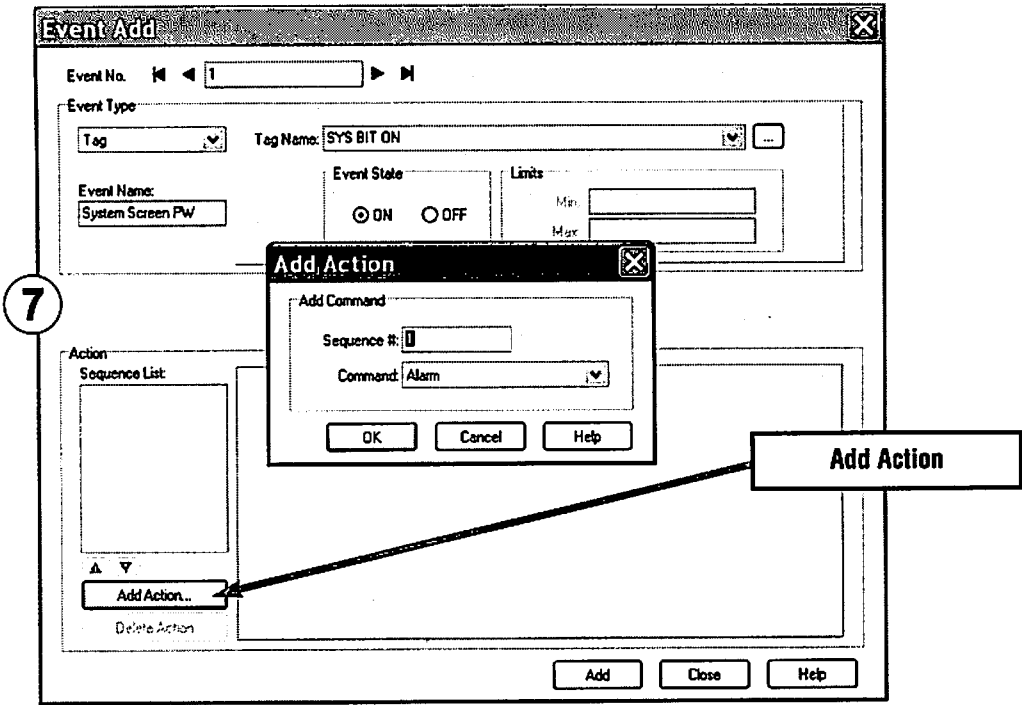
Add Close Help

The Sequence List will now be cleared out.

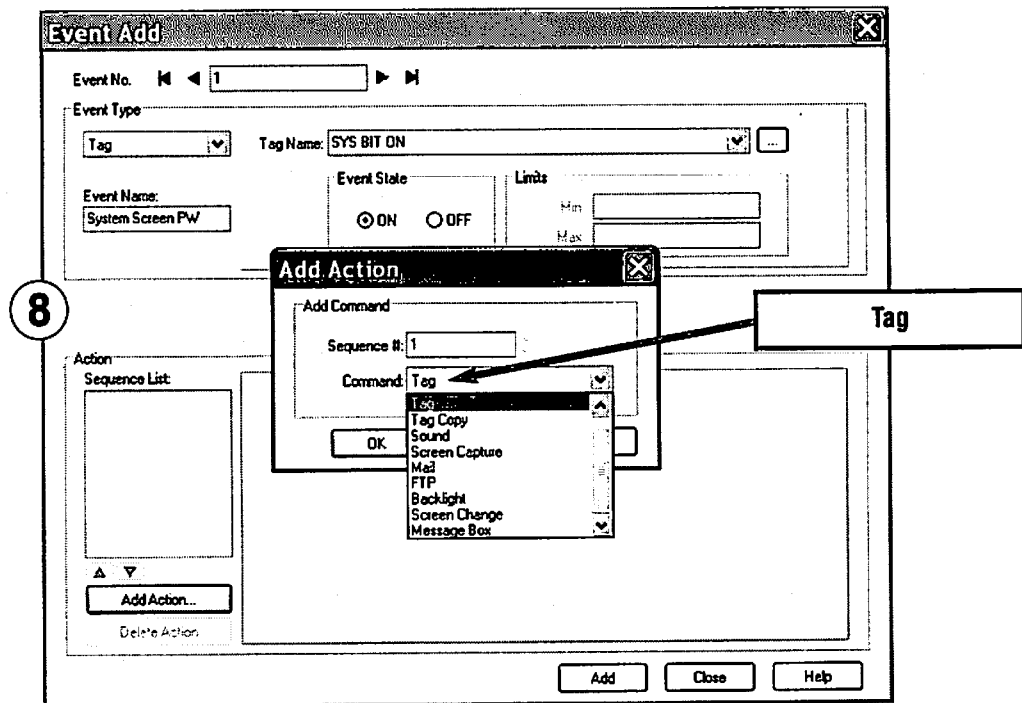
System Setup Screens – Enable Password (cont'd)

In the Action box, click on the Add Action... button. This will bring up the Add Action dialog box as shown below:

5

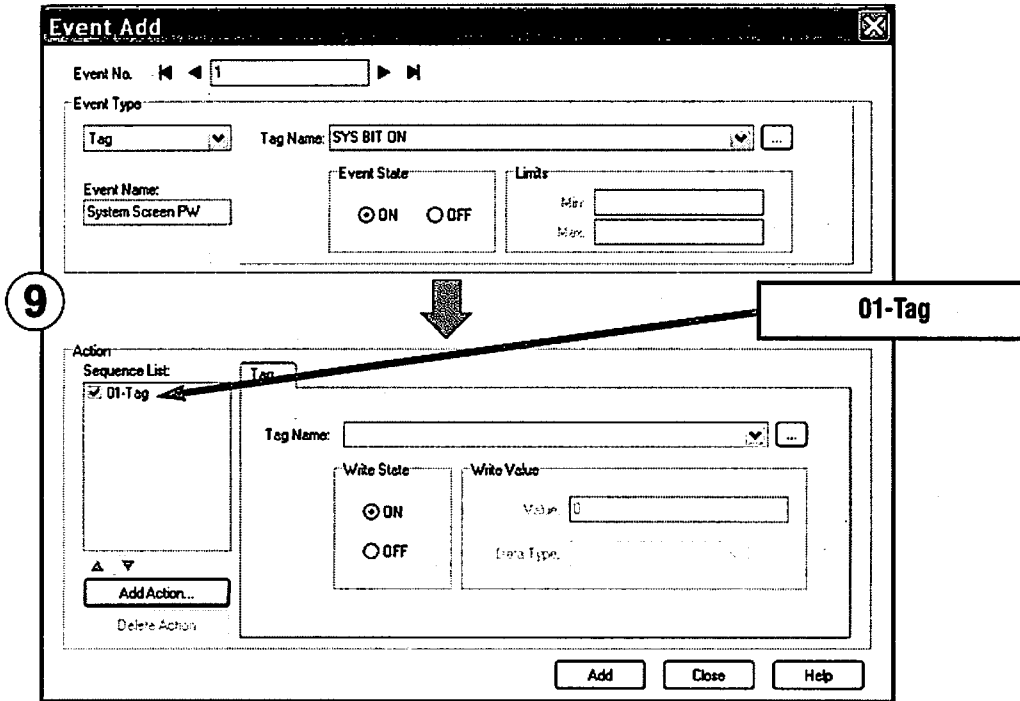


Click on the Command: pull down list in the Add Command box, select Tag from the list, then click OK.



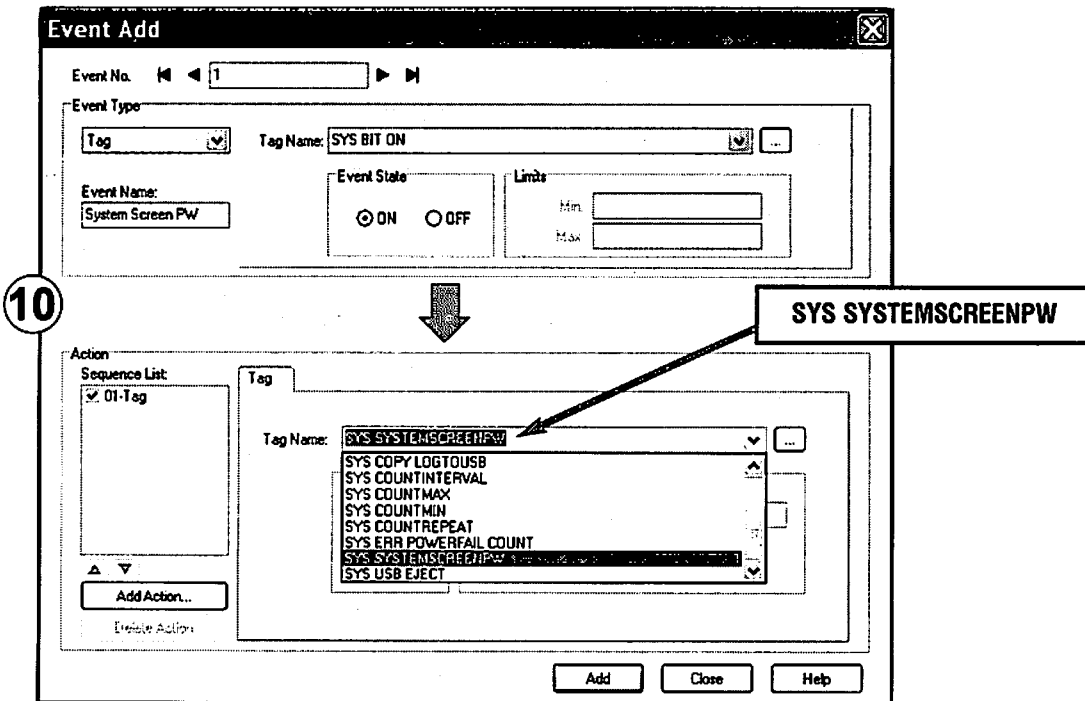
System Setup Screens – Enable Password (cont'd)

A 01-Tag action item will then be added to the Sequence List.



5

Click on the Tag Name: pull down list down arrow in the Action box's Tag tab, select SYS SYSTEMSCREENPW from the list, and click OK.



System Setup Screens – Enable Password (cont'd)

Enter a numeric value into the Value: box, such as “777”. This value becomes the Password code to access the System Setup Screen’s Main Menu.

5

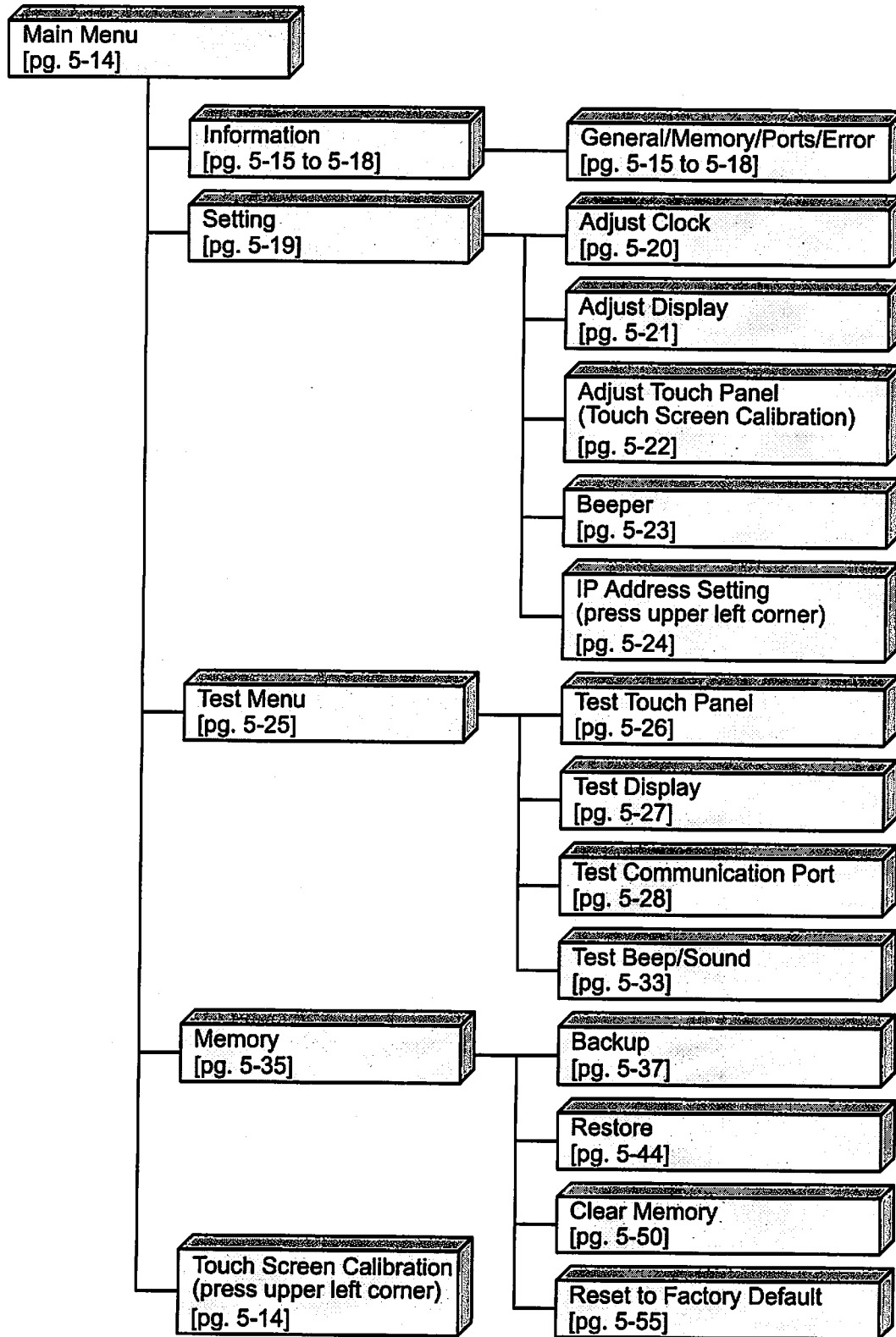
11

Click the Add button in the Event Add dialog box and then the Close button to return to the Event Manager Database. You now will see that the first event in the database is for the System Screen Password and it is enabled.

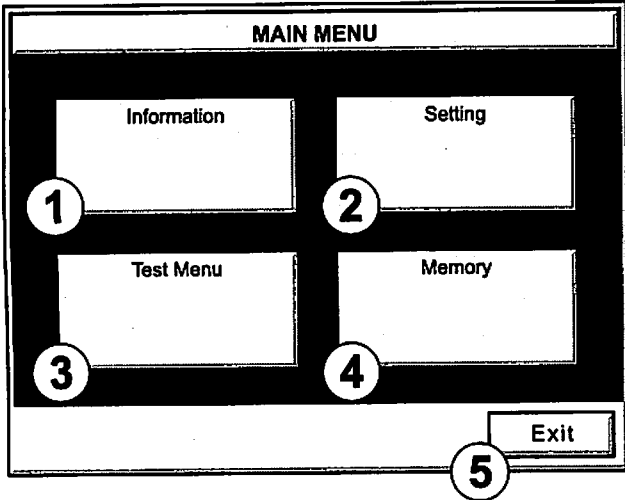
12

Event Manager Database						
Event						
Event No.	Event Name	Event Type	Alarm	Tag	Tag Copy	Sound
1	System Scre...	Tag		Yes		

System Setup Screens Flowchart



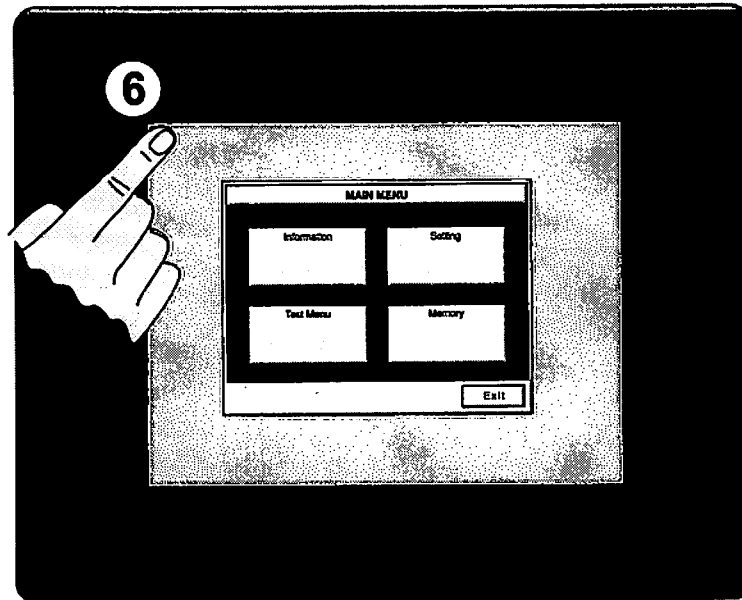
Main Menu



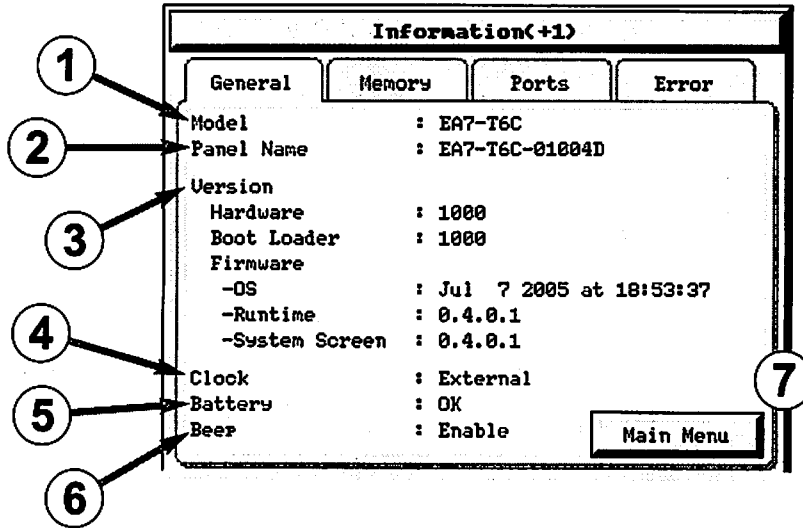
The Main Menu system setup screen is the top layer in the menu structure.

The menu is displayed at full screen on the 6 inch touch panel models. It is displayed in the center on the 8, 10, 12, or 15 inch models.

Item No.	Function	Description	Comment
1	Information	Press to go to the Information Menu.	
2	Setting	Press to go to the Setting Menu.	
3	Test Menu	Press to go to the Test Menu.	
4	Memory	Press to go to the Memory Menu.	
5	Exit	Press to return to the user screen.	
6	Touch Screen Calibration	While the Main Menu system setup screen is being displayed, the extreme upper left corner of the touch panel can be pressed for 3 seconds to access the Touch Screen Calibration display.	This feature is only used if the touch panel data becomes corrupted and touching the Main Menu buttons does not work. It allows a shortcut to the touch panel calibration screen.



Information Menu – General tab

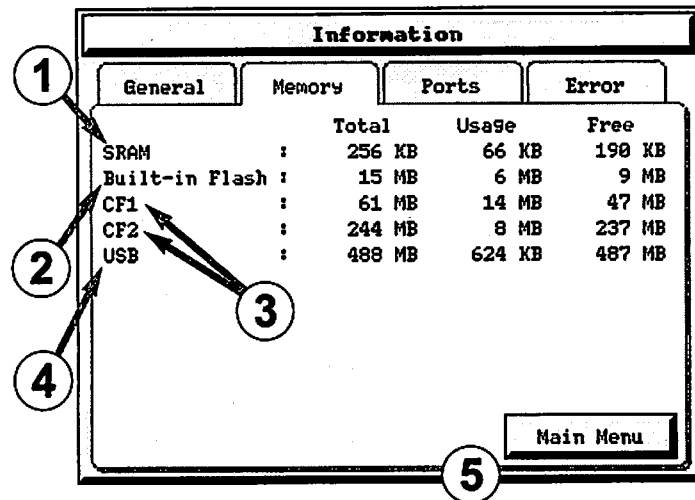
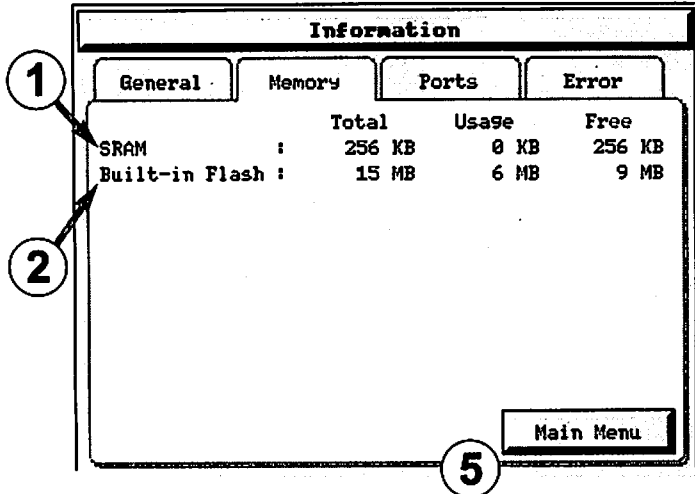


The General tab under the Information menu provides detailed information of the *C-more* Touch Panels model, Panel Default Name based on Model type and MAC address, hardware, boot loader and firmware versions, etc.

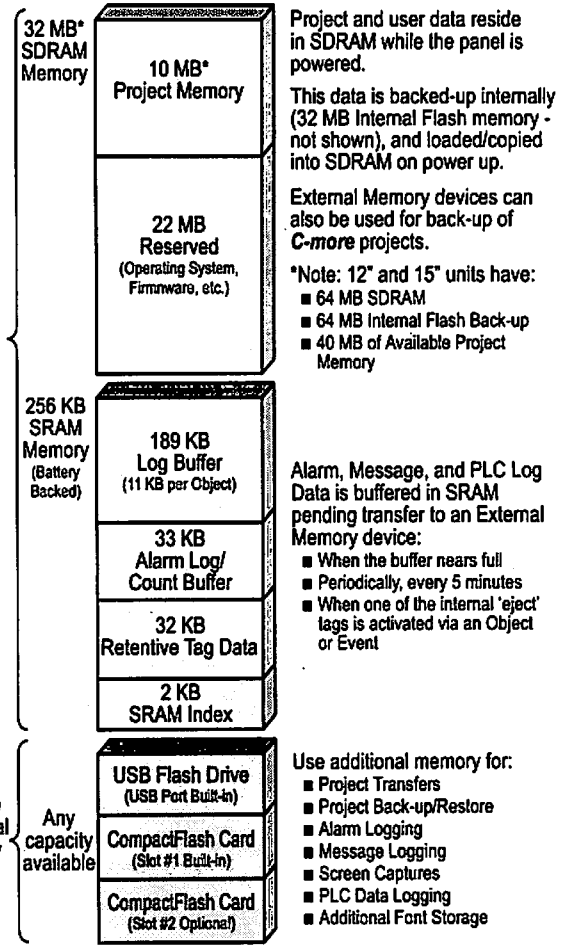
5

Item No.	Function	Description	Comments
1	Model	EA7-S6M-R, EA7-S6C-R, EA7-S6M, EA7-S6C, EA7-T6C, EA7-T8C, EA7-T10C, EA7-T12C, EA7-T15C	
2	Panel Default Name	[Model Name]-01XXXX "01 XXXX" is the lower 3 bytes of the Mac Address MAX: 15 characters (15 bytes)	e.g. EA7-S6M-01004D This is the default name. The name can be changed in the <i>C-more</i> Programming Software.
3	Version	1.)Hardware: XXXX 2.)Boot loader: XXXX 3.)Firmware a) OS:Timestamp of NK.BIN file b) Runtime: X.X.X.X (Version of Runtime.EXE file) c) System Screen: X.X.X.X (Version of Panel.exe file)	Files reside in the <i>C-more</i> touch panel's memory.
4	Clock	Internal/External clock selection.	Configured in the <i>C-more</i> Programming Software.
5	Battery	Battery status, either OK or Battery Low.	
6	Beep	Enable/Disable the internal beeper.	Configurable in the Setting Menu – Beeper shown on page 5-23 or in the <i>C-more</i> Programming Software.
7	Main Menu	Press to return to the Main Menu screen.	Main Menu shown on page 5-14.

Information Menu – Memory tab

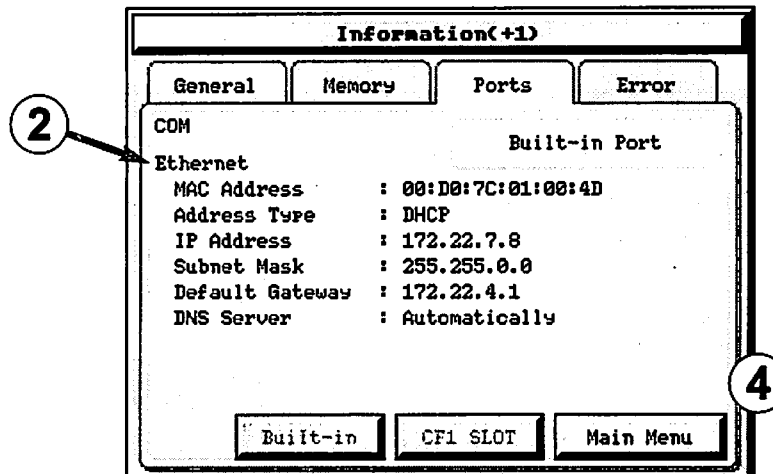
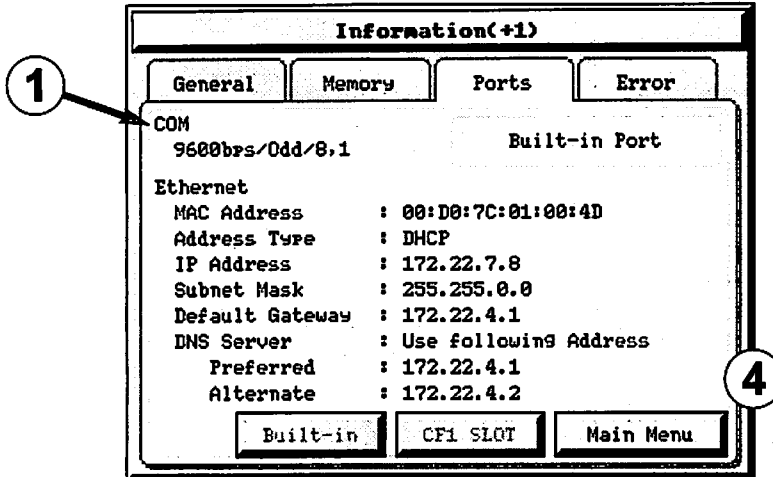


C-more Memory Organization



Item	Function	Description	Comment
1	SRAM System Memory	1.) Total: 2.) Usage: 3.) Free:	Size of unit displayed: 1.) KB When size is 1 to 999 bytes. It will be shown as 1KB. 2.) KB or MB 3.) MB or GB
2	Built-in Flash Memory	1.) Total: 2.) Usage: 3.) Free:	
3	Expansion Memory 1.) CF1: 2.) CF2: (only visible when present)	1.) Total: 2.) Usage: 3.) Free: Note: N/A - not available on base featured models (-R)	
4	Expansion Memory 3.) USB: (only visible when present)	1.) Total: 2.) Usage: 3.) Free:	
5	Main Menu	Press to return to the Main Menu screen.	

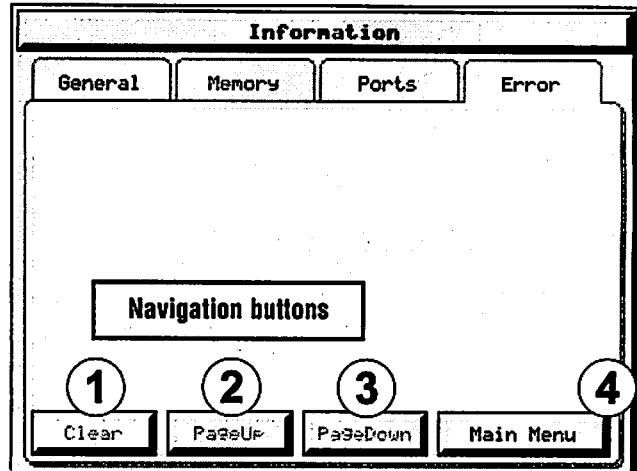
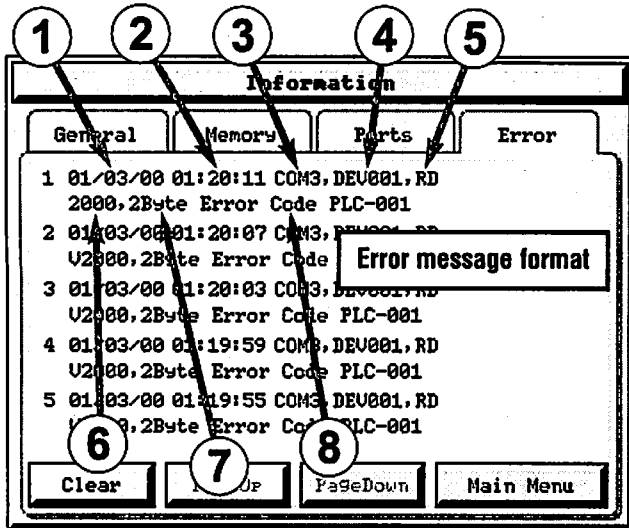
Information Menu – Ports tab



5

Item No.	Function	Description	Comment
1	COM (Built-in Ports)	PLC Serial Communications Port Settings: baud rate/party/data bit, stop bit	Configured in the <i>C-more</i> Programming Software.
2	Ethernet (Built-in Ports)	Ethernet Settings: MAC Address: 00 D0 7C 01 XX XX Address Type: DHCP/Static IP Address: Subnet Mask: Default Gateway: DNS: 1.) Automatically 2.) Use Designated Address Note: N/A - not available on base featured models (-R)	Configurable in the Setting Menu – IP Address Setting shown on page 5-24 or in the <i>C-more</i> Programming Software.
3	Ethernet (CF1 Slot)	Future	Future
4	Main Menu	Press to return to the Main Menu screen.	

Information Menu – Error tab



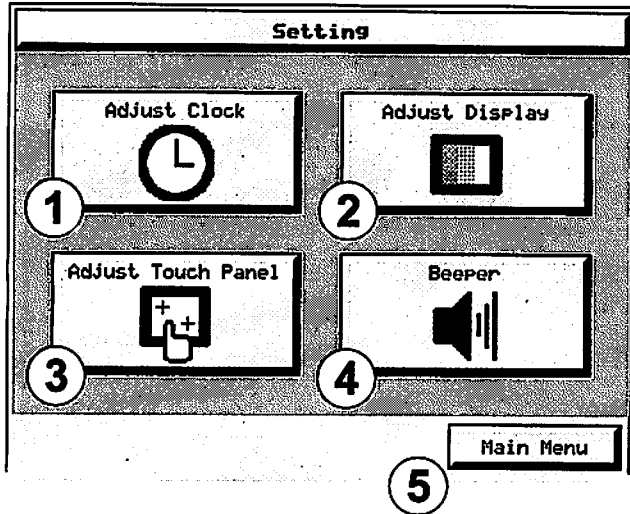
Error message format:

Item No.	Function	Description	Comment
Order of error message functions: Error Number, Date, Time, Error Port, Device Name, Error Type, PLC Device, Access Bytes, Error Message			
1	Date	Format: MM/DD/YY	Date error occurred.
2	Time	Format: HH/MM/SS	Time error occurred.
3	Error Port	PLC Serial Communications Port: Ethernet:	
4	Device Name	The assigned device name in the programming software.	Configurable in the <i>C-more</i> Programming Software Panel Manager
5	Error Type	RD: Read WT: Write	
6	PLC Address	The assigned address of the PLC that caused the error.	
7	Access Bytes	The number of access bytes.	
8	Error Message	The error message is the same as the message displayed in the upper left of the <i>C-more</i> touch panel's display.	A list of Error Messages is shown in Appendix A

Error message navigation buttons:

Item No.	Function	Description	Comment
1	Clear	Press to clear all error messages. This button is grayed out when there are no error messages to display.	
2	Page Down	Press to go to the next page. This button is grayed out when there are no error messages on the next page.	
3	Page Up	Press to go to the previous page. This button is grayed out when there are no error messages on the previous page.	
4	Main Menu	Press to return to the Main Menu screen.	

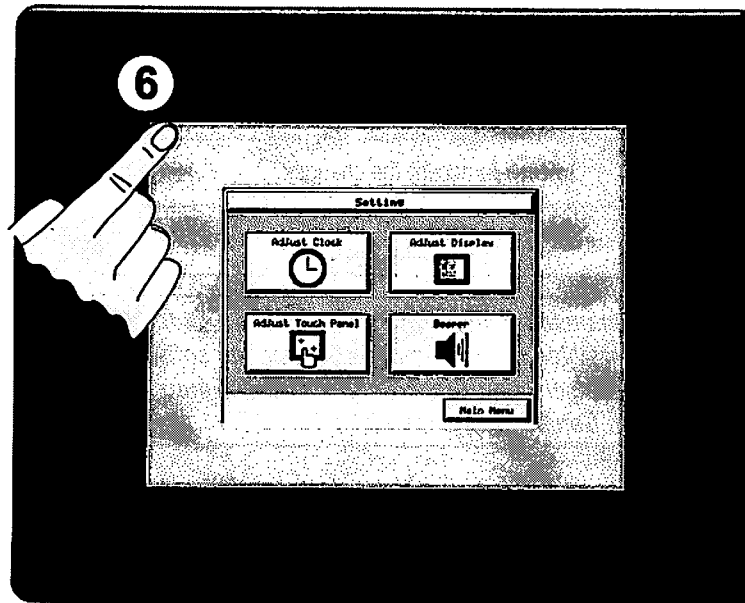
Setting Menu



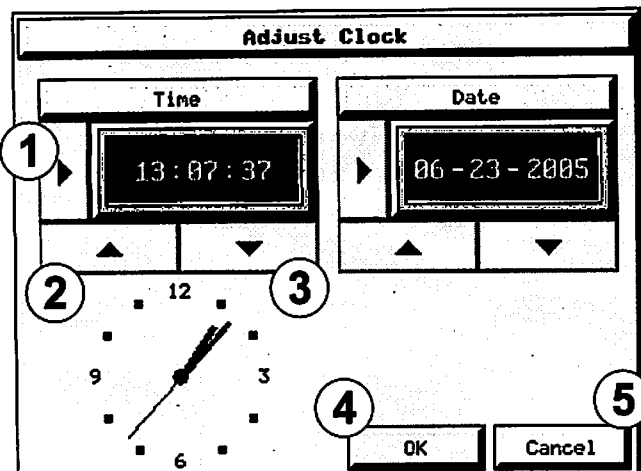
The Setting Menu is used to adjust the time & date, adjust the contrast or brightness of the display depending on which model is being used, adjust (calibrate) the touch screen, and enable or disable the internal beeper.

5

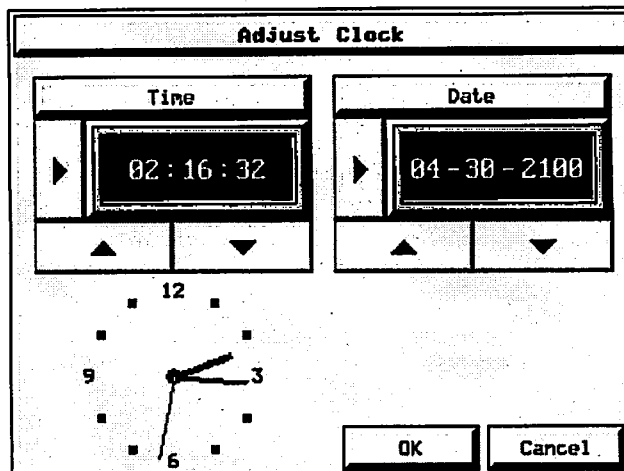
Item No.	Function	Description	Comments
1	Adjust Clock	Press to go to the Adjust Clock screen.	
2	Adjust Display	Press to go to the Adjust Display screen.	
3	Adjust Touch Panel	Press to go to the Adjust Touch Panel screen.	
4	Beeper	Press to go to the Adjust Beeper screen.	
5	Main Menu	Press to return to the Main Menu screen.	
6	IP Address setting	While the Setting Menu system setup screen is being displayed, the extreme upper left corner of the touch panel can be pressed for 3 seconds to access the IP Address setting screen.	The IP Address setting screen is only accessible from the Setting Menu screen as described. There is no direct button to call it from any of the setup screens. The IP Address can also be assigned in the C-more Programming Software.






Setting – Adjust Clock



Color Touch Panel



Grayscale Touch Panel

Item No.	Function	Description	Comments
1	Select 	Time: Each press of the Select button will cycle thru the following settings. 1.) No Selection to Hours 2.) Hours to Minutes 3.) Minutes to Seconds 4.) Seconds back to Hours Date: Each press of the Select button will cycle thru the following settings. 1.) Month to Day 2.) Day to Year 3.) Year back to Month	
2	Up 	Press to increment the value by "1" with each press.	
3	Down 	Press to decrement the value by "1" with each press.	
4	OK	Press to accept the changes.	
5	Cancel	Press to return to the Setting Menu screen without accepting the changes.	

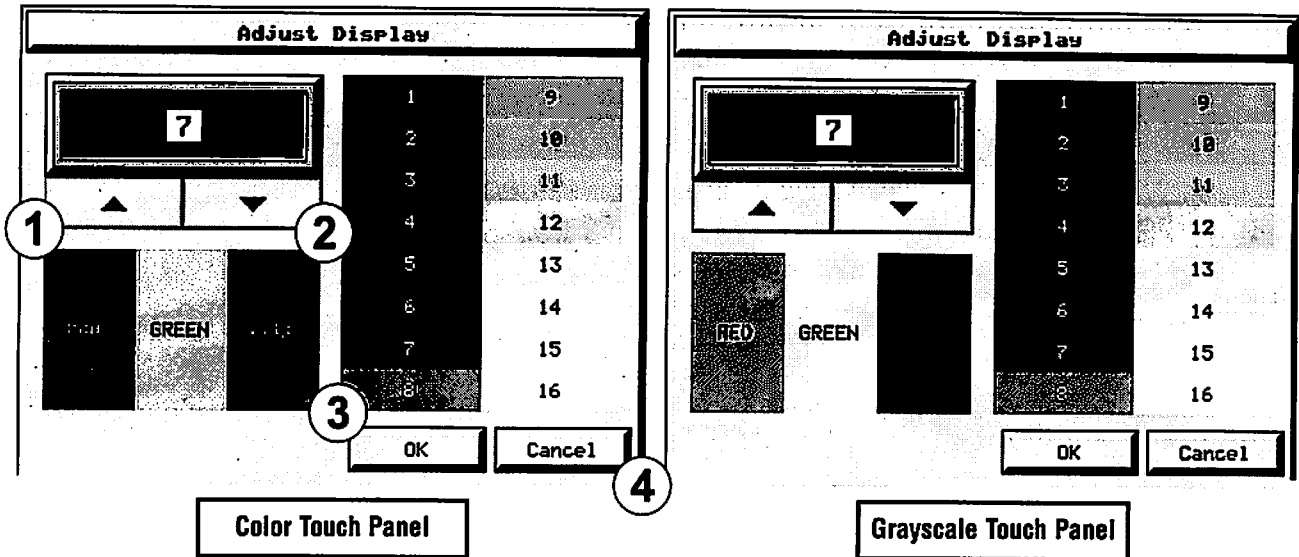


NOTE: The function buttons used to adjust the clock settings on the panel's setup screen are disabled if an External clock source is selected in the C-more programming software. The choice of an internal or external clock source is available by selecting Clock Source in the C-more programming software under the Main Menu drop down function Setup.





NOTE: The panel's clock can also be adjusted from the C-more programming software. The Adjust Clock function can be accessed in the software by selecting Adjust Clock under the Main Menu drop down function Panel or selecting Adjust Clock under the Panel tab in the software's Navigation window.

Setting – Adjust Display



5

Item No.	Function	Description	Comments
<p>The STN type display models, both color and grayscale, can have the contrast adjusted. The TFT type display models can have the brightness adjusted. See the table below.</p>			
1	Up 	Press to increment the value by "1" with each press.	
2	Down 	Press to decrement the value by "1" with each press.	
3	OK	Press to accept the changes.	
4	Cancel	Press to return to the Setting Menu screen without accepting the changes.	

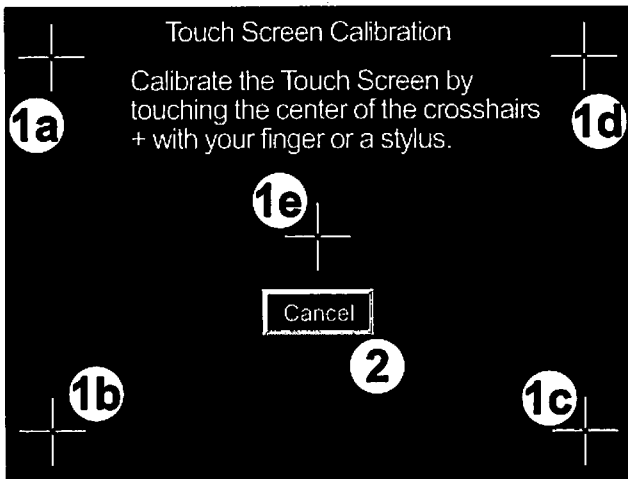
Item No.	Model	Selection Range		Default	
		Brightness	Contrast	Brightness	Contrast
A	TFT Models: EA&-T6C, EA7-T8C, EA7-T10C, EA7-T12C & EA7-T15C	1 to 7	N/A	7	N/A
B	STN Color: EA7-S6C-R & EA7-S6C	N/A	1 to 7	N/A	3
C	STN Grayscale: EA7-S6M-R & EA7-S6M	N/A	1 to 7	N/A	6

Setting – Touch Screen Calibration

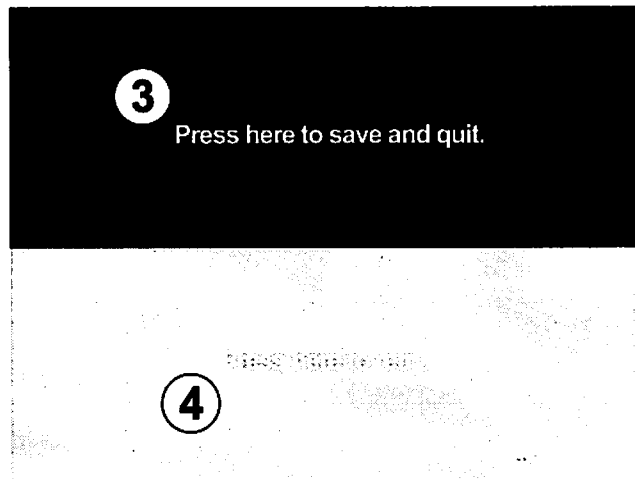
This procedure is used to calibrate the touch screen to ensure accuracy of the touch areas. There are five points on the touch screen that the calibration is based around. The adjustment relies on very narrow areas for the calibration points.

5

Item No.	Function	Description	Comment
1	Points 1a thru 1e	The touch screen calibration crosshairs will appear individually in the order of point 1a thru 1e respectively as each proceeding crosshair is pressed.	If the touched co-ordinate point is too far off from normal, then the procedure will return to Point 1a.
2	Cancel	Press to return to the Setting Menu screen without accepting the changes.	
3	Press here to save & quit.	Press to accept the changes and return to the Setting Menu screen.	If you do not save, you will have to calibrate the panel again after the next power cycle.
4	Press here to retry.	The current adjustment data is canceled and the procedure is returned to point 1a.	

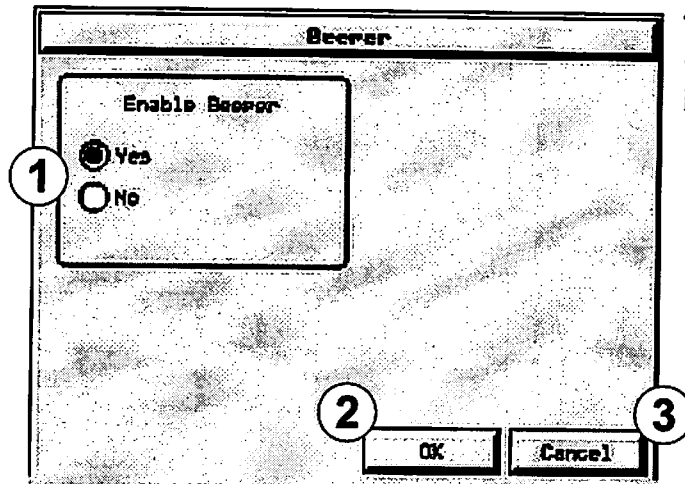


Points 1a thru 1e



Final

Setting – Beeper



This system setup screen function is used to enable or disable the touch panel's internal beeper.

5

Item No.	Function	Description	Comments
1	Yes	Change Enable to Beeper.	
2	No	Change Disable to Beeper.	
3	OK	Press to accept the changes and return to the Setting Menu screen.	
4	Cancel	Press to return to the Setting Menu screen without accepting the changes.	



NOTE: The project settings in the **C-more** programming software **Panel Manager** will override the touch panel's internal setting upon initial download.

Setting – IP Address Setting

IP Address Setting(Ethernet Port)

DHCP

Use the following IP Address

IP Address : 172.22.7.8

Subnet Mask : 255.255.0.0

Default Gateway : 172.22.4.1

1	2	3	4	5	CL	DEL
6	7	8	9	0	.	ENT

OK Cancel

IP Address Setting(Ethernet Port)

DHCP

Use the following IP Address

IP Address : 172.22.7.8

Subnet Mask : 255.255.0.0

Default Gateway : 172.22.4.1

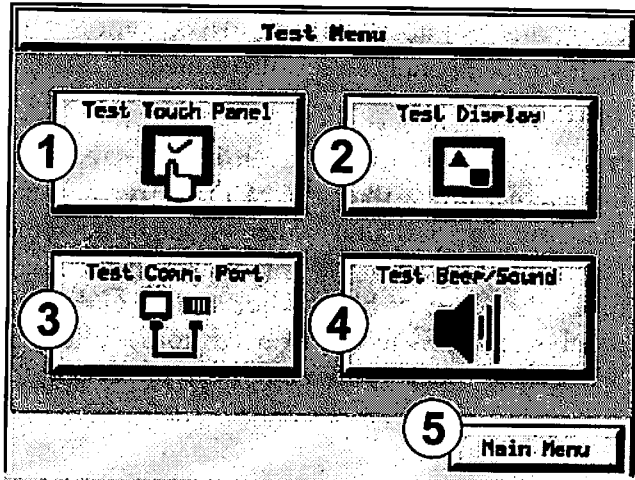
1	2	3	4	5	CL	DEL
6	7	8	9	0	.	ENT

OK Cancel

5

Item No.	Function	Description	Comment
1	DHCP	"DHCP" is enabled as the default when this system setup screen is first selected. All of the other selections on this screen are dimmed when "DHCP" is selected and are not available.	
2	IP Address	The "Use the following IP Address" setting is selected when its radio button is pressed. An IP Address can be assigned as follows: 1.) Select the address type: a.) IP Address b.) Subnet Mask c.) Default Gateway 2.) Use the numerical keypad to input the address. Use the decimal key to enter the dot separator. 3.) Press the "ENT" key when finished with each field.	Note: If an Ethernet cable is not connected to the touch panel from an active Ethernet device, then the IP Address will show as 0.0.0.0.
3	IP Address Subnet Mask Default Gateway	Select the field that needs to be assigned by touching the entry value and use the keypad to enter the desired address.	Each field can be independently assigned.
4	Keypad	The keypad is used to enter the Address: Use the numeric keys and the "dot" key to enter the address, e.g: 192.168.10.1 "ENT" = Enter key sets value "CL" = Clear value entered "DEL" = Delete 1 character with each press	The "ENT" key must be pressed to accept the entry. If the "ENT" key is not pressed, then the previous value will remain when another area is selected or the "Cancel" key is pressed.
5	OK	Press to accept the changes and return to the Setting Menu screen.	
6	Cancel	Press to return to the Setting Menu screen without accepting the changes.	

Test Menu

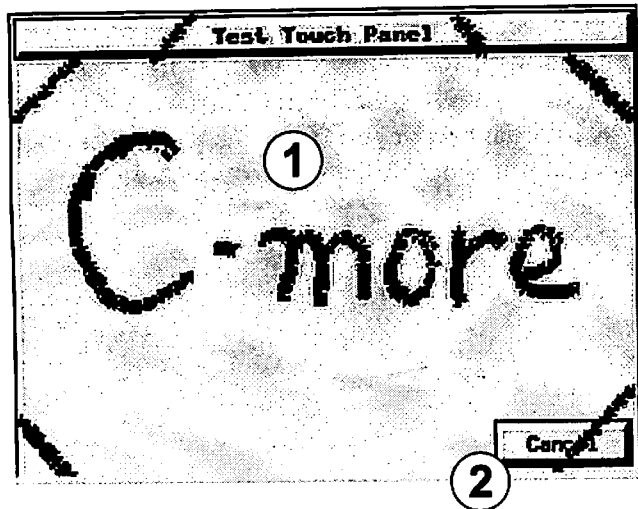


The Test Menu gives the user the ability to test the operation of the touch screen, test the LCD display, test the various communication ports, and also test the internal beeper and the audio line out through an user supplied amplified (stereo) speaker(s).

5

Item No.	Function	Description	Comments
1	Test Touch Panel	Press to go to the Test Touch Panel screen.	
2	Test Display	Press to go to the Test Display screen.	
3	Test Communication Port	Press to go to the Test Communication Port screen.	
4	Test Beep/Sound	Press to go to the Test Beep/Sound screen.	
5	Main Menu	Press to return to the Main Menu screen.	

Test Menu – Test Touch Panel



Using this test, normal or unusual operation of the analog touch panel can be determined.

Testing:

If an area of the touch screen is suspected to be inoperable, touch that area of the screen while in the Test Touch Panel screen mode. The screen pixels should turn black in that area. If the screen pixels do not turn black when touched, then the touch screen is defective or needs to be calibrated. See Setting - Adjust Touch Screen on page 5-22.

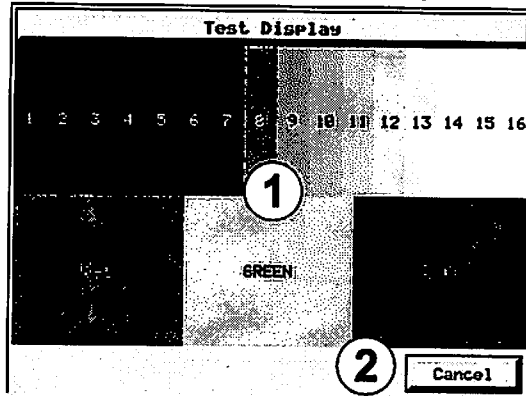
5

Item No.	Function	Description	Comments										
1	Touch area	<table border="0"> <tr> <td>Display Size</td> <td>Touch Area</td> </tr> <tr> <td>6 Inch</td> <td>320 X 240</td> </tr> <tr> <td>8/10 Inch</td> <td>640 X 480</td> </tr> <tr> <td>12 Inch</td> <td>800 X 600</td> </tr> <tr> <td>15 Inch</td> <td>1024 X 768</td> </tr> </table>	Display Size	Touch Area	6 Inch	320 X 240	8/10 Inch	640 X 480	12 Inch	800 X 600	15 Inch	1024 X 768	Both the title bar (Test Touch Panel) and Cancel button can be drawn across to test the touch operation.
Display Size	Touch Area												
6 Inch	320 X 240												
8/10 Inch	640 X 480												
12 Inch	800 X 600												
15 Inch	1024 X 768												
2	Cancel	Press to return to the Test Menu screen.											

Test Menu – Test Display

There are two different test patterns ran on the LCD display to allow the user to check for display screen defects. If the screen is not touched within 3 seconds of Test Pattern 1 being displayed, then Test Pattern 2 will be displayed until such time as the screen is touched during its test, otherwise Test Pattern 1 will remain until cancelled.

Test Pattern 1 displays a test pattern of 16 grayscale graduations and RGB colors.



5

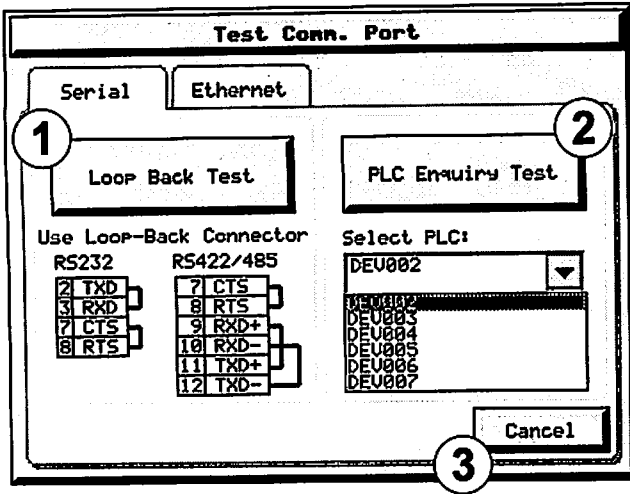
Test Pattern 2 will follow the pattern as shown in the following chart with the color wiping across the screen in the direction indicated by the arrows, then repeats:

Color	1st Time	2nd Time	3rd Time	4th Time
RED	→	↑	↓	←
GREEN	←	→	↑	↓
BLUE	↓	←	→	↑

Item No.	Function	Description	Comments
1	Touch the Test Display screen.	Press the screen anywhere except the Cancel button and the shown Test Pattern 1 remains.	If the Test Display screen is not touched, then in three seconds the display will move to Test Pattern 2.
2	Cancel (Test Pattern 1)	Press to return to the Test Menu screen.	
3	Touch Anywhere (Test Pattern 2)	Touch the screen anywhere during Test Pattern 2 and return to the Test Menu screen.	

Test Results: If any pixels on the screen do not appear the same color as its surrounding pixels, the LCD screen may be defective. A single pixel gone bad is relatively common. Surrounding pixels going bad over time is another indication the LCD screen may be defective.

Test Menu – Test Communication Ports: Serial

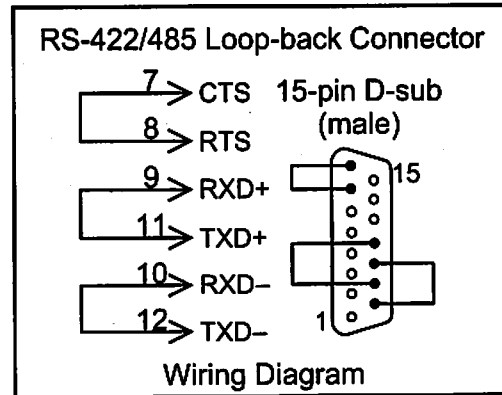
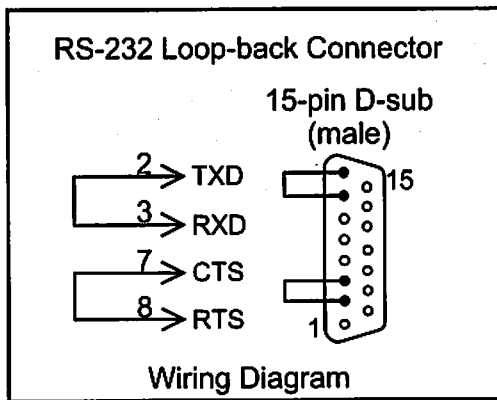


The following test can be used to check the operation of the serial communication port, with the use of a loop back connector and can also check the status of the serial communications to any connected and configured PLC.

Continued on the next two pages.

5

Item No.	Function	Description	Comments
1	Loop Back Test	This function checks the serial comm port for proper operation with a loop back connector.	
2	PLC Enquiry Test	This function allows the ability to select any PLC that that may be connected to the touch panel via a serial connection and checks to see if the communications are working correctly.	Note: The PLC serial communications port settings must be configured in the <i>C-more</i> programming software.
3	Cancel	Press to return to the Test Menu screen.	

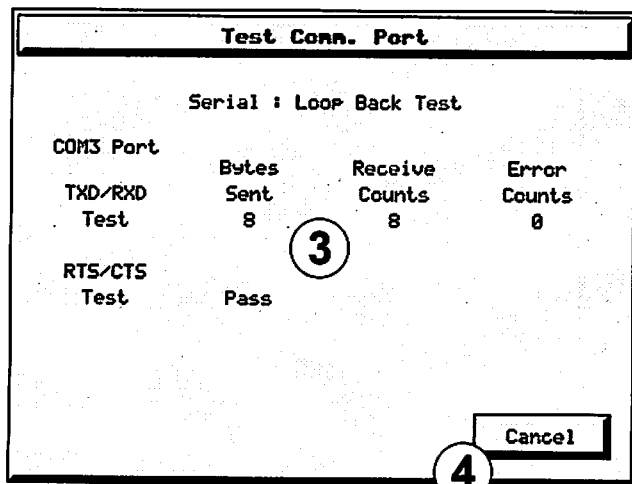


Test Menu – Serial Port Test

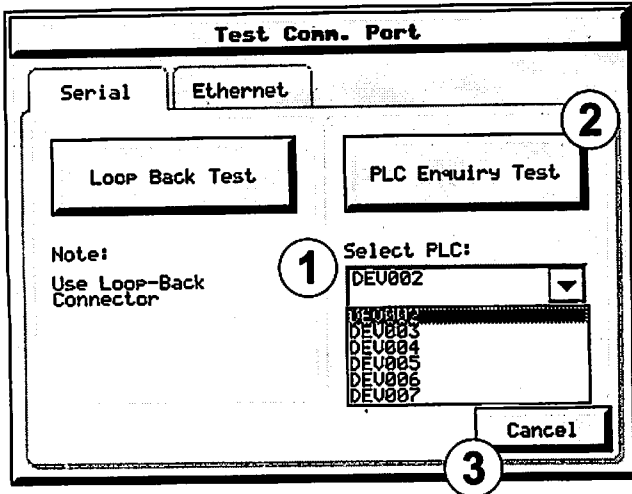
PLC Serial Comm Port – Loop Back Test

Item No.	Function	Description	Comments
1	Determine Loop Back Connector	1.) When testing an RS-232C serial connection, connect pin 2 to 3 and pin 7 to 8 on an appropriate D-SUB 15-pin male connector and plug it into the serial PLC comm port on the rear of the touch panel. 2.) When testing an RS-422 or RS-485 serial connection, connect pin 9 to 11, pin 10 to 12 and pin 7 to 8 on an appropriate D-SUB 15-pin male connector and plug it into the serial PLC comm port on the rear of the touch panel.	
2	Start Test	Press the Loop Back Test button to start the serial comm port test.	
3	Test Results	1.) Bytes Sent: The number of bytes sent after a test is started. 2.) Receive Counts: The number of bytes which are received after the test is started. 3.) Error Counts: The number of bytes which have not been received after the test is started. 4.) RTS/CTS Test: Pass/Fail RTS is turned on and if CTS receives the signal then the test shows "Pass", otherwise the test shows "Fail".	Note: The test will continue to run until the Cancel button is pressed. If there are any error counts, check the loop back connector. If it is OK, call Tech Support.
4	Cancel	Press to return to the Test Comm. Port screen.	

5



Test Menu – PLC Enquiry Test: Serial Connection



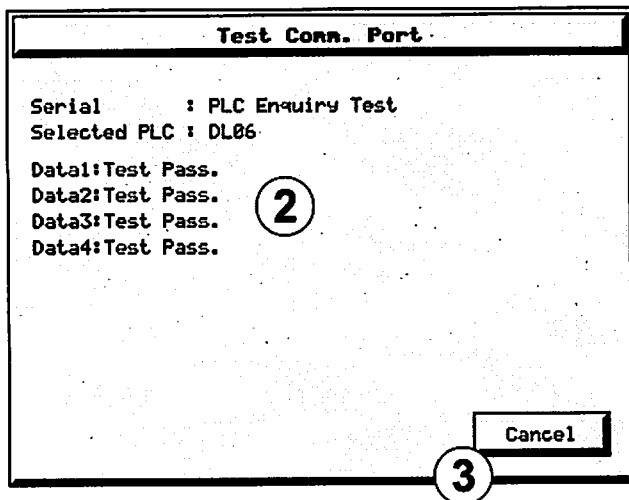
This function allows the ability to select any PLC that may be connected to the touch panel through a serial comm. port connection and checks to see if the communications are working correctly.



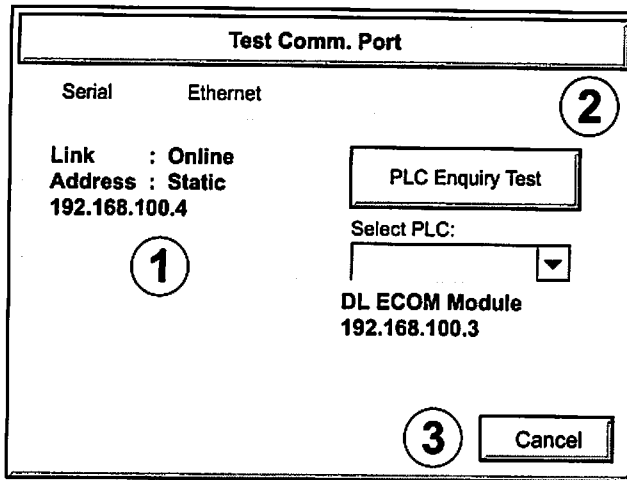
Note: The communications protocol for the PLC being selected must be configured the same as the C-more touch panel. The touch panel's PLC serial communications are configured using the C-more Programming Software's Panel Manager.

5

Item No.	Function	Description	Comments
1	Select PLC	Select any PLC that is shown in the drop down menu. The PLC selected will connect to the touch panel at the time of a test.	Only PLC's that have been configured in the C-more Programming Software will appear in the Select PLC: list.
2	PLC Enquiry Test	Four test read packets are sent to the selected PLC. Test result will be either Pass or Fail.	
3	Cancel	Press to return to the Test Menu screen.	



Test Menu – Test Communication Ports: Ethernet



The following test feature can be used to check the operation of the Ethernet communication port by indicating if an Ethernet link has been established or not, and can also check the status of the Ethernet communications to any connected PLC.

Base featured models (-R) do not include an Ethernet port, therefore this check is not displayed.

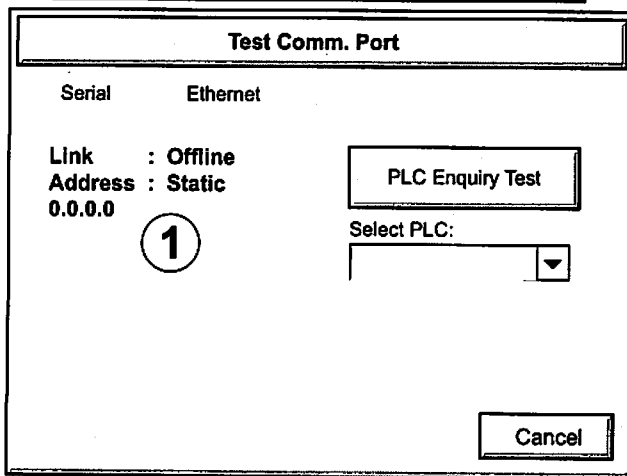


Note: The communications protocol for the PLC being selected must be configured the same as the C-more touch panel. The touch panel's PLC Ethernet communications are configured using the C-more Programming Software's Panel Manager.

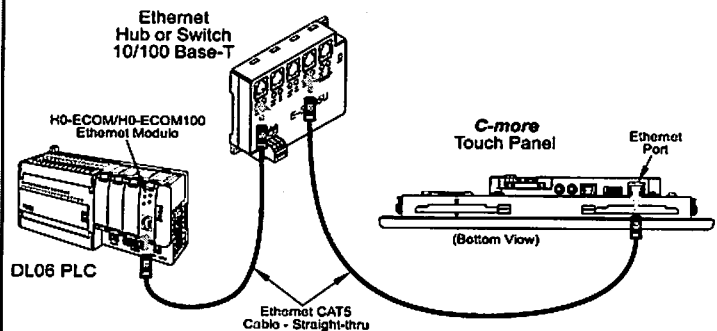
5

Item No.	Function	Description	Comments
1	Ethernet Connected	This area displays information to whether an Ethernet link has been established for the touch panel's Ethernet comm port or not. Displays panel's IP address and shows whether it is static or assigned by a DHCP server.	
2	PLC Enquiry Test	This function allows the ability to select any PLC configured in the project that may be connected to the touch panel via an Ethernet connection and checks to see if the communications are working correctly.	
3	Cancel	Press to return to the Test Menu screen.	

Example of displayed message when the touch panel's Ethernet port is not connected.



Typical Ethernet connection with Ethernet switch.



Test Menu – PLC Enquiry Test: Ethernet Connection

This function allows the ability to select any PLC configured in the project that may be connected to the touch panel through an Ethernet port connection and checks to see if the communications are working correctly.

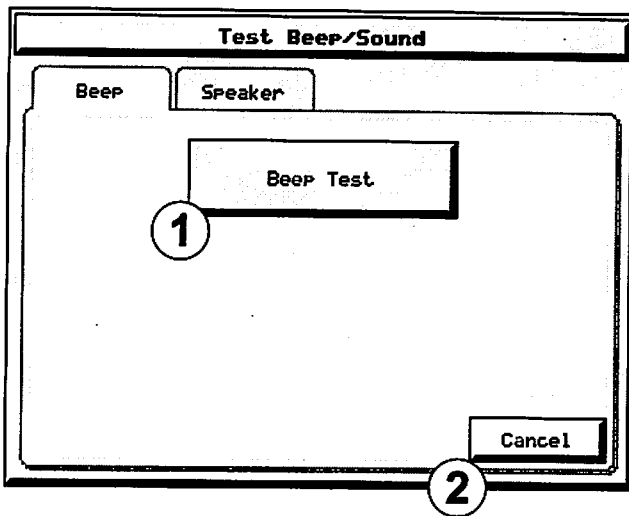


Note: The communications protocol for the PLC being selected must be configured the same as the C-more touch panel. The touch panel's PLC Ethernet communications are configured using the C-more Programming Software's Panel Manager.

5

Item No.	Function	Description	Comments
1	Select PLC	Select any PLC that is shown in the drop down menu.	
2	PLC Enquiry Test	The following are the steps that the Ethernet PLC Enquiry Test performs: 1.) Ping the network 4 times for the PLC selected. 2.) Four of the test read packets are sent to the selected PLC. Test result will be either Pass or Fail. However, if the result of pinging the network shows an error, the test is stopped.	
3	Cancel	Press to return to the Test Menu screen.	

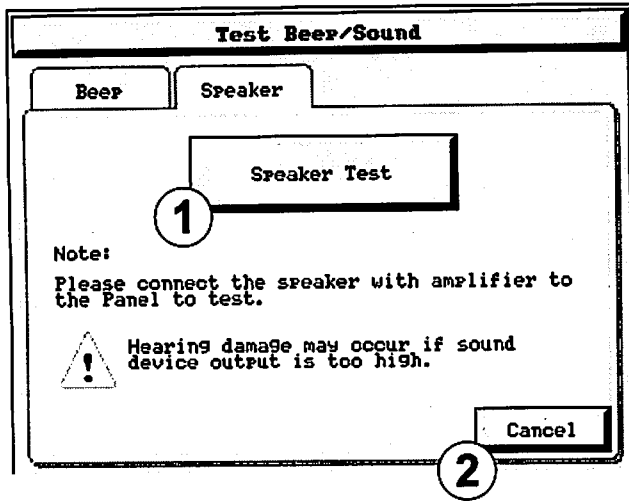
Test Menu – Test Beep/Sound



5

Item No.	Function	Description	Comments
1	Beep Test	The internal Beeper can be tested from this system setup screen whether the Beeper is enabled or disabled. After the Beep Test button is pressed then released, the Beeper will sound for 500 msec.	
2	Cancel	Press to return to the Test Menu screen.	

Test Menu – Test Beep/Sound (cont'd)



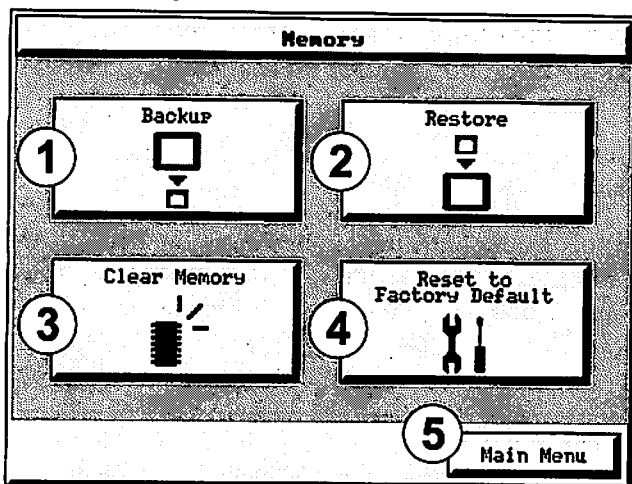
5



WARNING: Hearing damage may occur if the volume on the user supplied external amplified speaker is set too high.

Item No.	Function	Description	Comments
1	Speaker Test	The Speaker Test function requires that a speaker(s) with an amplifier (can be stereo) be connected to the Audio Line Out stereo jack on the rear of the touch panel. After the Speaker Test button is pressed then released, a system provided Test.WAV file will play once.	
2	Cancel	Press to return to the Test Menu screen.	

Memory Menu



The user's project, system, log and recipes files can be backed up and restored to either a CompactFlash memory card (CF1 or CF2), or a USB memory device. From this menu the user can also clear the project log files. The user also has the ability to clear the memory within the *C-more* touch panel.

Base featured models (-R) do not include CF1 or CF2.

5

Item No.	Function	Description	Comments
1	Backup	Backup project, system, log & recipe files to the following memory devices: USB port - Type A: USB pen drive CF Slot #1 (standard port): CompactFlash CF Slot #2 (optional port): CompactFlash See page 5-37 for details.	Any USB pen drive or CompactFlash memory device capacity available is supported. The backup data files are created and copied to a folder on the memory device named "EA_Memory Copy." The project file is named StartupStorage.eas "Log" and "Recipe" folders with the appropriate data files are also created on the memory device.
2	Restore	Restore project, system, log & recipe files to the internal memory from one of the following memory devices: USB port - Type A: USB pen drive CF Slot #1 (standard port): CompactFlash CF Slot #2 (optional port): CompactFlash See page 5-44 for details.	A folder on the memory device named "EA_Memory Copy" must exist containing a file named "StartupStorage.eas". The project data file is stored in this file, and if the system data file was backed up, it also will be stored in this file. Any backed up log or recipe data files will be located under the appropriate "Log" or "Recipe" folders.
3	Clear Memory	Clear selected data files from the memory of the following internal memory or external memory devices: Built-in FLASH Memory USB port - Type A: USB pen drive CF Slot #1 (standard port): CompactFlash CF Slot #2 (optional port): CompactFlash See page 5-50 for details.	Can only clear project, log and recipe data files of the Built-in FLASH memory. Can clear entire contents or individual data files of external memory devices.
4	Reset to Factory Default	The touch panel's internal memory is set to the original factory defaults.	Clears all project memory.
5	Main Menu	Press to return to the Main Menu screen.	

Project Executed from CompactFlash (CF Slot #1)

If a CompactFlash card is located in the CF1 slot at the time a project is transferred to the panel, the project will be stored on the CompactFlash card, not in the internal Built-in FLASH memory.

If CF1 slot contains a CompactFlash with a project and:

- 1.) The touch panel's power is cycled, then
- 2.) The project file stored on the CompactFlash is loaded into the touch panel's internal DRAM memory and executed. Please note that the project stored in the panel's internal FLASH memory is NOT loaded into the internal DRAM memory when a CompactFlash memory card is present. Any project in the internal FLASH memory is cleared.

5



WARNING: During power up with a CompactFlash plugged into the CF1 Slot, please do not remove the memory card from the slot. Damage to the CompactFlash and possibly the touch panel may result.

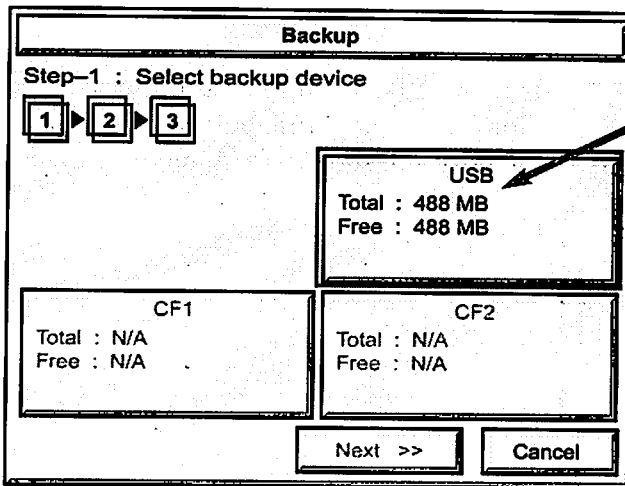


WARNING: After a firmware update, the project files which are located in either the touch panel's internal FLASH memory or the CompactFlash plugged into CF1 Slot are cleared. The programming software will need to be used to Transfer the project file back into the panel. If you wish to retain the project on the CompactFlash, power down the panel and remove the CompactFlash before performing a firmware upgrade.

Increasing Project Memory Size using a CompactFlash in CF1 Slot:

If a project is transferred to the panel with a CompactFlash card in CF1 Slot, the Font and Recipe data files are not included in the 10MB (40MB for 12" and 15" models) project size. Therefore using CF1 can allow a project to be loaded that is larger than 10MB if the excessive size is caused by Fonts and/or Recipe Sheets.

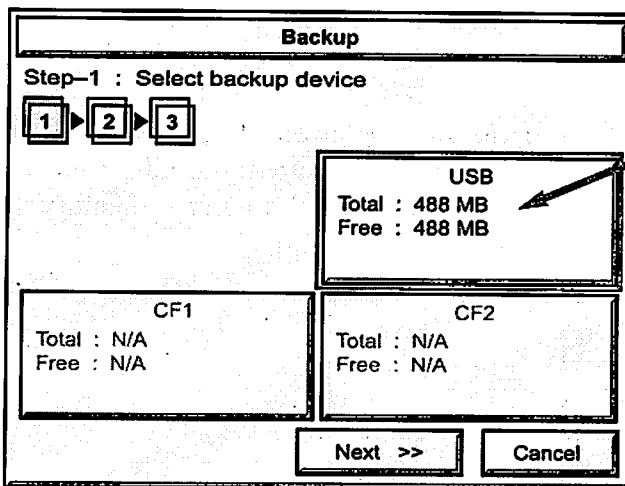
Memory – Backup



The Memory - Backup selection allows you to backup the panel's Project, Log files, Recipe files or even the System (firmware & OS) files to either a CompactFlash (CF) or USB pen drive. The available memory devices will be displayed showing the total and free available memory for that device. If the device is not available, it will be grayed out. The Next button is grayed out until a device is selected.

The Cancel button can be pressed at any time to return to the Memory Menu screen.

5



This is an example of a USB memory device selected to be used for backing up the panel's data file(s).

The selected device is highlighted. Pressing again un-selects it.

When there are more than two available backup devices, the one selected will be highlighted. If there is only one available memory device, it still needs to be highlighted in order to go to the next step.

Press the Next button to continue to Step 2.

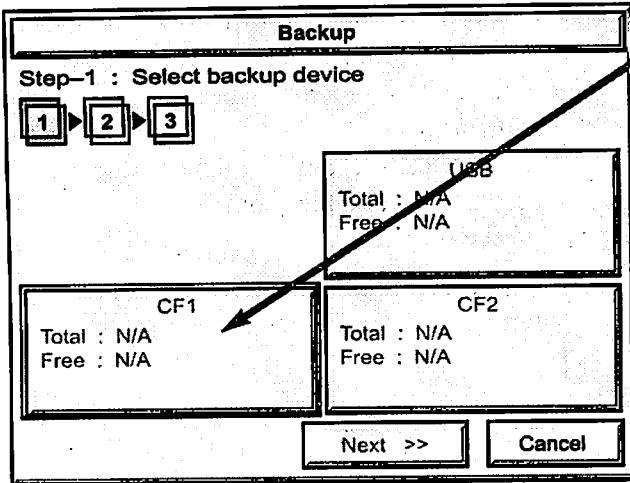


Note: If you have a memory device inserted into the proper port on the touch panel, but it doesn't show up as highlighted in Step 1 of the **Backup** setup screen, then try a different device to determine if the memory device is defective or if there is a possible problem with the memory device connection. It may not be compatible with the panel. This rarely happens with CF memory, but some USB pen drives are not USB 1.1 compatible and will not work with C-more touch panels. Also, some USB pen drives may take several minutes before they are recognized by the panel.

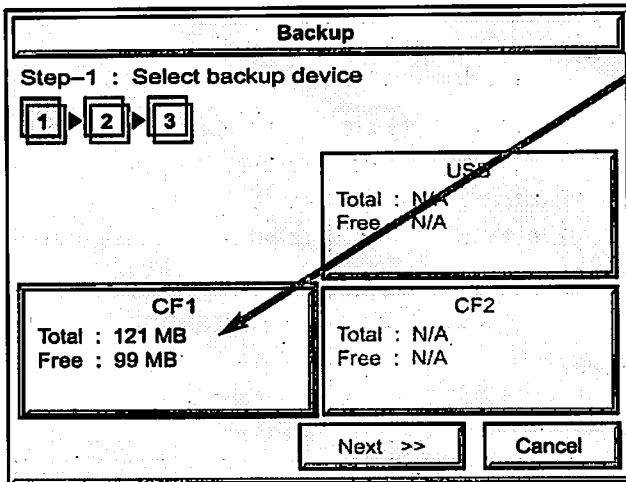
Please read the explanation for the availability of CF1 under different conditions as shown on the next two pages.

Memory – Backup (cont'd)

CF1 Availability Explanation:



If there is no CompactFlash inserted into CF1 Slot, then the CF1 button's Total and Free memory will show as N/A and be grayed out.

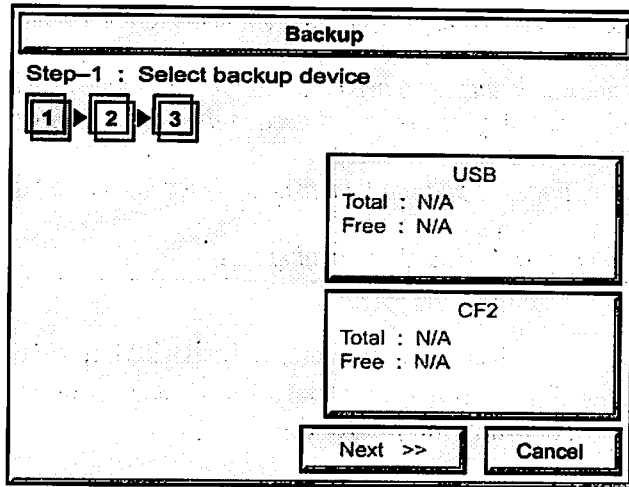


If the panel is powered up or rebooted with a CompactFlash inserted into CF1 Slot, then the CF1 button's Total and Free memory will be displayed.

5

Memory – Backup (cont'd)

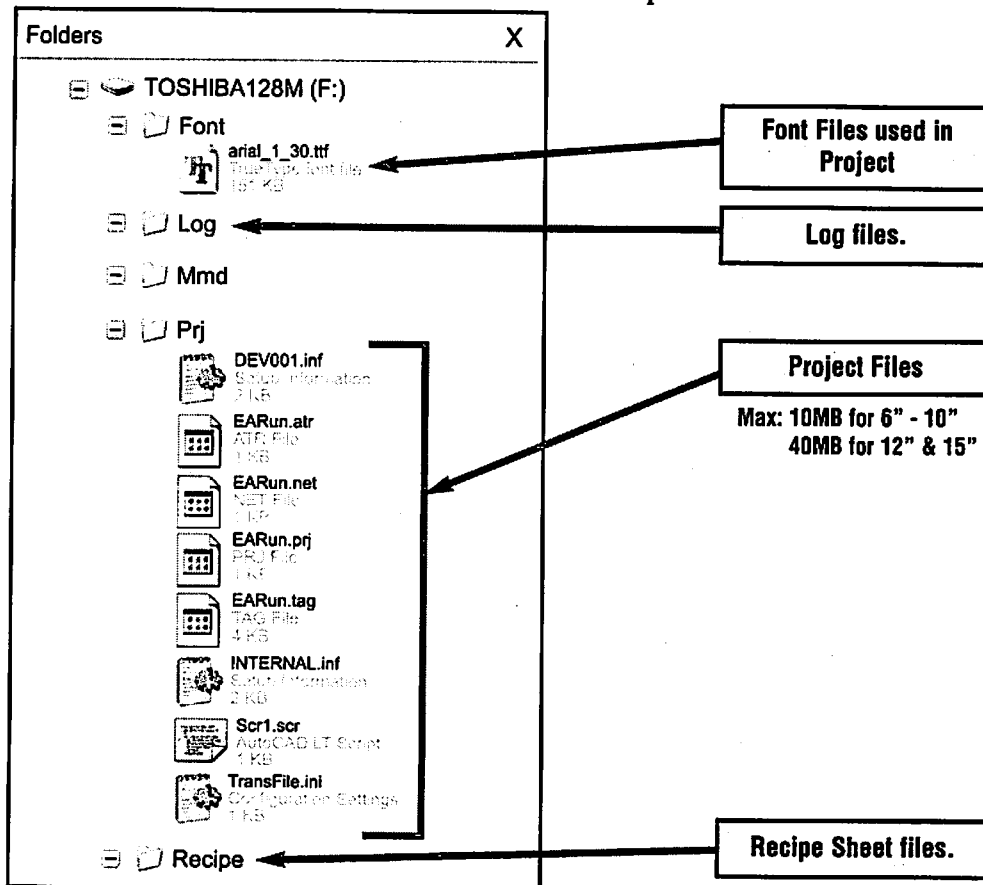
CF1 Availability Explanation (cont'd):



If a CompactFlash is inserted into CF1 Slot and a project is transferred using the *C-more* Programming Software's Project Transfer utility Panel > Transfer, then the CF1 will not show up in the Memory - Backup Step 1 device choices. The CompactFlash will have the runtime files stored on it that get loaded into the touch panel's internal DRAM memory when powered up or rebooted.

5

Below is an example of the folder and file structure that is stored on the CompactFlash in the CF1 Slot for a project that was directly transferred from the *C-more* Programming Software's Project Transfer function when viewed in Windows® Explorer on a PC.



Memory – Backup (cont'd)



Note: The following definitions are for the various file types that can be backed up:

Project data – consists of the actual developed project data that is created in the **C-more** programming software and includes all functionality, objects, screens, tag names, labels, comments, graphics, etc. Included in backup file name *StartupStorage.eas*.

Recipe data – consists of all the data values and labels that have been created for the various recipe sheets. Includes all recipe sheets loaded to the panel. Only recipe sheets used in the project are loaded to the panel.

System data – consists of the operating system, firmware and run time files. Included in backup file name *StartupStorage.eas*.

Log data – consists of the Alarm Log, Message Log and Trend Data Logging files.

5

Backup

Step-2 : Select Data Area to Backup

1 2 3

Project Total : 172 KB	Recipe Total : 1 KB
Log Total : 268 KB	System Total : 16 MB

<< Prev. Next >> Cancel

Select the data file(s) to be backed up by pressing the appropriate data file button. The selection will be highlighted.

Pressing the highlighted data file button again will turn it off.

The Next >> button will stay grayed out until at least one data file is selected.

Any file type not available will be grayed out.

Backup

Step-2 : Select Data Area to Backup

1 2 3

Project Total : 172 KB	Recipe Total : 1 KB
Log Total : 268 KB	System Total : 16 MB

<< Prev. Next >> Cancel

This is an example of data files selected for backing up.

The selected data files are highlighted.

The Next >> button is now enabled.

Pressing Cancel will return to the previous menu.

Press the Next button to continue.

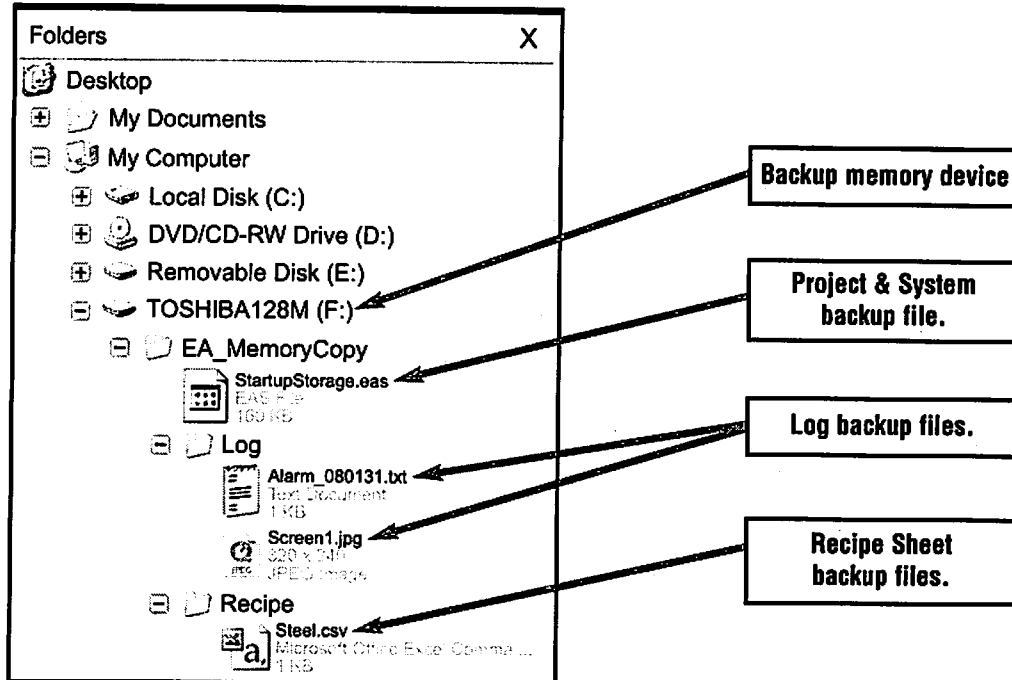


Note: In the case of the **Project** and **System** files, these can be **Restored** later to another panel. In the case of the **Recipe** files, they can be edited externally from the panel and then **Restored** to the panel. The **Log** files are for viewing purposes only. See Page 5-44 for instructions on Restoring the Project, System and or Recipe files to a Panel.

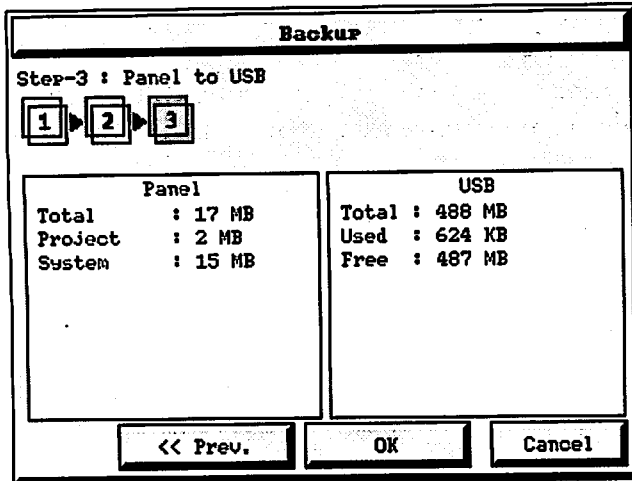
Memory – Backup (cont'd)

Backup Data Files Naming and Organization

The following graphic shows how the various data files are organized on the memory device when doing a Backup and also the file naming convention that is used when viewed in Windows® Explorer on a PC.



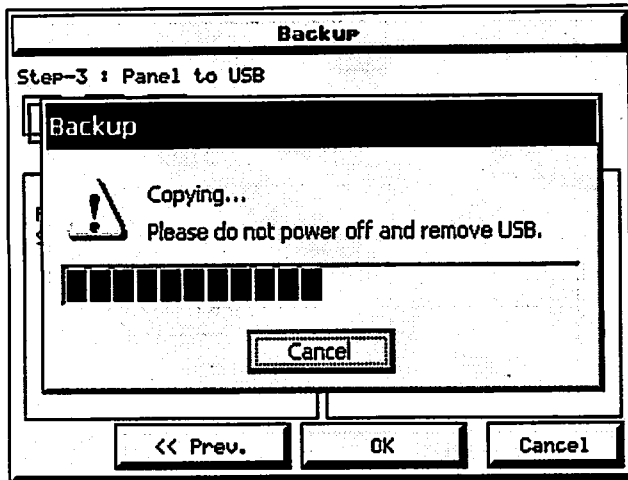
Memory – Backup (cont'd)



The next system setup screen allows the verification of the data file selections. When the OK button is pressed, the backup begins.

The user can return to the previous screen by pressing the << Prev. button.

5



This message is displayed during the Backup copying process. Press the Cancel button to abort the backup.

The following text is shown in the copying progress message box:

Copy to USB Memory:

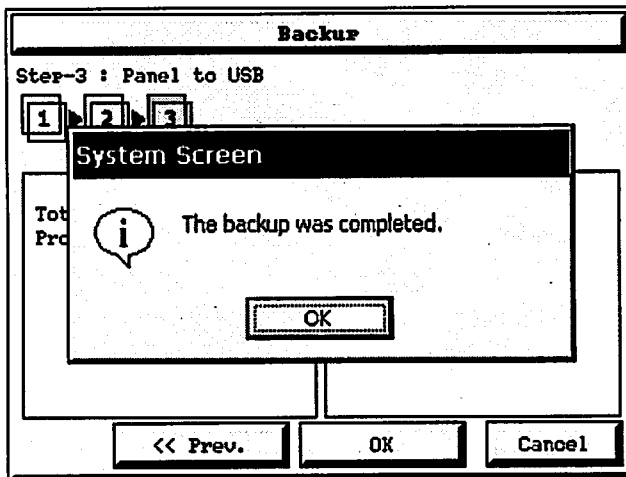
"Please do not Power Off or Remove USB"

Copy to CF1 or CF2:

"Please do not Power Off or Remove CF"

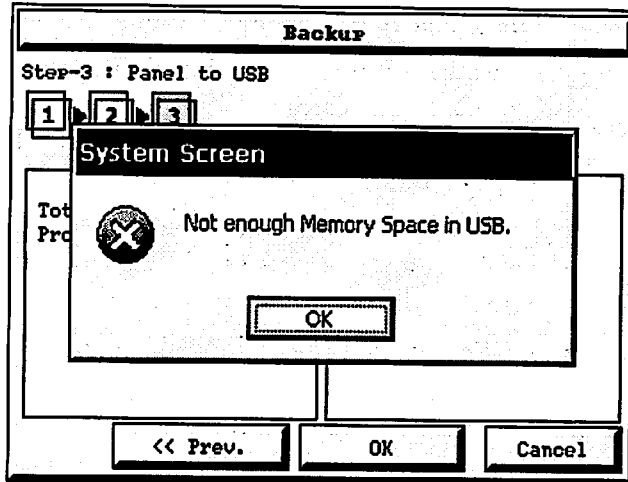


WARNING: During the copying process, Do not power off the touch panel or remove the memory device.



This message is displayed to indicate the Backup is complete. Press the OK button to return to the previous menu selection.

Memory – Backup (cont'd)



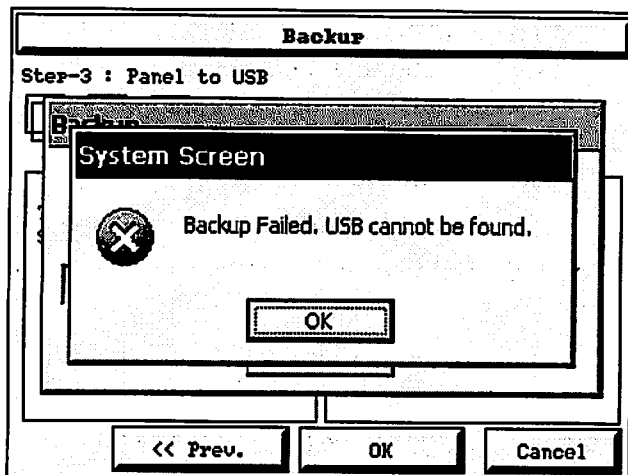
Warning Messages

If the destination does not have enough space to store the selected memory size, then the message shown here will be displayed. Press the OK button to clear the warning message.

The warning message will read "Not enough Memory Space in %Device%".

%Device% will show either "CF1", "CF2", or "USB".

5

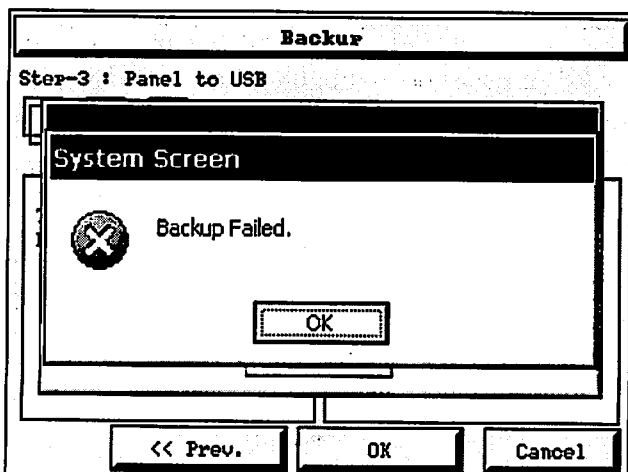


This warning message will be displayed if the backup Memory device fails or is removed during the backup. Press the OK button to clear the warning message.

The warning message will read "Backup Failed. %Device% cannot be found".

%Device% will show either "CF1", "CF2", or "USB".

Refer to Chapter 8: Troubleshooting for additional help.

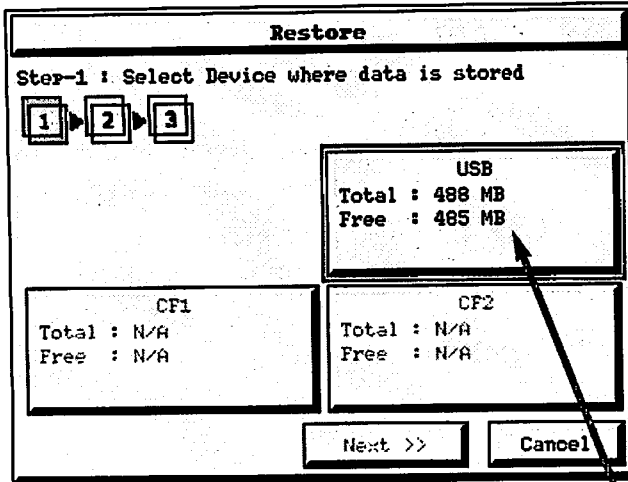


For any other reason the backup fails, then this warning message will be displayed. Press the OK button to clear the warning message.

The warning message will read "Backup Failed".

Refer to Chapter 8: Troubleshooting for additional help.

Memory – Restore

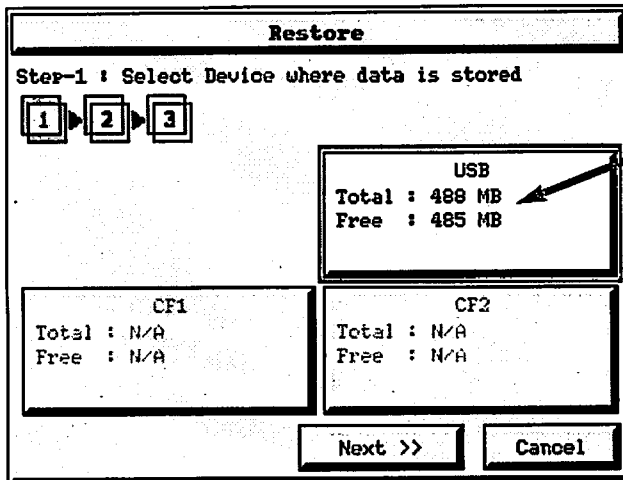


The Memory - Restore function is used to:

- 1.) Restore a project previously backed up on a CompactFlash card or USB pen drive memory device to the same panel. See Memory - Backup on page 5-37.
- 2.) Copy a project from one panel to another panel using a memory device to physically transport the data files.
- 3.) Restore a project into the panel that was transferred to an "External Memory Device" using the C-more Programming Software.
- 4.) Restore Recipe Sheet(s) previously backed up to a memory device or copied to the memory device using a PC.

The available memory devices will be displayed showing the total and free available memory for that device. If the device is not available, it will be grayed out. The Next button is grayed out until a device is selected.

The Cancel button can be pressed at any time to return to the Memory Menu screen.



This is an example of a USB memory device selected to be used for restoring the data file(s).

The selected device is highlighted. Pressing again unselects it.

When there are more than two available restore devices, the one selected will be highlighted. If there is only one available memory device, it needs to be highlighted in order to go to the next step.

Press the Next button to continue to continue to Step 2.

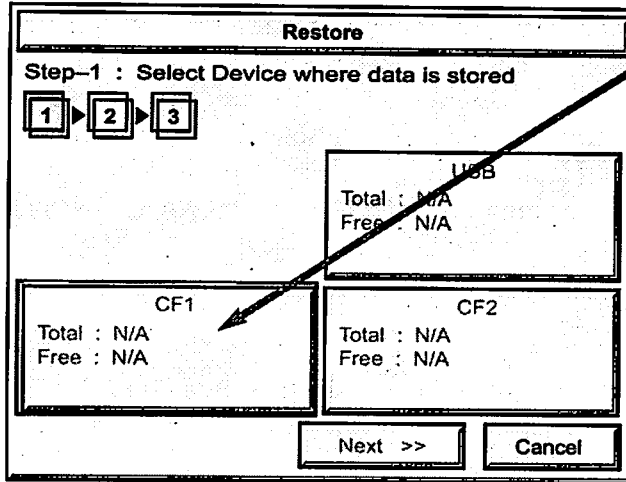


Note: If you have a memory device inserted into the proper port on the touch panel, but it doesn't show up as highlighted in Step 1 of the Restore setup screen, then try a different device to determine if the memory device is defective or if there is a possible problem with the memory device connection. It may not be compatible with the panel. This rarely happens with CF memory, but some USB pen drives are not USB 1.1 compatible and will not work with C-more touch panels. Also, some USB pen drives may take several minutes before they are recognized by the panel.

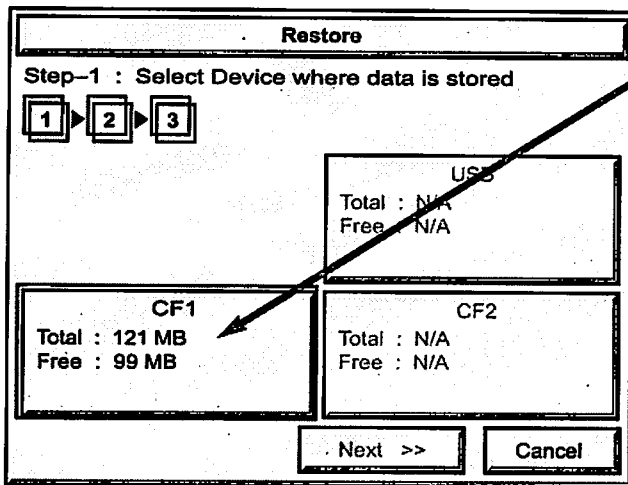
Memory – Restore (cont'd)

Please read the explanation for the availability of CF1 under different conditions as shown on this page and the next.

CF1 Availability Explanation:

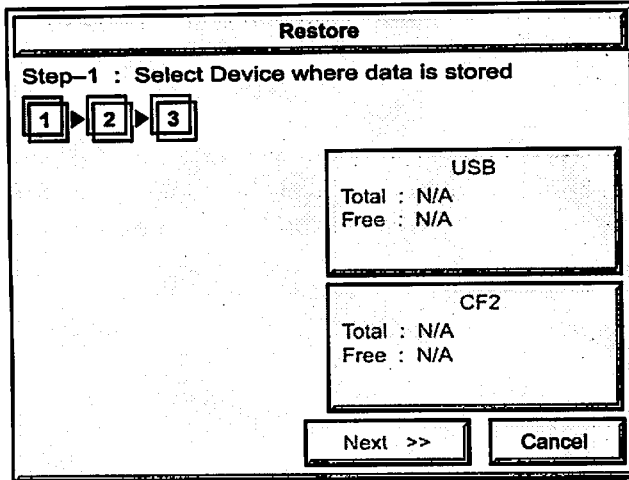


If there is no CompactFlash inserted into CF1 Slot, then the CF1 button's Total and Free memory will show as N/A and be grayed out.



If the panel is powered up or rebooted with a CompactFlash inserted into CF1 Slot, then the CF1 button's Total and Free memory will be displayed.

Memory – Restore (cont'd)

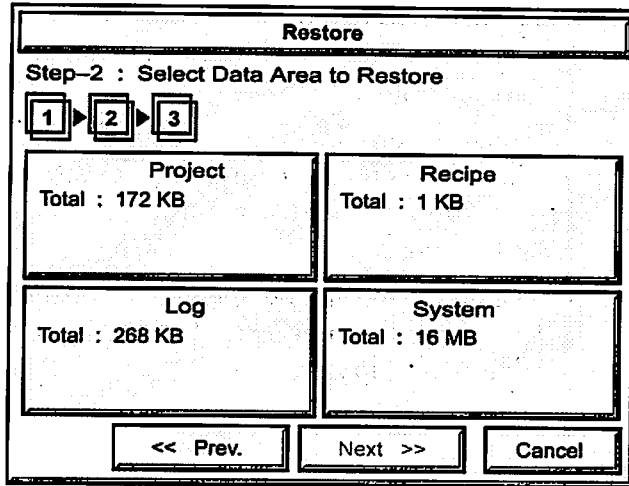


CF1 Availability Explanation (cont'd):

If a CompactFlash is inserted into CF1 Slot and a project is transferred using the *C-more* Programming Software's Project Transfer utility Panel > Transfer, then the CF1 will not show up in the Memory - Backup Step 1 device choices. The CompactFlash will have the runtime files stored on it that get loaded into the touch panel's internal DRAM memory when powered up or rebooted.

See page 5-39 for an example of the folder and file structure that is stored on CF1.

Memory – Restore (cont'd)



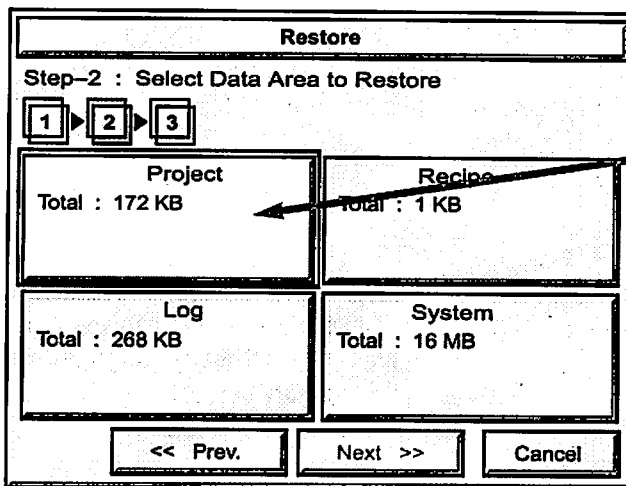
Select the data file(s) to be restored by pressing the appropriate data file button. The selection will be highlighted. The data file can be either the Project, System and / or Recipe files.. The selected data is restored to the internal built-in FLASH memory if there is no CompactFlash memory card inserted into the CF1 slot.

Pressing the highlighted data file again will turn it off.

The Next >> button will stay grayed out until at least one data file is selected.

Any file type not available will be grayed out.

5



This is an example of a file selected to restore.

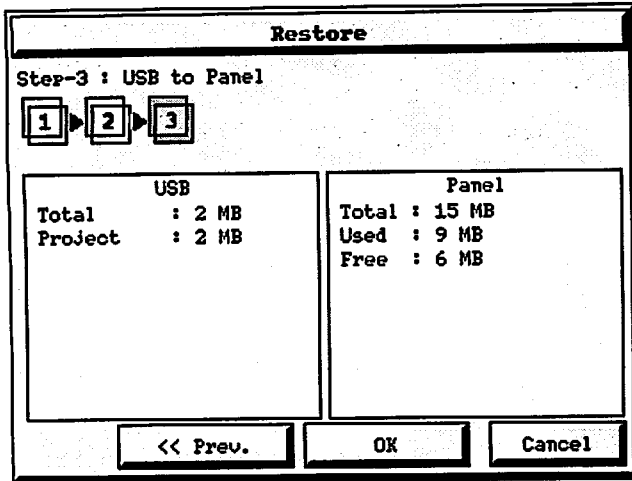
The selected file is highlighted.

The Next >> button is now enabled.

Pressing Cancel will return to the previous menu.

Press the Next button to continue.

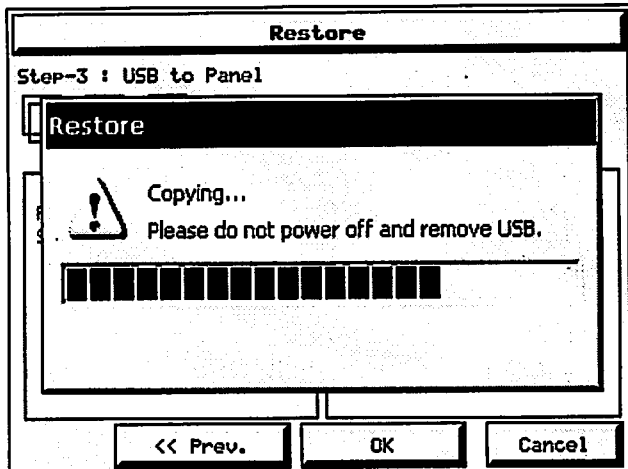
Memory – Restore (cont'd)



The data selected to restore is checked. If the data is good, then the OK button can be pressed to start the restore.

If there is a problem with the data, the OK button will remain grayed out and the user can return to the previous screen by pressing the << Prev button.

The problem could be caused by a corrupted data file. See Chapter 8: Troubleshooting for additional help.



This message is displayed during the Restore process. Press the Cancel button to abort the backup.

The following text is shown in the copying progress message box:

Copy to USB Memory:

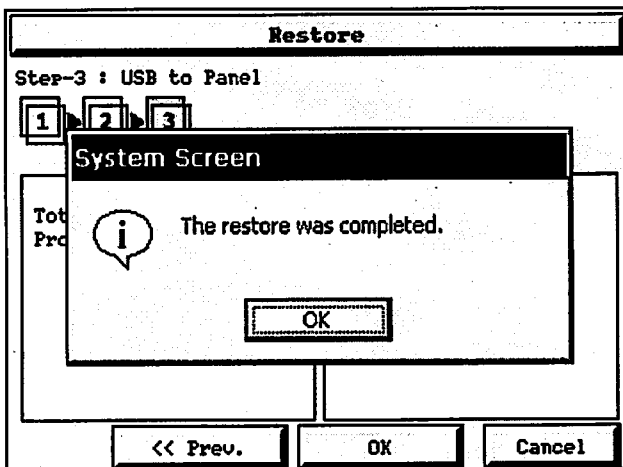
"Please do not Power Off or Remove USB"

Copy to CF1 or CF2:

"Please do not Power Off or Remove CF"

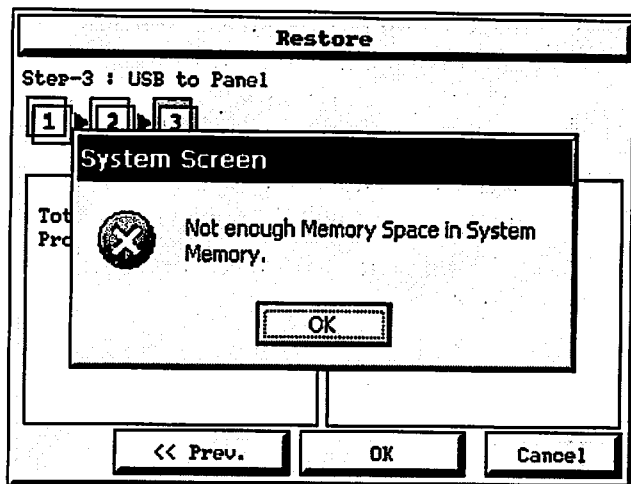


WARNING: During the copying process, Do not power off the touch panel or remove the memory device.



This message is displayed to indicate the Restore is complete. Press the OK button to return to the previous menu selection.

Memory – Restore (cont'd)



Warning Messages:

If the system memory does not have enough space to restore the selected memory size, then the message shown here will be displayed. Press the OK button to clear the warning message.

The warning message will read "Not enough Memory Space in System Memory".

The Project size must be less than 10 MByte for 6"-10" panels and less than 40 MByte for 12" & 15" panels.

5

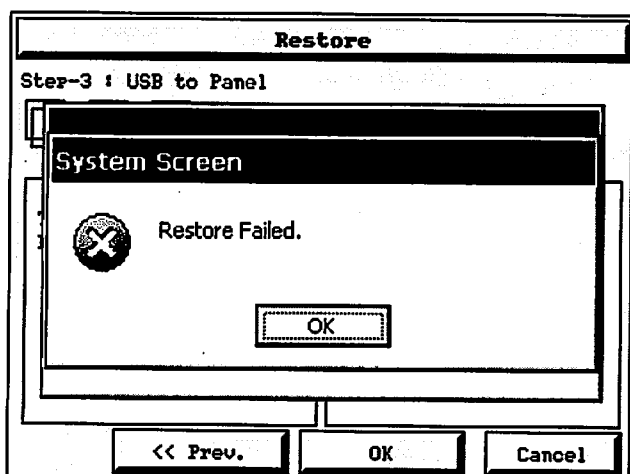


This warning message will be displayed if the restore Memory device fails or is removed during the backup. Press the OK button to clear the warning message.

The warning message will read "Restore Failed. %Device% cannot be found".

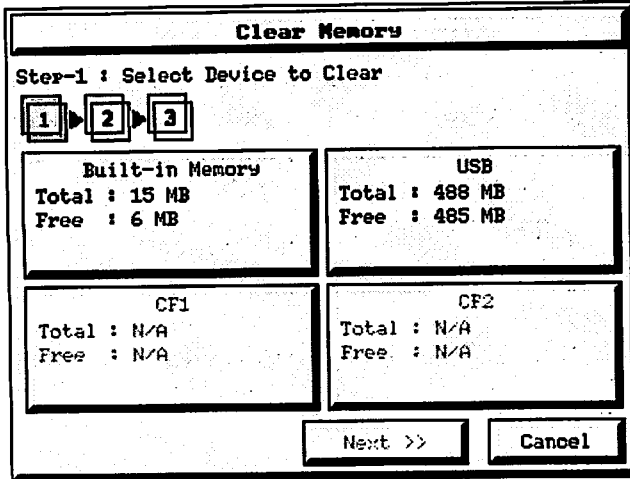
%Device% will show show "CF1", "CF2", or "USB".

Try using a different device with known good data in the same connector or using the device that is causing the error in a different connector.



For any other reason the restore fails, then this warning message will be displayed. Press the OK button to clear the warning message.

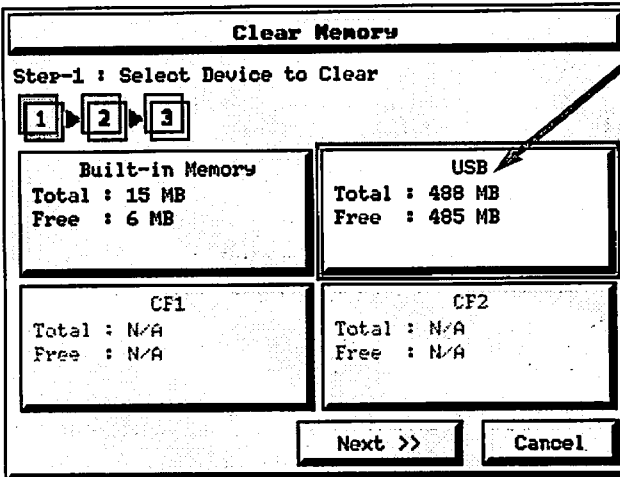
Memory – Clear Memory



This function is used to clear individually selected data files, or all data files, within the panel's Built-in Memory, or any installed memory device such as a USB pen drive, CompactFlash (CF1 or CF2).

Select the memory device to clear. If the device is not available, it will be grayed out.

The Next button is grayed out until a device is selected.



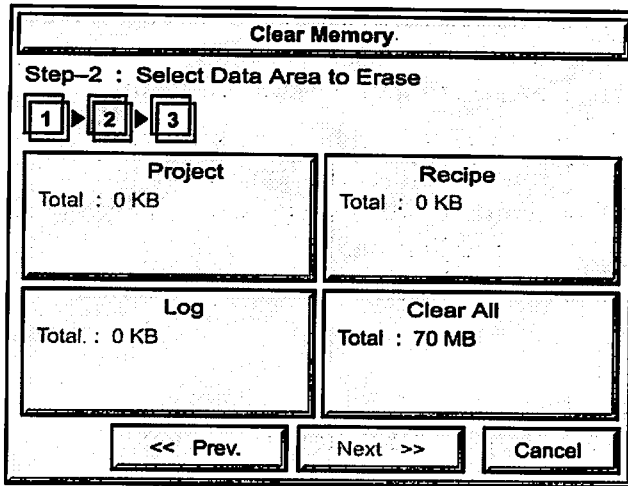
The selected device is highlighted. Pressing again un-selects it.

When there are more than two available backup devices, the one selected will be highlighted. If another is selected, then the highlight will change to the last one pressed. Only one device can be selected at a time.

Press the Next button to continue.

5

Memory – Clear Memory (cont'd)



Select the data file(s) to be cleared.

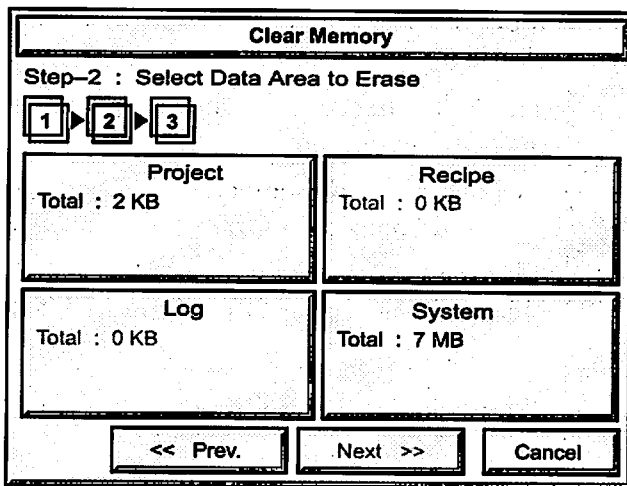
This is an example of CF1, CF2 or USB memory that was selected in Clear Memory - Step-1.

The selected file will be highlighted. Pressing again un-selects it.

The Next >> button will stay grayed out until file(s) are selected.

Selecting Clear All will erase all files located on the memory device.

5

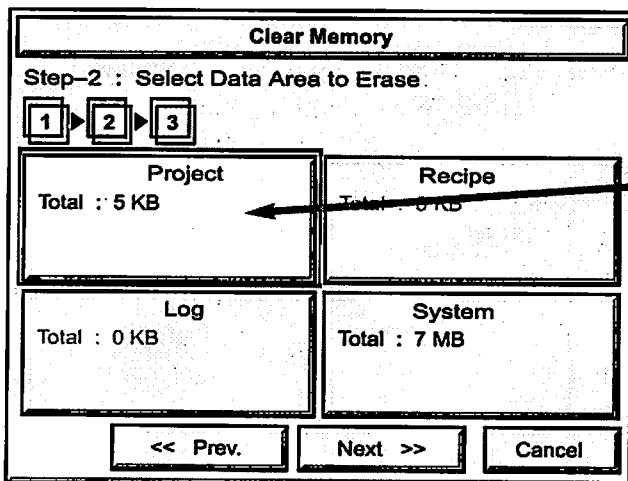


This is an example of Built-in Memory that was selected in Clear Memory - Step-1.

Notice the ability to select either the Project file, Log files, Recipe files, or the System files.



Note: System files can not be cleared from the internal memory.



This is an example of the Project data file being selected for clearing.

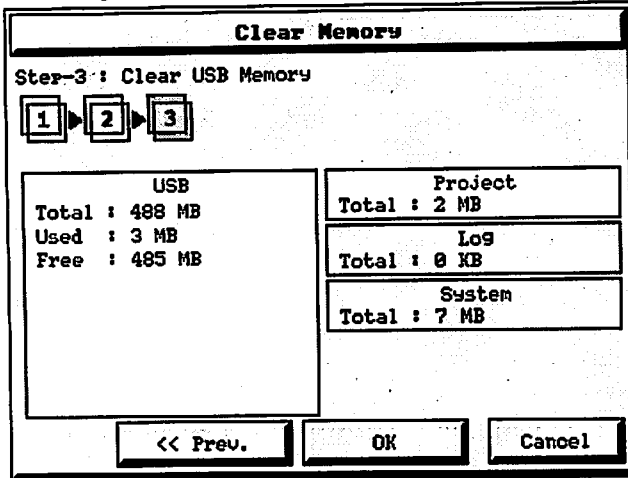
The selected memory area is highlighted. Pressing again un-selects it.

The Next >> button is now enabled.

Pressing Cancel will un-select the file(s).

Press the Next button to continue.

Memory – Clear Memory (cont'd)

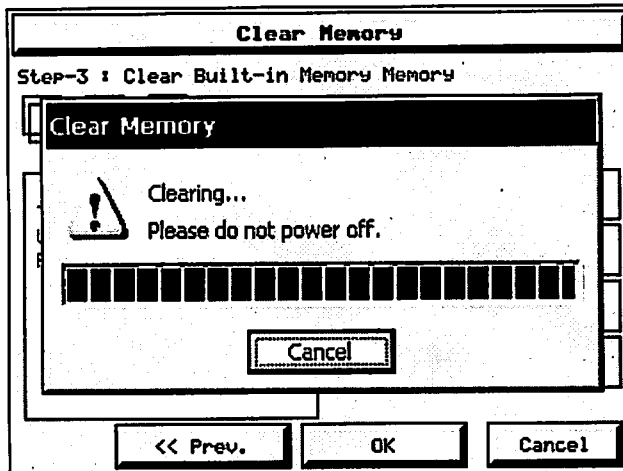


The data file(s) selected to clear are checked. If the data file is good, then the OK button can be pressed to start the clear procedure.

If there is a problem with the data file, the OK button will remain grayed out and the user can return to the previous screen by pressing the << Prev button.

5

Press the OK button to continue.



This message is displayed during the clearing process. Press the Cancel button to abort the clearing.

The following text is shown in the clearing progress message box:

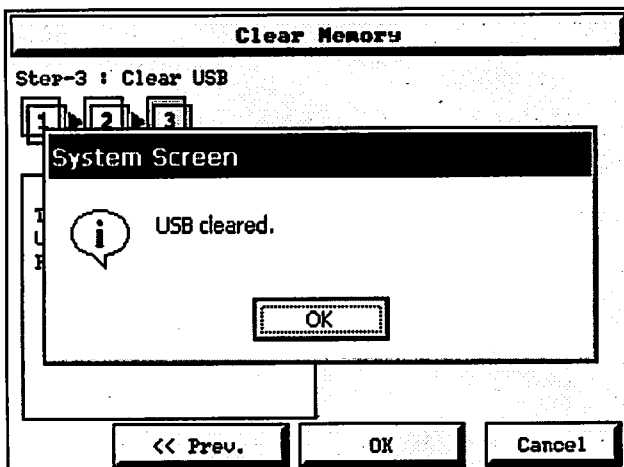
Clearing Built-in Memory:
"Please do not Power Off"

Clearing USB Memory:
"Please do not Power Off or Remove USB"

Clearing CF1 or CF2
"Please do not Power Off or Remove CF"



WARNING: During the clearing process, do not power off the touch panel or remove the memory device.



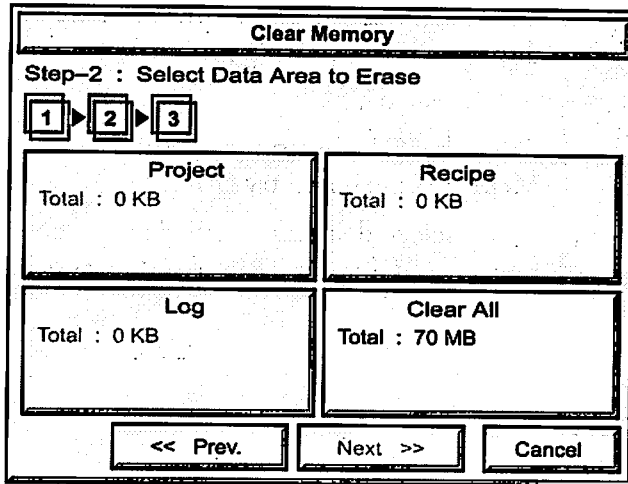
The following message is displayed when the clearing process is complete:

"%Device% cleared"

%Device% will show either "CF1", "CF2", or "USB".

Press the OK button to return to the Memory Menu screen.

Memory – Clear Memory (cont'd)



The following is an example of Clear All selected for clearing.

The selected device is highlighted.

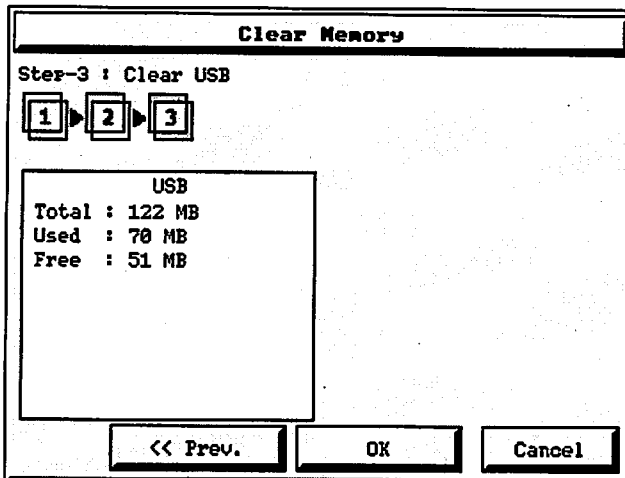
The Next >> button is now enabled.

Pressing Cancel will un-select the Clear All.

5



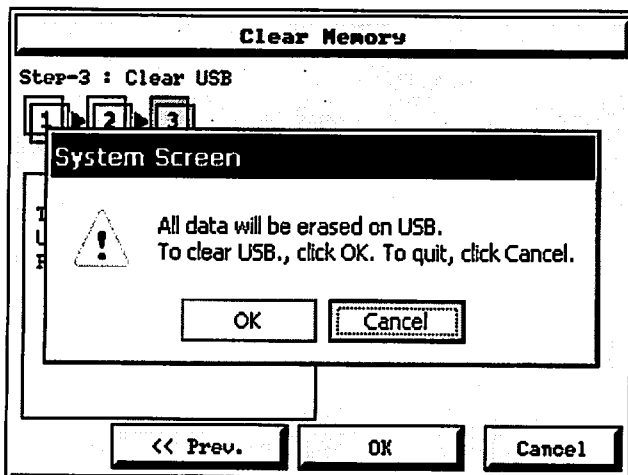
Note: If Clear All is selected, all files will be erased from the memory device, even those not related to the C-more touch panel.



The data file(s) selected to clear are checked. If the data file is good, then the OK button can be pressed to start the clear procedure.

If there is a problem with the data file, the OK button will remain grayed out and the user can return to the previous screen by pressing the << Prev button.

Press the OK button to continue.

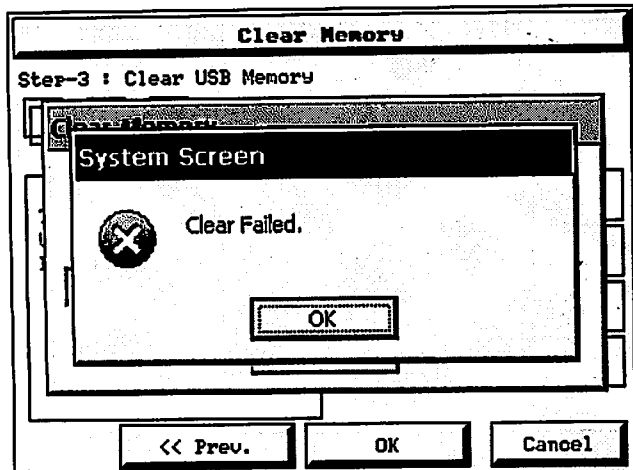


The warning message shown here will be displayed to give the user the opportunity to decide if they want to proceed or not.

Press the OK button to continue.

The Clear All process will start with a warning message as seen in the first example and continue until a message saying the device is cleared or a warning message as shown on the next page will appear.

Memory – Clear Memory (cont'd)



The warning message shown here will be displayed if the clearing process fails.

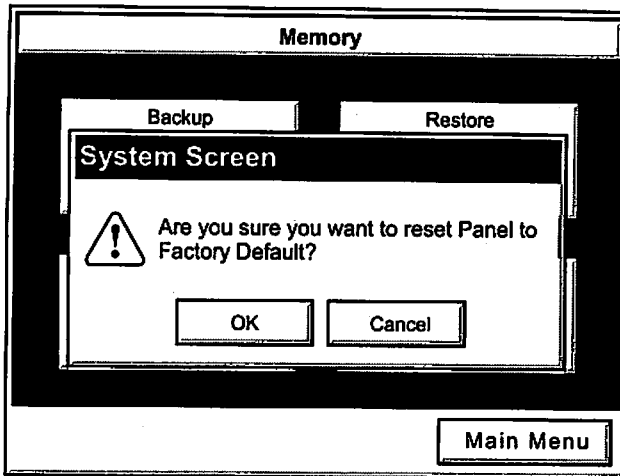
"Clear Failed".

Press the OK button to return to the Clear Memory screen and try again.

If the selected memory still fails to clear, then refer to Chapter 8: Troubleshooting for additional help.

5

Memory – Reset to Factory Default



After pressing the Reset to Factory Default button from the Memory Menu, the message box shown will be displayed.

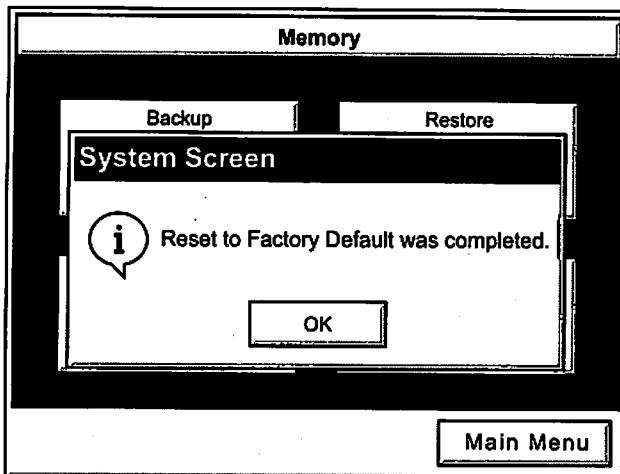
Resetting to the Factory Defaults produces the following actions:

- 1.) The touch screen calibration is reset to the Factory Defaults.
- 2.) The project file is cleared.
- 3.) The log, recipe & WAV files are cleared.
- 4.) The IP address is set to DHCP.

5

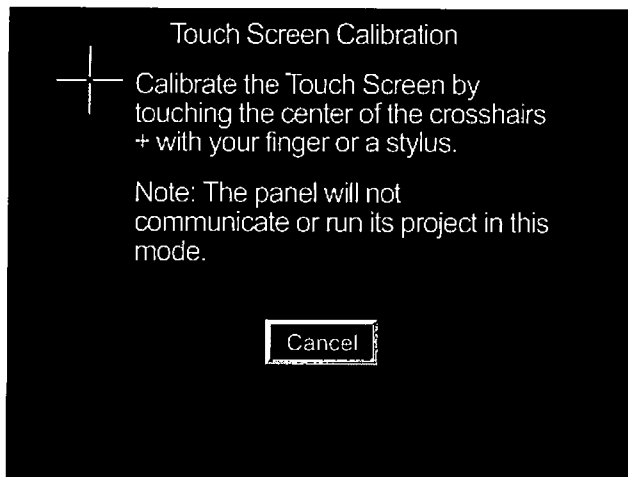


WARNING: Please make a backup file to either a CF or USB memory device using the Memory Backup function before resetting to the Factory Defaults as a precautionary measure.



The message shown here is displayed once the Factory Default values have been stored into the system memory.

Press OK to continue.



After pressing OK, the touch panel will reboot and startup on the Touch Screen Calibration procedure as shown here.

The following note is also shown on the calibration screens to remind the user that the Project File has been cleared, there's no communications with the PLC, and the calibration procedure must be performed in order to ready the panel to download a project:

Note: The panel will not communicate or run its project in this mode.

Also, the *C-more* Programming Software will not connect to the panel in this situation.

PLC COMMUNICATIONS



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PLC Compatibility Table	6-3
PLC Communication Cables & Wiring Diagrams	6-5
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<i>Direct</i> LOGIC PLCs RS-422A/RS-485A	6-10
<i>Direct</i> LOGIC Universal Isolated Network Adapter, p/n FA-ISOCAN	6-14
<i>Direct</i> LOGIC Universal Converter, p/n F2-UNICON	6-15
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Introduction

The *C-more* family of touch panels is capable of communicating with a wide variety of Programmable Logic Controllers. *C-more* is capable of communicating over RS232, RS422 and RS485 serial networks as well as Ethernet networks. It communicates with all controllers in the *Direct LOGIC* family of PLC's utilizing various protocols. *C-more* also communicates with other brands of PLCs by their different protocols. The table on the next page lists all of the various PLCs and protocols that can be configured. The page after the protocol table lists the various serial communication cables that are available to purchase. The rest of this chapter is devoted to show the pin to pin connections of all the available cables plus wiring diagrams that the user can refer to in order to construct their own cables, along with wiring diagrams of cables that are not available for purchase. To simplify RS422/RS485 wiring schemes, we have included wiring diagrams showing connections for available terminal connectors such as our ZIPLink Communication Adapter Module, p/n DN-15TB, used for example with our DL-06 and D2-260 PLCs and *C-more* D-Sub 15-pin to Terminal Block Adapter p/n EA-COMCON-3.

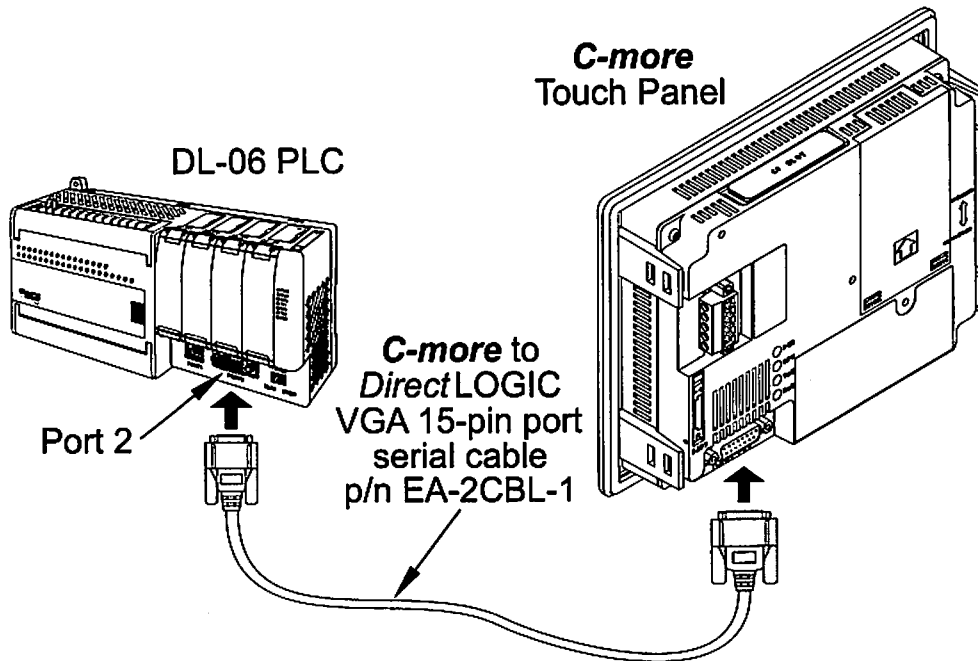
If you have difficulty determining whether the particular PLC and/or protocol you are using will work with the *C-more* series of touch panels, please contact our technical support group at 770-844-4200

6

DirectLOGIC PLCs Password Protection



NOTE: *DirectLogic* PLCs support multi-level password protection of the ladder program. This allows password protection while not locking the communication port to an operator interface. The multilevel password can be invoked by creating a password with an upper case "A" followed by seven numeric characters (e.g. A1234567). Please refer to the specific PLC user manual for further details.



PLC Protocol & Cables

PLC Compatibility Table			
PLC Family	Model	Protocols	
DirectLOGIC	DL05/DL06	all	K-Sequence
			<i>Direct</i> NET
		H0-ECOM/H0-ECOM100	Modbus (Koyo addressing)
			<i>Direct</i> LOGIC Ethernet
	DL105	all	K-Sequence
	DL205	D2-230	K-Sequence
		D2-240	K-Sequence
			<i>Direct</i> NET
		D2-250/D2-250-1/D2-260	K-Sequence
			<i>Direct</i> NET
			Modbus (Koyo addressing)
		D2-240/D2-250-1/D2-260 Using DCM	<i>Direct</i> NET
			Modbus (Koyo addressing)
		H2-ECOM/H2-ECOM100	<i>Direct</i> LOGIC Ethernet
	DL305	D3-330/330P (Requires the use of a Data Communications Unit)	<i>Direct</i> NET
		D3-340	<i>Direct</i> NET
		D3-350	K-Sequence
			<i>Direct</i> NET
			Modbus (Koyo addressing)
		D3-350 DCM	<i>Direct</i> NET
			Modbus (Koyo addressing)
	DL405	D4-430	K-Sequence
			<i>Direct</i> NET
		D4-440	K-Sequence
		<i>Direct</i> NET	
D4-450		K-Sequence	
		<i>Direct</i> NET	
		Modbus (Koyo addressing)	
	All with DCM	<i>Direct</i> NET	
		Modbus (Koyo addressing)	
	H4-ECOM/H4-ECOM100	<i>Direct</i> LOGIC Ethernet	
	H2-WinPLC (Think & Do) Live V5.2 or later and Studio any version	Think & Do Modbus RTU (serial port)	
	H2-WinPLC (Think & Do) Live V5.5.1 or later and Studio V7.2.1 or later	Think & Do Modbus TCP/IP (Ethernet port)	

PLC Compatibility Table continued on the next page.

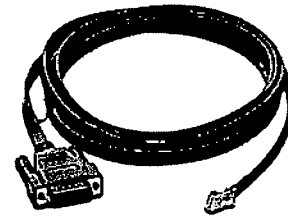
PLC Protocol & Cables (cont'd)

PLC Compatibility Table (cont'd)		
PLC Family	Model	Protocols
Allen-Bradley	MicroLogix 1000, 1100, 1200, 1500, SLC 5-01/02/03, PLC5	DH485/AIC/AIC+
	MicroLogix 1000, 1100, 1200 and 1500	DF1 Half Duplex; DF1 Full Duplex
	SLC 5-03/04/05	
	ControlLogix™, CompactLogix™, FlexLogix™	DF1 Full Duplex
	PLC-5	
	ControlLogix, CompactLogix, FlexLogix - Tag Based	DF1 Half Duplex; DF1 Full Duplex
	ControlLogix, CompactLogix, FlexLogix - Generic I/O Messaging	EtherNet/IP Server
	ControlLogix, CompactLogix, FlexLogix - Tag Based	EtherNet/IP Client
	MicroLogix 1100 & SLC 5/05, both via native Ethernet port	
MicroLogix 1000, 1100, 1200, 1500, SLC 5-03/04/05, all via ENI adapter		
Modbus TCP/IP	Modbus TCP/IP devices	Modbus TCP/IP
GE	90/30, 90/70, Micro 90, VersaMax Micro	SNPX
Mitsubishi	FX Series	FX Direct
Omron	C200 Adapter, C500	Host Link
	CJ1/CS1 Serial	FINS
	CJ1/CS1 Ethernet	
Modicon	984 CPU, Quantum 113 CPU, AEG Modicon Micro Series 110 CPU: 311-xx, 411-xx, 512-xx, 612-xx	Modbus RTU
Siemens	S7-200 CPU, RS-485 Serial	PPI
	S7-300, Ethernet	Ethernet ISO over TCP

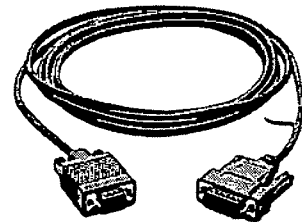
6

PLC Communication Cables & Wiring Diagrams

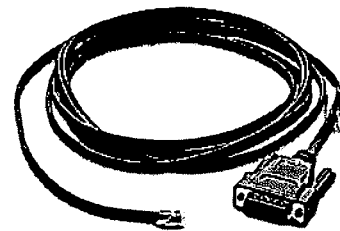
Purchased Cable Description	Cable Part Number
DirectLOGIC PLC RJ-12 port, DL05, DL06, DL105, DL205, D3-350, D4-450 & H2-WINPLC (RS-232C)	EA-2CBL
DirectLOGIC (VGA Style) 15-pin port, DL06, D2-250 (250-1), D2-260 (RS-232C)	EA-2CBL-1
DirectLOGIC PLC RJ-11 port, D3-340 (RS-232C)	EA-3CBL
DirectLOGIC DL405 PLC 15-pin D-sub port, DL405 (RS-232C)	EA-4CBL-1
DirectLOGIC PLC 25-pin D-sub port, DL405, D3-350, DL305 DCU and all DCM's (RS-232C)	EA-4CBL-2
Allen-Bradley MicroLogix 1000, 1100, 1200 & 1500 (RS-232C)	EA-MLOGIX-CBL
Allen-Bradley SLC 5-03/04/05, ControlLogix, CompactLogix, FlexLogix DF1 port (RS-232C)	EA-SLC-232-CBL
Allen-Bradley PLC-5 DF1 port (RS-232C)	EA-PLC5-232-CBL
Allen-Bradley MicroLogix, SLC 5-01/02/03, PLC5 DH485 port (RS-232C)	EA-DH485-CBL
GE 90/30, 90/70, Micro 90, VersaMax Micro 15-pin D-sub port (RS-422A)	EA-90-30-CBL
MITSUBISHI FX Series 25-pin port (RS-422A)	EA-MITSU-CBL
MITSUBISHI FX Series 8-pin mini-DIN (RS-422A)	EA-MITSU-CBL-1
OMRON Host Link C200 Adapter, C500 (RS-232C)	EA-OMRON-CBL



Part No. EA-2CBL



Part No. EA-2CBL-1



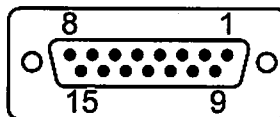
Part No. EA-3CBL



NOTE 1: The above list of pre-made communications cables may be purchased. See further in this chapter for wiring diagrams of additional **user constructed cables**. This chapter also includes wiring diagrams for the pre-made cables.

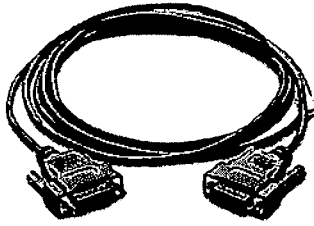
NOTE 2: EZTouch serial PLC communication cables are compatible with **C-more touch panels**.

C-more PLC Serial Communications Port

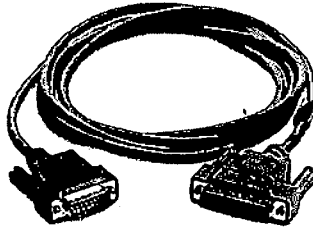


D-Sub 15-pin female on rear of touch panel

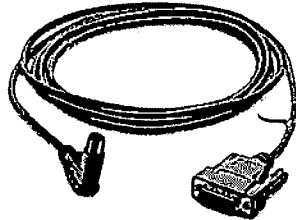
PLC Communication Cables & Wiring Diagrams



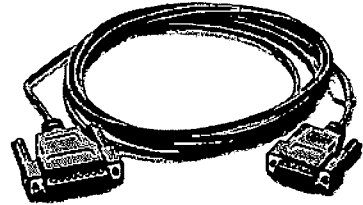
Part No. EA-4CBL-1



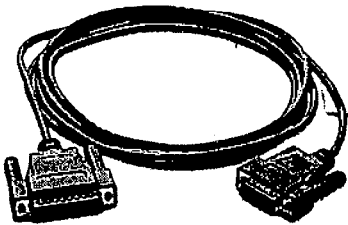
Part No. EA-4CBL-1



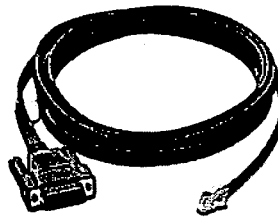
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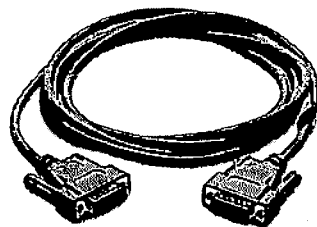
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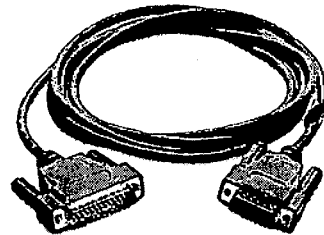
Part No. EA-PLC5-232-CBL



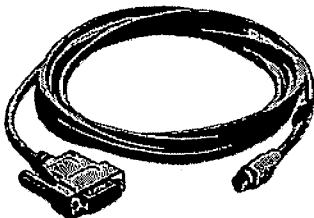
Part No. EA-DH485-CBL



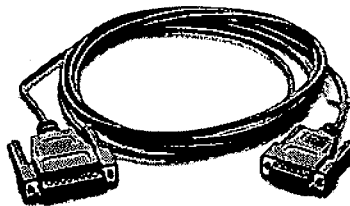
Part No. EA-90-30-CBL



Part No. EA-MITSU-CBL



Part No. EA-MITSU-CBL-1



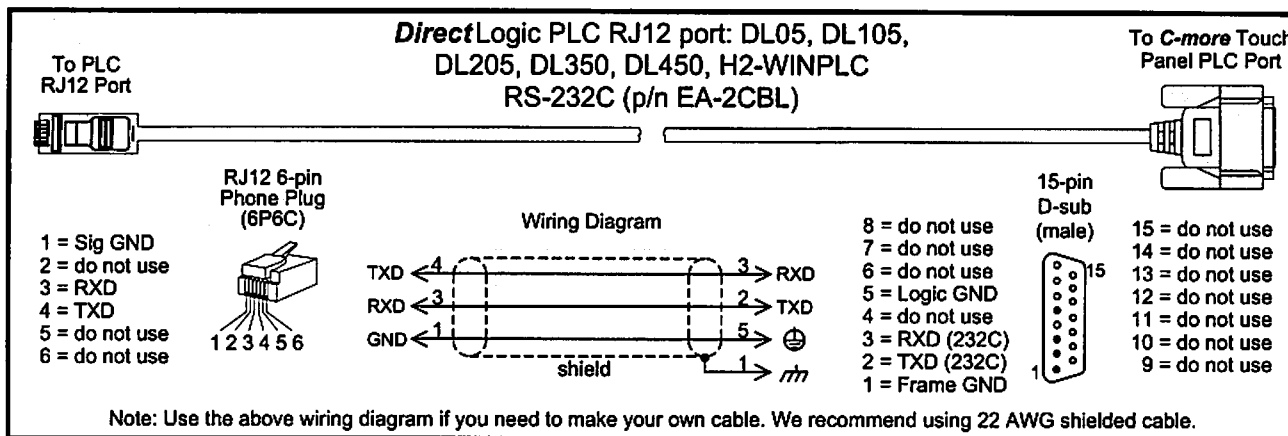
Part No. EA-OMRON-CBL

PLC Communication Cables & Wiring Diagrams (cont'd)

The following series of wiring diagrams show the connectors and wiring details for the communication cables that are used between the *C-more* touch panels and various PLC controllers. Part numbers are included with the pre-made cables that can be purchased from *AutomationDirect*. The information presented will allow the user to construct their own cables if so desired.

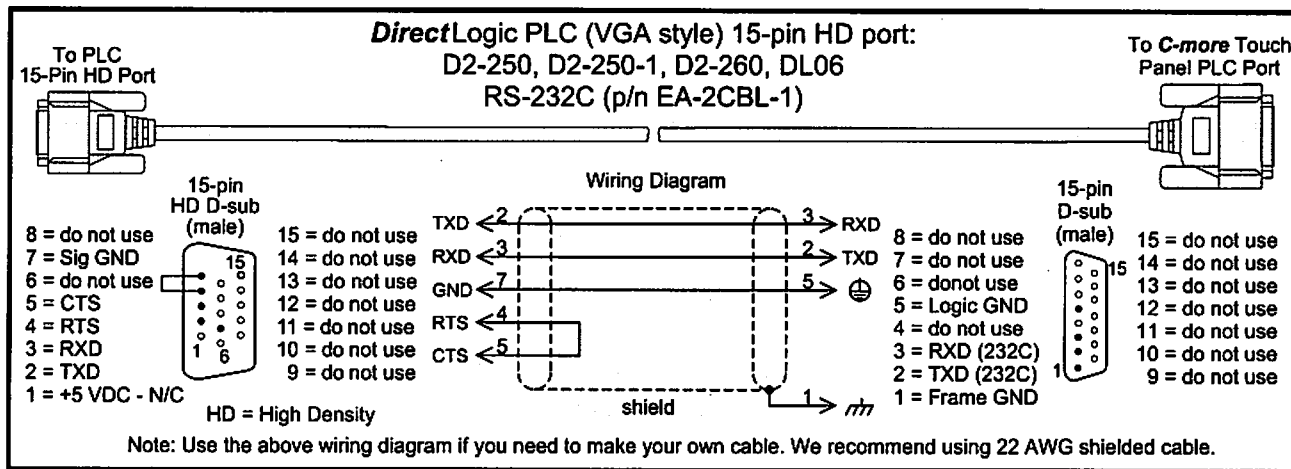
DirectLOGIC PLCs RS-232C Serial:

EA-2CBL



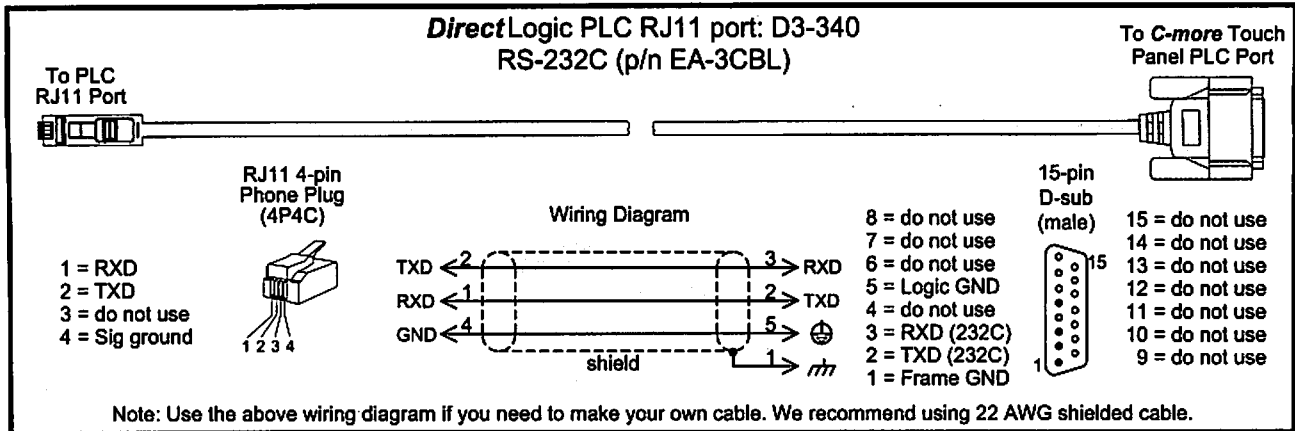
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EA-2CBL-1



Direct LOGIC PLCs RS-232C Serial (cont'd):

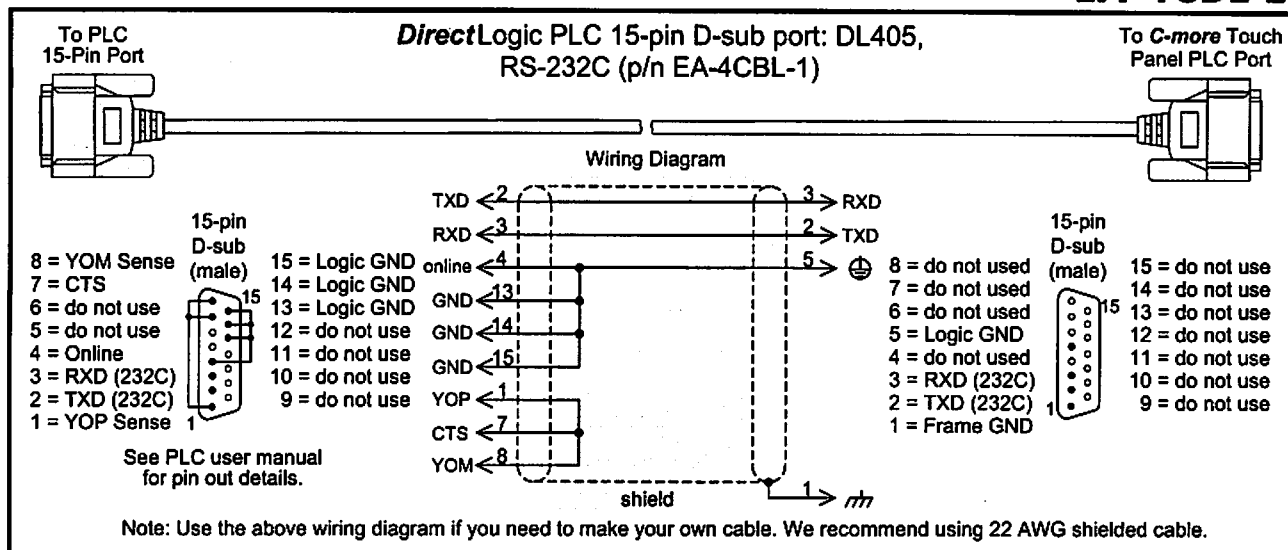
EA-3CBL



6

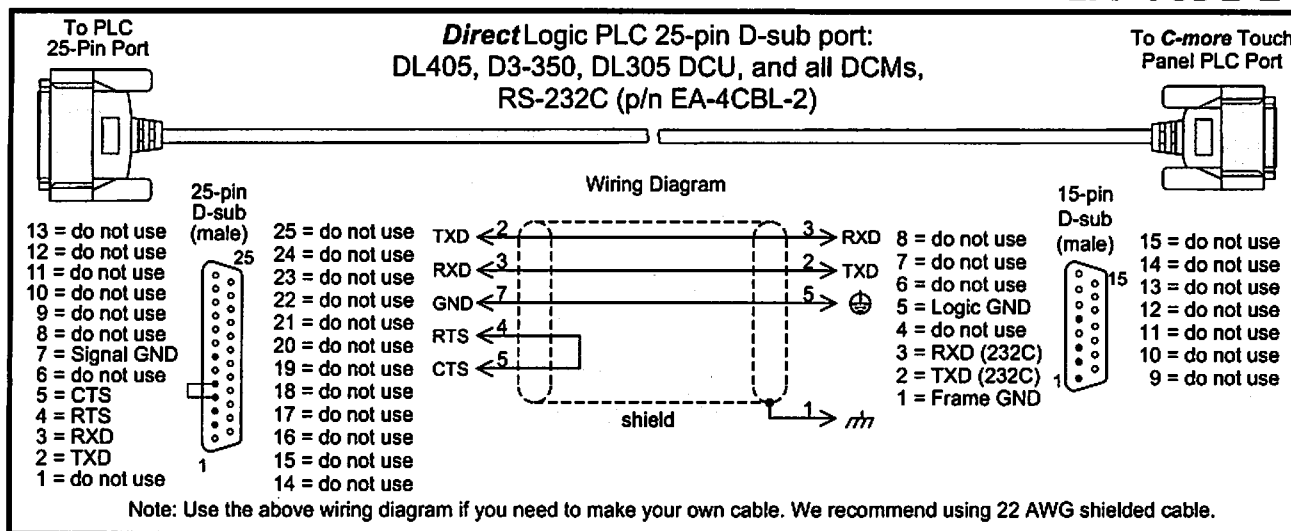
Direct LOGIC PLCs RS-232C Serial (cont'd):

EA-4CBL-1



6

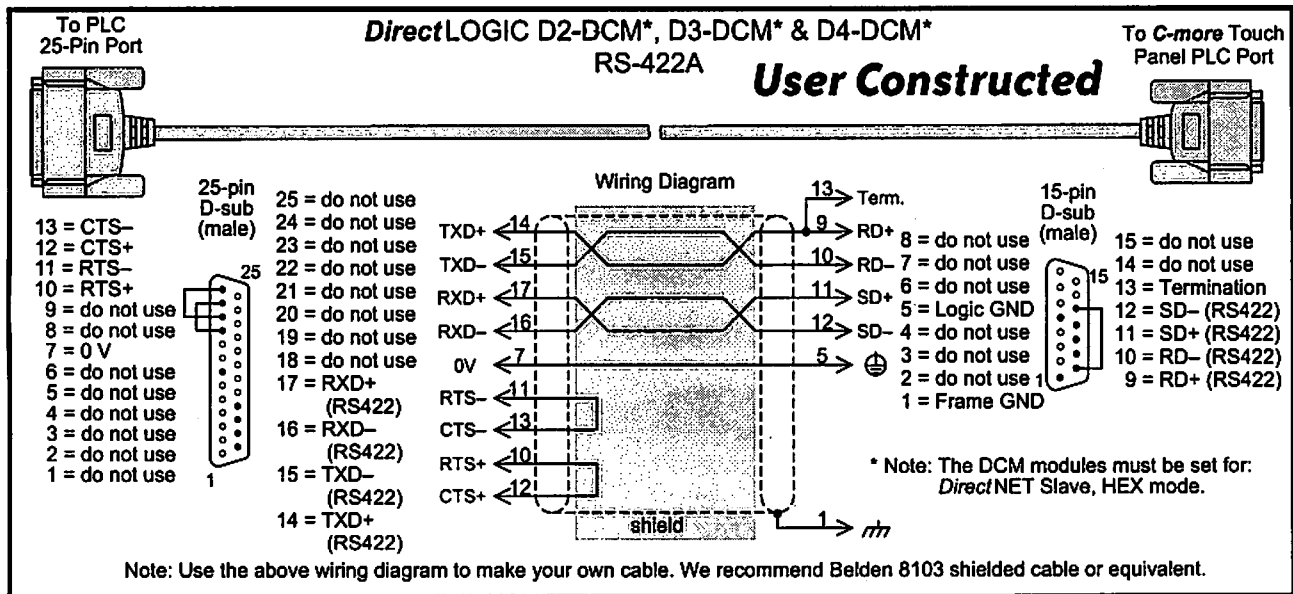
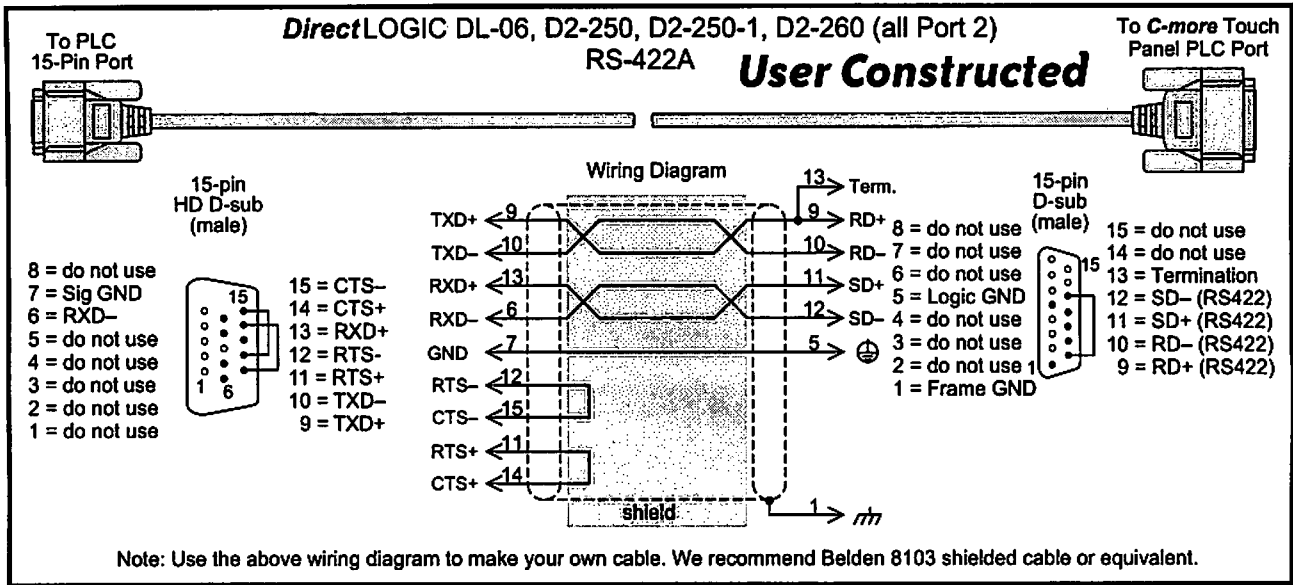
EA-4CBL-2



Direct LOGIC PLCs RS-422A/RS-485A:

When using the RS-422A/RS-485A capabilities of the *C-more* PLC communications port, the termination resistor is placed between the RXD- and RXD+ terminals on the PLC side of the connection between the touch panel and PLC. The Termination Resistor value is based on the characteristic impedance of the cable being used. To enable the built-in 120 Ohm Termination Resistor, jumper pin 13 to pin 9 (RXD+) on the *C-more* 15-pin PLC communications port.

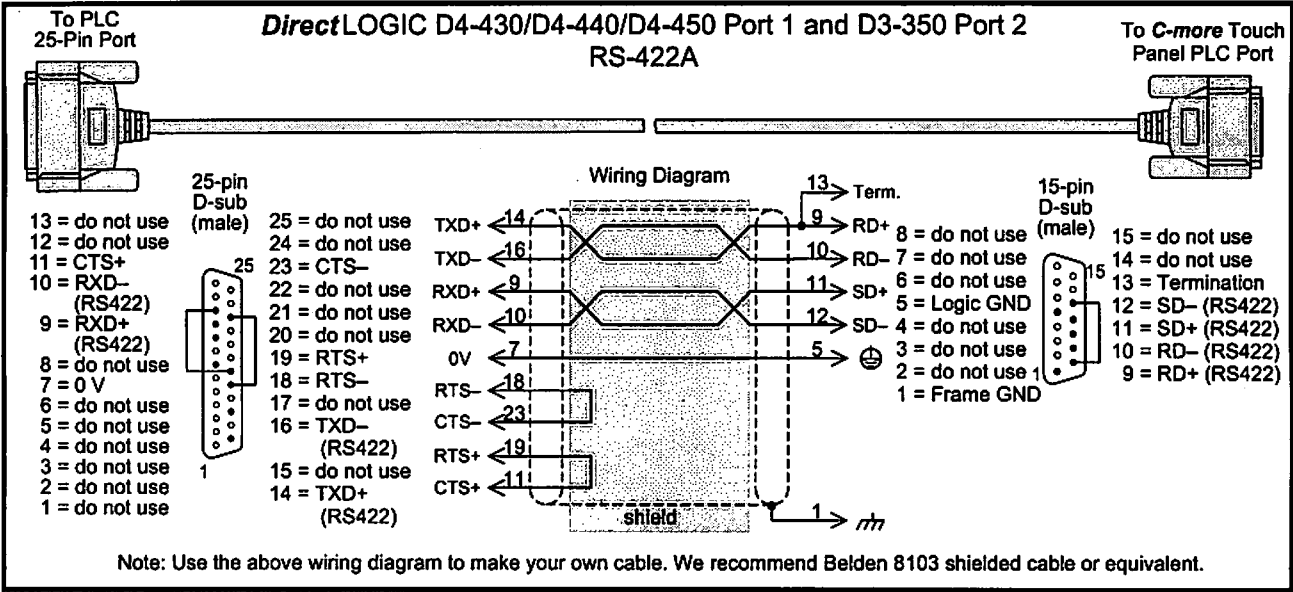
6



NOTE: The RS-422 wiring diagrams shown above are not for multi-drop networks involving connecting more than one PLC to a panel. Refer to the wiring diagram example on page 6-14 if more than one PLC will be connected to a panel.

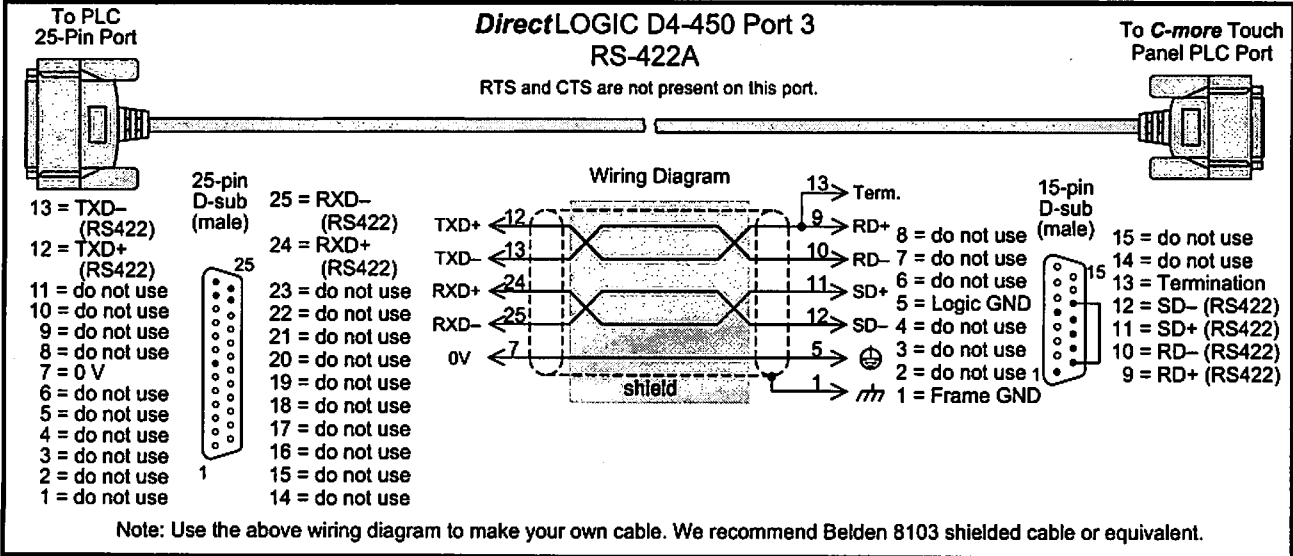
Direct LOGIC PLCs RS-422A/RS-485A (cont'd):

User Constructed



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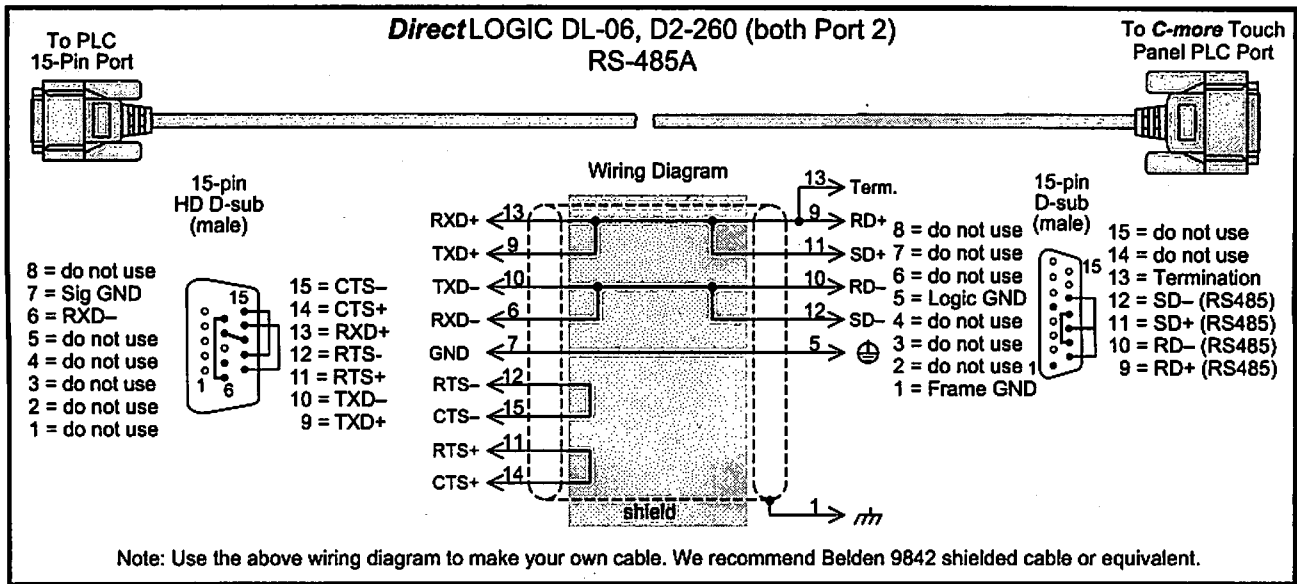
User Constructed



NOTE: The RS-422 wiring diagrams shown above are not for multi-drop networks involving connecting more than one PLC to a panel. Refer to the wiring diagram example on page 6-14 if more than one PLC will be connected to a panel.

Direct LOGIC PLCs RS-422A/RS-485 (cont'd):

User Constructed

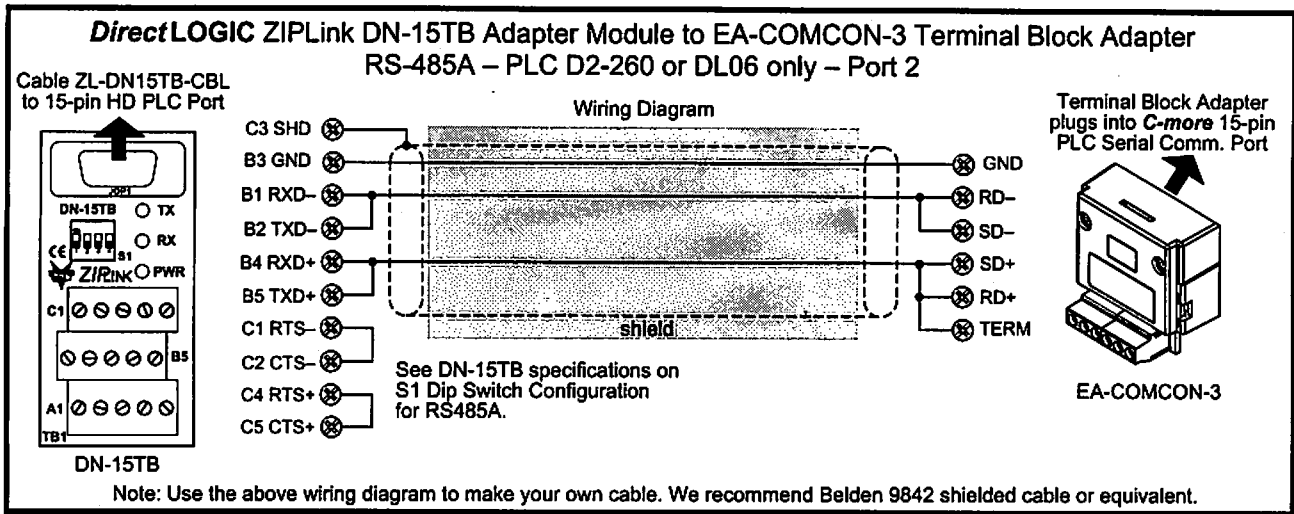


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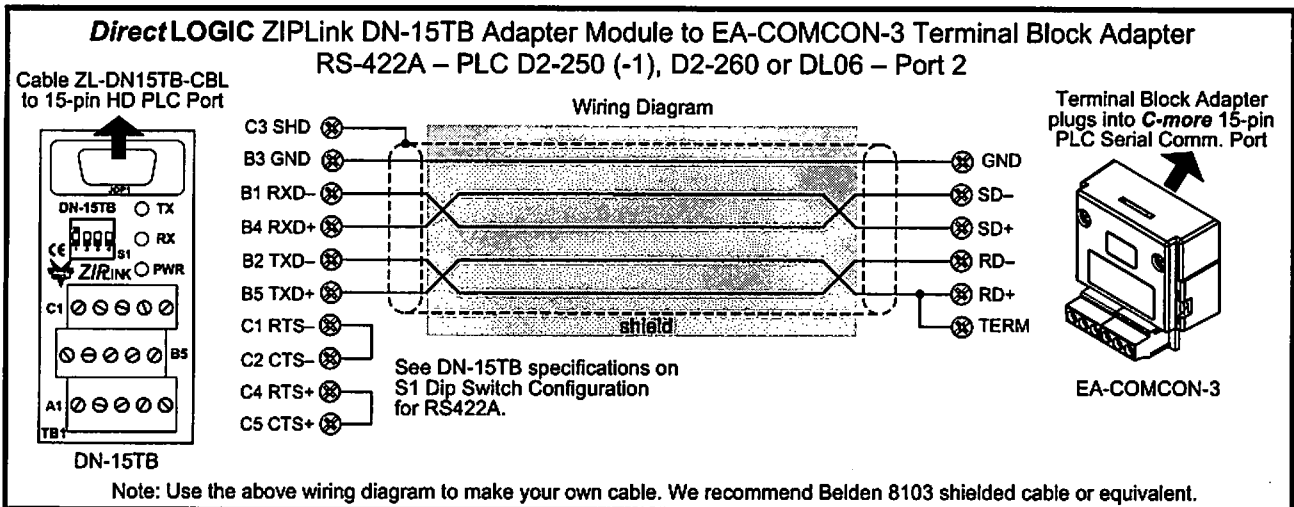


NOTE: The RS-485 wiring diagram shown above is not for multi-drop networks involving connecting more than one PLC to a panel. Refer to the wiring diagram example on page 6-16 if more than one PLC will be connected to a panel.

Direct LOGIC PLCs RS-422A/RS-485A (cont'd):



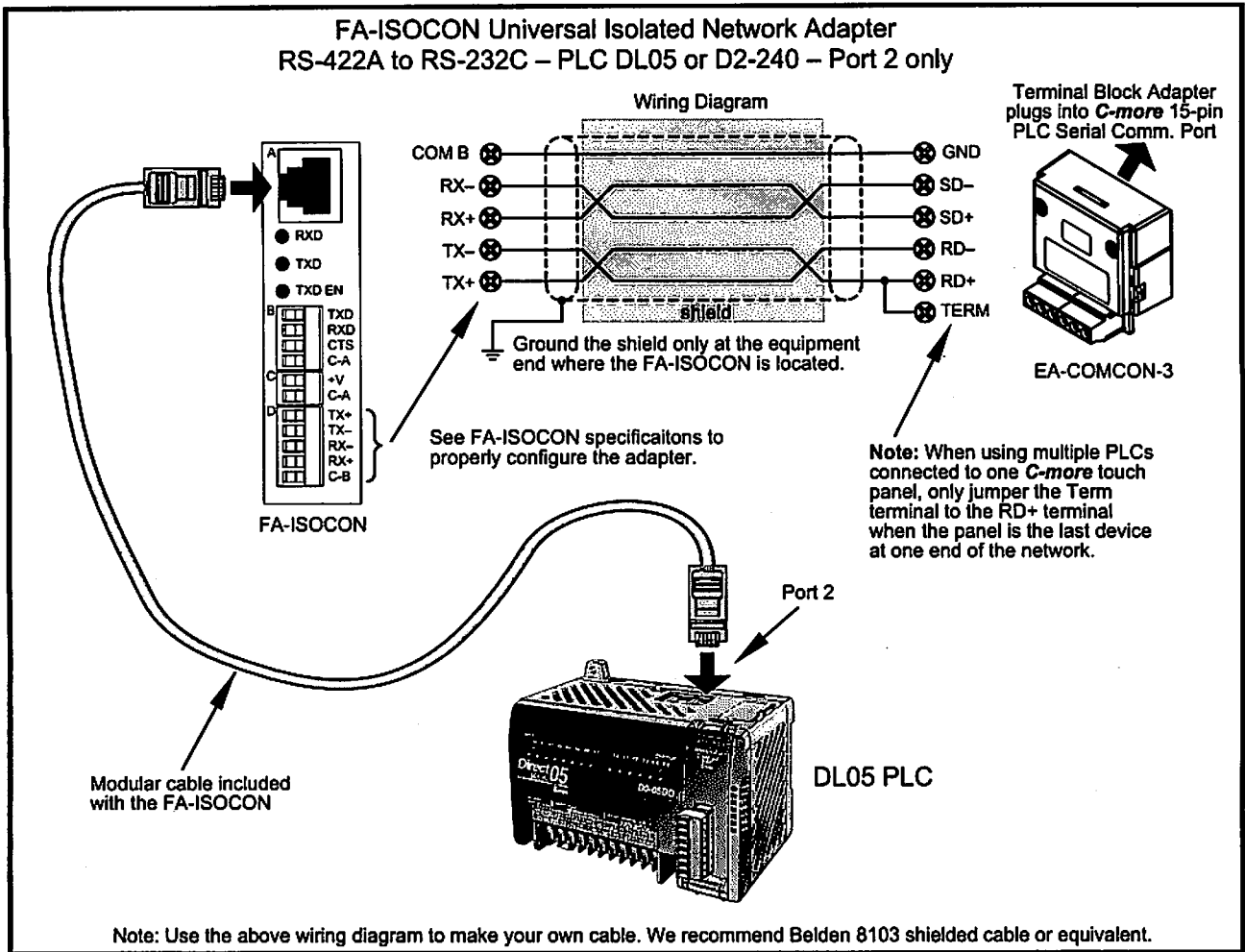
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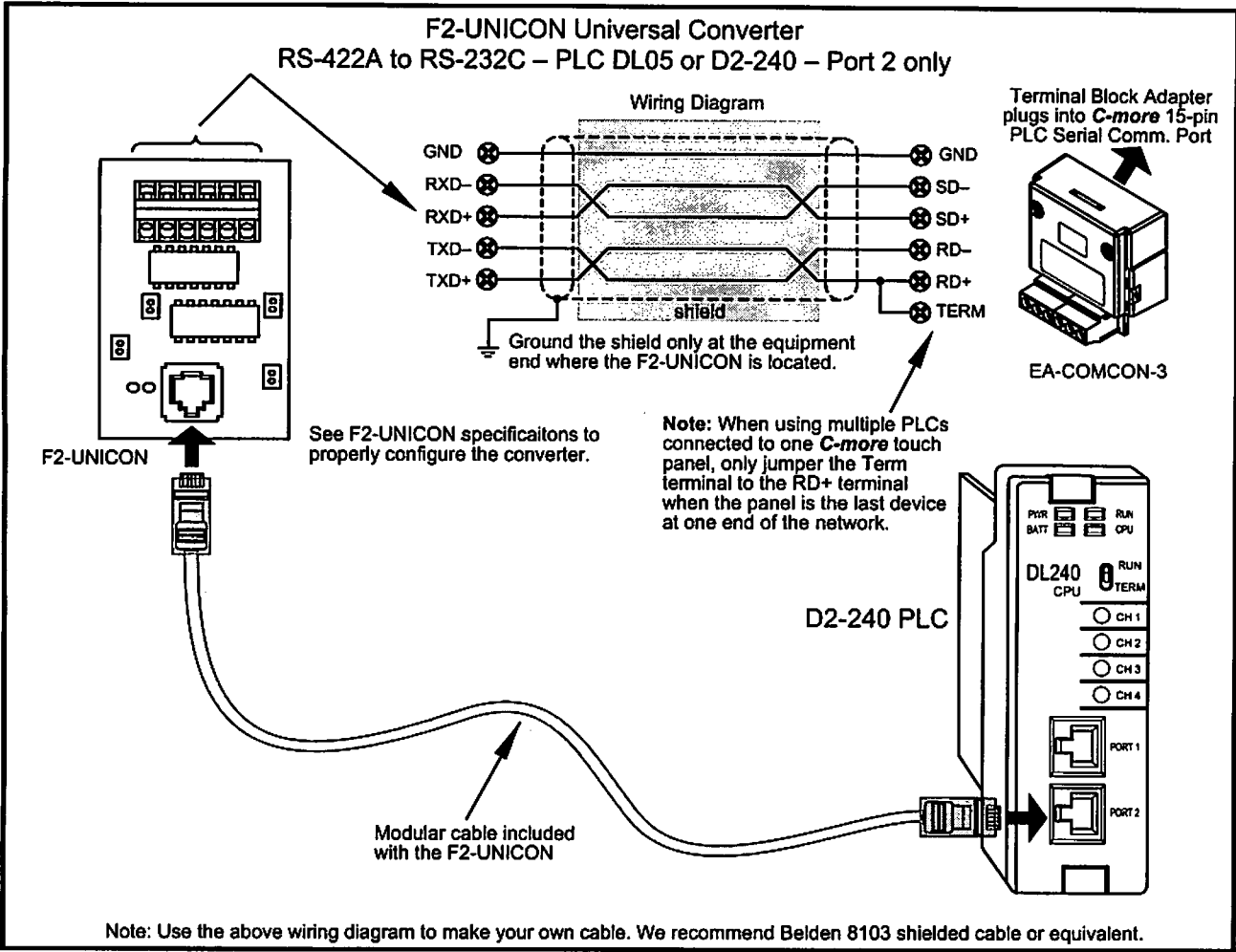
NOTE: The RS-422 and RS-485 wiring diagrams shown above are not for multi-drop networks involving connecting more than one PLC to a panel. Refer to the wiring diagram examples starting on page 6-14 if more than one PLC will be connected to a panel.

DirectLOGIC Universal Isolated Network Adapter, p/n FA-ISOCON:

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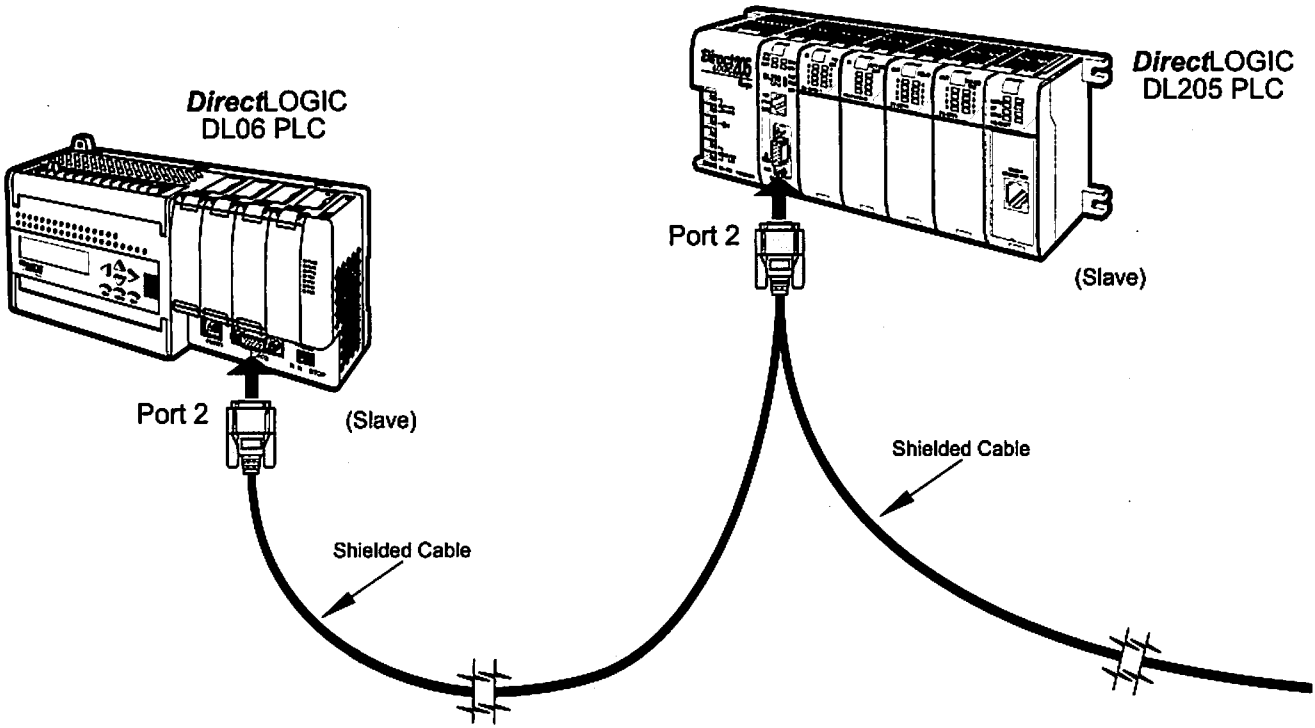


Direct LOGIC Universal Converter, p/n F2-UNICON:

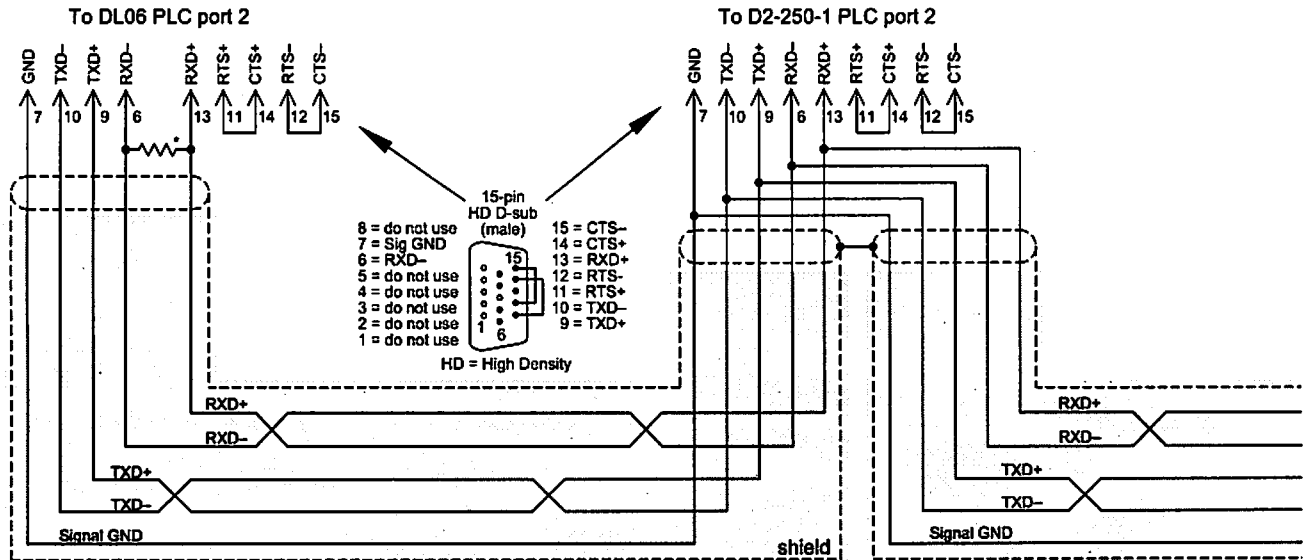


RS-422A/RS-485A Multi-Drop Wiring Diagram Examples

6



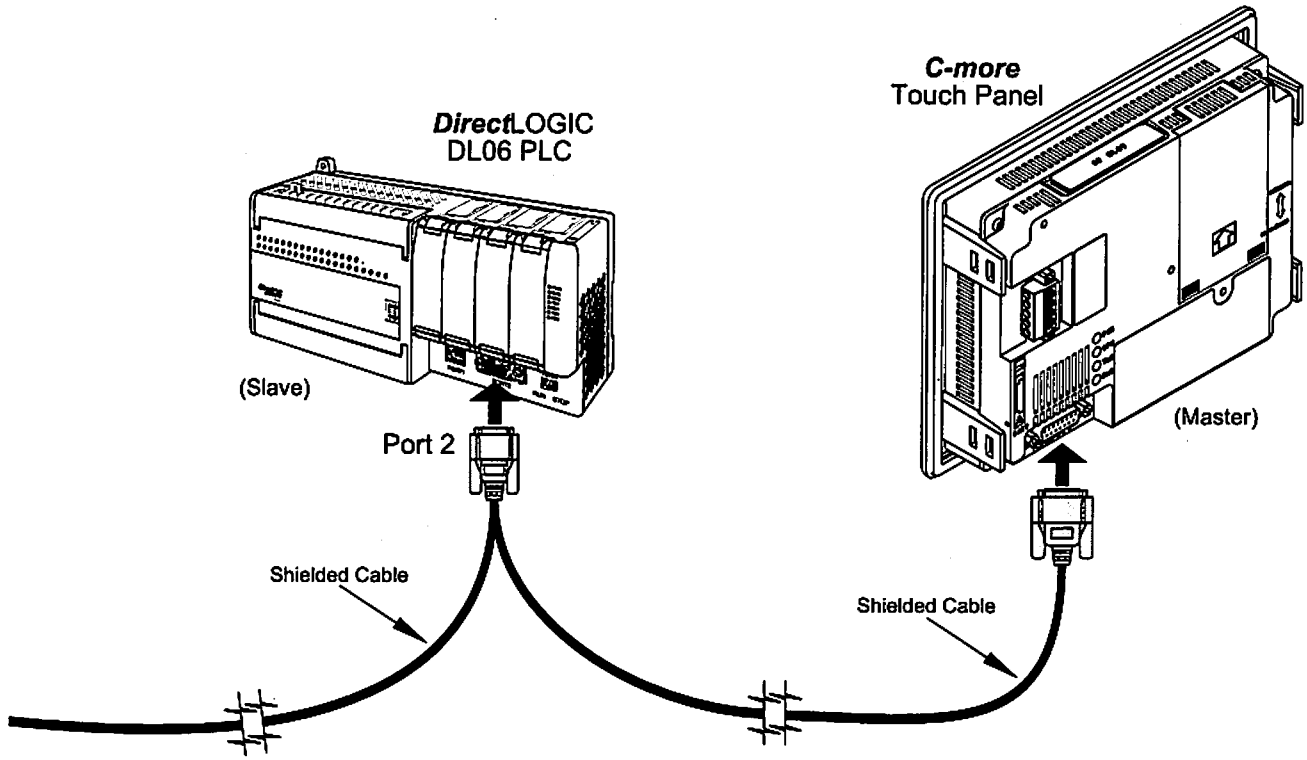
Note: We recommend Belden 8103 shielded cable or equivalent.



* Termination resistors required at both ends of the network receive data signals to match the impedance of the cable (between 100 and 500 ohms).

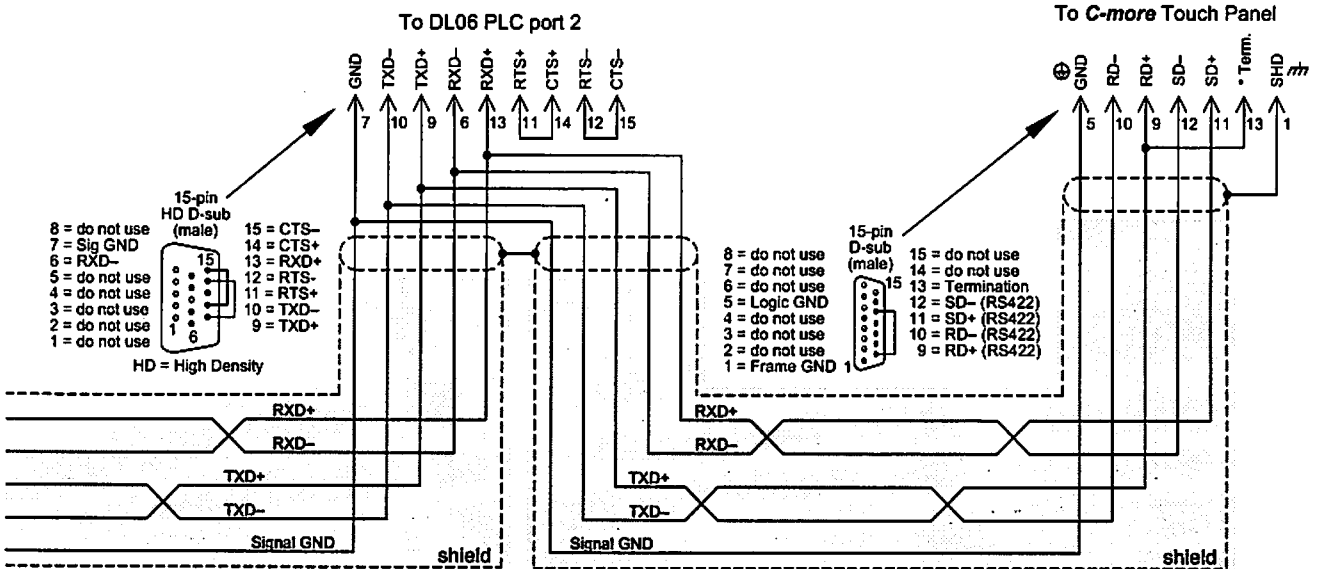
Typical RS-422 Multi-Drop Wiring Diagram

RS-422A/RS-485A Multi-Drop Wiring Diagram Examples (cont'd)



6

Note: We recommend Belden 8103 shielded cable or equivalent.

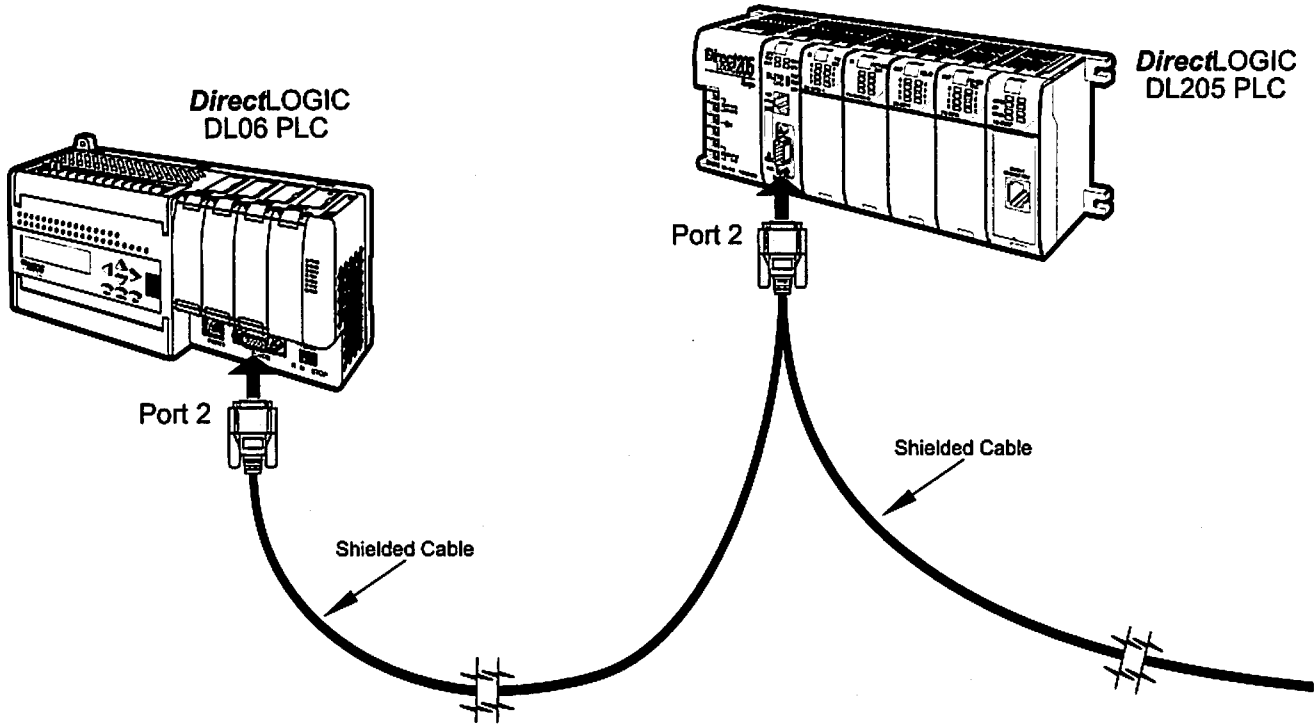


Typical RS-422 Multi-Drop Wiring Diagram (cont'd)

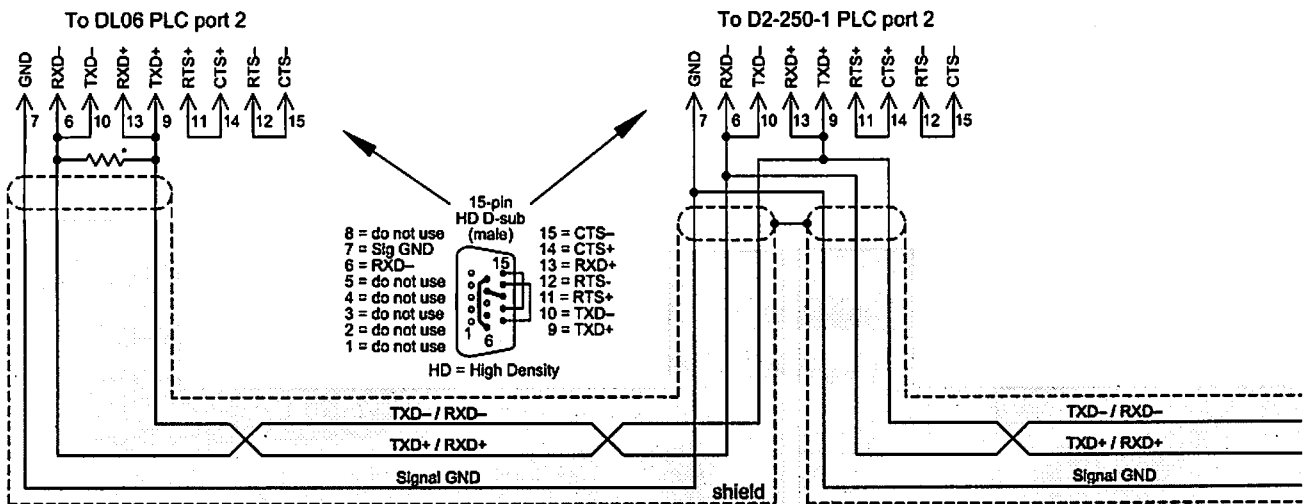
* Termination resistors required at both ends of the network receive data signals to match the impedance of the cable (between 100 and 500 ohms). Jumper pin 13 to 9 on the C-more Touch Panel 15-pin connector to place the 120Ω internal resistor into the network. If the cable impedance is different, then use an external resistor matched to the cable impedance.

RS-422A/RS-485 Multi-Drop Wiring Diagram Examples (cont'd)

6



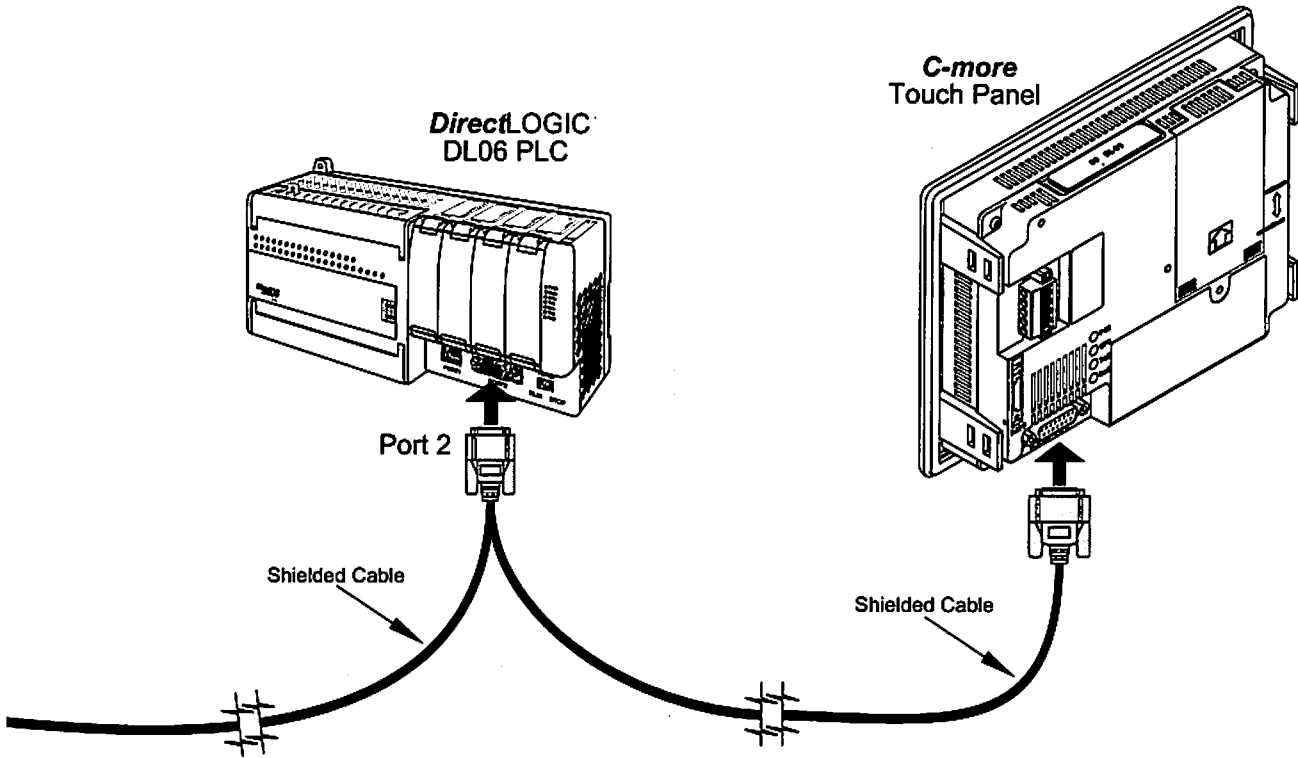
Note: We recommend Belden 88102 shielded cable or equivalent.



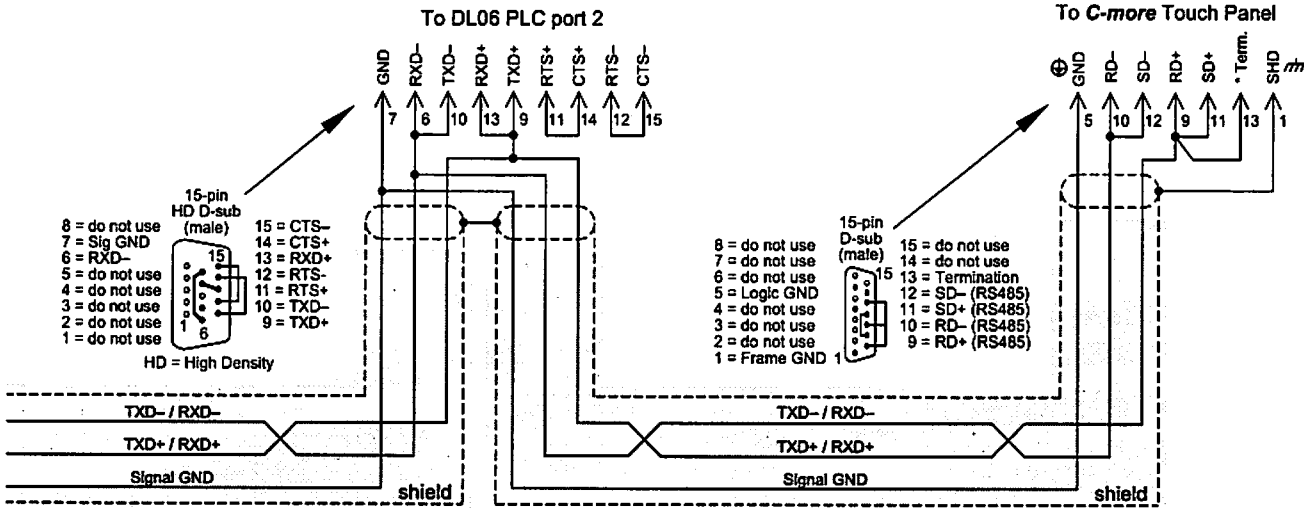
* Termination resistors required at both ends of the network to match the impedance of the cable (between 100 and 500 ohms).

Typical RS-485 Multi-Drop Wiring Diagram

RS-422A/RS-485A Multi-Drop Wiring Diagram Examples (cont'd)



Note: We recommend Belden 88102 shielded cable or equivalent.

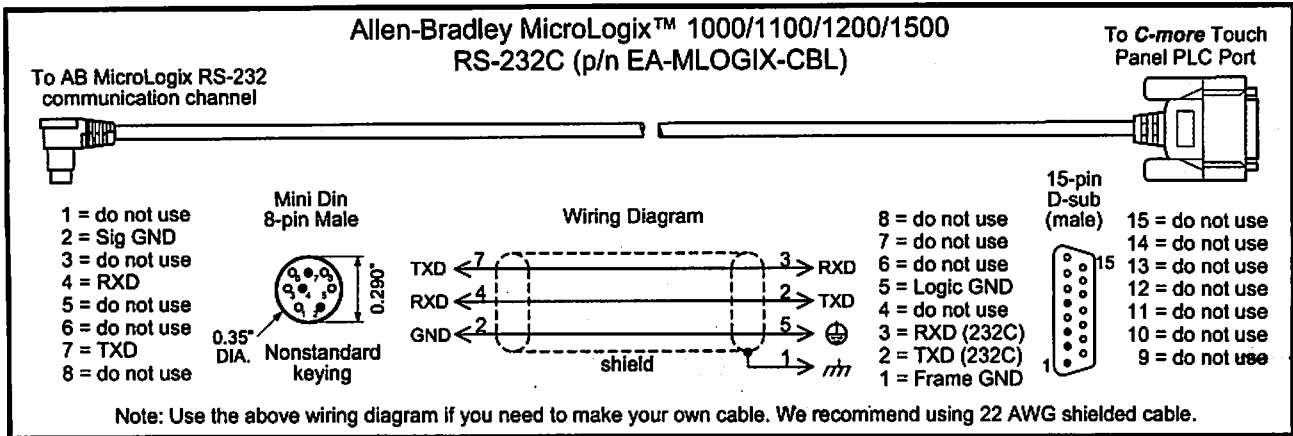


* Termination resistors required at both ends of the network receive data signals to match the impedance of the cable (between 100 and 500 ohms). Jumper pin 13 to 9 on the C-more EA-MG-SP1 15-pin connector to place the 120Ω internal resistor into the network. If the cable impedance is different, then use an external resistor matched to the cable impedance.

Typical RS-485 Multi-Drop Wiring Diagram (cont'd)

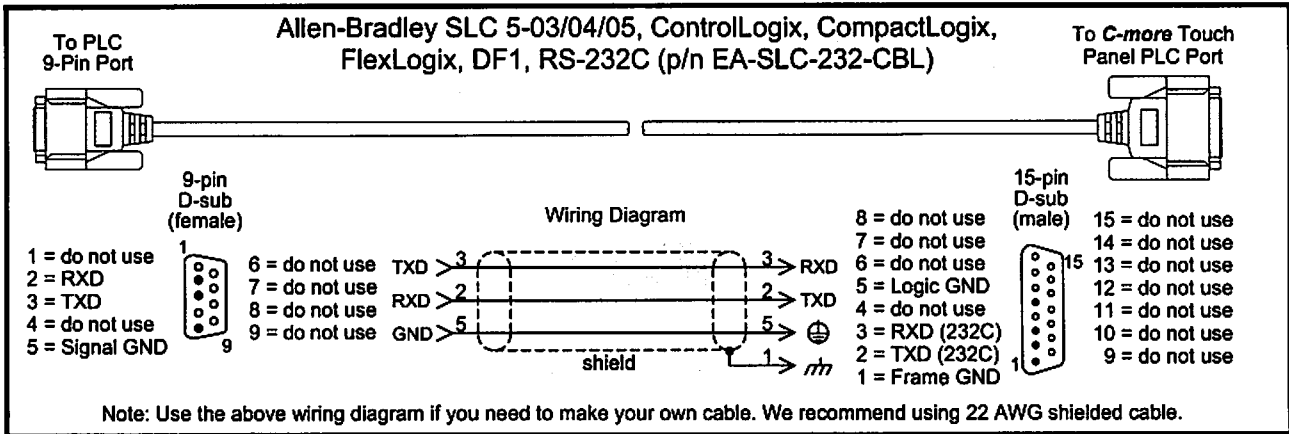
Allen-Bradley:

EA-MLOGIX-CBL

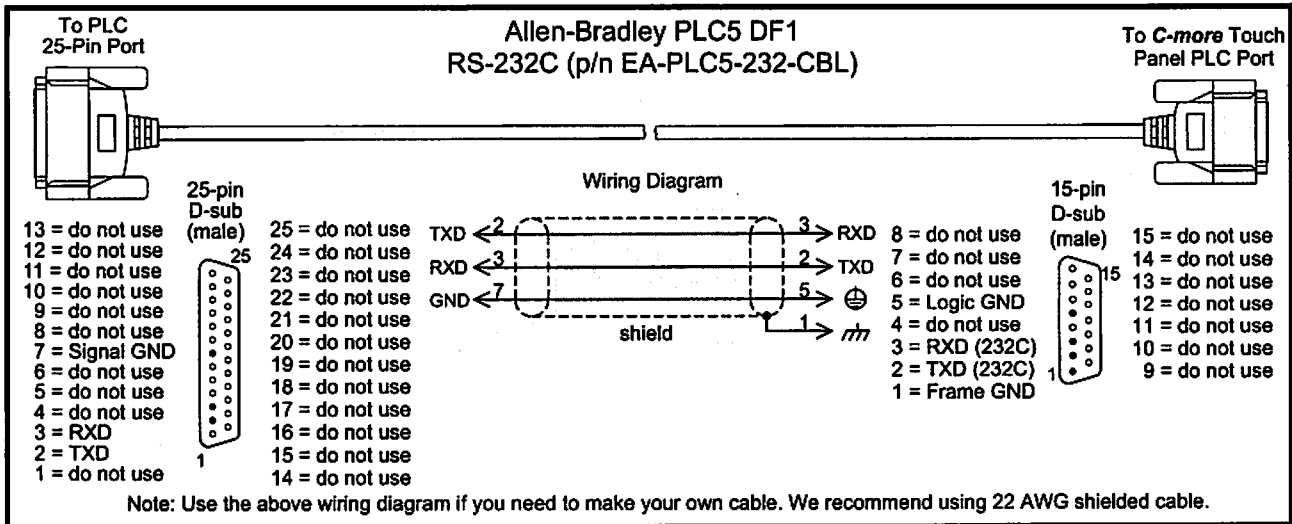


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EA-SLC-232-CBL

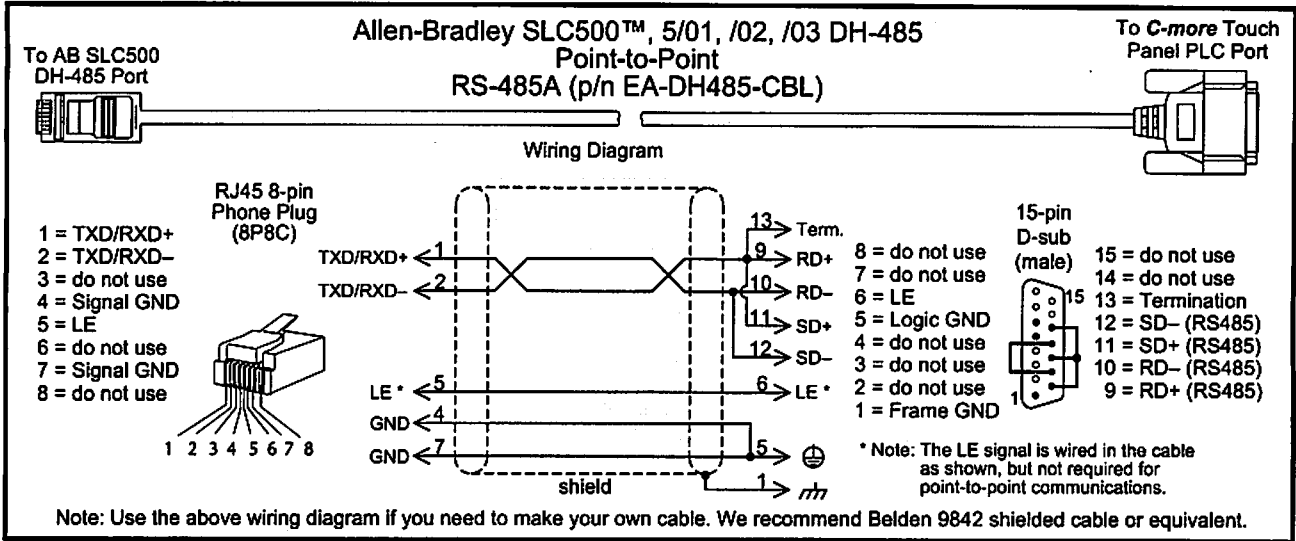


EA-PLC5-232-CBL

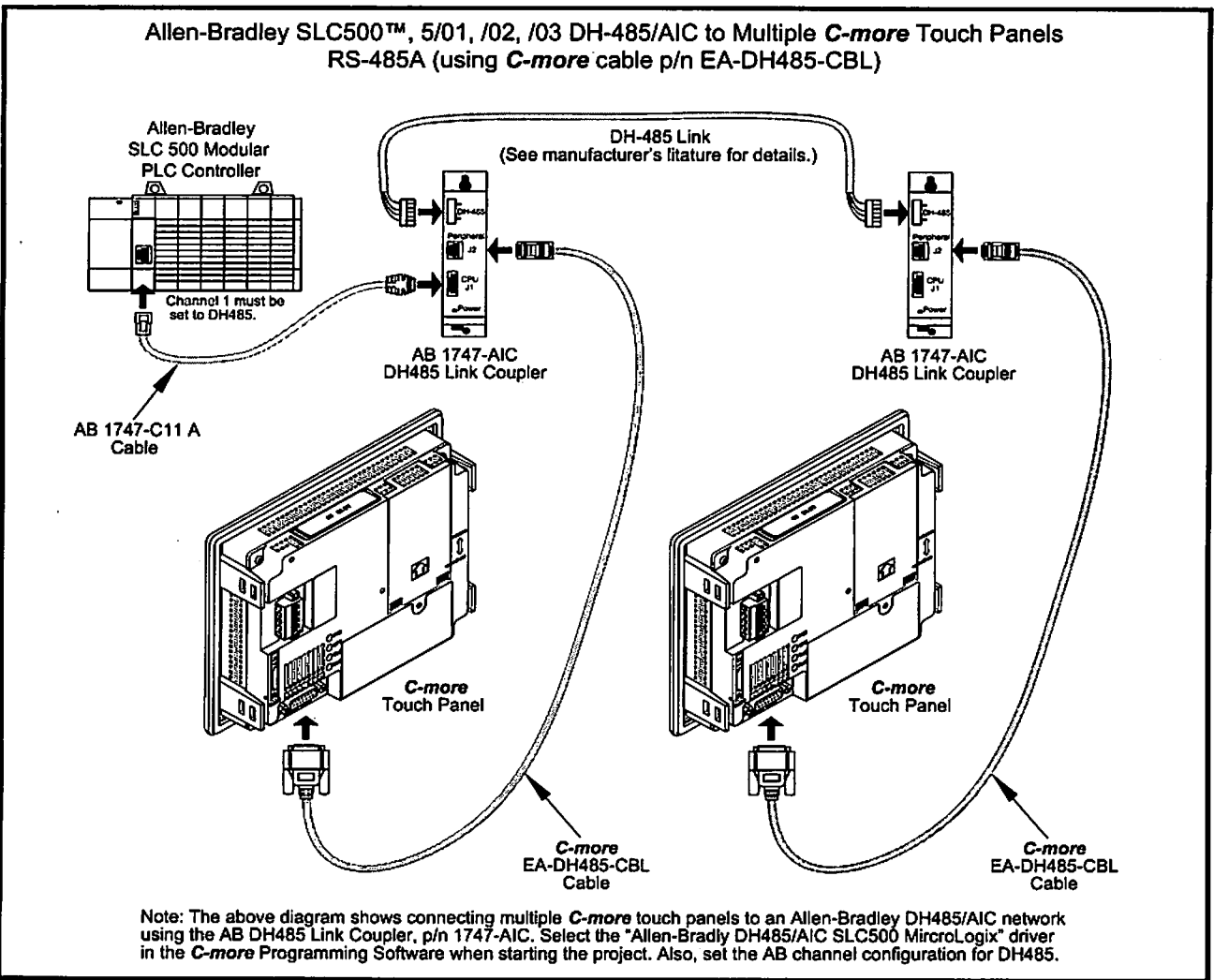


Allen-Bradley (cont'd):

EA-DH485-CBL

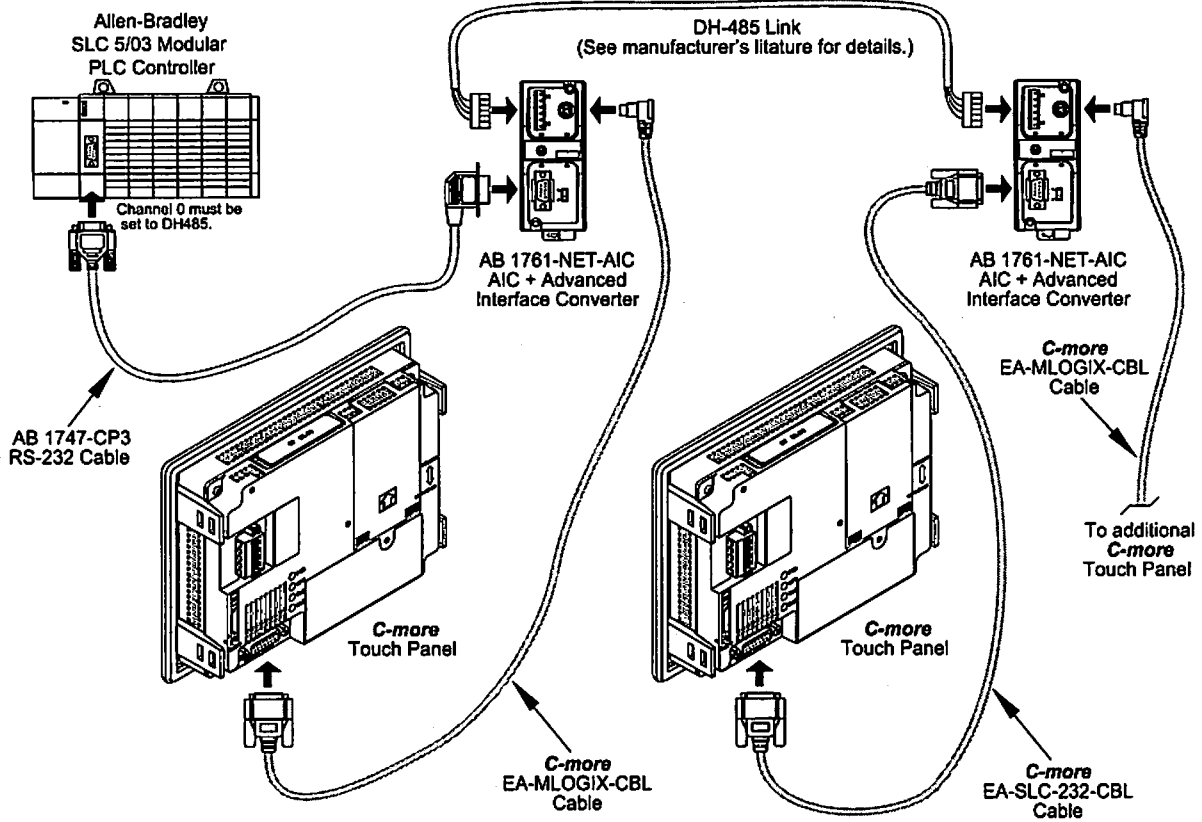


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Allen-Bradley (cont'd):

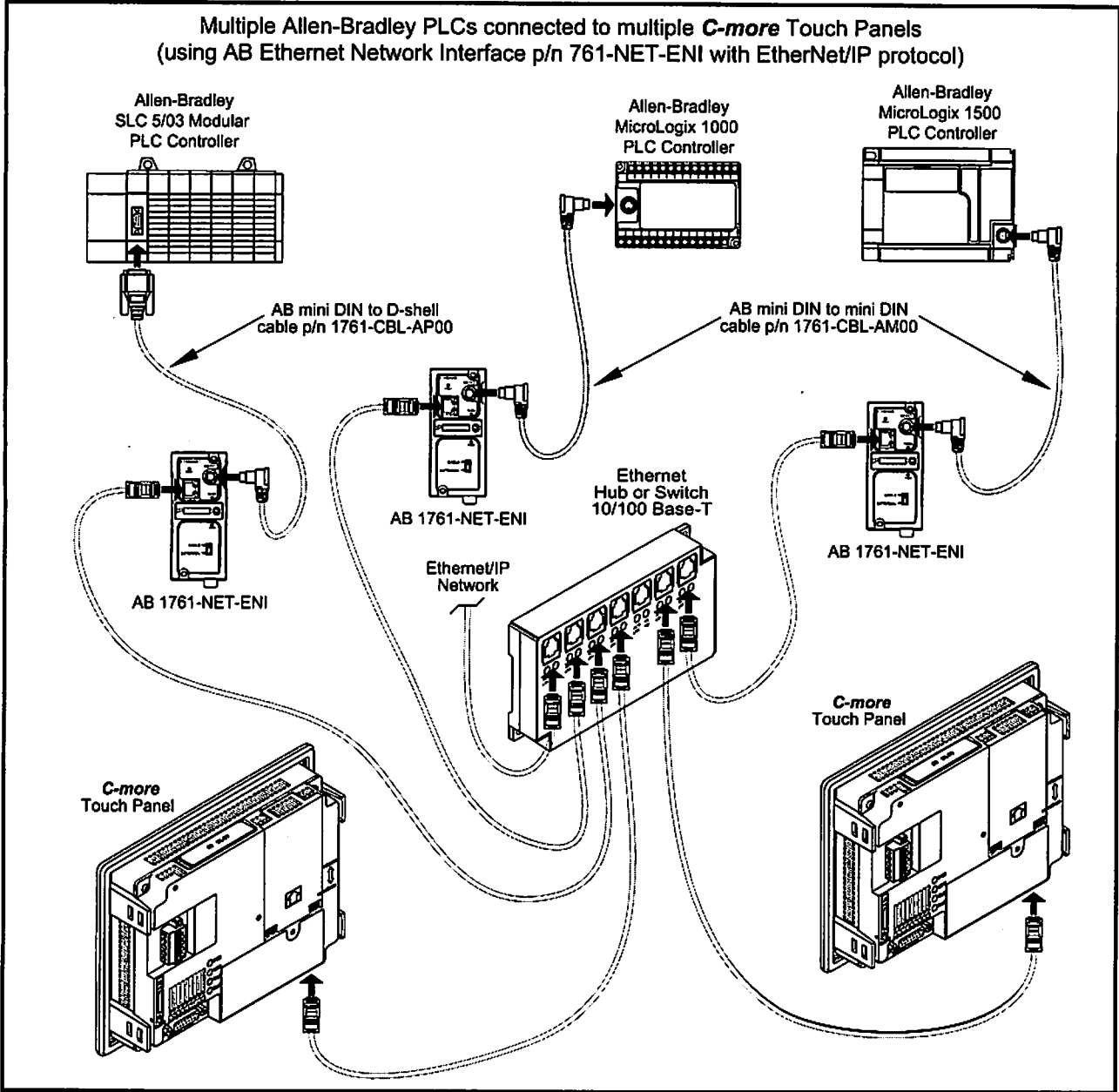
Allen-Bradley SLC500™ 5/03 DH-485/AIC to Multiple *C-more* Touch Panels
(using *C-more* cables p/n EA-MLOGIX-CBL, EA-SLC-232-CBL)



Note: The above diagram shows connecting multiple *C-more* touch panels to an Allen-Bradley DH485/AIC network using the AB AIC+ Advanced Interface Converter, p/n 1761-NET-AIC. Select the "Allen-Bradley DH485/AIC SLC500 MicroLogix" driver in the *C-more* Programming Software when starting the project. Also, set the AB channel configuration for DH485.

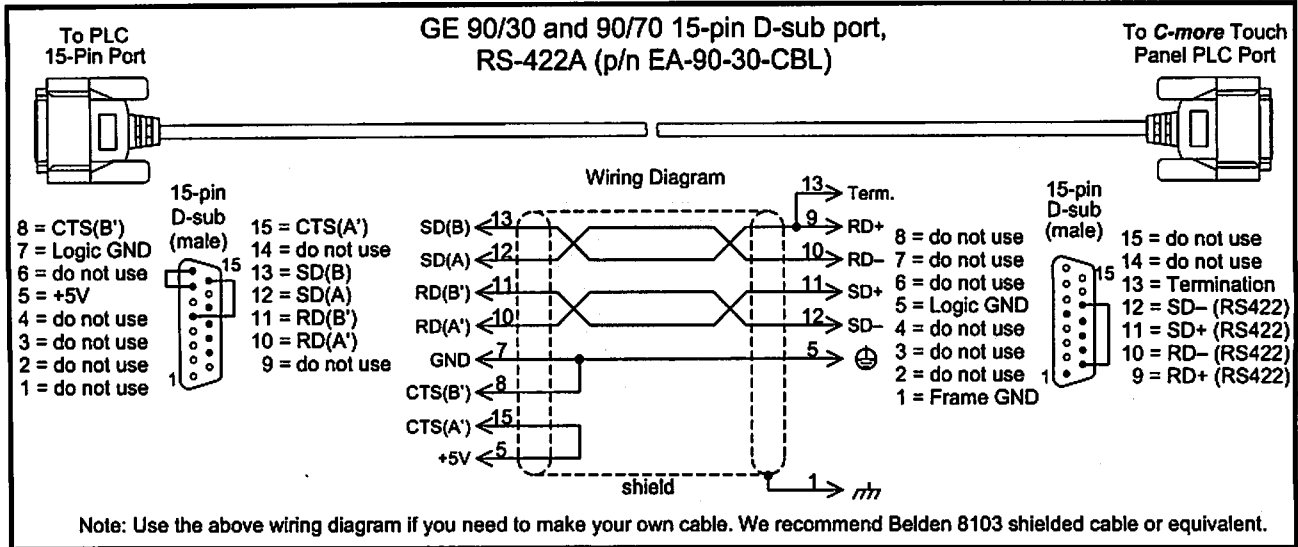
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Allen-Bradley (cont'd):



GE:

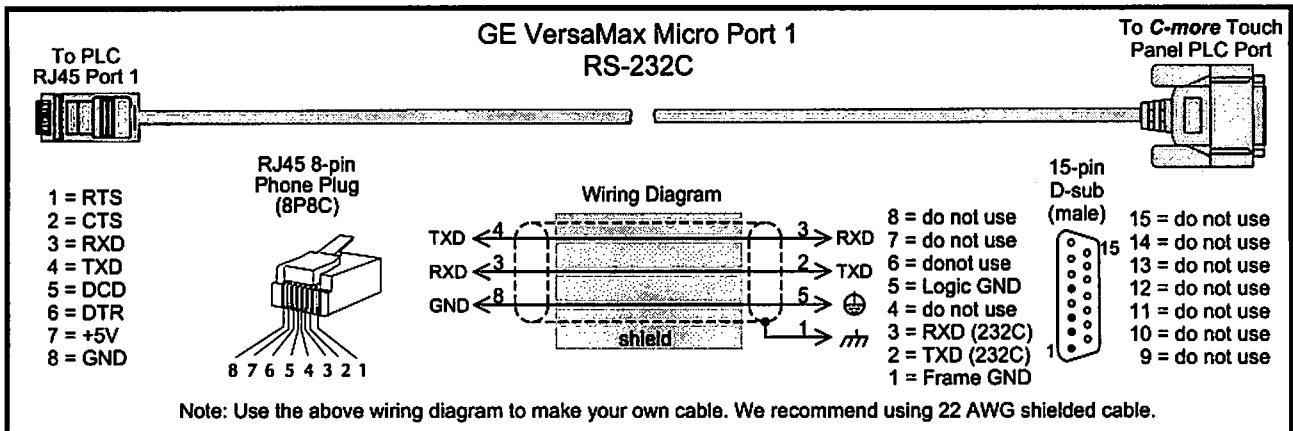
EA-90-30-CBL



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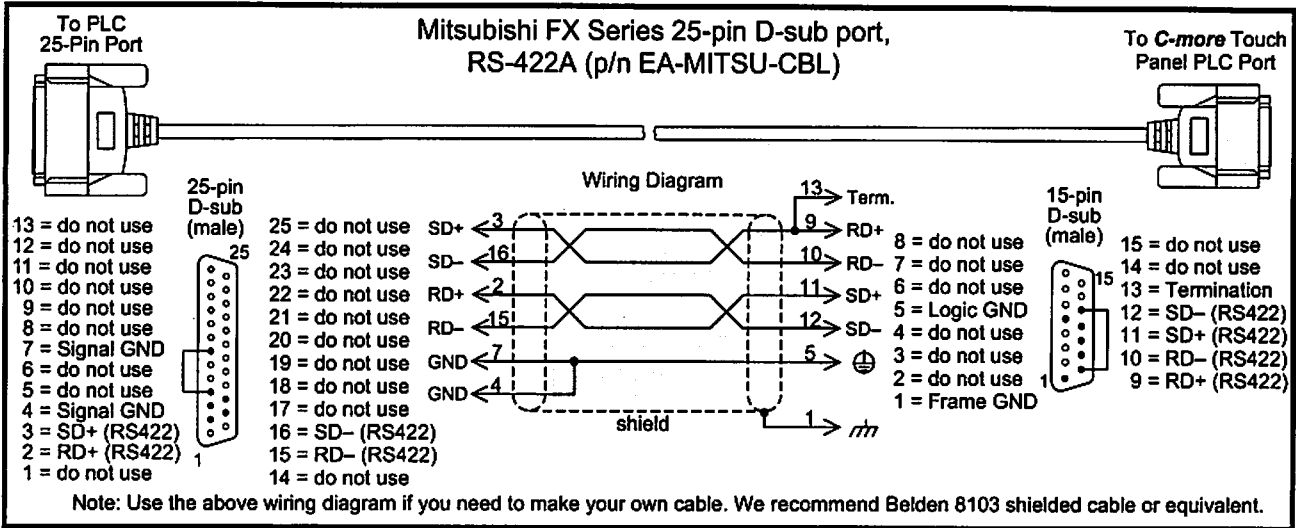
GE VersaMax Micro:

User Constructed



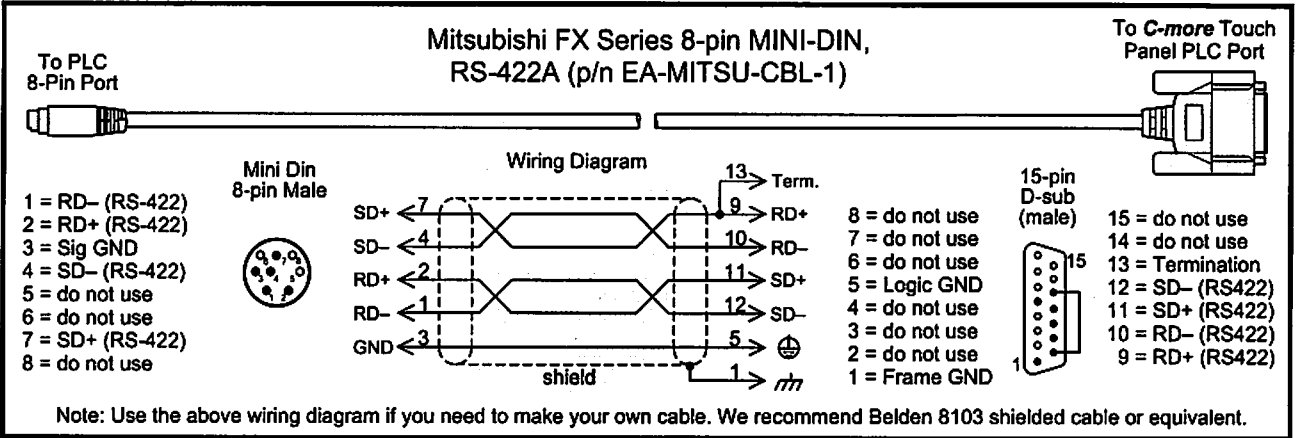
Mitsubishi:

EA-MITSU-CBL



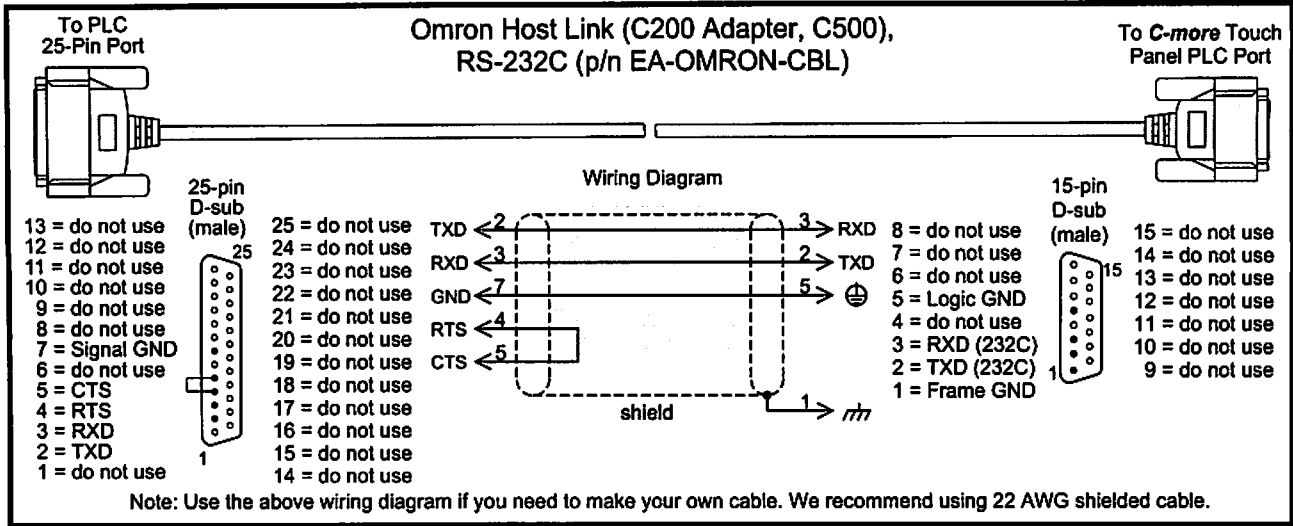
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EA-MITSU-CBL-1



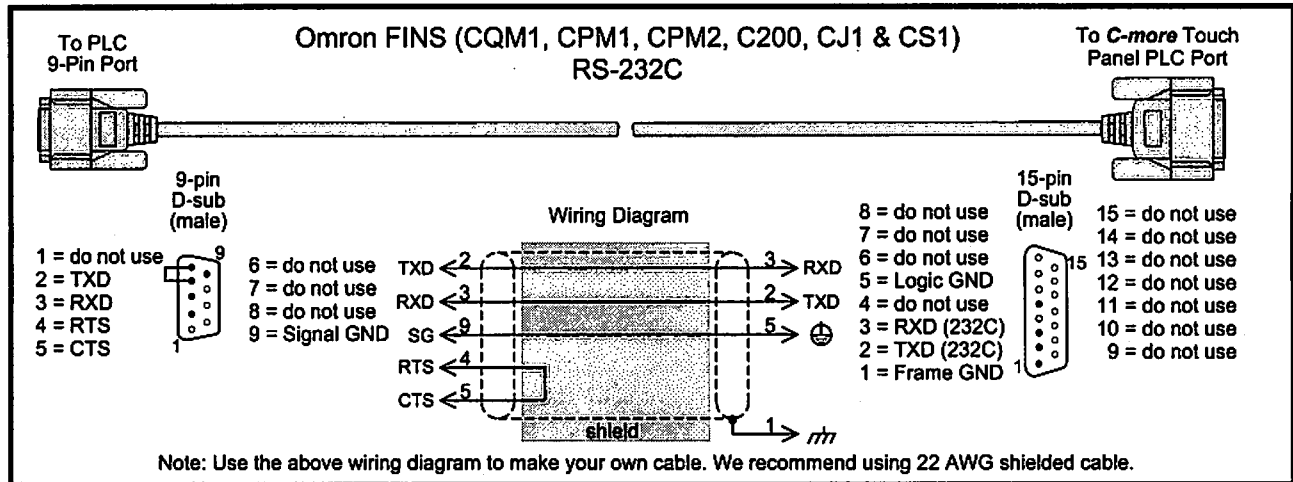
Omron:

EA-OMRON-CBL

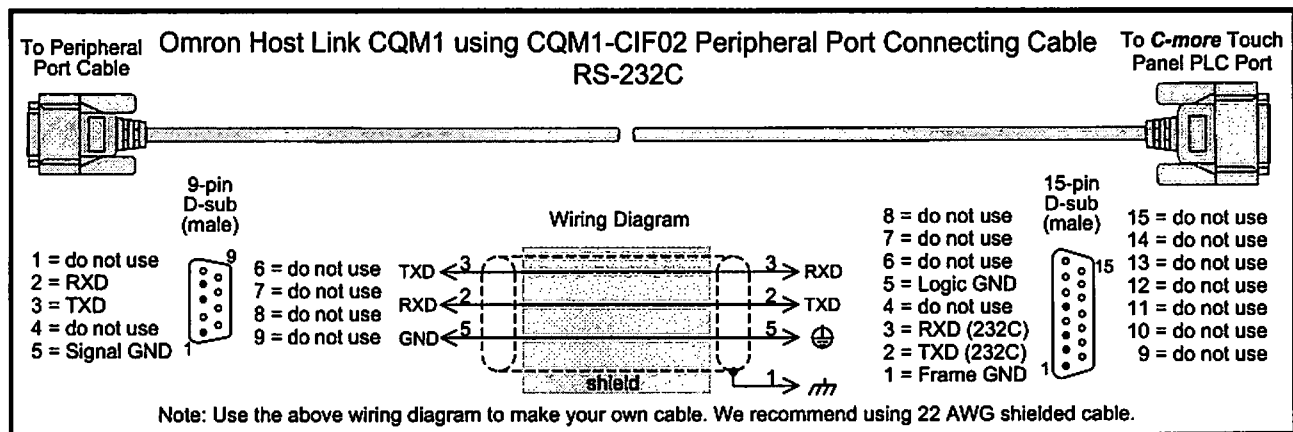


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User Constructed

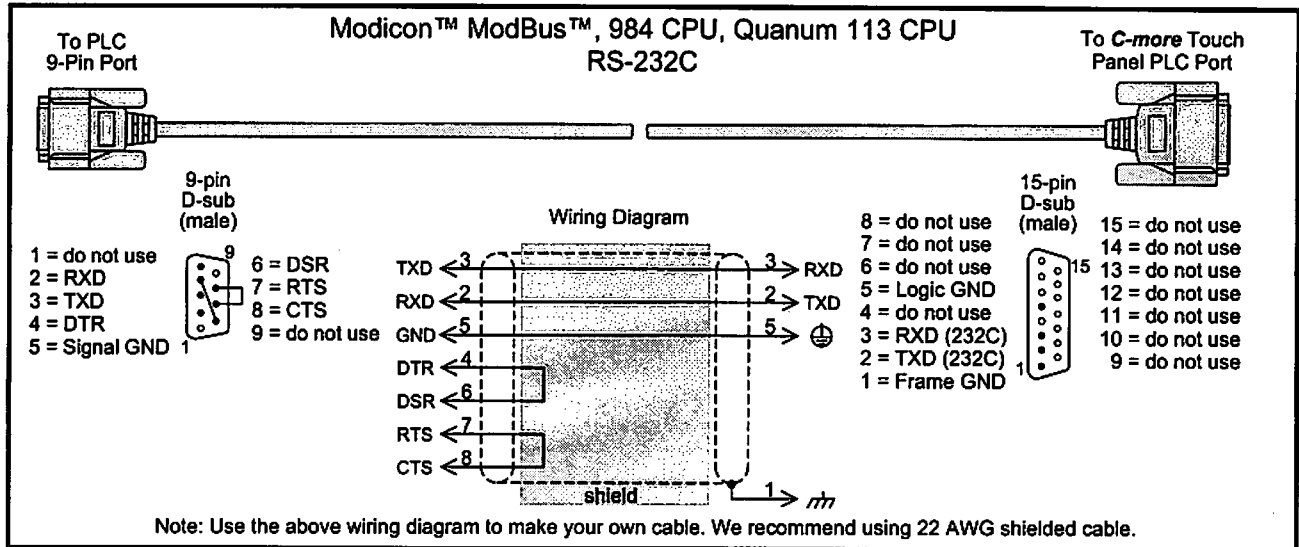


User Constructed



Modicon ModBus RS-232:

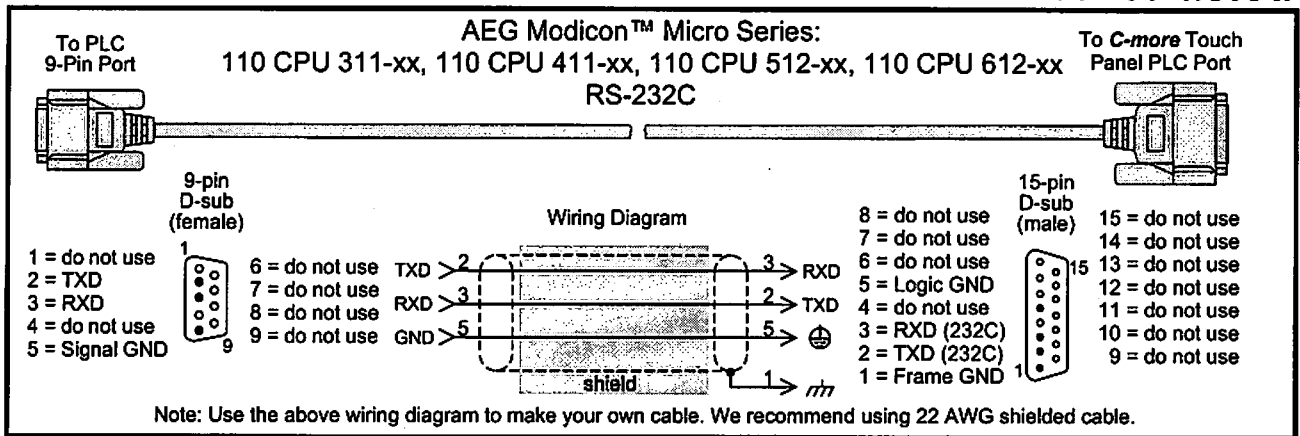
User Constructed



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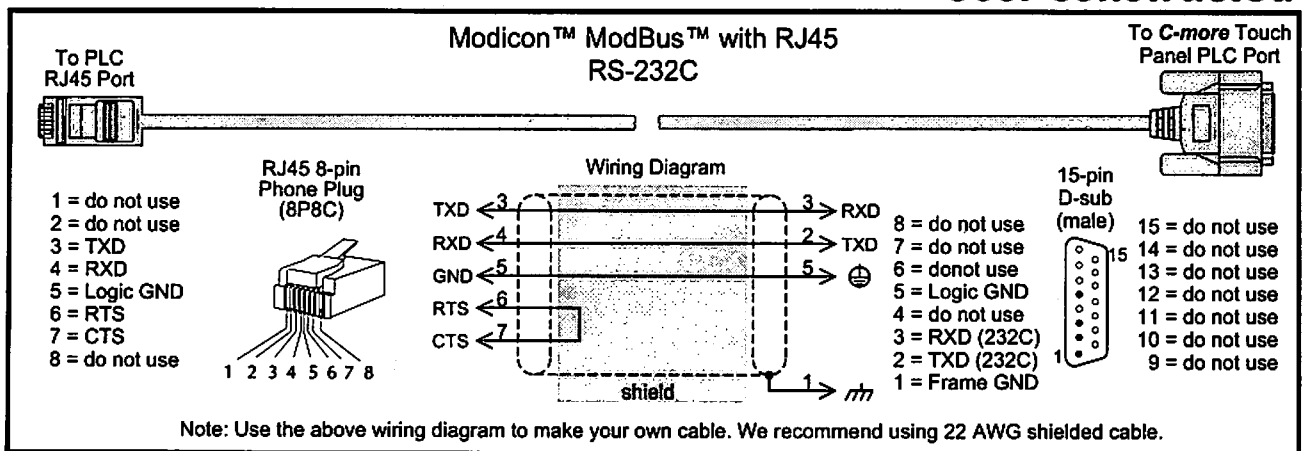
Modicon Micro Series:

User Constructed



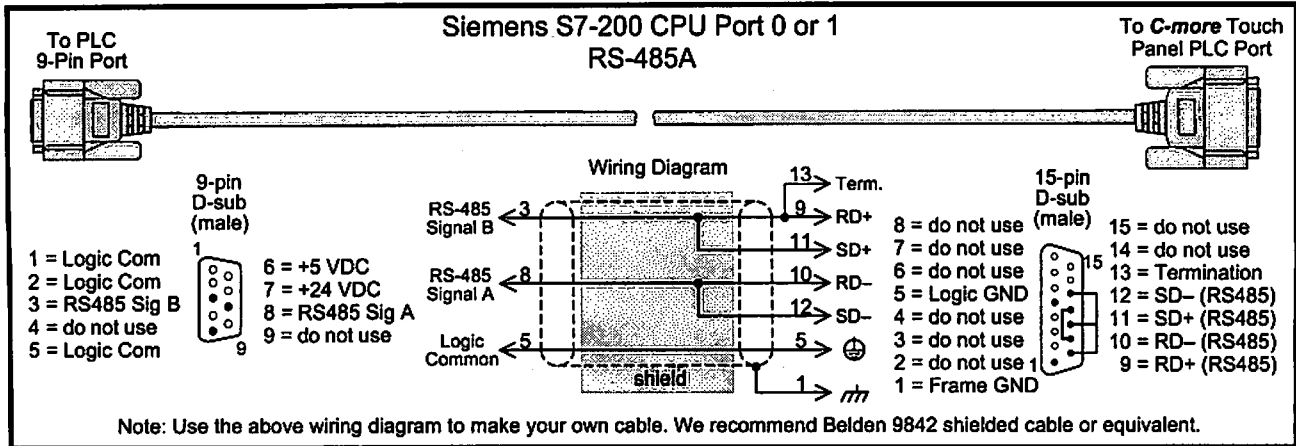
Modicon ModBus with RJ45:

User Constructed



Siemens:

User Constructed



6

MAINTENANCE



In This Chapter...

Project Backup7-2
Check Operating Environment7-2
Check Operating Voltage7-2
Check Status Indicators7-2
Check Physical Conditions7-3
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Checks from <i>C-more</i> Programming Software7-6

Maintenance



Although the *C-more* touch panels require very little maintenance, setting up a routine maintenance schedule will insure the longevity of the product in your application.

The following are some suggestions of items to include in a preventive maintenance list or schedule. Most of these items should be scheduled quarterly or bi-annually.

Project Backup

- During a routine preventive maintenance schedule is a good time to make sure that there is an up-to-date backup of the application project. Although the *C-more* touch panel with its programming software has the ability to upload the complete project from a panel through the programming software, insurance is warranted just in case the worse case scenario happens and the entire touch panel is destroyed.

Check Operating Environment

- Make sure the touch panel is operating in the proper temperature range: (0 to 50 °C (32 to 122 °F)).
- Make sure the touch panel is operating within the specified humidity range: (10–85% RH, non-condensing).
- Make sure the operating environment is free of corrosive gasses.



Check Operating Voltage

- Check the input voltage that is powering the touch panel to make sure it is within the appropriate range,

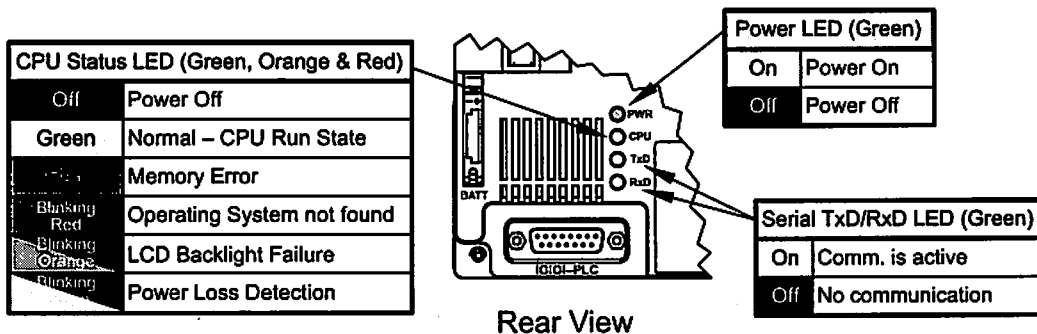


DC: If the panel is being powered with a DC power source, then the acceptable range is 20.4 to 28.8 VDC. (24 VDC, -15%, +20%, minimum of 1.5 A)

AC: If the panel is being powered from an AC/DC Power Adapter, EA-AC, then the acceptable input voltage range to the adapter is 100-240 VAC, 50/60 Hertz.

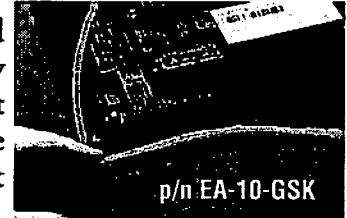
Check Status Indicators

- During a routine maintenance check is a good time to take a quick look at the status indicators on the rear of the touch panel. The Power LED (PWR) indicator should be on and there should be activity on the TxD and RxD LED indicators when connected serially to a PLC or control device. Check the status of the CPU LED and compare it to the chart shown in the illustration below. Any indication of the CPU LED other than a solid green shows there is a possible problem, and the condition needs to be corrected.



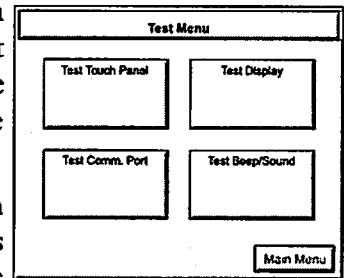
Check Physical Conditions

- Make sure that harmful chemicals are not being used around the panel. Look for any deterioration of the touch panel's bezel and front display area. See Chapter 2: Specifications for a chemical compatibility list.
- Check the mounting gasket to make sure it is sealing properly and has not deteriorated. Replace the mounting gasket if there are any signs of deterioration, or if there is any evidence that moisture/liquids have penetrated to the inside of the enclosure where the panel is mounted. Information on a replacement gaskets can be found in Chapter 9: Replacement Parts.
- Check to make sure that none of the cooling vents around the inside section of the touch panel are clogged with dust or debris. Also make sure that there is clearance around the touch panel as shown in Chapter 4: Installation and Wiring.



Run Tests under System Setup Screens

- Use the touch panel's System Setup Screens to test the touch screen, display, communication ports, beeper and audio output (only with external amplifier and speaker(s) connected). See Chapter 5: System Setup Screens for additional details for the Test Menu.



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Test Touch Panel - allows the user to check the analog touch function of the screen by drawing free hand lines and shapes across the entire touch area. The display will retain the lines where the screen has been touched until the Cancel button is pressed.

Test Display - used to test the display and color rendition. A test pattern will first show both the primary colors (if applicable) and a gray scale. If the touch screen is not pressed within a few seconds, the display will go into alternating color sweeps across the screen until the panel is pressed again. If the screen is pressed when the test pattern first appears, it will stay in this mode until the Cancel button is pressed.

Test Comm. Port - used to test the functionality of both the 15-pin PLC communication serial port and the Ethernet port (non -R models only). A loop-back connector can be fabricated and used on the 15-pin serial port to test both the RS-232 and RS-422/485 communications for the TxD and RxD signals and also the RTS and CTS signals if applicable. The Test Comm. Port setup screen and Chapter 5 show pin-outs for the both the RS-232 and RS-422/485 loop-back connectors. The Ethernet connection can also be tested for communications if it is at least connected to an Ethernet hub or switch. If the touch panel is connected to a PLC, then an inquiry test can also be done to test the communications between the panel and the PLC. Press the Cancel button when finished to return to the Test Menu screen.

Test Beeper/Sound - used to test the touch panel's internal beeper and also test the audio line output port with an external amplifier and speaker(s) connected. Testing the audio output is done by playing an included internal WAV file. Press the Cancel button when finished to return to the Test Menu screen.

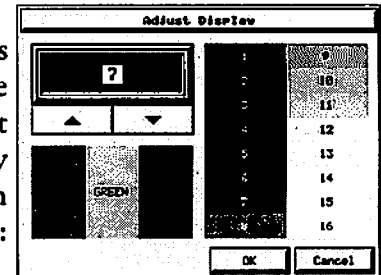
Check Memory Usage via System Setup Screens

- A good time to check and record the touch panel's memory usage for future reference is during a routine maintenance schedule. The various memory devices being used by the panel are listed under the tab. This includes the SRAM, Built-in Flash and any external memory device such as a USB pen drive or CompactFlash memory. If no external memory device is inserted, it will not show up on the list. The amount of total, used and free memory is shown. The memory usage can be viewed by use of the panel's System Setup Screen's Main Menu, and then selecting the Information button. Look under the Memory tab. See Chapter 5: System Setup Screens for additional details on using the Memory tab.

Information			
General	Memory	Ports	Error
	Total	Used	Free
SRAM	256 KB	66 KB	190 KB
Built-in Flash	15 MB	6 MB	9 MB
CF1	64 MB	14 MB	47 MB
CF2	244 MB	0 MB	237 MB
USB	488 MB	624 KB	487 MB

Check/Adjust Display Brightness or Contrast

- It is good practice to occasionally check the display brightness or contrast and adjust as required. This is done by using the Setting Menu in the System Setup Screens. Keep in mind that only the contrast can be adjusted on the STN type display models, both color and grayscale, and only the brightness can be adjusted on the TFT type display models. See Chapter 5: System Setup Screens for additional details.



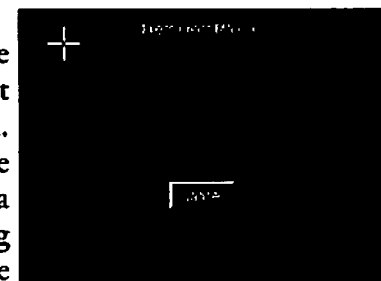
Check Error Log via System Setup Screens

- Another good practice is to review the touch panel's Error Log. The log can be viewed by use of the panel's System Setup Screen's Main Menu, and then selecting the Information button. Look under the Error tab. See Chapter 5: System Setup Screens for additional details on using the Error tab, Appendix A: PLC Protocol Error Codes for a list of the error codes as they relate to the specific PLC that is being used with a description of the error, and Appendix B: Touch Panel Runtime Errors for a list of errors that may occur when the panel is in operation.

Information			
General	Memory	Ports	Error
1	01/03/00 01:20:11	COM3, DEV001, RD	2000, 2Byte Error Code PLC-001
2	01/03/00 01:20:07	COM3, DEV001, RD	U2000, 2Byte Error Code PLC-001
3	01/03/00 01:20:03	COM3, DEV001, RD	U2000, 2Byte Error Code PLC-001
4	01/03/00 01:19:59	COM3, DEV001, RD	U2000, 2Byte Error Code PLC-001
5	01/03/00 01:19:55	COM3, DEV001, RD	U2000, 2Byte Error Code PLC-001

Adjust Touch Panel via System Setup Screens

- It is recommended that a regularly scheduled maintenance program include adjusting the touch panel. The adjustment can be looked at as "calibrating" the touch area of the panel. The procedure should also be done anytime that it seems the touch area being pressed for an object is out of position by a small amount. The procedure is done by using the Setting Menu in the System Setup Screens and then selecting the Adjust Touch Panel button. See Chapter 5: System Setup Screens for additional details.



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Replace Battery Periodically

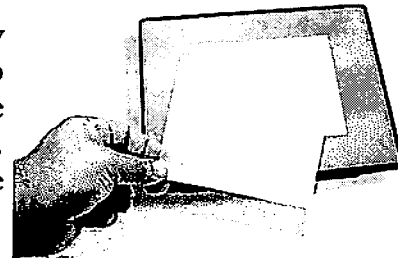
- The lithium battery in the touch panel is used to maintain the system SRAM retentive memory and the CPU date/time registers when the unit is without external power. Before replacing the battery, back-up the data in your SRAM retentive memory as a precaution. Input power needs to be maintained to the panel during battery replacement or the SRAM retentive memory and date/time registers will be cleared. Typical battery life is five years, which includes panel runtime and normal shutdown periods. The battery's status can be checked under the General tab of the Information screen of the System Setup Screens, see Chapter 5. However, consider installing a fresh battery if your battery has not been replaced recently and the unit will be without power for a period of more than ten days. A replacement battery can be purchased from *AutomationDirect* as part number D2-BAT-1 (#CR2354).



D2-BAT-1

Cleaning the Display Screen

- The display screen should be cleaned periodically by wiping it with a lint free damp cloth using a mild soap solution. Dry the surface when finished with a lint free cloth. Do not clean with ammonia based products. The ABS material the bezel is made from is reactive with ammonia.
- The longevity of the display can be increased by the use of a non-glare screen protector, p/n EA-XX-COV2, where XX = touch panel screen size, 6, 8, 10, 12, or 15. See Chapter 3: Accessories for additional information on the screen protectors.
- To prevent damage to the display screen, avoid touching the screen with sharp objects, striking the screen with a hard object, the use of abrasives near the screen, or using excessive force when pressing the touch screen. In the event that the touch screen membrane becomes damaged or scratched, the bezel, which includes the clear membrane window, can be replaced on the 8", 10", 12" and 15" touch panels. See Chapter 9: Replacement Parts for additional information on the replacement bezels. The bezel with clear membrane window can be replaced on the 6" touch panels by calling our technical support department at 770-844-4200 to make arrangements for returning the unit for repair.



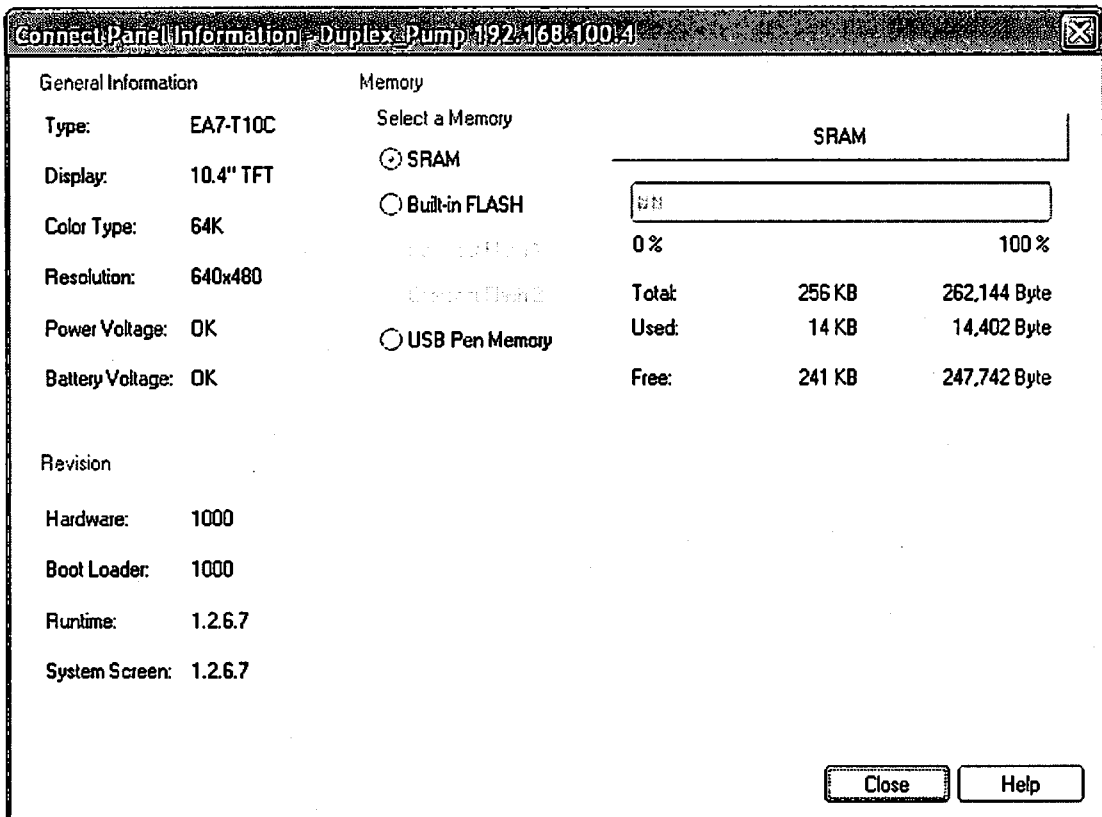
EA-6-COV2

Check Project Functionality

- During a routine maintenance schedule is a good time to check the functionality of your application, making sure that various areas on different screens do what they were designed to do. An outline or specification for the application is a useful tool for testing the various aspects of your application. As a starting point, you may want to run through all the screens to make sure they are accessible.
- If there are any trouble-shooting procedures built into the touch panel application, now is a good time to also check these aids.

Checks from *C-more* Programming Software

- If you have a PC available with the *C-more* programming software, EA-PGMSW, installed, and the PC is connected to the touch panel, there are checks you can make to the status of the touch panel by using the **Panel Information...** feature located under the **Main Menu** heading **Panel**. This includes the following:
 - Connect Panel Information
 - Memory availability and usage
 - Power Voltage
 - Battery Voltage:
 - Revisions



- Other functions that can be accessed from the programming software directly to the touch panel include: **Display Screen**, **Reboot**, **Adjust Clock**, **Memory Clear**, and **Update Firmware**. Additional information for these functions can be found in the *C-more* programming software on-line help.

7

TROUBLESHOOTING



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The following topics are some of the more likely problems that may be encountered during the installation and operation of your *C-more* touch panel. We have made some suggestions on what to check in order to correct the problem. Please start with the troubleshooting flow chart that covers the more common problems encountered by other users.

Common Problems

The troubleshooting flow chart shown on the following page is based on the more common problems fielded by our technical support team. If you are having problems, please start with the flow chart, follow the suggestions listed, and if you still need help, call our tech support team @ 770-844-4200. In addition to having ready the information suggested in the flow chart, please have the following available:

- 1) *C-more* touch panel part number including serial number with date code. See page 1-5 in this hardware user manual for an explanation of the part number, serial number, and date code breakdown. Why is this information important? The various sizes of the touch panel use different processors and memory sizes, and therefore can have different types of problems within the particular panel size.
- 2) Programming software version and build that you are currently using. For example: Version 1.21, Build 6.18E. Having the software version number will allow our tech support team member to assess whether there are similar problems that have been reported when using the same version of the software. The programming software version can be found by clicking on "About *C-more* Programming Software..." selection under the Help pull down menu in the software. Also, it is always a good practice to visit the Software/Firmware Downloads area under the Tech Support section of the *AutomationDirect* website and check to see if you are using the latest version of the programming software. If you aren't using the latest software version, we suggest that you upgrade to see if this resolves your problem.

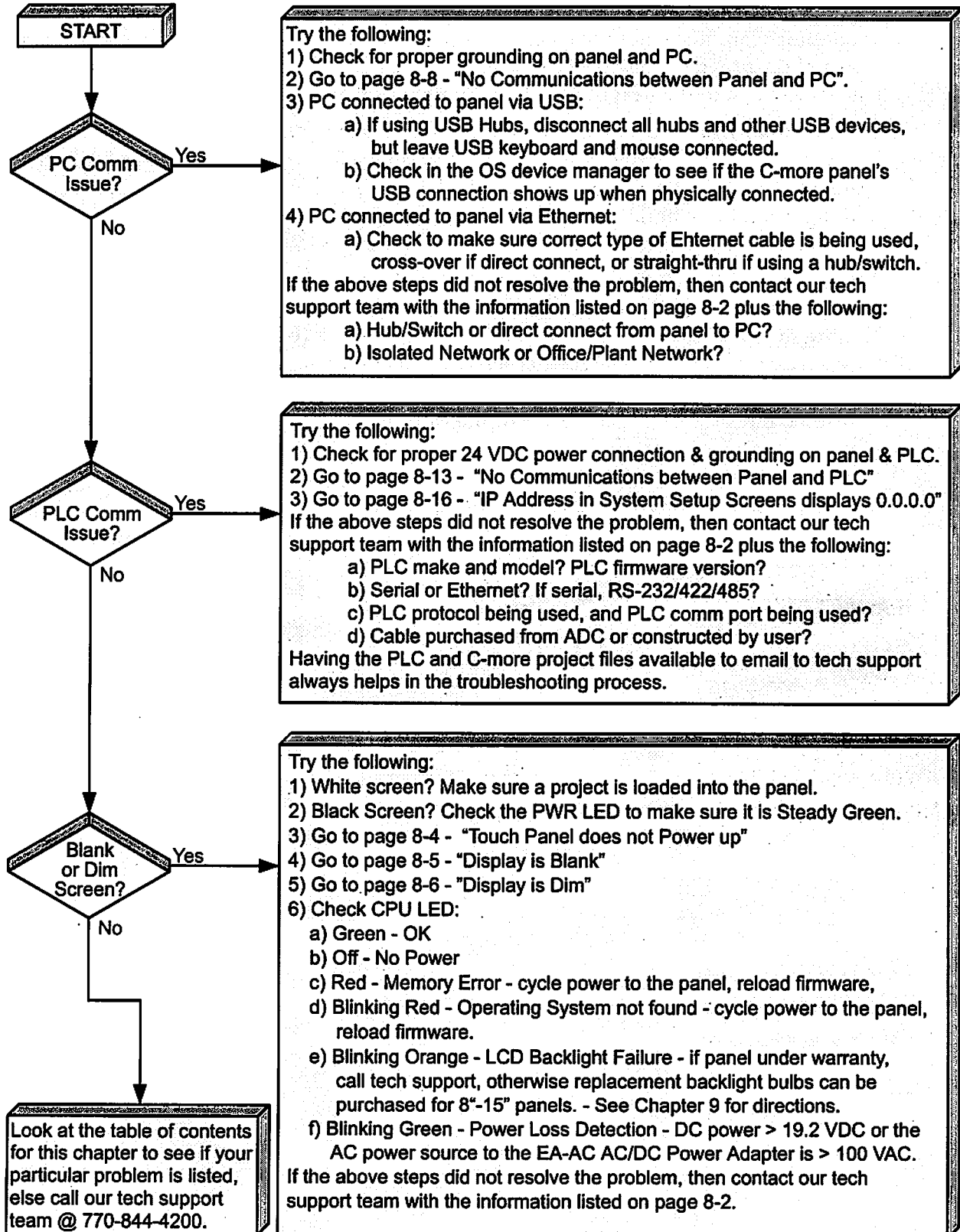


Note: The "About *C-more* Programming Software..." dialog box will show a Firmware version on the newer releases of the programming software. This is the current firmware version that is included with the programming software and does not reflect what firmware is actually loaded on your *C-more* touch panel. See the following for details on how to check the firmware version.

- 3) Firmware version of the *C-more* touch panel. For example: 2.0 Build 07.32 or 2.0.07.32. The firmware version can be checked by using the System Setup Screens, going to the Information menu under the Main Menu, and looking under the General tab for Firmware: -Runtime. The firmware version can also be checked by using the programming software, while connected to the panel, and clicking on the Panel Information selection under the Panel pull down menu. As with the programming software version, it is important for our tech support associates to know which firmware version you are using so they can check on any known problems. As with the programming software, we strongly suggest that the firmware be updated to the latest version. Check for the latest version and download from the Software/Firmware Downloads area of the *AutomationDirect* website.

It is also helpful to have a copy of your project file for our tech support associates to use in troubleshooting a problem, so please be prepared to forward a copy of your project if it is requested.

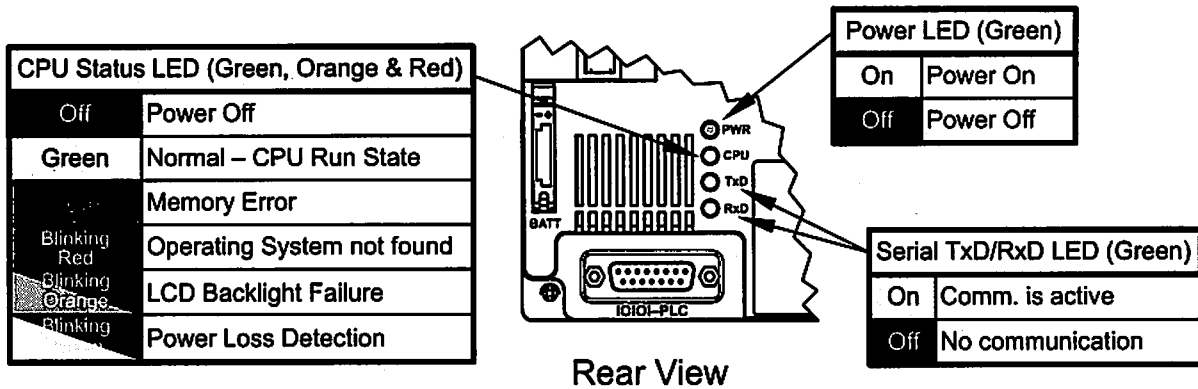
Troubleshooting Flow Chart



Touch Panel does not Power up

- 1.) Check the status indicators on the rear of the panel to see if the Power LED (Green) indicator is on. Reference the diagram shown below. If the Power LED (Green) indicator is on and the panel was observed showing "Initializing..." during power up, but the display is now blank, go to the next troubleshooting tip, Display is Blank.
- 2.) If the Power LED (Green) indicator is off and the panel is being powered with a 24 VDC power source, use a voltmeter to check the incoming DC voltage level. The DC voltage level should be in the range of 20.4 to 28.8 VDC. If the incoming DC voltage is zero, check any fusing that may be in the circuit. If the fuse is open, determine cause and replace. If the DC voltage level is out of range, the DC power source needs to be corrected or replaced.
- 3.) If the Power LED (Green) indicator is off and the panel is being powered with an AC/DC Power Adapter, EA-AC, use a voltmeter to check the incoming AC power. The AC voltage to the AC/DC Power Adapter should be in the range of 100 to 240 VAC, 50/60 Hertz. If the incoming AC voltage is zero, check any fusing that may be in the circuit. If the fuse is open, determine cause and replace. If proper AC voltage is present on the AC/DC Power Adapter, but the Power LED (Green) indicator is off, replace the AC/DC Power Adapter, EA-AC.

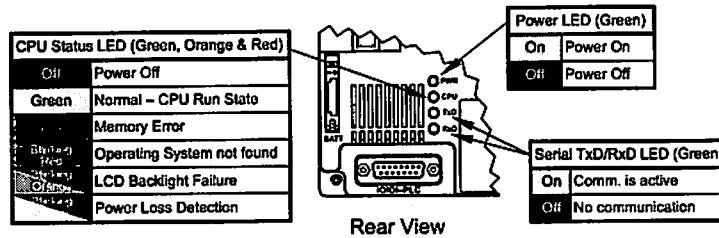
C-more LED Status Indicators



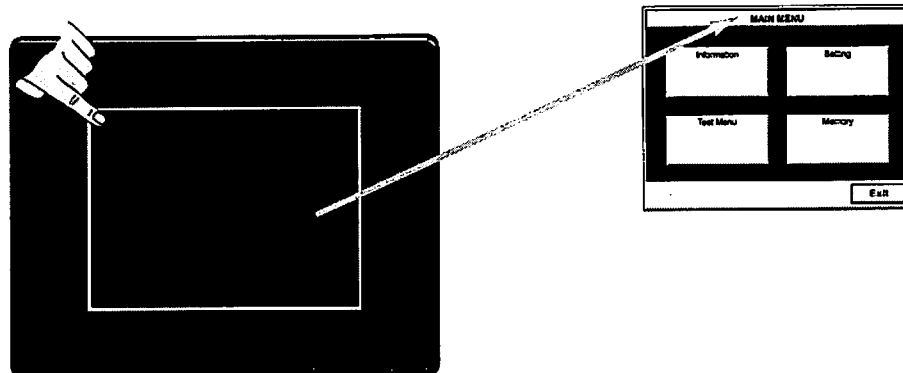
Display is Blank

- 1.) Touch the screen to make sure the panel is not in the Screen Saver mode.
- 2.) If the panel is not in Screen Saver mode, check the status indicators on the rear of the panel.

C-more LED Status Indicators

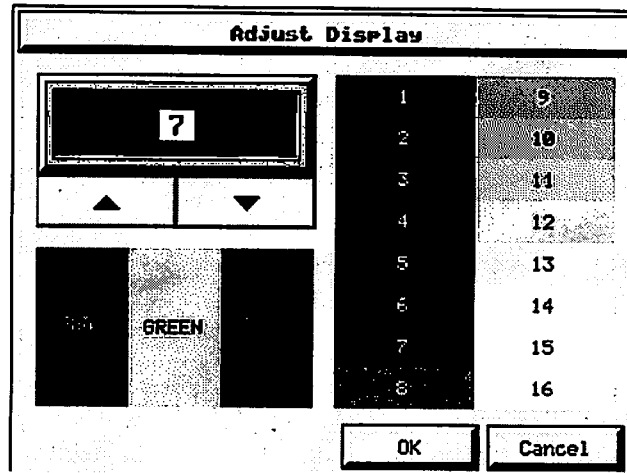


- The Power LED (Green) should be on. If not, check the incoming power as explained in the “Touch Panel does not Power Up” section.
 - Make sure the CPU status LED (Green, Orange, Red) is a steady Green.
 - A **blinking Orange** colored CPU status LED indicates a failed LCD display backlight. The backlights are user replaceable on the 8”, 10”, 12” and 15” C-more touch panels. See Chapter 9: Replacement Parts for additional information on the replacement backlights.
 - If the CPU status LED is **blinking Green**, then the supply voltage is below 19.2 VDC, or below 100 VAC when using the optional C-more AC/DC Power Adapter, EA-AC. The backlight will turn off immediately to extend the power retention period. The panel will continue to run and the LCD display will be slightly visible. This may be seen as the display being dim, so it is advisable to check the incoming voltage. The panel does not turn off until the DC voltage drops below 5 VDC or below 58 VAC when using the AC/DC Power Adapter, EA-AC.
 - A **blinking Red** CPU status LED indicates that the operating system could not be found. Reload the firmware to the touch panel. If this does not resolve the problem, contact the *AutomationDirect* returns department @ 1-800-633-0405 to make arrangements for returning the unit for repair.
- 3.) There is always the remote possibility that a project has been transferred to the touch panel that includes a screen that uses a black background and has no objects placed on the screen. To check for this possibility, access the Main Menu of the touch panel System Setup Screens by pressing the extreme upper left corner of the panel display area for three (3) seconds as shown below. If the System Setup Screen’s Main Menu is displayed, then most likely an empty black background screen is being displayed.



Display is Dim

- 1.) Check either the contrast or brightness setting found under the System Setup Screens. Keep in mind that the STN type display models, both color and grayscale, can have the contrast adjusted. The TFT type display models can have the brightness adjusted. See Chapter 5: System Setup Screens for additional information.



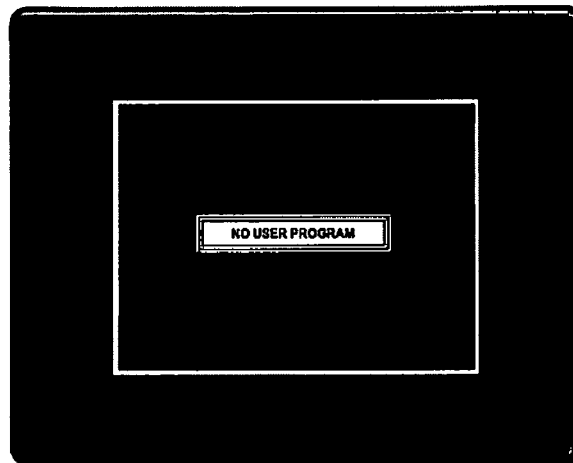
- 2.) Backlights will slowly lose some luminance causing the display to slightly dim. The backlight average lifetime is rated at 50,000 hours and is defined as the average usage time it takes before the brightness becomes 50% of the initial brightness. The lifetime of the backlight depends on the ambient temperature; the lifetime decreases in low or high temperatures. To improve the backlight life, use the Start Screen Saver function that is available in the *C-more* Programming Software in the Panel Manager dialog box. The backlights are user replaceable on the 8", 10", 12" and 15" *C-more* touch panels. See Chapter 9: Replacement Parts for additional information on the replacement backlights.
- 3.) Another condition that may make the display appear dim is to view the touch panel in direct sunlight or in a location where direct light is reflected onto the display. The *C-more* touch panel displays have Display Brightness ratings of 150 to 300 cd/m² (NITS), depending on the particular model. The higher the cd/m² (NITS) rating, the more visible the display will be under bright lighting conditions.

No User Program

If the touch screen is displaying the message “No User Program” after it has powered up, then either:

- the built-in Flash memory does not contain a recognized project, or
- a CompactFlash memory card is plugged into the CF1 slot and there is no project on the CompactFlash memory card.

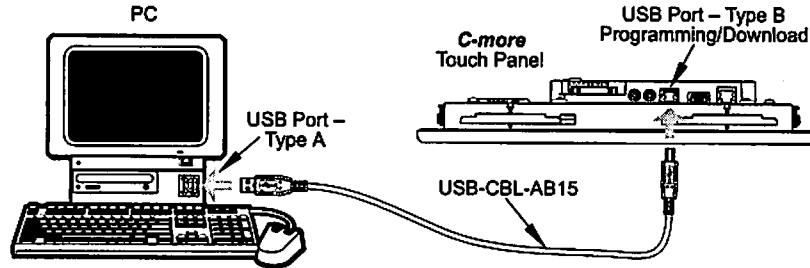
Keep in mind that on power up, the touch panel will either copy the project from its internal Flash memory to its internal SDRAM memory and run the project, or if a CompactFlash memory card is plugged into the CF1 slot, then any project contained on the CF memory card will be copied to the panel’s internal SDRAM memory and be run. In other words, the memory of a CompactFlash card on CF1 will override the panel’s internal Flash memory on power up or reboot, even if the CompactFlash memory card does not contain a project.



No Communications between Panel and PC (Personal Computer)

The *C-more* touch panel is programmed using the *C-more* Programming Software, EA-PGMSW. The developed project is transferred from the PC to the touch panel by either a USB or an Ethernet connection between the two. (Ethernet available on full feature units only.)

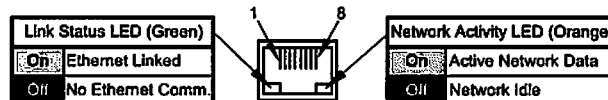
- 1.) If using USB, then a USB type AB programming cable, such as p/n USB-CBL-AB15, should be used to make a connection between the panel's USB Port, Type B and a USB port on the PC. The *C-more* Programming Software will install a USB driver on the PC during the software installation.



Use the programming software to check the status of the USB communications. From the Navigation window, select the Panel tab. At the bottom of the Panel tab is the Communication Config dialog box. If the USB communications to the panel is working, then the USB radio button should be checked and there should be a "green" indicator next to the USB selection. For reference, if the USB driver is working and you open the Device Manager in Windows, you should see a "C-more HMI" USB connection under Universal Serial Bus controllers selection. You can also make sure the *C-more* USB driver has been installed by looking for the following file: C:\WINDOWS\System32\Drivers\kyceusb.sys If the indicator is "red", then try using a different cable. If replacing the cable does not fix the communications, you may need to try a different USB port on the PC. If there are any USB hubs or other USB devices being used, you may need to temporarily eliminate them to see if this solves the problem.

Note: When transferring a project to the panel using the *Send Project to Panel* function, there is a possibility even with a USB programming cable properly connected between the touch panel and PC, and having a green indicator displayed next to the USB radio button in the **Step 3 - Project Transfer** dialog box, that the **Transfer** button in the dialog box will still be dim. The green indicator means that the very lowest level of USB communications is connected, but it does not necessarily mean the panel and PC are communicating. If the **Transfer** button is dim, then the panel and PC are not communicating. If a PLC is connected to the serial port of the panel, try disconnecting it. If this corrects the problem, then check your grounding for the PLC and the panel. If this does not correct the problem, see the *C-more Programming Software Installation Guide* for reinstalling the USB driver.

- 2.) When using an Ethernet connection to communicate between the touch panel and the PC and the communications does not seem to be working, the first area to check is the Ethernet status indicators located next to the 10/100 Base-T Ethernet Port on the rear of the panel. The Link Status LED must be displaying a Steady Green.

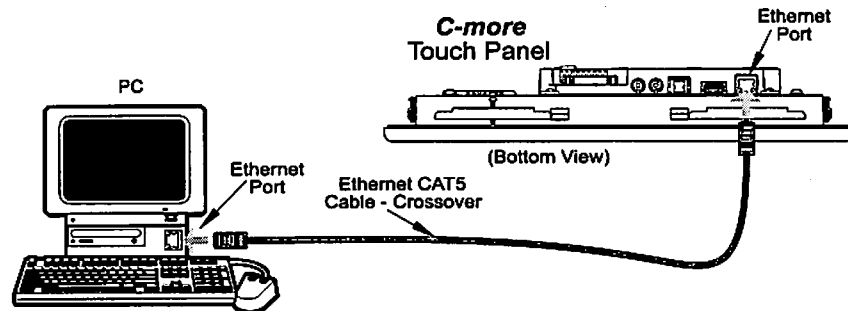


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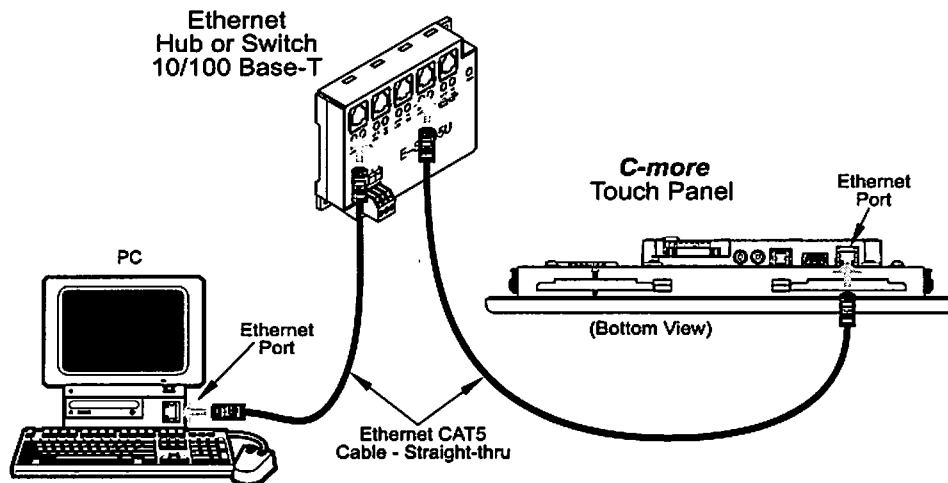


No Communications between Panel and PC (Personal Computer) (cont'd)

If using an Ethernet connection to program the touch panel, there are two basic ways to make the connection. You can use a “crossover” Ethernet cable to make a direct connection between



the touch panel and the PC or a “straight-thru” Ethernet cable from the touch panel to a hub, switch, etc. that is also connected to the PC.

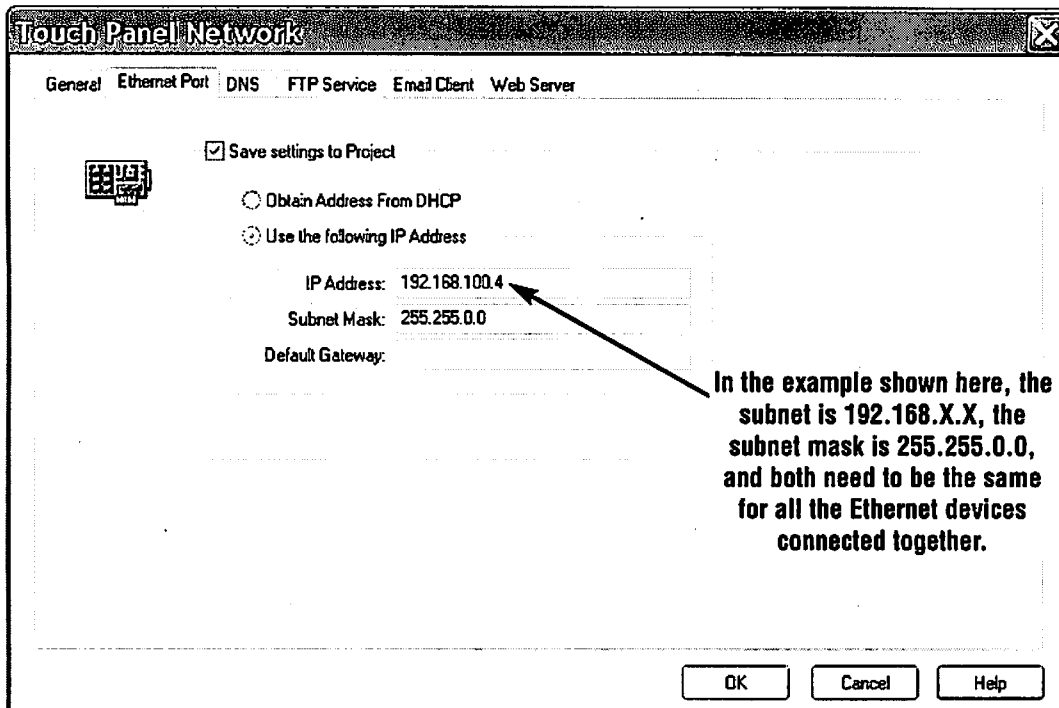


Use the *C-more* programming software to check the status of the Ethernet communications. From the Navigation window, select the Panel tab. At the bottom of the Panel tab is the Communication Config dialog box. Select the Browse button. If the connection is working the panel will be listed in the online link list. Select the panel and then select OK. If the Ethernet communications to the panel is working, then the Ethernet radio button should be checked and there should be a “green” indicator next to the Ethernet selection. There should also be an IP Address shown in the browse box below the Ethernet selection. If the Ethernet radio button is “red”, then you will need to check your Ethernet cables and connections or Browse for the panel. There can also be a conflict with another Ethernet connection that may be using the same IP Address. You may want to check the setup both in the touch panel and also in your PC. As a starting point, it is best to start with an assigned IP Address and Subnet mask, mainly to eliminate IP addressing conflicts. Use the *C-more* programming software and open the Touch Panel Network dialog box under the Main Menu’s Setup drop down menu. Click on the Ethernet Port tab to display the dialog box used to set up the touch panel’s Ethernet port.

Another cause of an Ethernet communications problem that may be encountered, is the touch panel doesn’t show up in the node list, which can be caused by the PC having a firewall.

No Communications between Panel and PC (Personal Computer) (cont'd)

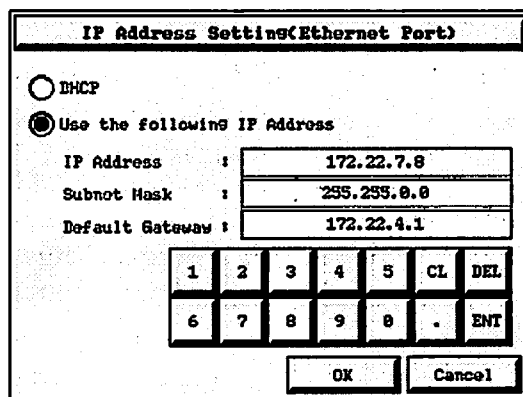
The figure below shows the Touch Panel Network dialog box with the Ethernet port tab opened. The Save settings to Project check box is checked and we are using the Use the following IP Address selection by checking its radio button. The subnet (192.168.X.X) and the subnet mask (255.255.0.0) must be the same for both the panel and the PC. See the *C-more* programming software on-line help for additional details regarding the Touch Panel Network.



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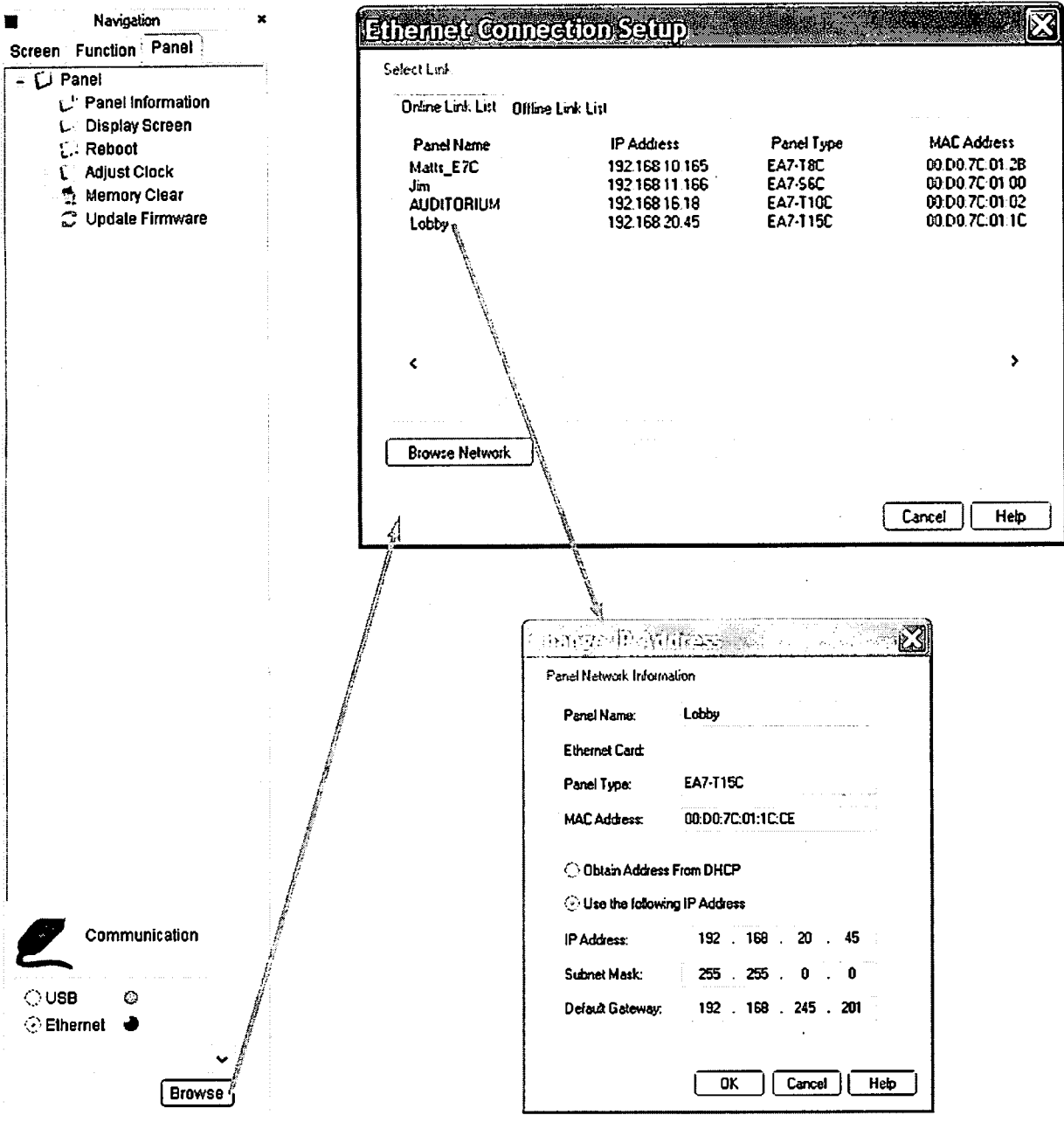
The IP Address assigned to the touch panel can also be checked or edited by using the system setup screens built into the touch panel. See Chapter 5: System Setup Screens for additional information.

The figure below shows a different example of the panel's System Setup Screens' Ethernet Port dialog box for configuring the Ethernet port. Again, make sure the subnet (172.22.X.X) and subnet mask (255.255.0.0) is the same for both the panel and the PC.



No Communications between Panel and PC (Personal Computer) (cont'd)

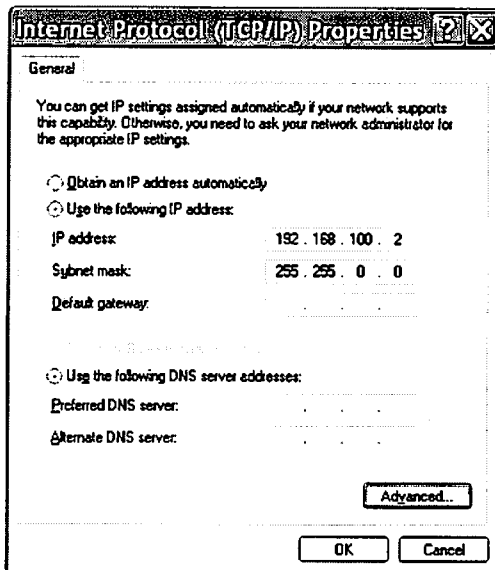
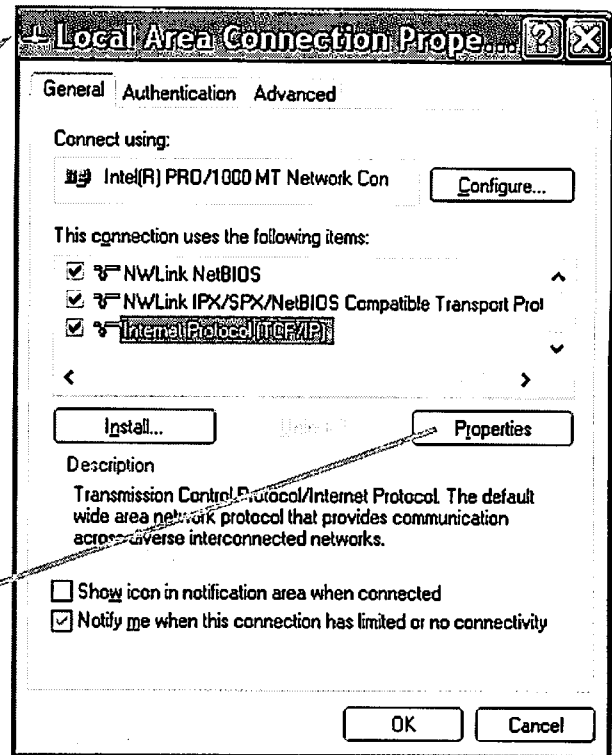
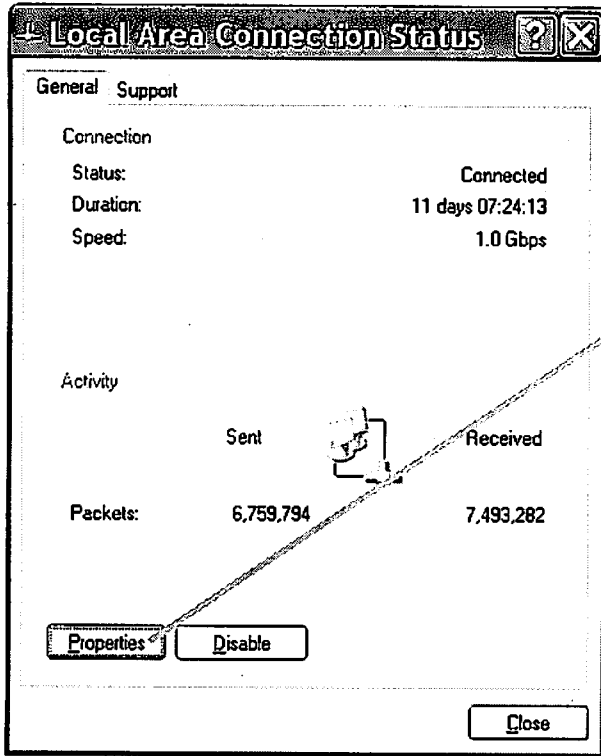
Another option for accessing the IP Address assigned to the touch panel is to use the *C-more* Programming Software. Open the Navigation window's Panel tab and click on the Browse button under the Communication window at the bottom. This will open the Ethernet Connection Setup window. The Online Link List tab will show all of the connected panels. If none are shown, try clicking the Browse Network button to search for attached devices. Double click on the Panel Name you want to access and this will bring up the Change IP Address window. In this window changes can be made to the panel's name, IP address, subnet mask, and default gateway.



No Communications between Panel and PC (Personal Computer) (cont'd)

Check the IP Address setting of the PC by opening the Windows operating system's Control Panel and then selecting the Network Connections utility. Click on Properties, scroll down to Internet Protocol (TCP/IP) and click Properties. The Internet Protocol (TCP/IP) Properties dialog box will open. Again, make sure the Subnet Mask is set the same for both the panel and the PC and also make sure that the IP Addresses do not conflict.

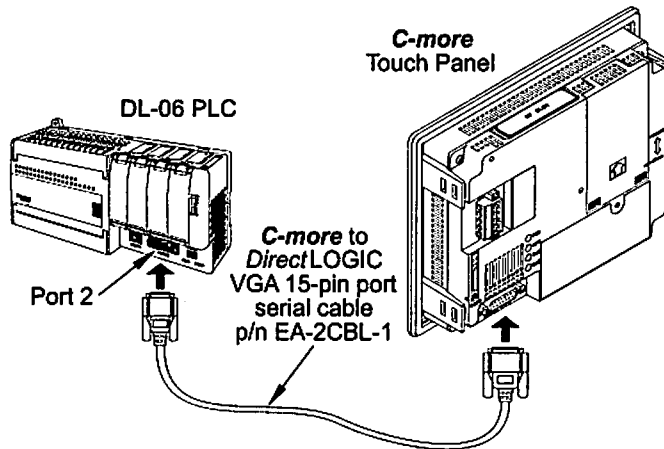
Note: If a DHCP Server is being used to obtain the IP Address for the PC, there are ways to identify the IP Address. For example, if using Windows XP, open a Command Prompt (Run > CMD) and type IPCONFIG /ALL. A list of all Ethernet assignments for the PC will be shown.



No Communications between Panel and PLC

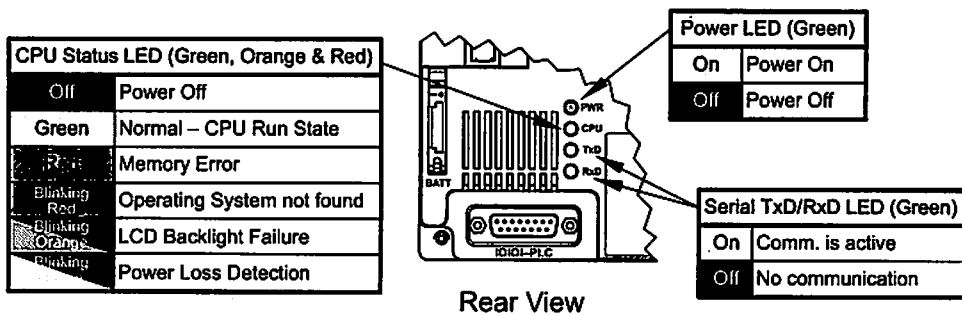
The communications between the *C-more* touch panel and designated PLC or controlling device can be accomplished by either a serial connection to the panel's 15-pin PLC Communications Port or by an Ethernet connection to the panel's 10/100 Base-T Ethernet Port. (Ethernet available on full feature units only.)

- 1.) If the touch panel and PLC are connected serially and the communications have seemed to stop working, then first check the TxD and RxD status indicators on the rear of the panel for activity.



If there is no activity on one or both the TxD and RxD status indicators, then it should be suspected that either:

- serial comm port settings are incorrect
- the cable is bad and needs to be replaced
- the serial port on the panel is defective
- the PLC serial port is bad



The status indicators will show activity whether the serial communications is wired for RS-232 or RS-422/485.

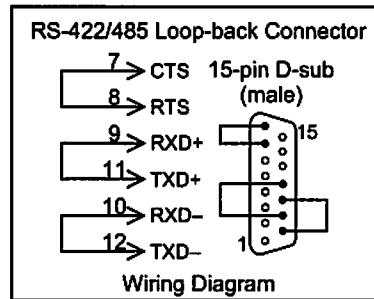
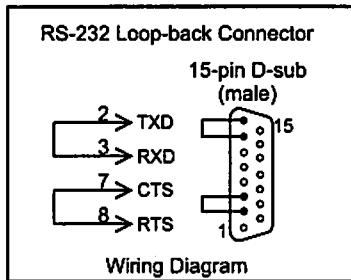
Electrical noise, pulse generating wiring and/or improper grounding can also cause problems with communications. Refer to the Electrical Noise Problems section on page 8-17 for additional help.

(Serial connections between the touch panel and PLC continued on next page.)

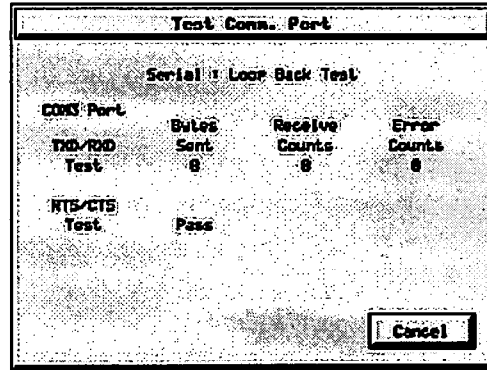
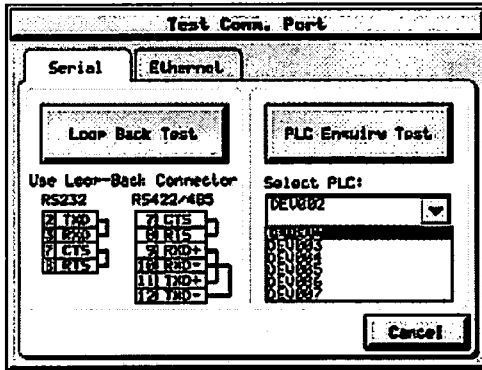
No Communications between Panel and PLC (cont'd)

The serial port on the *C-more* touch panel can be tested using the panel's system setup screens. Access the Main Menu of the panel's system setup screens, press the Test Menu button and then press the Test Comm. Port button. You will need to fabricate a Loop Back Connector for the type of serial connection that is being used in your application, either RS-232 or RS-422/485, per the wiring diagrams shown below. Plug the loop back connector into the panel's 15-pin PLC serial communications port and then press the Loop Back Test button to run the test. See Chapter 5: System Setup Screens for additional information.

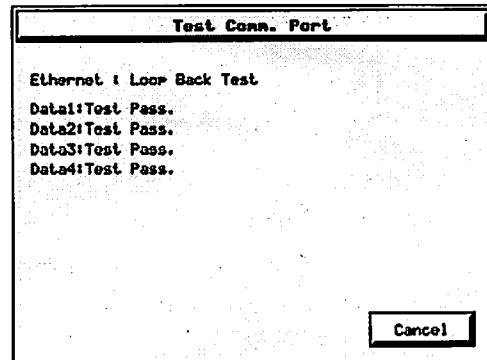
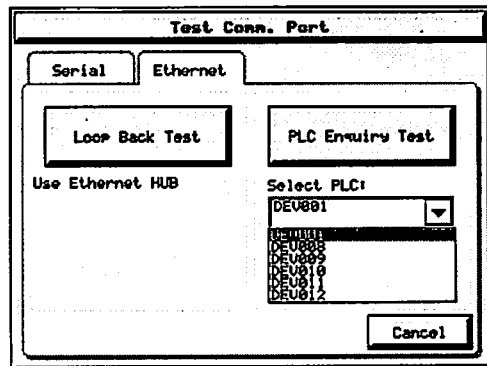
Loop back connector wiring diagrams:



System setup screens Test Comm. Port dialog boxes:



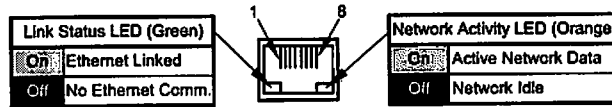
The PLC Enquiry Test can also be performed to determine if the Ethernet communication is working correctly between the panel and designated PLC .



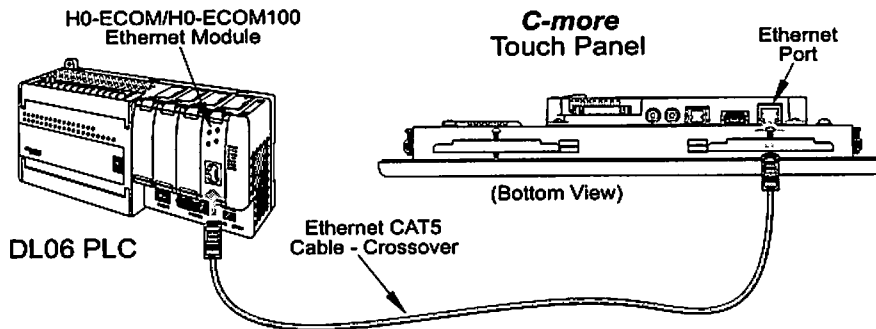
(Ethernet connections between the touch panel and PLC continued on next page.)

No Communications between Panel and PLC (cont'd)

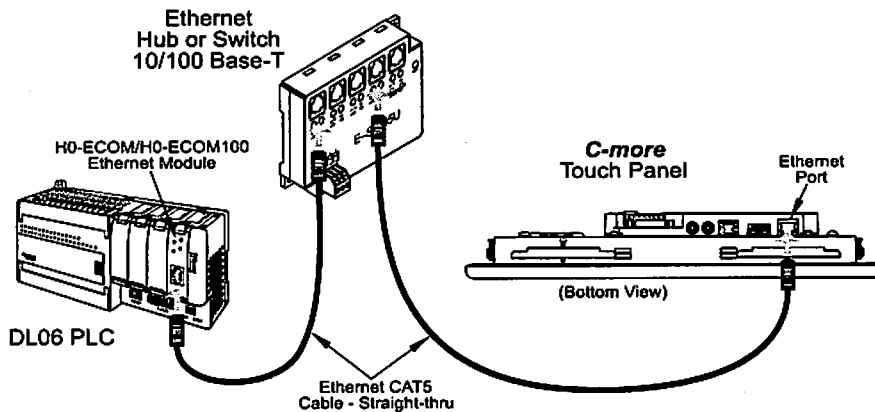
2.) If using an Ethernet connection between the touch panel and the PLC, and there is a problem with the communications, the first area to check is the Ethernet status indicators located next to the 10/100 Base-T Ethernet Port (shown below) on the rear of the panel.



There are two basic ways to make the connection. You can use a crossover Ethernet cable (shown below) to make a direct connection between the touch panel and the PLC or a



regular Ethernet cable (shown below) from the touch panel to a hub, switch, etc. that is also connected to the PLC.

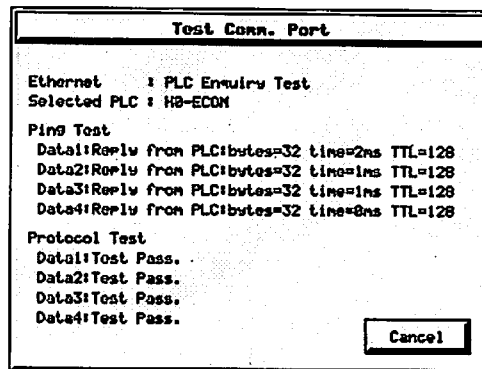
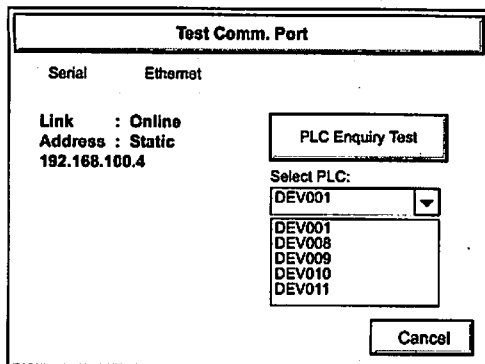


Check the status indicators that may be included with the Ethernet communications module or device that is part of the PLC. Refer to the PLC's Ethernet user manual for further troubleshooting information.

(Ethernet connections between the touch panel and PLC continued next page.)

No Communications between Panel and PLC (cont'd)

The Ethernet port on the *C-more* touch panel can be tested by using the panel's system setup screens. Access the Main Menu of the panel's system setup screens, press the Test Menu button and then press the Test Comm. Port button. Select the Ethernet tab in the Test Comm. Port dialog box, make sure the Ethernet port is connected to an Ethernet hub or other Ethernet communications device, and then press the Loop Back Test button to run the test. See Chapter 5: System Setup Screens for additional information.



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If a PC running the *C-more* programming software is connected to the Ethernet network that is also connected to both the touch panel and PLC, then certain functions in the software, such as the Main Menu's Setup drop down selection for Panel Manager or Touch Panel Network and the Main Menu's Panel drop down selection for Panel Information, can be used to help troubleshoot problems with the touch panel's communications and operation. See the *C-more* programming software's on-line help for additional information.

IP Address in System Setup Screens displays 0.0.0.0

Note: If entering an IP Address for the *C-more* touch panel using the System Setup Screens, and the IP Address keeps displaying 0.0.0.0, even after entering an IP address, the panel is not functionally connected to an active network. Either the cable, hub, or switch is bad. The entered IP Address is stored in the panel's memory, but won't show up until a good connection is established. Keep in mind that if in the *C-more* programming software's Touch Panel Network dialog box, under the Ethernet Port tab, you have checked the Save settings to Project check box and have entered an IP Address of 0.0.0.0, then anytime the project is transferred to the panel, the panel's IP Address will be overwritten with the entered address.

PLC Protocol Error Codes

The *C-more* touch panel includes built-in PLC communication protocol diagnostics that monitor the exchange of data between the panel and the PLC. The diagnostics look for the proper exchange of data, correct handshaking signals, addressing errors, incorrect data bytes, wrong packet format, etc. The diagnostics also monitor and report any of the errors that the designated PLC would normally generate if there is a problem with the PLC's communications. Each brand of PLC has its own unique set of diagnostic errors that are typically communicated over the PLC's communications port. The PLC generated errors are interpreted by the *C-more* software. See the PLC manufacturer's user manuals for additional details on the designated PLC's errors.

If a *C-more* communications error does occur, the error message will be displayed in the upper left of the *C-more* screen and the Error Code is recorded in the panel's error log. If a PLC error occurs, the PLC error code number will appear across the top of the screen, the PLC error message may not be included in some cases. The error log can be viewed using the system setup screens. See Chapter 5: System Setup Screens under the Information window to bring up the Error tab which includes a description of the logged data.

A detailed list and description of the various PLC protocol errors can be found in Appendix A: PLC Protocol Error Codes.

PLC Protocol Error Codes example:

Error Codes for <i>DirectLOGIC</i> K-Sequence		
Error Code	Error Message	Description
PLC-001	PLC Communication Timeout (for single PLC) %Device% PLC Communication Timeout (for multiple PLCs, such as RS-422/485)	A timeout occurred after sending a request to the PLC %Device%. %Device% indicates the device name, such as DEV001. Example error message for multiple PLCs: DEV001 PLC Communication Timeout
PLC-002	NAK received from PLC	A negative acknowledgement (NAK) control code has been generated during a read/write request.
PLC-004	STX is not found	A Start of Text (STX) control code was not found in the data packet received from the PLC.

Touch Panel Runtime Errors

The *C-more* touch panel includes built-in diagnostics that check for proper operation of the panel when it is running a project that has been transferred to its memory. Faults detected while the panel is running will produce a “Runtime” error. These errors are displayed in the upper left of the panel’s display and are also recorded in the panel’s error log. The error log can be viewed using the system setup screens. See Chapter 5: System Setup Screens under the Information window to bring up the Error tab which includes a description of the logged data.

A detailed list and description of the various touch panel runtime errors can be found in Appendix B: Touch Panel Runtime Errors.

Touch Panel Runtime Errors example:

No.	Error Log Code	Error Message Located at upper left of screen	Error Message Tag	Tag Error Code Value	System Screen Info > Error	Cause
Log Error						
1	RTE-001	Log Failed. Not enough Memory Space in %Device%	SYS ERR ERRORCODE	2001	MM/DD/YY HH/MM/SS Error Code RTE-001	The size of the destination memory is not large enough to store the data.
2	RTE-002	Log Failed. %Device% cannot be found	SYS ERR ERRORCODE	2002	MM/DD/YY HH/MM/SS Error Code RTE-002	No device available or the device is defective.
Battery						
1	RTE-031	Low Battery	SYS ERR ERRORCODE	2031	MM/DD/YY HH/MM/SS Error Code RTE-031	The panel's backup battery voltage level has fallen below 1.8 VDC and should be replaced.

8

Panel Constantly Displays “Initializing” when Powering up

If the touch panel constantly displays a message reading “Initializing” while powering up, then check the following possible causes.

- 1.) The project that is loaded into the panel’s internal SDRAM memory is corrupted. Either use the *C-more* programming software to clear the panel’s memory and re-transfer the project to the touch panel, or press the upper left corner of the touch panel screen while powering up to bypass the project and go directly to the System Setup Screen menu. Select the Memory menu, and use either the Clear Memory or Set to Factory Default utility to clear the panel’s memory and re-transfer the project to the touch panel.
- 2.) A CompactFlash memory card has been plugged into the CF1 slot and the CompactFlash either has no project stored on it or the project is corrupted. Remove the CompactFlash memory card from the CF1 slot and either load the project to the panel’s internal Flash memory, or use a CF card reader connected to a PC to clear and re-format the CompactFlash card, or try a different CompactFlash memory card.



Note: In the Error Log you may find the error RTE-500 - Check Sum Error, which is defined as “Memory in the panel has been corrupted by power loss, etc.” If this is the case, try cycling power to the panel, re-transfer the project to the panel, and re-transfer the firmware, etc. in sequential steps to try to correct the problem.

Data not Logging Problems

If the data log is missing entries, or a Runtime Error for the Log Errors as shown in Appendix B: Touch Panel Runtime Errors is seen, then check the following possible causes.

- 1.) Check that the memory devices, that were selected for Data Storage under the *C-more* programming software’s Main Menu - Setup drop down - Panel Manager dialog box, are plugged into their proper location. Alarms, messages and screen captures can be independently selected to be saved to either a USB pen drive plugged into the USB Port - Type A, or a CompactFlash memory card plugged into CF1 or CF2. (Full feature units only.)
- 2.) The memory device could be bad. If possible, check it by plugging it into a PC that has the ability to access the memory device. Also, not all USB devices are compatible with the *C-more* touch panels. Try using the *AutomationDirect* USB Pen Drive, p/n SDCZ4-2048-A10. Check System Screen, Memory for the presence of the USB device inserted.

Loss of Date/Time and Retentive Data

If power is cycled to the *C-more* touch panel and it is then noticed that either the Date/Time of the panel is no longer correct, or any data that has been setup to be retentive is inaccurate, most likely the backup battery is exhausted and needs to be replaced. See Chapter 9: Replacement Parts for additional information on replacing the panel’s battery.



D2-BAT-1

Electrical Noise Problems

Noise is one of the most difficult problems to diagnose. Electrical noise can enter a system in many different ways which fall into one of two categories, conducted or radiated. It may be difficult to determine how the noise is entering the system but the corrective actions for either of the types of noise problems are similar.

- Conducted noise is when the electrical interference is introduced into the system by way of an attached wire, panel connection, etc. It may enter through a power supply connection, the communication ground connection, or the chassis ground connection.
- Radiated noise is when the electrical interference is introduced into the system without a direct electrical connection, much in the same manner as radio waves.

While electrical noise cannot be eliminated, it can be reduced to a level that will not affect the system.

- Most noise problems result from improper grounding of the system. A good earth ground can be the single most effective way to correct noise problems. If a ground is not available, install a ground rod as close to the system as possible. Ensure all ground wires are single point grounds and are not daisy chained from one device to another. Ground metal enclosures around the system. A loose wire can act as a large antenna, introducing noise into the system. Therefore, tighten all connections in your system. Loose ground wires are more susceptible to noise than the other wires in your system. Review **Chapter 4: Installation & Wiring** if you have questions regarding how to ground the touch panel.
- Electrical noise can enter the system through the power source for the touch panel. Installing a properly wired isolation transformer (neutral grounded) for all AC sources can help the problem, but only if wired correctly. DC sources should be well-grounded good quality supplies.
- Never run communication cables or low-voltage power wiring close to high voltage wiring or pulse generating wiring that controls such devices as solenoids, servos, VFOs, etc.

REPLACEMENT PARTS



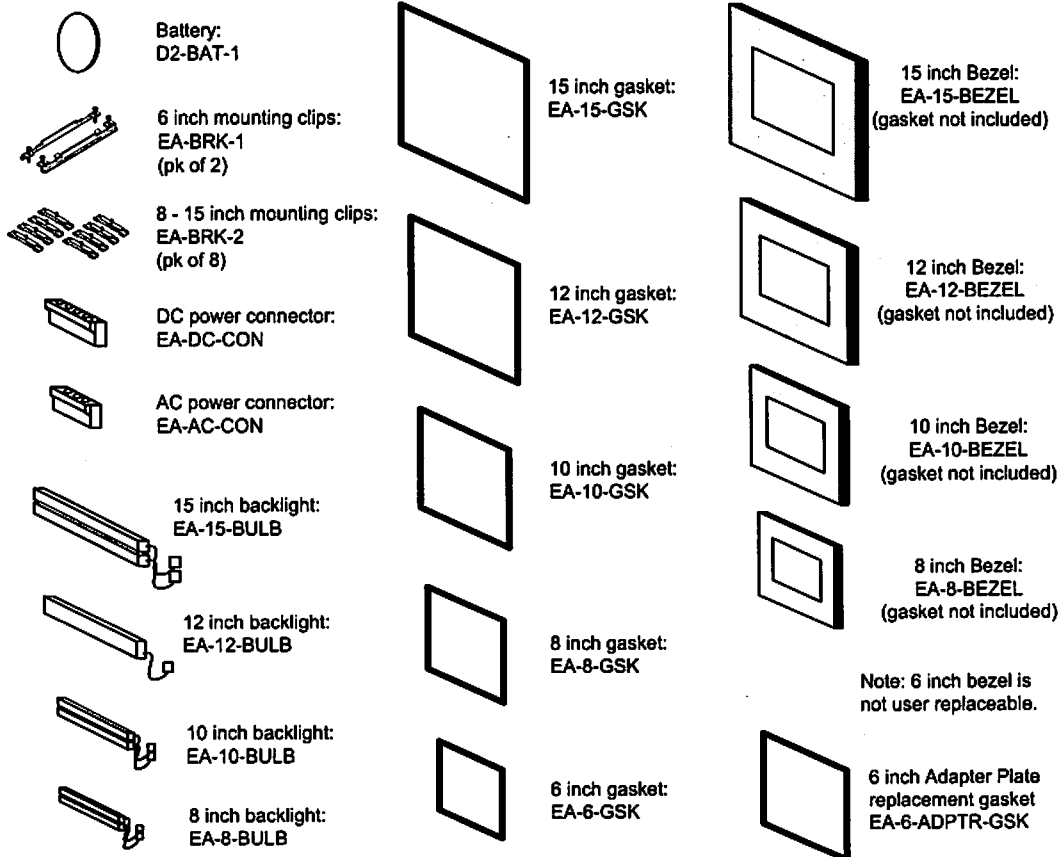
In This Chapter...

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Replacement Parts Overview

Part Number	Description	Part Number	Description
D2-BAT-1	Battery Replacement	EA-12-GSK	12" Panel Gasket Replacement
EA-BRK-1	6" Panel Mounting Clip Replacements (2 per pk.)	EA-10-GSK	10" Panel Gasket Replacement
EA-BRK-2	8-15" Panel Mounting Clip Replacements (8 per pk.)	EA-8-GSK	8" Panel Gasket Replacement
EA-DC-CON	DC Panel Power Connector Replacement	EA-6-GSK	6" Panel Gasket Replacement
EA-AC-CON	AC Power Adapter Connector Replacement	EA-15-BEZEL	15" Panel Bezel Replacement
EA-15-BULB	15" Panel Backlight Bulb Replacement	EA-12-BEZEL	12" Panel Bezel Replacement
EA-12-BULB	12" Panel Backlight Bulb Replacement	EA-10-BEZEL	10" Panel Bezel Replacement
EA-10-BULB	10" Panel Backlight Bulb Replacement	EA-8-BEZEL	8" Panel Bezel Replacement
EA-8-BULB	8" Panel Backlight Bulb Replacement	EA-6-ADPTR-GSK	6" Adapter Plate Gasket Replacement
EA-15-GSK	15" Panel Gasket Replacement		

9 Replacement Parts at a Glance:



Battery Replacement – D2-BAT-1



The *C-more* touch panels are supplied with a SRAM retentive memory backup battery that also is used to backup the internal CPU date/time registers. The battery should be replaced every 5 years or during any routine maintenance to the touch panel. As a note, the battery used in the *C-more* touch panels is the same battery that is used for backup in *AutomationDirect's* DL06, D2-250(-1), D2-260 and D3-350 PLCs.

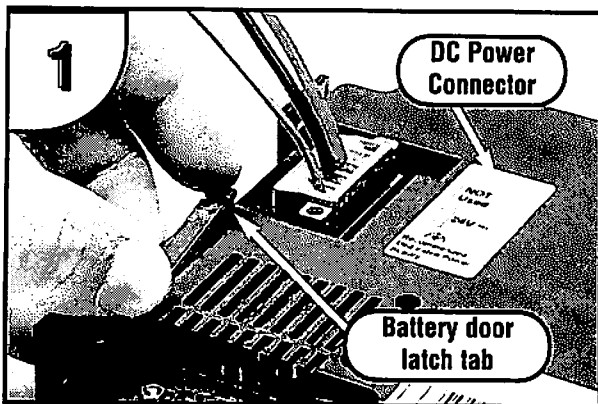
Battery Replacement Instructions:



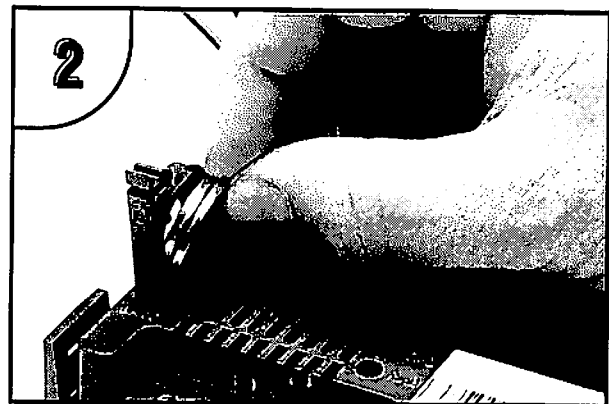
NOTE: The lithium battery in your panel is used to maintain the system **SRAM** retentive memory and the CPU date/time registers when the unit is without external power. Before replacing the battery, back-up the data in your **SRAM** retentive memory as a precaution. Input power needs to be maintained to the panel during battery replacement. Typical battery life is five years, which includes panel runtime and normal shutdown periods. However, consider installing a fresh battery if your battery has not been replaced recently and the unit will be without power for a period of more than ten days.

Preparation: If the touch panel is not mounted in or has been removed from a control cabinet, then it is recommended the panel be placed face down on a lint-free soft surface to prevent scratching the front of the panel. The battery door is located on the rear just below and to the left of the DC Power Connector.

9



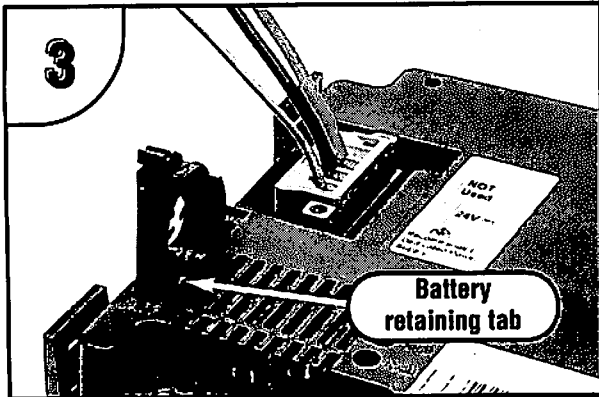
Open the battery holder door by pressing down on the upper latch tab while lifting upward and rotating the door in a downward motion. The battery door will pivot toward its bottom hinge point.



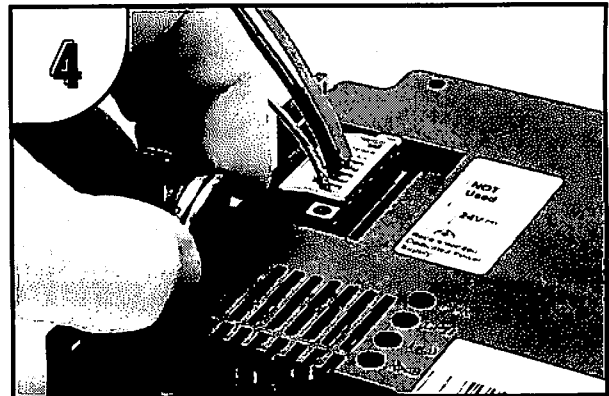
The coin cell style battery is located in the battery holder. To remove the battery, use the slot in the top of the holder to pry the battery away from the holder and while grasping the battery, lift it upward.

Continued on next page.

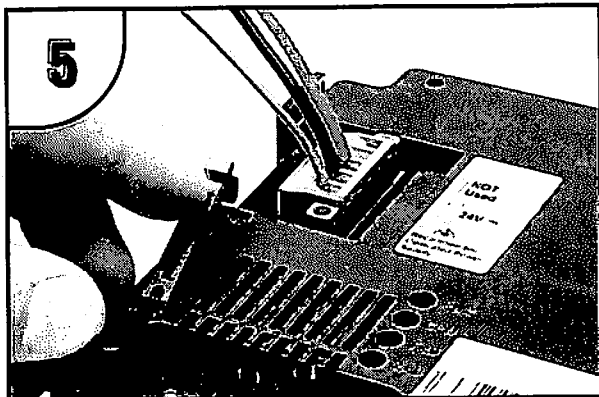
Battery Replacement Instructions (cont'd):



Above shows the empty battery holder and also points out the location of the battery retaining tab for reference in the next step.



To install the battery, hold the battery so that the larger diameter (+ symbol) is outward. Set the battery to the inside of the retaining tab and then press the upper top of the holder into the holder.



Press the battery holder door downward until the upper latch tab locks into place. Make a note of the date the battery was installed.

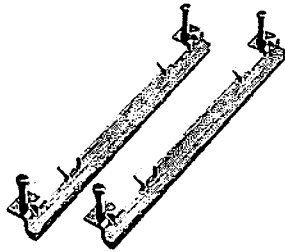


WARNING: DO NOT attempt to recharge the battery or dispose of an old battery by fire. The battery may explode or release hazardous materials. CR lithium batteries are safe for disposal in the municipal waste stream, but it is suggested that where possible, the battery be fully discharged prior to disposal. Additional precautions:

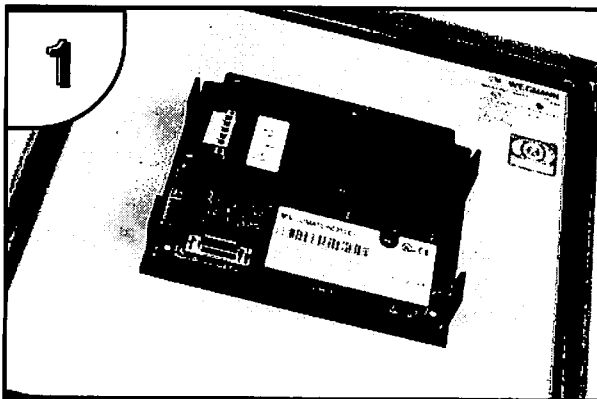
- Do not short circuit the battery and be sure to make the correct polarity connections.
- Avoid extremely high or low temperatures and high humidity when storing.
- Do not dismantle the battery.

6" Panel Mounting Clip Replacements – EA-BRK-1

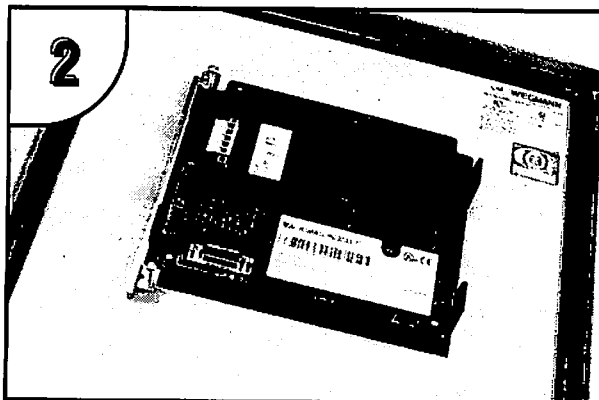
Spare panel mounting clips for 6 inch *C-more* touch panels.
Package of 2 clips with 4 screws.



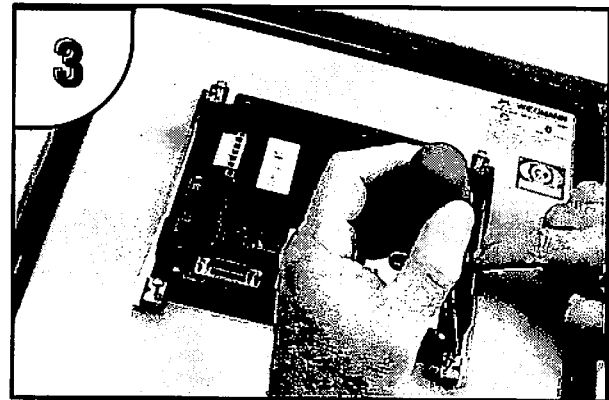
Installation Instructions



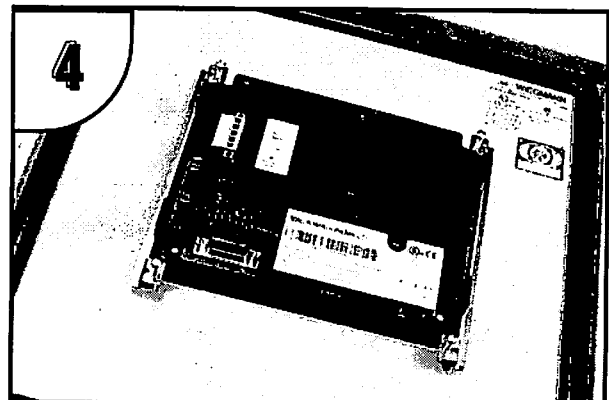
Position the touch panel through the cutout in the control cabinet door and hold in place. The mounting clips can be positioned into one of two different set of slots for different cabinet thicknesses. See table below.



The above photo shows one mounting clip in place. The example is using the lower mounting clip slots that accommodates an enclosure thickness of 0.039 – 0.24 inches [1 – 6 mm]. The upper slots can be used for an enclosure thickness of 0.20 – 0.63 inches [5 – 16 mm].



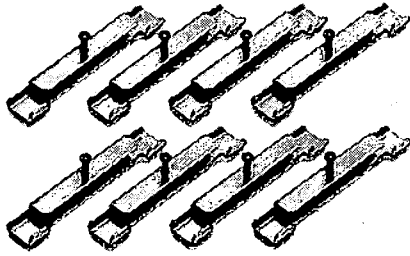
Tighten the mounting screws in an alternating fashion while observing the front of the touch panel. The goal is to make sure the front bezel is pulled up against the enclosure sheet metal uniformly, and the touch panel gasket is fully compressed all the way around its perimeter. Tighten the screws to a torque rating shown in the table below. Avoid over-tightening the screws to the point that they start to deform or bend the mounting clip.



The above photo shows both mounting clips in place and the touch panel secured.

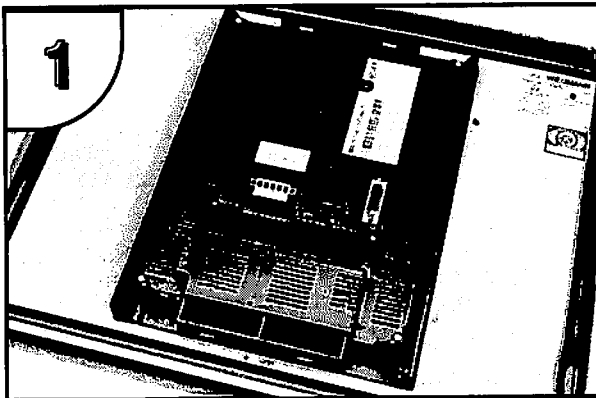
Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
6" lower mounting clip position	0.039 - 0.24 inch [1 – 6 mm]	35 ~ 50 oz-in [0.25 ~ 0.35 Nm]
6" upper mounting clip position	0.20 - 0.63 inch [5 – 16 mm]	35 ~ 50 oz-in [0.25 ~ 0.35 Nm]

8–15" Panel Mounting Clip Replacements– EA-BRK-2



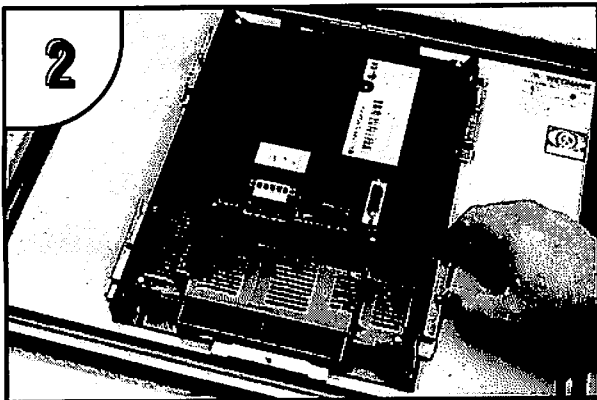
Spare panel mounting clips for the 8 inch through 15 inch *C-more* touch panels. Package of 8 clips with 8 screws.

Installation Instructions

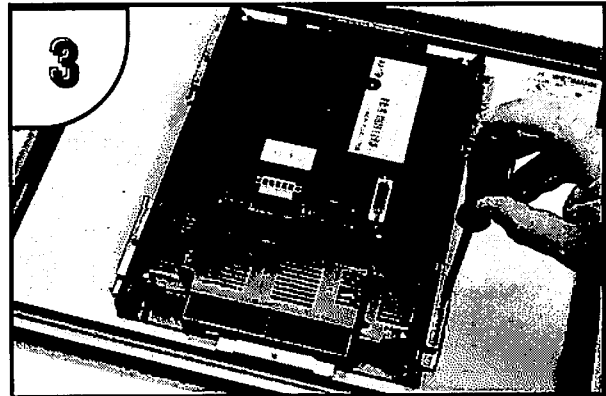


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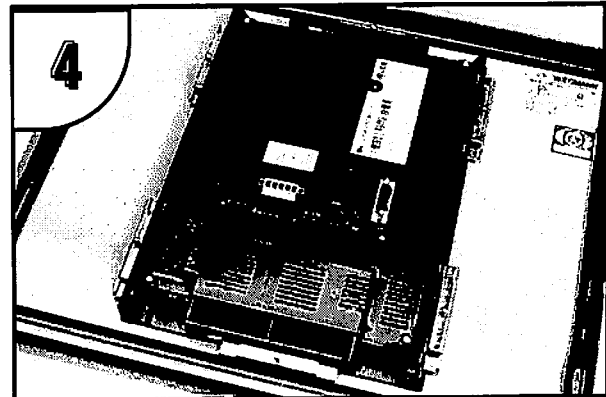
Position the touch panel through the cutout in the control cabinet door and hold in place. The mounting clips are positioned into the slots around the outside edge of the touch panel rear.



The mounting clips are positioned into the larger portion of the slot at two locations, and then slid toward the smaller portion of the slots to lock them in place. Some slots are arranged to slide to the left and others to the right.



Tighten the mounting screw for each mounting clip in an alternating fashion at all clips while observing the front of the touch panel. The goal is to make sure the front bezel is pulled up against the enclosure sheet metal uniformly, and the touch panel gasket is fully compressed all the way around its perimeter. Tighten the screws to a torque rating shown in the table below. Avoid over-tightening the screws to the point that they start to deform or bend the mounting clip.

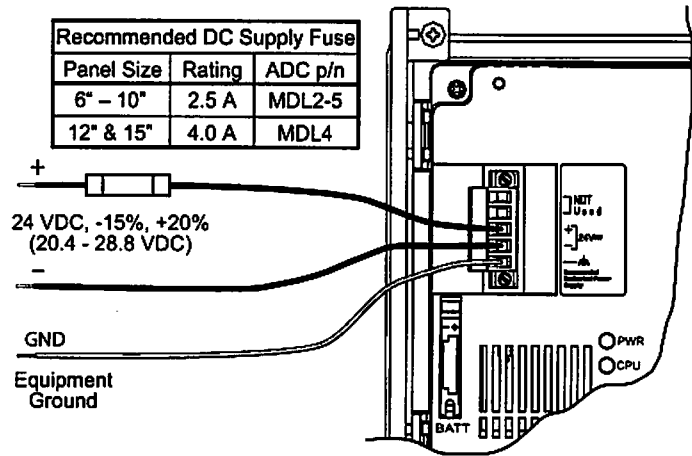
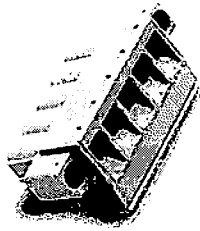


The above photo shows all mounting clips in place and the touch panel secured. The 8", 10" and 12" touch panels require 6 mounting clips and the 15" touch panel requires 8 mounting clips.

Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
6" upper mounting clip position	0.20 - 0.63 inch [5 - 16 mm]	35 ~ 50 oz-in [0.25 ~ 0.35 Nm]

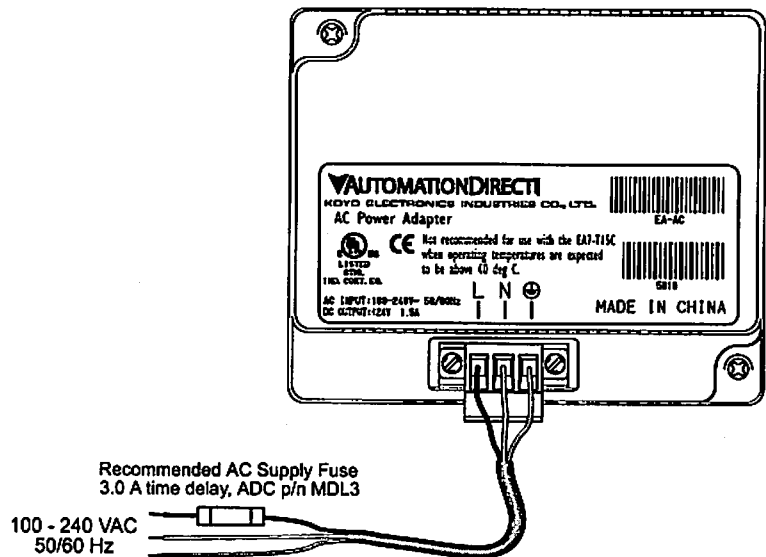
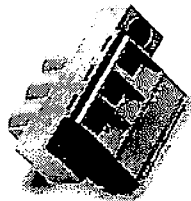
DC Panel Power Connector Replacement – EA-DC-CON

C-more touch panel 5-position DC power connector terminal block replacement. One (1) DC Power Connector is supplied with each touch panel.

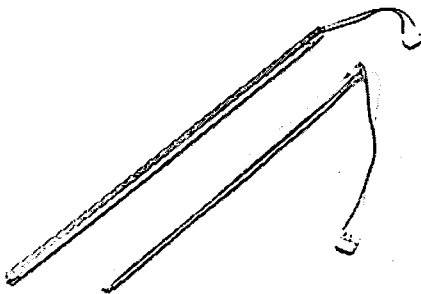


AC Power Adapter Connector Replacement – EA-AC-CON

C-more AC power adapter 3-position AC power connector terminal block replacement. One (1) AC Power Connector is supplied with each AC/DC Power Adapter, EA-AC.



8-15" Panel Backlight Bulb Replacements – EA-xx-BULB



Backlight assembly, customer replaceable, for *C-more* 8", 10", 12" and 15" touch panels. The 8", 10" and 15" touch panels use two bulbs per panel and the 12" touch panels use one bulb per panel. The bulbs are packaged two per box for the 8", 10" and 15" touch panels and one per box for the 12" touch panels.

(The part number is completed by substituting the panel size, 08, 10, 12 or 15, for the xx shown above.)

Backlight Bulb Installation Instructions Example:

(See the Data Sheet insert for the specific backlight bulb that is being replaced for more detailed information.)



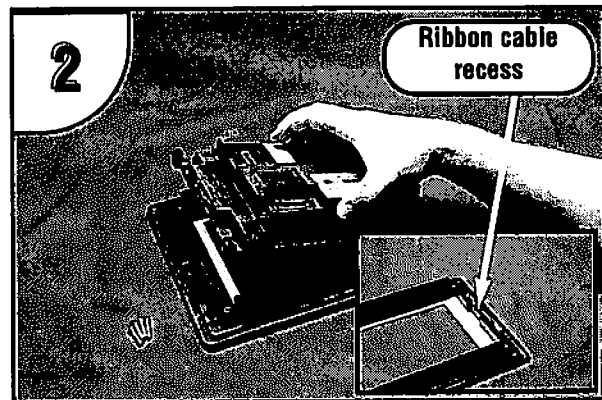
WARNING: This procedure should only be performed by qualified personnel who are experienced in working with electronic equipment. Take the necessary steps to prevent damage from static electricity discharge. Disconnect input power to the touch panel before proceeding. Be careful not to pinch the ribbon cable between the housing and bezel when re-assembling the panel.

9

Preparation: Disconnect input power and all other connections, then remove the touch panel from the control cabinet. In a clean environment, place the panel face down on a lint-free soft surface to prevent scratching the front of the panel.



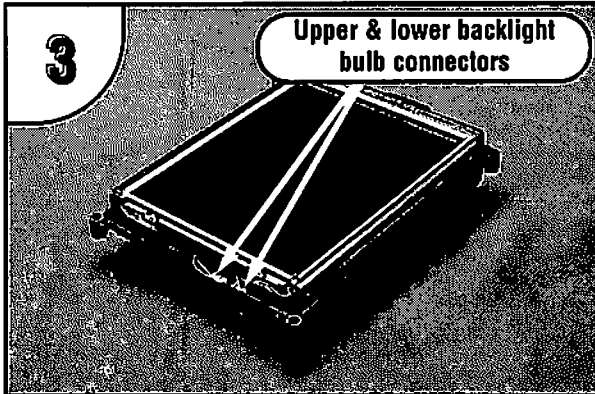
1 With power disconnected, use a #2 Phillips screwdriver to remove the four outer screws holding the touch panel's main electronics housing to the front bezel.



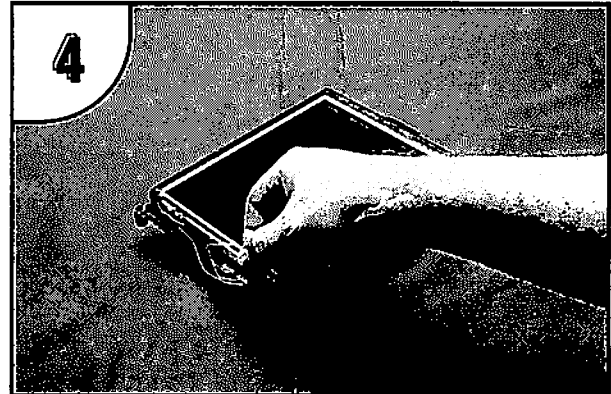
2 Lift the touch panel's main electronics housing from the front bezel. Set the front bezel and four screws to the side. Observe the ribbon cable recess on the front bezel (see detail) for use in re-assembling the panel.

Continued on next page.

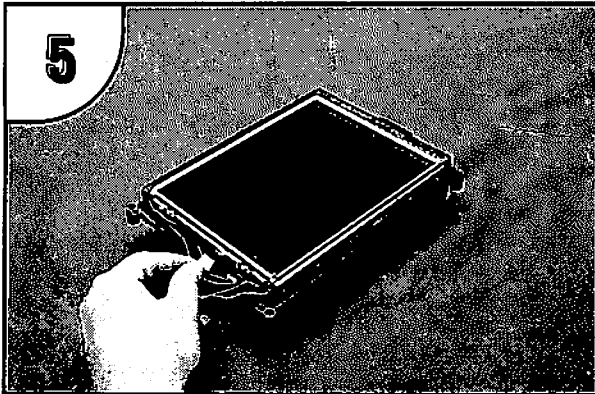
Backlight Bulb Installation Instructions Example (cont'd):



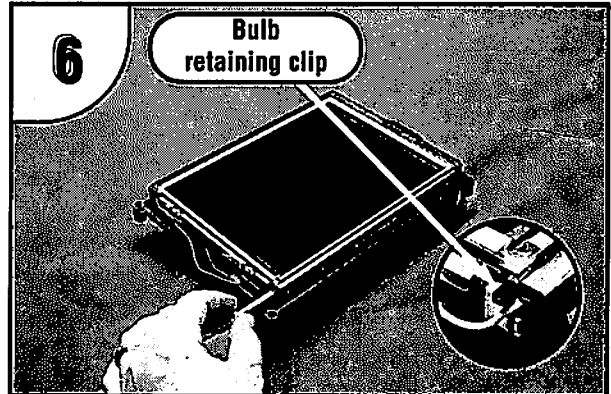
Place the touch panel's main electronics housing facing up on a lint-free soft surface. Position the housing so that the backlight bulb connectors are in plain view.



Carefully lift the bulb's wires out of the wire guides so they are free from obstructions. Do this for both the upper and lower backlight bulbs.



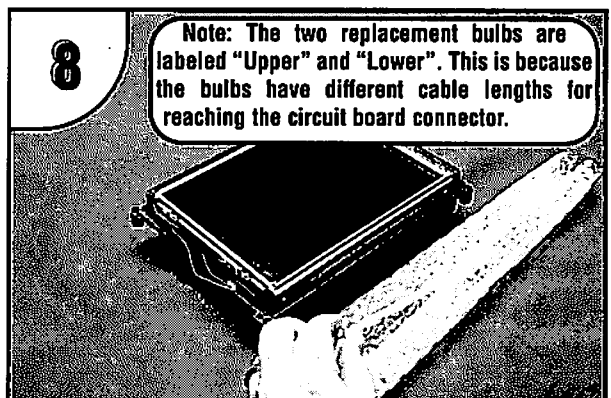
Unplug the backlight bulb's power cable connector from the circuit board connector. Again, do this for both the upper and lower backlight bulbs.



Push up on the bulb retaining clip (see detail) while grasping the plastic end of the bulb assembly and gently slide the bulb from its guide. Do this for both bulbs. The bulb is glass and fragile, so handle with care.



This photo shows the backlight bulb completely removed from its guide in the panel's main electronics housing. (Only one bulb shown.)

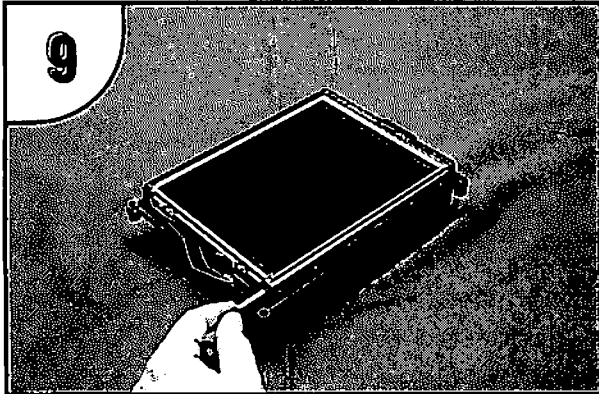


Remove the replacement bulb from its shipping tube and the protective bubble wrap. Note: The replacement bulbs come in pairs and should be replaced in pairs for longevity and maintenance convenience.

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Continued on next page.

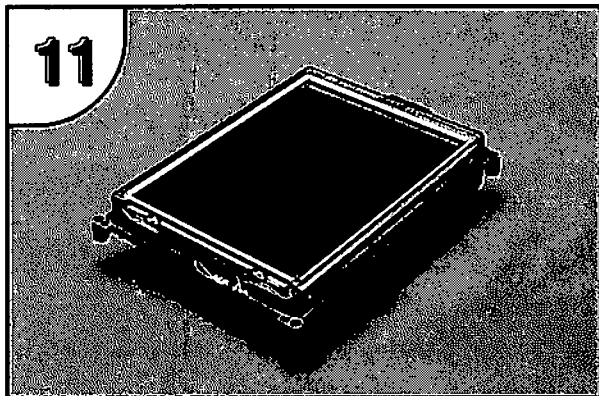
Backlight Bulb Installation Instructions Example (cont'd):



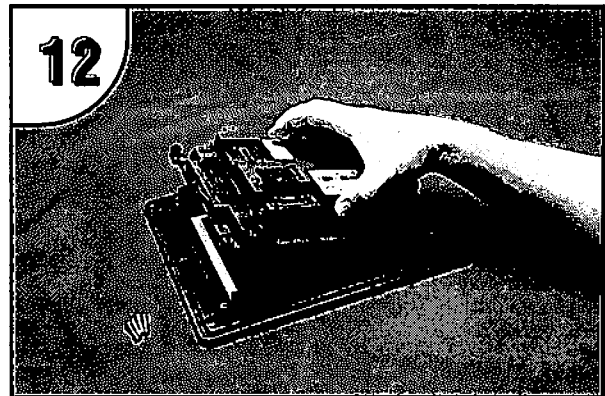
Position the replacement bulb so that the opening in its three-sided gold colored reflector faces toward the LCD touch screen. Using gentle pressure, slide the bulb into the guide until the retaining clip locks.



Plug each backlight bulb's power cable connector back into its respective circuit board connector.

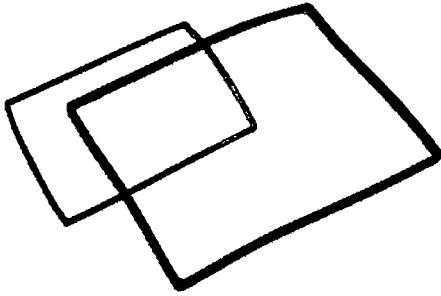


Gently position each backlight bulb's wires back into their respective wire guides to help clear any obstructions when inserting the panel's main electronics housing back into the front bezel. Position any excess wire length in between the printed circuit board and the LCD to prevent it from becoming pinched between the housing and bezel.



Position the touch panel's main electronics housing into the front bezel so that the flat ribbon cable on the housing aligns with the recess in the front bezel. Insert the four screws and tighten to a maximum of 70 oz-in [0.5 Nm].

6-15" Panel Gasket Replacements – EA-xx-GSK

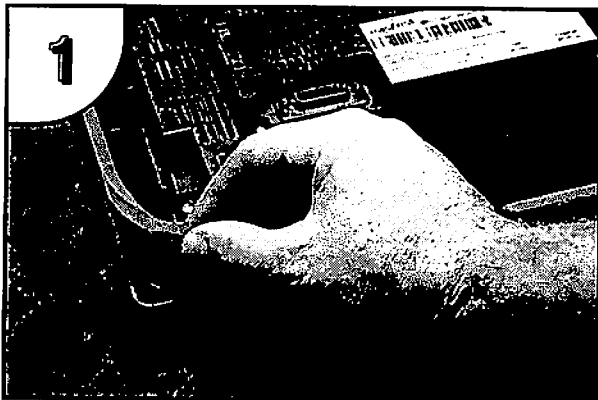


Replacement NEMA 4/4X touch panel gaskets for *C-more* 6", 8", 10", 12" and 15" touch panels.

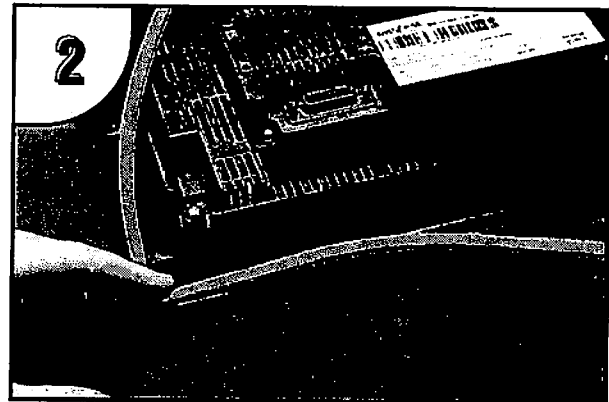
(The part number is completed by substituting the panel size, 06, 08, 10, 12 or 15, for the xx shown above.)

Gasket Replacement Installation Instructions:

Preparation: Disconnect input power and all other connections, then remove the touch panel from the control cabinet. In a clean environment, place the panel face down on a lint-free soft surface to prevent scratching the front of the panel.

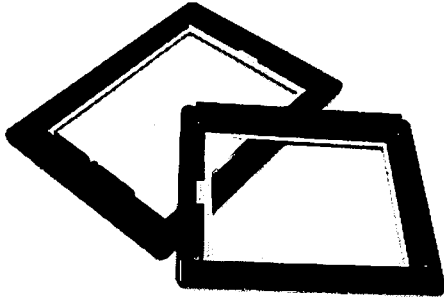


1 Start at one corner and pull the old gasket out of the channel that holds the gasket in place. Pull the gasket up as you work around the entire perimeter of the touch panel. Discard the old gasket.



2 Lay the new gasket over the channel so that the long and short sides of the gasket match up to the long and short sides of the touch panel. Start at one corner and match the gasket's corner to the channel's corner. Press the gasket into the channel and work all away around the perimeter of the touch panel. Re-install the touch panel.

8-15" Panel Bezel Replacement – EA-xx-BEZEL



The NEMA 4/4X bezels used on the *C-more* 8", 10", 12" and 15" touch panels can be easily replaced. The replacement bezel includes the clear membrane element that protects the touch sensitive area. A gasket is not included. The bezel and membrane element do not require replacement under normal use. In the event that the clear membrane is scratched from the use of sharp objects or abrasive materials, follow the procedure outlined below to replace the front bezel.

(The part number is completed by substituting the panel size, 08, 10, 12 or 15, for the xx shown above.)



Note: The bezel on the 6" *C-more* touch panels is not user replaceable and can only be replaced by *AutomationDirect*. Contact the *AutomationDirect* returns department @ 1-800-633-0405 to make arrangements for returning the unit for repair.

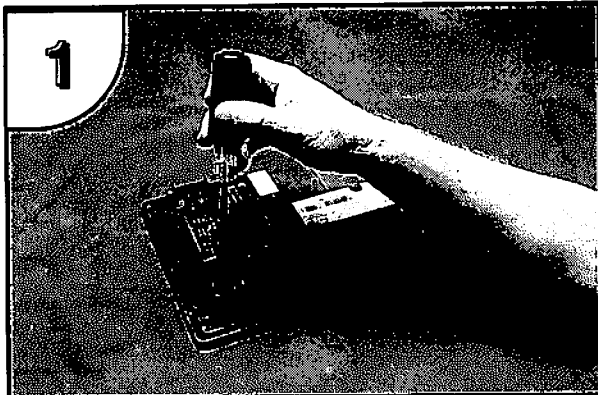
Bezel Replacement Instructions Example:

9

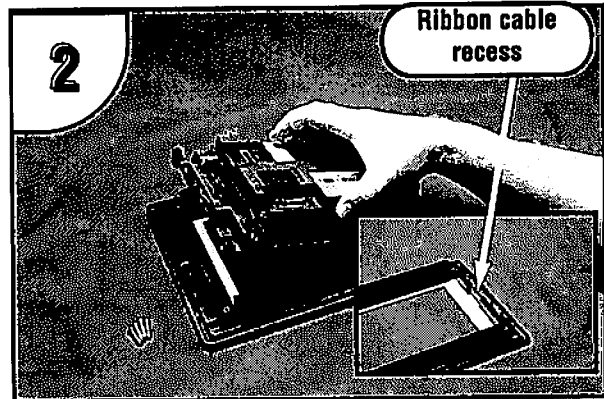


WARNING: This procedure should only be performed by qualified personnel who are experienced in working with electronic equipment. Take the necessary steps to prevent damage from static electricity discharge. Disconnect input power to the touch panel before proceeding. Be careful not to pinch the ribbon cable between the housing and bezel when re-assembling the panel.

Preparation: Disconnect input power and all other connections, then remove the touch panel from the control cabinet. In a clean environment, place the panel face down on a lint-free soft surface to prevent scratching the front of the panel.



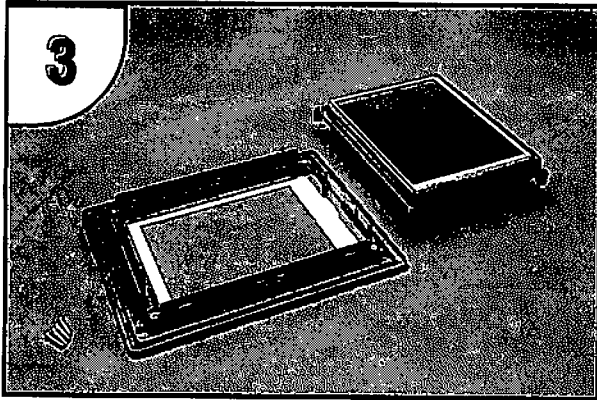
With power disconnected, use a #2 Phillips screwdriver to remove the four outer screws holding the touch panel's main electronics housing to the front bezel.



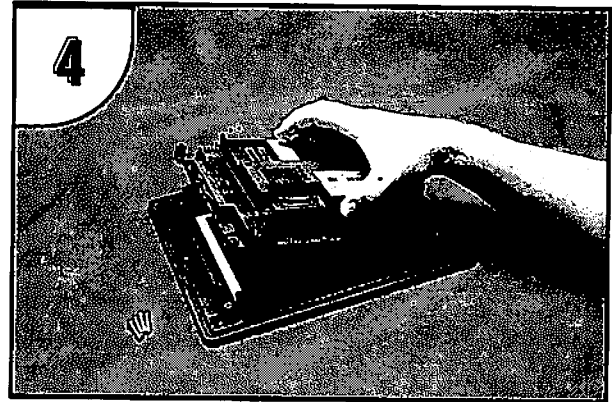
Lift the touch panel's main electronics housing from the front bezel. Set the four screws to the side and discard the original bezel. Observe the ribbon cable recess on the front bezel (see detail) for use in re-assembling the panel.

Continued on next page.

Bezel Replacement Instructions Example (cont'd):

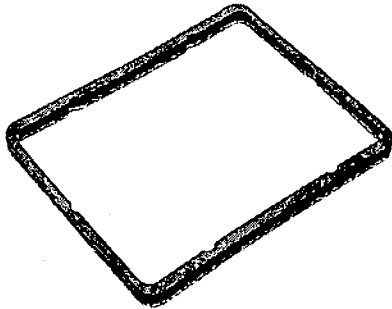


Place the new bezel facing down on the lint-free soft surface along with main electronics and four screws.



Position the touch panel's main electronics housing into the new bezel so that the flat ribbon cable on the housing matches up with the recess in the front bezel. Insert the four screws and tighten to a maximum of 70 oz-in [0.5 Nm].

6" Adapter Plate Gasket Replacement – EA-6-ADPTR-GSK

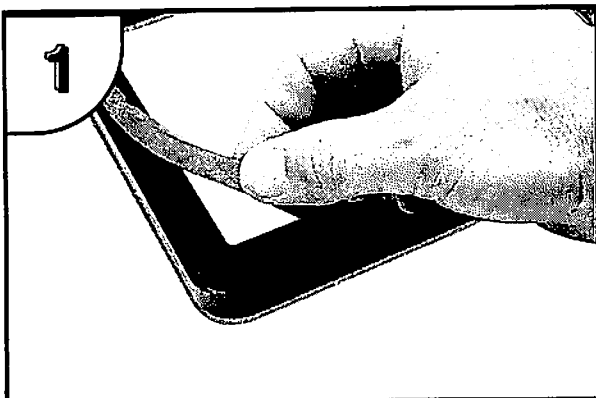


6-inch replacement NEMA 4/4X gasket for the *C-more* touch panel adapter plate.

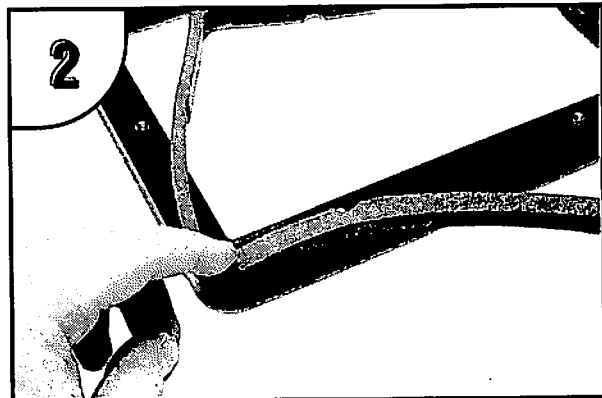
6" Adapter Plate Gasket Replacement Instructions:

Preparation: Disconnect input power and all other connections, remove the touch panel from the 6" adapter plate, and then remove the adapter plate from the control cabinet by removing the six (6) screws that secure the adapter to the control cabinet. In a clean environment, place the adapter plate face down on a lint-free soft surface to prevent scratching the adapter plate.

9

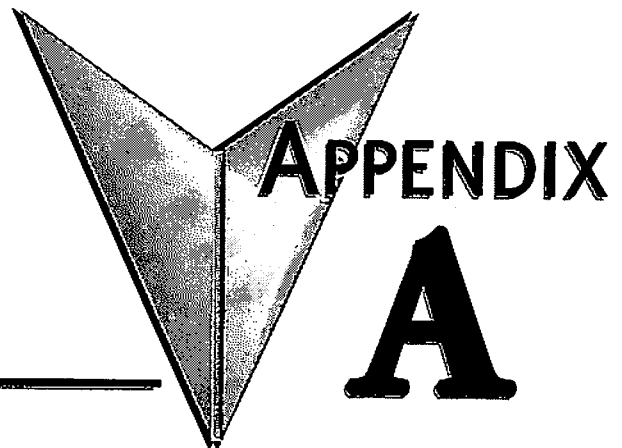


Start at one corner and pull the old gasket out of the channel that holds the gasket in place. Pull the gasket up as you work around the entire perimeter of the adapter plate. Discard the old gasket.



Lay the new gasket over the channel so that the long and short sides of the gasket match up to the long and short sides of the adapter plate. Start at one corner and match the gasket's corner to the channel's corner. Press the gasket into the channel and work all away around the perimeter of the adapter plate. Re-install the adapter plate and then the touch panel.

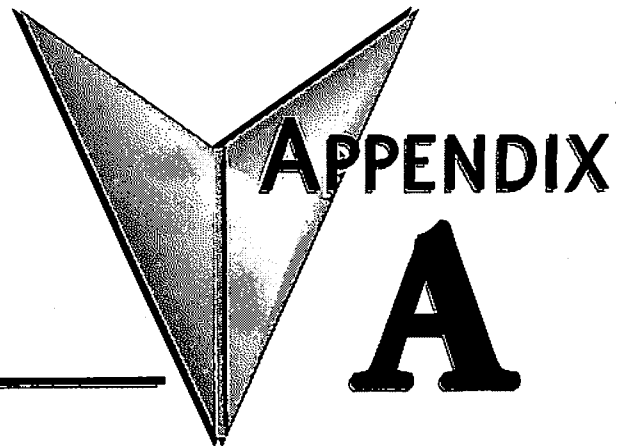
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PANEL & PLC ERROR CODE TABLES



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Introduction

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The *C-more* family of touch panels is capable of communicating with a wide variety of Programmable Logic Controllers. *C-more* is capable of communicating over RS232, RS422 and RS485 serial networks as well as Ethernet networks. It communicates with all controllers in the *Direct* LOGIC family of PLCs utilizing various protocols. *C-more* also communicates with other brands of PLCs by their different protocols. For a complete list of PLCs and protocols, see the table on page 16 of Chapter 1: Getting Started.

As with any network communications, errors will occur. To make it more simple for the user to identify the cause of the possible error, we have provided a error code table for all of the possible errors that *C-more* can detect.

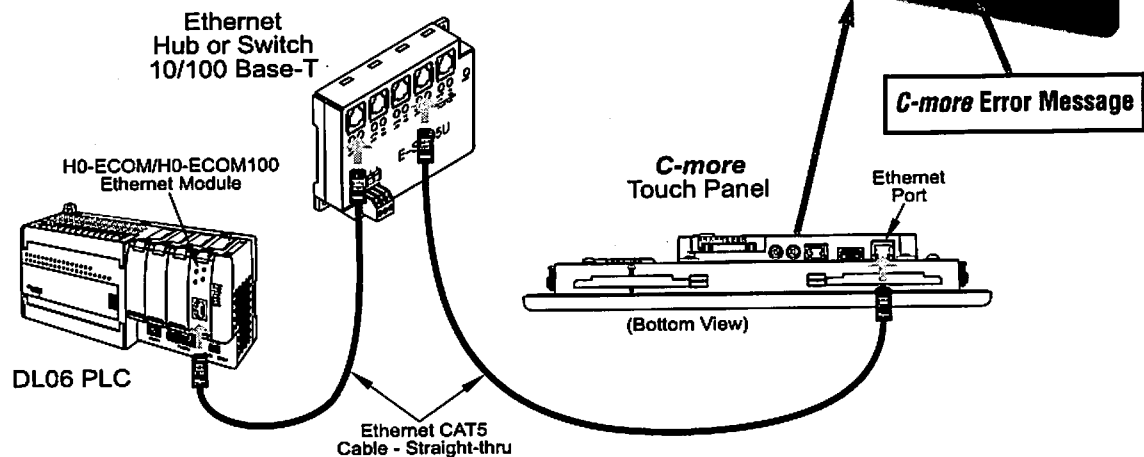
If a *C-more* communications error does occur, the error message will appear across the top of the screen. The *C-more* touch panel also monitors any errors that are generated by the various PLCs that are connected to it. If any of the PLC generated errors are detected, they are displayed across the top of the panel's display embedded as a hexadecimal value in error code P499's message. An explanation of how the specific PLC error is identified in the panel error code P499 is shown proceeding the specific manufacturer's PLC error tables. How the hexadecimal error code value is interrupted is slightly different between manufacturers, so it is important to check the explanation at the beginning of each manufacturer's tables.



Note: These PLC error codes are provided by the manufacturer of the related PLC and are subject to change by the PLC manufacturer. Please refer to the manufacturers documentation for a more complete and up-to-date list of error codes.

All errors are also logged into the panel's Error log under the Information tab in the panel's System Setup Screens and are identified by the error code number. See Chapter 5: System Setup Screens for additional details.

If you have difficulty determining the cause of the error, please refer to Chapter 8: Troubleshooting for some troubleshooting tips or contact our technical support group at 770-844-4200 or the 3rd party PLC manufacturer.



C-more Touch Panel Error Code Table

The following table includes all of the error codes and error messages that the panel will display if the listed cause is detected. All of these errors involve problems that could result with the panel communicating with the connected PLC. Be aware that not all of the panel errors are used with each type of PLC that can be connected to the panel.

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<i>C-more Touch Panel Error Code Table</i>		
Error Code	Error Message	Cause
PLC-001	PLC Communication Timeout (for single PLC) %Device% PLC Communication Timeout (for multiple PLCs, such as RS-422/485)	A timeout occurred after sending a request to the PLC %Device%. %Device% indicates the device name, such as DEV001. Example error message for multiple PLCs: DEV001 PLC Communication Timeout.
PLC-002	NAK received from PLC	A negative acknowledgement (NAK) control code has been generated during a read/write request.
PLC-003	EOT received from PLC	An End of Transmission (EOT) control code is sent by the PLC in response to a Read/Write/SetBit request..
PLC-004	STX is not found	A Start of Text (STX) control code was not found in the data packet received from the PLC.
PLC-005	ETX or ETB is not found	Neither an End of Text (ETX) nor an End of Transmission Block (ETB) control code was found in the data packet received from the PLC.
PLC-006	LRC does not match	There was an incorrect Longitudinal Redundancy Check (LRC) control code in the communications packet received from the PLC. This is an indication that the data in the packet is corrupted.
PLC-007	CRC does not match	There was an incorrect Cyclic Redundancy Check (CRC) control code in the communications packet received from the PLC. This is an indication that the data in the packet is corrupted.
PLC-008	Address does not match	The address value returned in the data packet from the PLC is incorrect.
PLC-009	Different function code received from PLC	The function code returned in the data packet from the PLC is incorrect.
PLC-010	Data size does not match	There are an incorrect number of bytes found in the data packet returned from the PLC.
PLC-011	Invalid value in function code	There is an invalid value in the function code.
PLC-012	Invalid command sent to PLC	There was an invalid command sent to the PLC that wasn't recognized by the PLC.
PLC-013	ENQ received from PLC	If the data packet does not include a negative acknowledgement (NAK - 0x15 value) in the defined packet field, then an enquiry (ENQ) control code error will be displayed.
PLC-014	Transaction ID does not match	This error will be displayed if after checking the Transaction ID Bytes in the data packet, there is no match to what was requested.
PLC-015	%Device% No device found	A PLC device designated as %Device% could not be found.
PLC-016	Data byte communication error	0 byte of data is recieved
PLC-017	Out of address range	The touch panel requested a file number larger than 255.
PLC-018	Panel communication timeout	The server panel did not respond when using the Panel Pass Through.
PLC-019	Found in parity error by hardware	An error detected in the PLC memory.
PLC-020	Can't open serial port	Cannot open the Serial Port. If this error shows on the panel, it indicates a hardware problem.
PLC-021	PLC number does not match	The PLC number does not match the PLC number configured.
PLC-022	Can't reset DCB	Unable to reset the data communication bit.
PLC-023	Cable not connected properly	Communication cable incorrectly installed.

C-more Touch Panel Error Code Table continued on the next page.

C-more Touch Panel Error Code Table (cont'd)

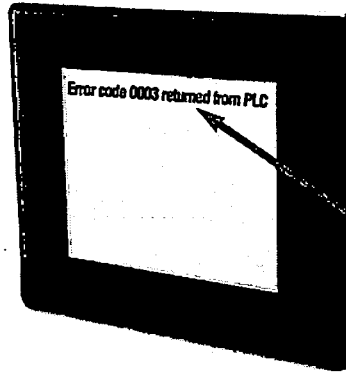
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<i>C-more</i> Touch Panel Error Code Table (cont'd)		
Error Code	Error Message	Cause
PLC-024	Cannot detect other devices on network	The panel is not communicating with other devices on the network.
PLC-025	Panel not in polling list	
PLC-026	PLC connection timeout	A timeout occurred after sending a request to the PLC.
PLC-027	Memory type incorrect	
PLC-028	PLC failed to respond	The PLC failed to respond after sending a request to the PLC.
PLC-495	Omron Ethernet Error	An error code specific to Omron Ethernet with a Value of XXXX has been returned from the PLC. See the explanation for error code PLC-495 proceeding the Omron CS/CJ FINS Ethernet error code tables.
PLC-496	Error code 0xaaaaaaaaa returned from PLC	Allen-Bradley EtherNET/IP specific. Encapsulation Error. See the explanation for error code PLC-496 proceeding the Allen-Bradley EtherNet/IP error code tables.
PLC-497	Error code 0xaaaaaaaaa returned from PLC	Allen-Bradley EtherNET/IP specific. CIP Error. See the explanation for error code PLC-497 proceeding the Allen-Bradley EtherNet/IP error code tables.
PLC-498	Error code 0xaaaaaaaaa returned from PLC	Allen-Bradley EtherNET/IP specific. Service Packet Error. See the explanation for error code PLC-498 proceeding the Allen-Bradley EtherNet/IP error code tables.
PLC-499	Error code XXXX returned from PLC	An error code with a value of XXXX has been returned from the PLC. See the explanation for error code PLC-499 below for <i>Direct</i> LOGIC and proceeding each set of PLC error code tables that use this error code.
PLC-500	Cannot write to Serial Port	Data cannot write to the Serial port. Data was sent to the PLC via the Serial Port. If this error shows on the Panel, it indicates a Hardware Problem.
PLC-700	Not enough buffer memory	There was an error while allocating memory for the read buffer. When this error is displayed, a memory leak may have occurred.
PLC-701	Access to inaccessible PLC memory	Request to inaccessible memory from the HMI layer to the PLC protocol layer. This error is an indication that there is a problem in the HMI layer.
PLC-702	Cannot access by different function code	A Read/Write/SetBit request has been sent to an invalid memory area. This error is an indication that there is a problem in the HMI layer.
PLC-703	Write request to PLC Read Only Memory	A PLC Write request was made to the PLC's Read-Only memory area. This error is an indication that there is a problem in the HMI layer or the PLC protocol layer.

DirectLOGIC – Panel Error Code PLC-499 Explanation

The PLC-499 error code is used to show any errors that are generated by the connected PLC. The PLC-499 error message includes a four digit hexadecimal value embedded in the message. This value can be looked up in the specific PLC's error tables to determine the cause of the error. The possible PLC generated error codes for the *DirectLOGIC* communication protocol is represented by a hexadecimal value as shown in the following message example.

DirectLOGIC Error Code PLC-499 Message Example:



Panel error code PLC-499 showing a hexadecimal value of 0003 indicates an "Illegal data value dependent upon the request." PLC error.

A

DirectLOGIC K-Sequence Protocol – PLC Error Code Table

The following table lists the errors that can be generated by the *DirectLOGIC* PLC when using the K-Sequence protocol.

PLC Error Codes for <i>DirectLOGIC</i> – K-Sequence	
Panel Error Code PLC-499 Hex Value	Description
01F8	Error setting value.
020D	Error in key mode.
021C	Password protected.



Note: The following errors can be generated from the designated PLC, are monitored by the *C-more* touch panel, and displayed on the touch panel's screen as a hexadecimal value in panel error code PLC-499 message, if active. Please refer to the PLC manufacturer's documentation for additional information.

DirectLOGIC DirectNET Protocol – PLC Error Codes

Only errors as listed in the Touch Panel Error Code Table shown on page A-3 can occur when using the *DirectLOGIC DirectNET* protocol, there are no PLC generated errors.

DirectLOGIC error code tables continued on the next page.

DirectLOGIC Modbus (Koyo) Protocol – PLC Error Code Table

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The following table lists the errors that can be generated by the *DirectLOGIC* PLC when using the Modbus (Koyo) protocol.

PLC Error Codes for <i>DirectLOGIC</i> – Modbus (Koyo)	
Panel Error Code PLC-499 Hex Value	Description
0x1	The function code is unknown by the server.
0x2	Dependent upon the request.
0x3	Illegal data value dependent upon the request.
0x4	The server failed during the execution.



Note: The following errors can be generated from the designated PLC, are monitored by the *C-more* touch panel, and displayed on the touch panel's screen as a hexadecimal value in panel error code PLC-499 message, if active. Please refer to the PLC manufacturer's documentation for additional information.

Modbus RTU Protocol – PLC Error Code Table

The following table lists the errors that can be generated by the *DirectLOGIC* PLC when using the Modbus RTU protocol.

PLC Error Codes for Modbus RTU	
Panel Error Code PLC-499 Hex Value	Description
0x1	The function code is unknown to the server.
0x2	Dependent upon the request.
0x3	Illegal data value dependent upon the request.
0x4	The server failed during the execution.



Note: The following errors can be generated from the designated PLC, are monitored by the *C-more* touch panel, and displayed on the touch panel's screen as a hexadecimal value in panel error code PLC-499 message, if active. Please refer to the PLC manufacturer's documentation for additional information.

Modbus TCP/IP Protocol – PLC Error Code Table

The following table lists the errors that can be generated by the *DirectLOGIC* PLC when using the Modbus TCP/IP protocol.

PLC Error Codes for Modbus TCP/IP	
Panel Error Code PLC-499 Hex Value	Description
0x1	The function code is unknown to the server.
0x2	Dependent upon the request.
0x3	Illegal data value dependent upon the request.
0x4	The server failed during the execution.



Note: The following errors can be generated from the designated PLC, are monitored by the *C-more* touch panel, and displayed on the touch panel's screen as a hexadecimal value in panel error code PLC-499 message, if active. Please refer to the PLC manufacturer's documentation for additional information.

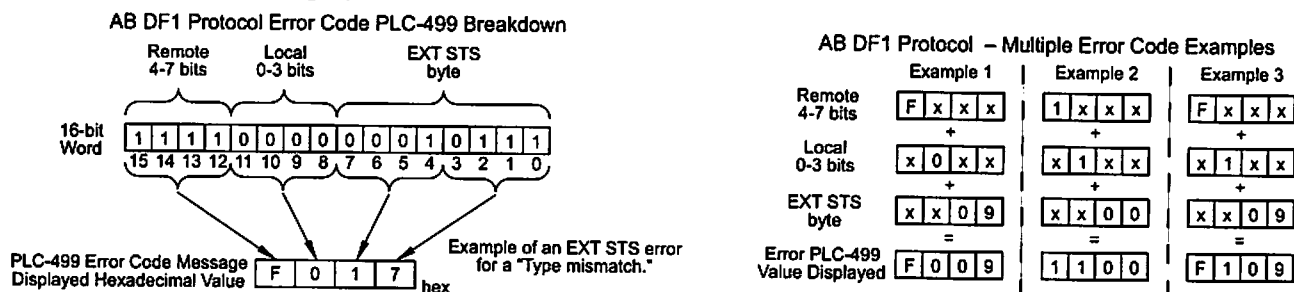
DirectLOGIC ECOM Protocol – PLC Error Codes

Only errors as listed in the Touch Panel Error Code Table shown on page A-3 can occur when using the *Direct*LOGIC ECOM protocol, there are no PLC generated errors.

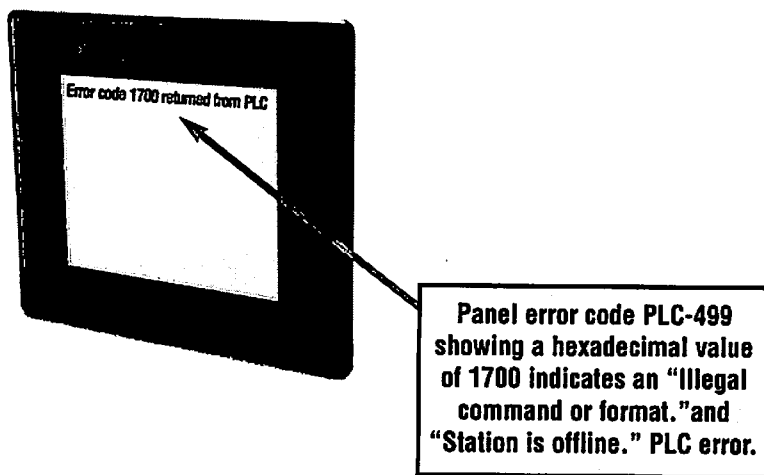
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Allen-Bradley – Panel Error Code PLC-499 Explanation

The PLC-499 error code is used to show any errors that are generated by the connected PLC. The PLC-499 error message includes a four digit hexadecimal value embedded in the message. This value can be looked up in the specific PLC's error tables to determine the cause of the error. The possible PLC generated error codes for the Allen-Bradley DF1 communication protocol is represented by a hexadecimal value as shown in the following message example. Please note that the error code is broken down into three sections. It is possible for more than one type of PLC error to be displayed in this value.



Allen-Bradley Error Code PLC-499 Message Example:



Allen-Bradley DF1 Protocol – PLC Error Code Tables

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The following PLC error code tables cover possible errors that are detected by the panel from Allen-Bradley PLCs using the DF1 protocol. This includes full and half duplex communications for the MicroLogix 1000, 1100, 1200 & 1500, SLC 5/03, /04, /05, ControlLogix, CompactLogix and FlexLogix, and full duplex communications for the PLC5.



Note: The following errors can be generated from the designated PLC, are monitored by the C-more touch panel, and displayed on the touch panel's screen as a hexadecimal value in panel error code PLC-499 message, if active. Please refer to the PLC manufacturer's documentation for additional information.

PLC Errors for Allen-Bradley DF1 Protocol, Local STS Errors (0-3 bits)	
Panel Error Code PLC-499 Hex Value	Description
0x0	Success; no error.
0x1	DST node is out of buffer space.
0x2	Cannot guarantee delivery; link layer. (The remote node specified does not ACK command.)
0x3	Duplicate token holder detected.
0x4	Local port is disconnected.
0x5	Application layer timed out waiting for response.
0x6	Duplicate node detected.
0x7	Station is offline.
0x8	Hardware fault.

PLC Errors for Allen-Bradley DF1 Protocol, Remote STS Errors (4-7 bits)	
Panel Error Code PLC-499 Hex Value	Description
0x0	Success; no error.
0x10	Illegal command or format.
0x20	Host has a problem and will not communicate.
0x30	Remote node host is missing, disconnected, or shut down.
0x40	Host could not complete function due to hardware fault.
0x50	Addressing problem or memory protect rungs.
0x60	Function not allowed due to command protection selection.
0x70	Processor is in Program Mode.
0x80	Compatibility mode file missing or communication zone problem.
0x90	Remote node cannot buffer command.
0xA0	Wait ACK (1775 KA buffer full).
0xB0	Remote node problem due to download.
0xC0	Wait ACK (1775 KA buffer full).
0xD0	not used
0xE0	not used
0xF0	Error code in the EXT STS byte. See the error code table on the next page.

(PLC generated error codes for the Allen-Bradley DF1 protocol continued on the next page.)

Allen-Bradley DF1 Protocol – PLC Error Code Tables (cont'd)

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PLC Errors for Allen-Bradley DF1 Protocol, EXT STS Command Code for F0 Command	
Panel Error Code PLC-499 Hex Value	Description
0x0	not used
0x1	A field has an illegal value.
0x2	Fewer levels specified in address than minimum for any address.
0x3	More levels specified in address than system supports.
0x4	Symbol not found.
0x5	Symbol is of improper format.
0x6	Address does not point to something usable.
0x7	File is wrong size.
0x8	Cannot complete request; situation has changed since start of the command.
0x9	Data or file size is too large.
0xA	Transaction size plus word address is too large.
0xB	Access denied; improper privilege.
0xC	Condition cannot be generated; resource is not available.
0xD	Condition already exists; resource is readily available.
0xE	Command cannot be executed.
0xF	Histogram overflow.
0x10	No access.
0x11	Illegal data type.
0x12	Invalid parameter or invalid data.
0x13	Address reference exists to deleted area.
0x14	Command execution failure for unknown reason; possible PLC 3 histogram overflow.
0x15	Data conversion error.
0x16	Scanner not able to communicate with 1771 rack adapter.
0x17	Type mismatch.
0x18	1771 module response was not valid.
0x19	Duplicated label.
0x22	Remote rack fault.
0x23	Timeout.
0x24	Unknown error.
0x1A	File is open; another node owns it.
0x1B	Another node is the program owner.
0x1C	Reserved
0x1D	Reserved
0x1E	Data table element protection violation.
0x1F	Temporary internal problem.

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Allen-Bradley DH485 Protocol – PLC Error Code Tables

The following PLC error code tables cover possible errors that are detected by the panel from Allen-Bradley PLCs using the DH485 protocol. This includes all MicroLogix and SLC500 PLCs, and any communication connection using an Allen-Bradley AIC device using the DH485 protocol.



Note: The following errors can be generated from the designated PLC, are monitored by the C-more touch panel, and displayed on the touch panel's screen as a hexadecimal value in panel error code PLC-499 message, if active. Please refer to the PLC manufacturer's documentation for additional information.

PLC Errors for Allen-Bradley DH485 Protocol, Local STS Errors (0-3 bits)	
Panel Error Code PLC-499 Hex Value	Description
0x0	Success; no error.
0x1	DST node is out of buffer space.
0x2	Cannot guarantee delivery; link layer. (The remote node specified does not ACK command.)
0x3	Duplicate token holder detected.
0x4	Local port is disconnected.
0x5	Application layer timed out waiting for response.
0x6	Duplicate node detected.
0x7	Station is offline.
0x8	Hardware fault.

PLC Errors for Allen-Bradley DH485 Protocol, Remote STS Errors (4-7 bits)	
Panel Error Code PLC-499 Hex Value	Description
0x0	Success; no error.
0x10	Illegal command or format.
0x20	Host has a problem and will not communicate.
0x30	Remote node host is missing, disconnected, or shut down.
0x40	Host could not complete function due to hardware fault.
0x50	Addressing problem or memory protect rungs.
0x60	Function not allowed due to command protection selection.
0x70	Processor is in Program Mode.
0x80	Compatibility mode file missing or communication zone problem.
0x90	Remote node cannot buffer command.
0xA0	Wait ACK (1775 KA buffer full).
0xB0	Remote node problem due to download.
0xC0	Wait ACK (1775 KA buffer full).
0xD0	not used
0xE0	not used
0xF0	Error code in the EXT STS byte. See the error code table on the next page.

(PLC generated error codes for the Allen-Bradley DH485 protocol continued on the next page.)

Allen-Bradley DH485 Protocol – PLC Error Code Tables (cont'd)

PLC Errors for Allen-Bradley DH485 Protocol, EXT STS Command Code for FD Command	
Panel Error Code PLC-499 Hex Value	Description
0x7	Insufficient memory module size (0000h is returned).
0xB	Access denied; privilege violation.
0xC	Resource not available or cannot do.
0xE	CMD cannot be executed.
0x12	Invalid parameter.
0x14	Failure during processing.
0x19	Duplicate label.
0x1A	File open by another node + owner's local node address, 1 byte.
0x1B	Program owned by another node + program owner's local node address, 1 byte.

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Allen-Bradley EtherNet/IP Protocol–

A Panel Error Code PLC-496, 497 and 498 Explanation

The PLC-499 error code is used to show any errors that are generated by the connected PLC. The PLC-499 error message includes a eight digit hexadecimal value displayed embedded in the message. This value can be looked up in the specific PLC's error tables to determine the cause of the error. The possible PLC generated error codes for the Allen-Bradley EtherNet/IP communication protocol is represented by a hexadecimal value as shown in the following message example.

Allen-Bradley Error Code PLC-496, 497, 498 Message Example:



Panel error code PLC-499 showing a hexadecimal value of 00000065 indicates an "The target received a message of invalid length." PLC error.

Allen-Bradley – EtherNet/IP Protocol – PLC Error Code Tables

ControlLogix, CompactLogix, & FlexLogix

The following PLC error code tables cover possible errors that are detected by the panel from Allen-Bradley PLCs using the EtherNet/IP protocol. This includes all ControlLogix, CompactLogix and FlexLogix PLCs.



Note: The following errors can be generated from the designated PLC, are monitored by the C-more touch panel, and displayed on the touch panel's screen as a hexadecimal value in panel error code PLC-496 message, if active. Please refer to the PLC manufacturer's documentation for additional information.

PLC Errors for Allen-Bradley EtherNet/IP Protocol – Encapsulation Errors (Error code 0xa0000000 returned from the PLC.)	
Panel Error Code PLC-496 Hex Value	Description
0x00000001	The sender issued an invalid or unsupported encapsulation command.
0x00000002	Insufficient memory resources in the receiver to handle the command. You can get this error if the 1761-NET-ENI cannot connect to the PLC serially.
0x00000003	Poorly formed or incorrect data in the data portion of the encapsulation message.
0x00000004 - 0x00000063	Reserved for legacy (Rockwell Automation).
0x00000064	An originator used an invalid session handle when sending an encapsulation message to the target.
0x00000065	The target received a message of invalid length.
0x00000066 - 0x00000068	Reserved for legacy (Rockwell Automation).
0x00000069	Unsupported encapsulation protocol revision.
0x0000006a - 0x0000ffff	Reserved for future expansion.

PLC Errors for Allen-Bradley EtherNet/IP Protocol – CIP Errors (Error code 0xa0000000 returned from the PLC.)	
Panel Error Code PLC-497 Hex Value	Description
0x010100	Connection Manager: Connection in Use or Duplicate Forward Open.
0x010103	Connection Manager: Transport Class and Trigger combination not supported.
0x010106	Connection Manager: Ownership Conflict.
0x010107	Connection Manager: Connection not found at target application.
0x010108	Connection Manager: Invalid connection type (problem with type or priority).
0x010109	Connection Manager: Invalid connection size.
0x010110	Connection Manager: Device not configured.
0x010111	Connection Manager: RPI not supported. Could also be problem with inactivity timeout.
0x010113	Connection Manager: Connection Manager cannot support any more connections.
0x010114	Connection Manager: Either the vendor ID or the Product Code in the key segment did not match the device.
0x010115	Connection Manager: Product Type in the key segment did not match the device.
0x010116	Connection Manager: Major or minor revision information in the key segment did not match the device.

(PLC generated error codes for the Allen-Bradley EtherNet/IP protocol for ControlLogix, CompactLogix, and FlexLogix continued on the next page.)

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Allen-Bradley – EtherNet/IP Protocol – PLC Error Code Tables ControlLogix, CompactLogix, & FlexLogix (cont'd)

PLC Errors for Allen-Bradley EtherNet/IP Protocol – CIP Errors (Error code 0xaaaaaaaa returned from the PLC.)	
Panel Error Code PLC-497 Hex Value	Description
0x010117	Connection Manager: Invalid connection point.
0x010118	Connection Manager: Invalid configuration format.
0x010119	Connection Manager: Connection request fails since there is no controlling connection currently open.
0x01011a	Connection Manager: Target application cannot support any more connections.
0x01011b	Connection Manager: RPI is smaller than the Production Inhibit Time.
0x010203	Connection Manager: Connection cannot be closed since the connection has timed out.
0x010204	Connection Manager: Unconnected Send timed out waiting for a response.
0x010205	Connection Manager: Parameter error in Unconnected send service.
0x010206	Connection Manager: Message too large for Unconnected message service.
0x010207	Connection Manager: Unconnected acknowledge without reply.
0x010301	Connection Manager: No buffer memory available.
0x010302	Connection Manager: Network Bandwidth not available for data.
0x010303	Connection Manager: No Tag filters available.
0x010304	Connection Manager: Not configured to send real-time data.
0x010311	Connection Manager: Port specified in Port segment not available.
0x010312	Connection Manager: Link address specified in port segment not available.
0x010315	Connection Manager: invalid segment type or segment value in path.
0x010316	Connection Manager: Path and Connection not equal in close.
0x010317	Connection Manager: Ether Segment not present or Encoded Value in Network Segment is invalid.
0x010318	Connection Manager: Link address to self invalid.
0x010319	Connection Manager: Resources on Secondary unavailable.
0x01031a	Connection Manager: Connection already established.
0x01031b	Connection Manager: Direct connection already established.
0x01031c	Connection Manager: Miscellaneous.
0x01031d	Connection Manager: Redundant connection mismatch.
0x01031e	Connection Manager: No more consumer resources available in the producing module.
0x01031f	Connection Manager: No connection resources exist for target path.
0x010320 - 0x0107ff	Connection Manager: Vendor specific.
0x020000	Resource unavailable: Connection Manager resources are unavailable to handle service request.
0x030000	Invalid parameter value.
0x040000	Path segment error: The path segment identifier or the segment syntax was not understood by the processing node.
0x050000	Path destination unknown: The path is referencing an object class, instance or structure element that is not known or is not contained in the processing node.
0x060000	Partial transfer: Only part of the expected data was transferred.
0x070000	Connection lost: The messaging connection was lost.

(PLC generated error codes for the Allen-Bradley EtherNet/IP protocol for ControlLogix, CompactLogix, and FlexLogix continued on the next page.)

Allen-Bradley – EtherNet/IP Protocol – PLC Error Code Tables ControlLogix, CompactLogix, & FlexLogix (cont'd)

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PLC Errors for Allen-Bradley EtherNet/IP Protocol – CIP Errors (Error code 0xaaaaaaaa returned from the PLC.)	
Panel Error Code PLC-497 Hex Value	Description
0x080000	Service not supported: The requested service was not implemented or was not defined for this Object Class/Instance.
0x090000	Invalid attribute value: Invalid attribute data detected.
0x0a0000	Attribute list error: An attribute in the Get_Attribute_List or Set_Attribute_List response has a non-zero status.
0x0b0000	Already in requested mode/state: The object is already in the mode/state being requested by the service.
0x0c0000	Object state conflict: The object cannot perform the requested service in its current mode/state.
0x0d0000	Object already exists: The requested instance of object to be created already exists.
0x0e0000	Attribute not settable: A request to modify non-modifiable attribute was received.
0x0f0000	Privilege violation: A permission/privilege check failed.
0x100000	Device state conflict: The device's current mode/state prohibits the execution of the requested service.
0x110000	Reply data too large: The data to be transmitted in the response buffer is larger than the allocated response buffer.
0x120000	Fragmentation of a primitive value: The service specified an operation that is going to fragment a primitive data value. For example, trying to send a 2 byte value to a REAL data type (4 byte).
0x130000	Not enough data: The service did not supply enough data to perform the specified operation.
0x140000	Attribute not supported: The attribute specified in the request is not supported.
0x150000	Too much data: The service supplied more data than was expected.
0x160000	Object does not exist: The object specified does not exist in the device.
0x170000	Service fragmentation sequence not in progress: The fragmentation sequence for this service is not currently active for this data.
0x180000	No stored attribute data: The attribute data of this object was not saved prior to the requested service.
0x190000	Store operation failure: The attribute data of this object was not saved due to a failure during the attempt.
0x1a0000	Routing failure, request packet too large: The service request packet was too large for transmission on a network in the path to the destination.
0x1b0000	Routing failure, response packet too large: The service response packet was too large for transmission on a network in the path from the destination.
0x1c0000	Missing attribute list entry data: The service did not supply an attribute in a list of attributes that was needed by the service to perform the requested behavior.
0x1d0000	Invalid attribute value list: The service is returning the list of attributes supplied with status information for those attributes that were invalid.
0x1e0000	Embedded service error: See Service Packet error list (PLC-498 Error codes) below:
0x1f0000	Vendor specific error: A vendor specific error has been encountered. This occurs when none of the specified errors relate to the error in the device.
0x200000	Invalid parameter: A parameter associated with the request was invalid. This code is used when a parameter does not meet the requirements defined in an Application Object specification.
0x210000	Write-once value or medium already written: An attempt was made to write to a write-once-medium that has already been written or to modify a value that cannot be change once established.
0x220000	Invalid Reply Received: An invalid reply is received (example: service code sent doesn't match service code received.).

(PLC generated error codes for the Allen-Bradley EtherNet/IP protocol for ControlLogix, CompactLogix and FlexLogix continued on the next page.)

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Allen-Bradley – EtherNet/IP Protocol – PLC Error Code Tables ControlLogix, CompactLogix, & FlexLogix (cont'd)

PLC Errors for Allen-Bradley EtherNet/IP Protocol – CIP Errors (Error code 0xaaaaaaaa returned from the PLC.)	
Panel Error Code PLC-497 Hex Value	Description
0x230000	Reserved by CIP for future extensions.
0x240000	Reserved by CIP for future extensions.
0x250000	Key failure in path: The key segment was included as the first segment in the path does not match the destination module. The object specific status shall indicate which part of the key check failed.
0x260000	Path Size Invalid: The size of the path which was sent with the Service Request is either not large enough to allow the Request to be routed to an object or too much routing data was included.
0x270000	Unexpected attribute in list: An attempt was made to set an attribute that is not able to be set at this time.
0x280000	Invalid Member ID: The Member ID specified in the request does not exist in the specified Class/Instance/Attribute.
0x290000	Member not settable: A request to modify a non-modifiable member was received.
0x2a0000	Group 2 only server general failure: This error code may only be reported by DeviceNet group 2 only servers with 4K or less code space and only in place of Service not supported, Attribute not supported and Attribute not settable.
0x2b0000 - 0xc0000	Reserved by CIP for future extensions.
0xd00000 - 0xff0000	Reserved for Object Class and service errors: This range of error codes is to be used to indicate Object Class specific errors. Use of this range should only be used when errors in this table don't accurately reflect the error encountered.

PLC Errors for Allen-Bradley EtherNet/IP Protocol – Service Packet Errors (Error code 0xaaaaaaaa returned from the PLC.)	
Panel Error Code PLC-498 Hex Value	Description
0x040000	This general status codes that the tag name could not be deciphered. This could mean that the tag name was entered incorrectly or does not exist in the PLC.
0x050000	The particular item referenced (usually instance) could not be found.
0x060000	The amount of data requested would not fit into the response buffer. Partial data transfer has occurred.
0x0a0000	An error has occurred trying to process one of the attributes.
0x130000	Not enough command data/parameters were supplied in the command to execute the service requested.
0x1c0000	An insufficient number of attributes were provided compared to the attribute count.

Allen-Bradley – EtherNet/IP Protocol – PLC Error Code Tables

MicroLogix 1100 & SLC 5/05, both via native Ethernet port;

MicroLogix 1000, 1100, 1200, 1500, SLC 5/03/04/05, all via ENI Adapter

The following PLC error code tables cover possible errors that are detected by the panel from Allen-Bradley PLCs using the EtherNet/IP protocol. This includes MicroLogix 1100 & SLC 5/05, both using their native Ethernet port, and MicroLogix 1000, 1100, 1200, 1500, SLC 5/03, 5/04 and 5/05 using an Allen-Bradly ENI Adapter.



Note: The following errors can be generated from the designated PLC, are monitored by the C-more touch panel, and displayed on the touch panel's screen as a hexadecimal value in panel error code PLC-496 message, if active. Please refer to the PLC manufacturer's documentation for additional information.

PLC Errors for Allen-Bradley EtherNet/IP Protocol – Encapsulation Errors (Error code 0xaaaaaaaa returned from the PLC.)	
Panel Error Code PLC-496 Hex Value	Description
0x00000001	The sender issued an invalid or unsupported encapsulation command.
0x00000002	Insufficient memory resources in the receiver to handle the command. You can get this error if the 1761-NET-ENI cannot connect to the PLC serially.
0x00000003	Poorly formed or incorrect data in the data portion of the encapsulation message.
0x00000004 - 0x00000063	Reserved for legacy (Rockwell Automation).
0x00000064	An originator used an invalid session handle when sending an encapsulation message to the target.
0x00000065	The target received a message of invalid length.
0x00000066 - 0x00000068	Reserved for legacy (Rockwell Automation).
0x00000069	Unsupported encapsulation protocol revision.
0x0000006a - 0x0000ffff	Reserved for future expansion.

PLC Errors for Allen-Bradley EtherNet/IP Protocol – CIP Errors (Error code 0xaaaaaaaa returned from the PLC.)	
Panel Error Code PLC-497 Hex Value	Description
0x010100	Connection Manager: Connection in Use or Duplicate Forward Open.
0x010103	Connection Manager: Transport Class and Trigger combination not supported.
0x010106	Connection Manager: Ownership Conflict.
0x010107	Connection Manager: Connection not found at target application.
0x010108	Connection Manager: Invalid connection type (problem with type or priority).
0x010109	Connection Manager: Invalid connection size.
0x010110	Connection Manager: Device not configured.
0x010111	Connection Manager: RPI not supported. Could also be problem with inactivity timeout.

(PLC generated error codes for the Allen-Bradley EtherNet/IP protocol for MicroLogix 1100, SLC 5/05, or ENI Adapter continued on the next page.)

Allen-Bradley – EtherNet/IP Protocol – PLC Error Code Tables

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MicroLogix 1100 & SLC 5/05, both via native Ethernet port;

MicroLogix 1000, 1100, 1200, 1500, SLC 5/03/04/05, all via ENI Adapter

PLC Errors for Allen-Bradley EtherNet/IP Protocol – CIP Errors (Error code 0xaaaaaaaa returned from the PLC.)	
Panel Error Code PLC-497 Hex Value	Description
0x010113	Connection Manager: Connection Manager cannot support any more connections.
0x010114	Connection Manager: Either the vendor ID or the Product Code in the key segment did not match the device.
0x010115	Connection Manager: Product Type in the key segment did not match the device.
0x010116	Connection Manager: Major or minor revision information in the key segment did not match the device.
0x010117	Connection Manager: Invalid connection point.
0x010118	Connection Manager: Invalid configuration format.
0x010119	Connection Manager: Connection request fails since there is no controlling connection currently open.
0x01011a	Connection Manager: Target application cannot support any more connections.
0x01011b	Connection Manager: RPI is smaller than the Production Inhibit Time.
0x010203	Connection Manager: Connection cannot be closed since the connection has timed out.
0x010204	Connection Manager: Unconnected Send timed out waiting for a response.
0x010205	Connection Manager: Parameter error in Unconnected send service.
0x010206	Connection Manager: Message too large for Unconnected message service.
0x010207	Connection Manager: Unconnected acknowledge without reply.
0x010301	Connection Manager: No buffer memory available.
0x010302	Connection Manager: Network Bandwidth not available for data.
0x010303	Connection Manager: No Tag filters available.
0x010304	Connection Manager: Not configured to send real-time data.
0x010311	Connection Manager: Port specified in Port segment not available.
0x010312	Connection Manager: Link address specified in port segment not available.
0x010315	Connection Manager: invalid segment type or segment value in path.
0x010316	Connection Manager: Path and Connection not equal in close.
0x010317	Connection Manager: Ether Segment not present or Encoded Value in Network Segment is invalid.
0x010318	Connection Manager: Link address to self invalid.
0x010319	Connection Manager: Resources on Secondary unavailable.
0x01031a	Connection Manager: Connection already established.
0x01031b	Connection Manager: Direct connection already established.
0x01031c	Connection Manager: Miscellaneous.
0x01031d	Connection Manager: Redundant connection mismatch.
0x01031e	Connection Manager: No more consumer resources available in the producing module.
0x01031f	Connection Manager: No connection resources exist for target path.
0x010320 - 0x0107ff	Connection Manager: Vendor specific.

(PLC generated error codes for the Allen-Bradley EtherNet/IP protocol for MicroLogix 1100, SLC 5/05, or ENI Adapter continued on the next page.)

Allen-Bradley – EtherNet/IP Protocol – PLC Error Code Tables
MicroLogix 1100 & SLC 5/05, both via native Etherent port;
MicroLogix 1000, 1100, 1200, 1500, SLC 5/03/04/05, all via ENI Adapter

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PLC Errors for Allen-Bradley EtherNet/IP Protocol – CIP Errors (Error code 0xaaaaaaaa returned from the PLC.)	
Panel Error Code PLC-497 Hex Value	Description
0x020000	Resource unavailable: Connection Manager resources are unavailable to handle service request.
0x030000	Invalid parameter value.
0x040000	Path segment error: The path segment identifier or the segment syntax was not understood by the processing node.
0x050000	Path destination unknown: The path is referencing an object class, instance or structure element that is not known or is not contained in the processing node.
0x060000	Partial transfer: Only part of the expected data was transferred.
0x070000	Connection lost: The messaging connection was lost.
0x080000	Service not supported: The requested service was not implemented or was not defined for this Object Class/Instance.
0x090000	Invalid attribute value: Invalid attribute data detected.
0x0a0000	Attribute list error: An attribute in the Get_Attribute_List or Set_Attribute_List response has a non-zero status.
0x0b0000	Already in requested mode/state: The object is already in the mode/state being requested by the service.
0x0c0000	Object state conflict: The object cannot perform the requested service in its current mode/state.
0x0d0000	Object already exists: The requested instance of object to be created already exists.
0x0e0000	Attribute not settable: A request to modify non-modifiable attribute was received.
0x0f0000	Privilege violation: A permission/privilege check failed.
0x100000	Device state conflict: The device's current mode/state prohibits the execution of the requested service.
0x110000	Reply data too large: The data to be transmitted in the response buffer is larger than the allocated response buffer.
0x120000	Fragmentation of a primitive value: The service specified an operation that is going to fragment a primitive data value. For example, trying to send a 2 byte value to a REAL data type (4 byte).
0x130000	Not enough data: The service did not supply enough data to perform the specified operation.
0x140000	Attribute not supported: The attribute specified in the request is not supported.
0x150000	Too much data: The service supplied more data than was expected.
0x160000	Object does not exist: The object specified does not exist in the device.
0x170000	Service fragmentation sequence not in progress: The fragmentation sequence for this service is not currently active for this data.
0x180000	No stored attribute data: The attribute data of this object was no saved prior to the requested service.
0x190000	Store operation failure: The attribute data of this object was not saved due to a failure during the attempt.
0x1a0000	Routing failure, request packet too large: The service request packet was too large for transmission on a network in the path to the destination.
0x1b0000	Routing failure, response packet too large: The service reponse packet was too large for transmission on a network in the path from the destination.
0x1c0000	Missing attribute list entry data: The service did not supply an attribute in a list of attributes that was needed by the service to perform the requested behavior.

(PLC generated error codes for the Allen-Bradley EtherNet/IP protocol for MicroLogix 1100, SLC 5/05, or ENI Adapter continued on the next page.)

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Allen-Bradley – EtherNet/IP Protocol – PLC Error Code Tables
MicroLogix 1100 & SLC 5/05, both via native Ethernet port;
MicroLogix 1000, 1100, 1200, 1500, SLC 5/03/04/05, all via ENI Adapter

PLC Errors for Allen-Bradley EtherNet/IP Protocol – CIP Errors (Error code 0xaaaaaaaa returned from the PLC.)	
Panel Error Code PLC-497 Hex Value	Description
0x1d0000	Invalid attribute value list: The service is returning the list of attributes supplied with status information for those attributes that were invalid.
0x1e0000	Embedded service error: See Service Packet error list (PLC-498 Error codes) below:
0x1f0000	Vendor specific error: A vendor specific error has been encountered. This occurs when none of the specified errors relate to the error in the device.
0x200000	Invalid parameter: A parameter associated with the request was invalid. This code is used when a parameter does not meet the requirements defined in an Application Object specification.
0x210000	Write-once value or medium already written: An attempt was made to write to a write-once-medium that has already been written or to modify a value that cannot be change once established.
0x220000	Invalid Reply Received: An invalid reply is received (example: service code sent doesn't match service code received.).
0x230000	Reserved by CIP for future extensions.
0x240000	Reserved by CIP for future extensions.
0x250000	Key failure in path: The key segment was included as the first segment in the path does not match the destination module. The object specific status shall indicate which part of the key check failed.
0x260000	Path Size Invalid: The size of the path which was sent with the Service Request is either not large enough to allow the Request to be routed to an object or too much routing data was included.
0x270000	Unexpected attribute in list: An attempt was made to set an attribute that is not able to be set at this time.
0x280000	Invalid Member ID: The Member ID specified in the request does not exist in the specified Class/Instance/Attribute.
0x290000	Member not settable: A request to modify a non-modifiable member was received.
0x2a0000	Group 2 only server general failure: This error code may only be reported by DeviceNet group 2 only servers with 4K or less code space and only in place of Service not supported, Attribute not supported and Attribute not settable.
0x2b0000 - 0xcf0000	Reserved by CIP for future extensions.
0xd00000 - 0xff0000	Reserved for Object Class and service errors: This range of error codes is to be used to indicate Object Class specific errors. Use of this range should only be used when errors in this table don't accurately reflect the error encountered.

(PLC generated error codes for the Allen-Bradley EtherNet/IP protocol for MicroLogix 1100, SLC 5/05, or ENI Adapter continued on the next page.)

Allen-Bradley – EtherNet/IP Protocol – PLC Error Code Tables

MicroLogix 1100 & SLC 5/05, both via native Ethernet port;

MicroLogix 1000, 1100, 1200, 1500, SLC 5/03/04/05, all via ENI Adapter

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PLC Errors for Allen-Bradley EtherNet/IP Protocol – Service Packet Errors (Error code 0xaaaaaaaa returned from the PLC.)	
Panel Error Code PLC-498 Hex Value	Description
0x010000	DST Node is out of buffer space.
0x020000	Cannot guarantee delivery; link layer (The remote node specified does not ACK command).
0x030000	Duplicate token holder detected.
0x040000	Local port is disconnected.
0x050000	Application layer timed out waiting for response.
0x060000	Duplicate node detected.
0x070000	Station is offline.
0x080000	Hardware fault.
0x100000	Illegal command or format. Typical error received from PLC when addressed requested to the PLC does not exist. Usually occurs if memory map has not been expanded in PLC to the range requested from panel.
0x200000	Host has a problem and will not communicate.
0x300000	Remote node host is missing, disconnected, or shut down.
0x400000	Host could not complete function due to hardware fault.
0x500000	Addressing problem or memory protected rungs.
0x600000	Function not allowed due to command protection selection.
0x700000	Processor is in Program Mode.
0x800000	Compatibility mode file missing or communication zone problem.
0x900000	Remote node cannot buffer command.
0xA00000	Wait ACK (1775 KA buffer full).
0xB00000	Not used.
0xC00000	Not used.
0xD00000	Error code in the EXT STS byte. See the error code table below.
0xE00000	Fewer levels specified in address than minimum for any address.
0xF00300	More levels specified in address than system supports.
0xF00400	Symbol not found.
0xF00500	Symbol is of improper format.
0xF00600	Address does not point to something usable.
0xF00700	File is wrong size.
0xF00800	Cannot complete request, situation has changed since start of the command.
0xF00900	Data or file size is too large.
0xF00900	Transaction size plus word address is too large.
0xF00B00	Access denied; improper privilege. This will occur if data file is set to constant or protected.
0xF00C00	Condition cannot be generated; resource is not available.
0xF00D00	Condition already exists; resource is readily available.

(PLC generated error codes for the Allen-Bradley EtherNet/IP protocol for MicroLogix 1100, SLC 5/05, or ENI Adapter continued on the next page.)

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Allen-Bradley – EtherNet/IP Protocol – PLC Error Code Tables

MicroLogix 1100 & SLC 5/05, both via native Ethernet port; MicroLogix 1000, 1100, 1200, 1500, SLC 5/03/04/05, all via ENI Adapter

PLC Errors for Allen-Bradley EtherNet/IP Protocol – Service Packet Errors (Error code 0xaaaaaaaa returned from the PLC.)	
Panel Error Code PLC-498 Hex Value	Description
0xF00E00	Command cannot be executed.
0xF00F00	Histogram overflow.
0xF01000	No access.
0xF01100	Illegal data type.
0xF01200	Invalid parameter or invalid data.
0xF01300	Address reference exists to deleted area.
0xF01400	Command execution failure for unknown reason; possible histogram overflow.
0xF01500	Data conversion error.
0xF01600	Scanner not able to communicate with 1771 rack adapter.
0xF01700	Type mismatch.
0xF01800	1771 module response was not valid.
0xF01900	Duplicated label.
0xF02200	Remote rack fault.
0xF02300	Timeout.
0xF02400	Unknown error.
0xF01A00	File is open; another node owns it.
0xF01B00	Another node is the program owner.
0xF01C00	Reserved.
0xF01D00	Reserved.
0xF01E00	Data table element protection violation.
0xF01F00	Temporary internal problem.

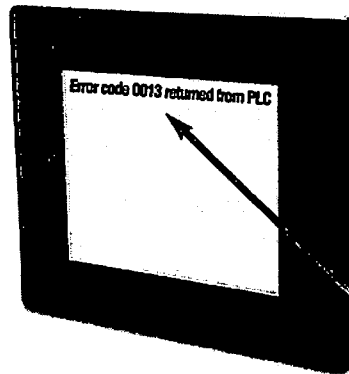
Generic EtherNet IP Protocol – PLC Error Codes

Only errors as listed in the Touch Panel Error Code Table shown on page A-3 can occur when using the Generic Ethernet IP protocol, there are no PLC generated errors.

GE 90-30 – Panel Error Code PLC-499 Explanation

The PLC-499 error code is used to show any errors that are generated by the connected PLC. The PLC-499 error message includes a four digit hexadecimal value embedded in the message. This value can be looked up in the specific PLC's error tables to determine the cause of the error. The possible PLC generated error codes for the GE 90-30 communication protocol is represented by a hexadecimal value as shown in the following message example.

GE 90-30 Error Code PLC-499 Message Example:



Panel error code PLC-499 showing a hexadecimal value of 0013 indicates an "Port configurator error." PLC error.

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GE 90-30 SNPX Protocol – PLC Error Code Tables

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The following table lists the errors that can be generated by the GE 90-30 PLC when using the SNPX protocol.



Note: The following errors can be generated from the designated PLC, are monitored by the C-more touch panel, and displayed on the touch panel's screen as a hexadecimal value in panel error code PLC-499 message, if active. Please refer to the PLC manufacturer's documentation for additional information.

PLC Errors for GE 90-30 SNPX Protocol (Major)	
Panel Error Code PLC-499 Hex Value	Description
No error	Successful completion. (This is the expected completion value in the COMMREQ Status Word.)
0x0002	Insufficient Privilege. For Series 90-70 PLC, the minor error code contains the privilege level required for the service request.
0x0004	Protocol Sequence Error. The CPU has received a message that is out of order.
0x0005	Service Request Error, the minor error code contains the specific error code.
0x0006	Illegal Mailbox Type. Service request mailbox type is either undefined or unexpected.
0x0007	The PLC CPU's Service Request Queue is full. The master should retry later. It is recommended that the master wait a minimum of 10 msec before sending another service request.
0x000A	SNP DOS Driver Error. The minor error code contains the specific error code.
0x000B	Illegal Service Request. The requested service is either not defined or not supported. (This value is returned in lieu of the actual 01h value passed in the SNP error message, to avoid confusion with the normal successful COMMREQ completion.)
0x000C	Local SNP/SNP-X Error. An error occurred within the SNP task in the CMM module in this PLC. This error may occur in either an SNP master or an SNP slave. The minor error code contains the specific error code.
0x000D	Remote SNP Error. An error occurred within the SNP slave task in the CMM module in the remote PLC. The minor error code contains the specific error code.
0x000E	Autodial Error. An error occurred while attempting to send a command string to an attached external modem. The minor error code contains the specific error code.
0x000F	SNP-X slave error. An error occurred within the SNPX task in the remote slave device. The minor error code contains the specific error code.
0x0013	Port configurator error.
0x0050	Problem with sending mail to the slave Service Request task. (Series 90-70 PLC CPUs only)
0x0051	Problem with getting mail from the slave Service Request task. (Series 90-70 PLC CPUs only)
0x0055	Slave SNP task timed out before receiving an SRP response. (Series 90-70 PLC CPUs only)
0x0056	Slave SNP task could not find the requested datagram connection. (Series 90-70 PLC CPUs only)
0x0057	Slave SNP task encountered an error in trying to write the datagram. (Series 90-70 PLC CPUs only)
0x0058	Slave SNP task encountered an error in trying to update the datagram. (Series 90-70 PLC CPUs only)

(PLC generated error codes for the GE 90-30 SNPX protocol continued on the next page.)

GE 90-30 SNPX Protocol – PLC Error Code Tables (cont'd)

A

PLC Errors for GE 90-30 SNPX Protocol (Minor-Major) (cont'd)	
Panel Error Code PLC-499 Hex Value	Description
PLC Error 0x010C	WAIT-type COMMREQ is not permitted; must use NOW AIT-type.
PLC Error 0x010E	Not used
PLC Error 0x010F	The service request code in an X-Request message is unsupported or invalid at this time. This error may occur if an SNP-X communication session has not been successfully established at the slave device.
PLC Error 0x020C	COMMREQ command is not supported.
PLC Error 0x020E	The modem command string length exceeds 250 characters.
PLC Error 0x020F	Insufficient privilege level in the slave PLC CPU for the requested SNP-X service. Password protection at PLC CPU may be preventing the requested service.
PLC Error 0x0213	Unsupported COMMREQ. These errors are only generated when there is no protocol currently being run on a port, and the port receives a COMMREQ. (The port may be disabled or an error has occurred in processing a new configuration).
PLC Error 0x030C	SNP communication is not active. Must initiate a new SNP communication by sending an Attach or Long Attach COMMREQ.
PLC Error 0x030E	COMMREQ Data Block Length is too small. Output command string data is missing or incomplete.
PLC Error 0x030F	Invalid slave memory type in X-Request message.
PLC Error 0x0313	Invalid COMMREQ length.
PLC Error 0x040C	SNP slave did not respond to Attach message from master.
PLC Error 0x040E	Serial output timeout. The CMM module was unable to transmit the modem autodial output from the serial port. (May be due to missing CTS signal when the CMM is configured to use hardware flow control.)
PLC Error 0x040F	Invalid slave memory address or range in X-Request message.
PLC Error 0x0413	Invalid COMMREQ status word location.
PLC Error 0x050C	Unable to write SNP Status Word to local PLC memory; may be due to invalid Status Word memory type or address.
PLC Error 0x050E	Response was not received from modem. Check modem and cable.
PLC Error 0x050F	Invalid data length in X-Request message. Data length must be non-zero, and may not exceed decimal 1000 bytes.
PLC Error 0x0513	Invalid COMMREQ data.
PLC Error 0x060C	Master device memory type is not valid in this PLC.
PLC Error 0x060E	Modem responded with BUSY. Modem is unable to complete the requested connection. The remote modem is already in use; retry the connection request at a later time.
PLC Error 0x060F	X-Buffer data length does not match the service request in X-Request message. The X-Buffer message length is obtained from the Next Message Length field in the X-Request message; the length of the data within the buffer message is always the message length.
PLC Error 0x070C	Master device memory address or length is zero.
PLC Error 0x070E	Modem responded with NO CARRIER. Modem is unable to complete the requested connection. Check the local and remote modems and the telephone line.
PLC Error 0x070F	Queue Full indication from Service Request Processor in slave PLC CPU. The slave is temporarily unable to complete the service request. The master should try again later. It is recommended that the master wait at least 10 msec before repeating the X-Request.

(PLC generated error codes for the GE 90-30 SNPX protocol continued on the next page.)

GE 90-30 SNPX Protocol – PLC Error Code Tables (cont'd)

A

PLC Errors for GE 90-30 SNPX Protocol (Minor-Major) (cont'd)	
Panel Error Code PLC-499 Hex Value	Description
0x080C	Unable to read or write master device memory locations specified in COMMREQ. Usually caused by invalid memory address for this PLC. SNP message exchange may have taken place.
0x080E	Modem responded with NO DIALTONE. Modem is unable to complete the requested connection. Check the modem connections and the telephone line.
0x080F	Service Request Processor response exceeds 1000 bytes; the SNP-X slave device cannot return the data in an X-Response message. (This error applies to CMM module only.)
0x090C	Master device memory data length exceeds maximum data size of CMM module (2048 bytes). Must use a smaller data length. Use multiple COMMREQs if total data length exceeds this maximum value.
0x090E	Modem responded with ERROR. Modem is unable to complete the requested command. Check the modem command string and modem.
0x0A0C	Slave device memory type is missing or not valid.
0x0A0E	Modem responded with RING, indicating that the modem is being called by another modem. Modem is unable to complete the requested command. Retry the modem command at a later time.
0x0B0C	Slave device memory address is missing or zero.
0x0B0E	An unknown response was received from the modem. Modem is unable to complete the requested command. Check the modem command string and modem. The modem response is expected to be either CONNECT or OK.
0x0C0C	COMMREQ Data Block Length is too small. (When expected COMMREQ length is 6 words or less. An improper length may cause other minor error codes 6-11.)
0x0D0C	Invalid Diagnostic Status Word (DSW) starting word or length.
0x0E0C	Invalid maximum SNP message data size. Must be an even value from 42 to 2048.
0x0F0C	Invalid Privilege Level. Must be 0 through 4 or -1.
0x100C	Invalid Fault Table selector. Must be 1 for I/O Fault Table, or 2 for PLC Fault Table.
0x100F	Unexpected Service Request Processor error. (This error applies to CMM module only; the unexpected SRP error code is saved in the Diagnostic Status Words in the CMM module.)
0x110C	Invalid Fault Table starting index. Must be 1-32 for I/O Fault Table, or 1-16 for PLC.
0x120C	Invalid fault count. Must be 1-32 for I/O Fault Table, or 1-16 for PLC Fault Table.
0x130C	Invalid Set PLC Date/Time mode. Must be 1-4.
0x140C	Invalid Set PLC Date/Time date, time, or day-of-week value.
0x150C	Unable to retrieve master device PLC time/date from PLC CPU.
0x150F	Requested service is not permitted in a Broadcast request. The master must direct the X-Request message to a specific SNP-X slave device.
0x160C	Invalid slave PLC type. Must be 0 for Series 90-70, or 1 for Series 90-30 or Series 90-20.
0x170C	Invalid datagram type. Must be 01h for normal datagram, or 81h (129) for permanent datagram.
0x180C	Missing or too many datagram point formats. Must be 1-32.
0x190C	Invalid datagram point format data.

(PLC generated error codes for the GE 90-30 SNPX protocol continued on the next page.)

GE 90-30 SNPX Protocol – PLC Error Code Tables (cont'd)

PLC Errors for GE 90-30 SNPX Protocol (Minor-Major) (cont'd)	
Panel Error Code PLC-499 Hex Value	Description
0x1A0C	Datagram area size is too small to include data for all specified point formats.
0x1B0C	Invalid number of Control Program Names. Must be 1-8.
0x1C0C	SNP-X Request exceeds maximum data size (1000 bytes). Must use a smaller data length. Use multiple COMMREQs if necessary.
0x1D0C	Invalid SNP-X communication session type. Must be 0 for a single slave device, or 1 for multiple slave devices.
0x1E0C	Illegal destination SNP ID specified for SNP-X slave. Must be 0-7 ASCII characters, plus a terminating null character (00h). The Null SNP ID (eight bytes of 00h) may be used to specify any single device. The Broadcast SNP ID (eight bytes of FFh) may be use to specify all slave devices on the serial link.
0x1F0C	Destination SNP ID does not match SNP-X session type. The Broadcast SNP ID is not permitted in a single-slave SNP-X session. The Null SNP ID is not permitted in a multiple-slave SNP-X session.
0x200C	Inactivity timeout (T3'). The SNP slave has not received any new SNP messages within the configured T3' time interval.
0x200F	Invalid Message Type field in a received X-Request message. The message type of an X-Request message must be 58h = 'X'.
0x210C	A Parity error has occurred on an Attach, Attach Response, or Update Real-time Datagram message. Communications have not been established.
0x210F	Invalid Next Message Type or Next Message Length field in a received X Request message. If this request does not use a buffer (0-2 bytes of data), the Next Message Type must be zero. If this request will be followed with a buffer message (more than 2 byte.), the Next Message Type must be 54h = 'T', and the Next Message Length must specify the length of the X-Buffer message. Valid X-Buffer message lengths are 9-1008 bytes (data length plus 8 bytes).
0x220C	A BCC (Block Check Code) error has occurred on an Attach, Attach Response, or Update Realtime Datagram message. Communications have not been established.
0x220F	Invalid Message Type field in a received X-Buffer message. The message type of an X-Buffer message must be 54h = 'T'.
0x230C	A Framing or Overrun serial error has occurred on an Attach, Attach Response, or Update Realtime Datagram message. Communications have not been established.
0x230F	Invalid Next Message Type field in a received X-Buffer message. Since an X-Buffer message is never followed by another message, the Next Message Type must always be zero.
0x240C	An invalid SNP message type was received when an Attach, Attach Response, or Update Realtime Datagram message was required. Communications have not been established.
0x250C	An invalid next message length value was specified in an Attach, Attach Response, or Update Realtime Datagram message. Communications have not been established.
0x260C	An unexpected SNP message type was received when an Attach, Attach Response, or Update Realtime Datagram was required. Communications have not been established.
0x270C	Another Break was received while SNP slave was waiting for an Attach or Update Realtime Datagram message.
0x280C	An SNP message has been sent and retried the maximum number of times. A maximum of two retries are permitted. A retry is caused by a NAK from from the remote SNP device.
0x290C	A received SNP message has been NAKed the maximum number of two times. The NAKed message may be retransmitted a maximum of two times.

(PLC generated error codes for the GE 90-30 SNPX protocol continued on the next page.)

GE 90-30 SNPX Protocol – PLC Error Code Tables (cont'd)

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PLC Errors for GE 90-30 SNPX Protocol (Minor-Major) (cont'd)	
Panel Error Code PLC-499 Hex Value	Description
0x2A0C	An unknown message was received when an acknowledge (ACK or NAK) was required.
0x2B0C	Sequence Error. An unexpected SNP message type was received.
0x2C0C	Received SNP message contains bad next message length value.
0x2D0C	Acknowledge timeout. An acknowledge (ACK or NAK) was not received within the configured T2 time interval. A slave device may generate this error if the master device has aborted after maximum response NAKs and does not NAK the next response retry.
0x2E0C	Response timeout. The SNP Master did not receive an SNP Response message within the configured T5' time interval.
0x2F0C	Buffer message timeout. An expected Text Buffer or Connection Data message was not received within the configured T5'' time interval.
0x300C	Serial output timeout. The CMM module was unable to transmit a Break, an SNP message, or SNP acknowledge (ACK or NAK) from the serial port. (May be due to missing CTS signal when the CMM module is configured to use hardware flow control.)
0x310C	SNP slave did not receive a response from the Service Request Processor in the PLC CPU.
0x320C	COMMREQ timeout. The COMMREQ did not complete within the configured time interval.
0x330C	An SNP Request or Response was aborted prior to completion due to reception of a Break.
0x340C	PLC backplane communications error
0x350C	Invalid Piggyback Status data memory type or address. Communications have not been established.
0x360C	Invalid SNP Slave SNP ID. Must be a 0-7 ASCII characters, plus a terminating null character (00h). The Null SNP ID (eight bytes of 00h) may be used to specify any single slave device.
0x370C	The SNP master has received a response message containing an unexpected data length. Usually indicates a problem with the remote SNP slave device. May occur when Series 90-70 commands (Task Memory or Program Block Memory Read/Write) are issued to a Series 90-30 slave device.
0x380C	Response code in received SNP-X response message does not match expected value. (Response code must equal the request code +80h.)
0x390C	SNP-X Response message exceeds maximum data size (decimal 1000 bytes). Data in the Response is ignored.
0x400C	A parity error has occurred on an X-Attach Response message when establishing a new SNP-X communication session. Communications have not been established.
0x400D	The requested service is not supported by the SNP slave.
0x400F	Serial output timeout. The slave was unable to transmit an SNP-X message from the serial port. (May be due to missing CTS signal when the CMM module is configured to use hardware flow control.)

(PLC generated error codes for the GE 90-30 SNPX protocol continued on the next page.)

GE 90-30 SNPX Protocol – PLC Error Code Tables (cont'd)

PLC Errors for GE 90-30 SNPX Protocol (Minor-Major) (cont'd)	
Panel Error Code PLC-499 Hex Value	Description
0x410C	A framing or overrun error has occurred on an X-Attach Response message when establishing a new SNP-X communication session. Communications have not been established.
0x410D	SNP slave on CMM module requires PLC CPU privilege level 2 to operate. The SNP slave has rejected a request to change to a higher or lower privilege level.
0x410F	An SNP-X request was aborted prior to completion due to reception of a Break.
0x420C	A BCC (Block Check Code) error has occurred on an X-Attach Response message when establishing a new SNP-X communication session. Communications have not been established.
0x420D	SNP Request or Response message exceeds maximum data length of the CMM module. (Total data length for Mailbox and all following Buffer messages is 2048 bytes.) The master must use a smaller data length. Use multiple requests if total data length exceeds the maximum value.
0x420F	An X-Buffer message was received containing greater than 1000 bytes of data. The data is ignored.
0x430C	An invalid message type was received when an X-Attach Response was required when establishing a new SNP-X communication session. Communications have not been established.
0x430D	Improper Write Datagram message format. Series 90-70 slave devices use a different format for this message than Series 90-30 or Series 90-20 slave devices. The master must use the proper message format for this SNP slave device. (The SNP master in the CMM module sends this message as part of the Establish Datagram COMMREQ command. The datagram has been partially established, but is not usable; the datagram should be cancelled by using the Datagram ID returned by the COMMREQ.)
0x430F	The SNP-X slave did not receive a response from the Service Request Processor in the PLC CPU.
0x440C	An invalid next message type value was detected in an X-Attach Response message when establishing a new SNP-X communication session. Communications have not been established.
0x440D	A datagram error occurred in a Series 90-70 slave device (dual-port error).
0x440F	PLC backplane communications error.
0x450C	An invalid response code was detected in an X-Attach Response message when establishing a new SNP-X communication session. Communications have not been established.
0x460C	An expected X-Attach Response message was not received within the response timeout interval when establishing a new SNP-X communication session. The master has retried the X-Attach message twice without receiving a response. Communications have not been established.
0x500C	A parity error has occurred on an X-Attach Response message when re-establishing an existing SNP-X communication session. Communications have not been established.
0x500F	A parity error has occurred in a received X-Attach message.
0x510C	A framing or overrun error has occurred on an X-Attach Response message when re-establishing an existing SNP-X communication session. Communications have not been established.
0x510F	A framing or overrun error has occurred in a received X-Attach message.
0x520C	A BCC (Block Check Code) error has occurred on an X-Attach Response message when re-establishing an existing SNP-X communication session. Communications have not been established.
0x520F	A BCC (Block Check Code) error has occurred in a received X-Attach message.

(PLC generated error codes for the GE 90-30 SNPX protocol continued on the next page.)

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GE 90-30 SNPX Protocol – PLC Error Code Tables (cont'd)

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PLC Errors for GE 90-30 SNPX Protocol (Minor-Major) (cont'd)	
Panel Error Code PLC-499 Hex Value	Description
0x530C	An invalid message type was received when an X-Attach Response was required when re-establishing an existing SNP-X communication session. Communications have not been established.
0x530F	An invalid Message Type was received when an X-Attach message was required. (For an X-Attach message, the message type must be 58h = 'T'.)
0x540C	An invalid Next Message Type value was detected in an X-Attach Response message when re-establishing an existing SNP-X communication session. Communications have not been established.
0x540F	An invalid Next Message Type value was detected in a received X-Attach message. (For an X-Attach message, the Next Message Length must be zero.)
0x550C	An invalid response code was detected in an X-Attach Response message when re-establishing an existing SNP-X communication session. Communications have not been established.
0x550F	An invalid request code was detected in a received X-Attach message.
0x560C	An expected X-Attach Response message was not received within the response timeout interval when re-establishing an existing SNP-X communication session. The master has retried the X-Attach message twice without receiving a response. Communications have not been established.
0x600C	A parity error has occurred on an X-Response message.
0x600F	A parity error has occurred in a received X-Request message.
0x610C	A framing or overrun error has occurred on an X-Response message.
0x610F	A framing or overrun error has occurred in a received X-Request message.
0x620C	A BCC (Block Check Code) error has occurred on an X-Response message.
0x620F	A BCC (Block Check Code) error has occurred in a received X-Request message.
0x630C	An invalid message type was received when an X-Response message was required.
0x640C	An invalid next message type value was detected in an X-Response message.
0x650C	An invalid response code was detected in an X-Response message.
0x660C	An expected X-Response message was not received within the response time.
0x700C	A parity error has occurred on an Intermediate Response message.
0x700F	A parity error has occurred in a received X-Buffer message.
0x710C	A framing or overrun error has occurred on an Intermediate Response message.
0x710F	A framing or overrun error has occurred in a received X-Buffer message.
0x720C	A BCC (Block Check Code) error has occurred on an Intermediate Response message.
0x720F	A BCC (Block Check Code) error has occurred in a received X-Buffer message.
0x730C	An invalid message type was received when an Intermediate Response message was required.
0x730F	An expected X-Buffer message was not received.
0x740C	An invalid next message type value was detected in an Intermediate Response message.
0x750C	An invalid response code was detected in an Intermediate Response message.
0x760C	An expected Intermediate Response message was not received within the response timeout interval.

(PLC generated error codes for the GE 90-30 SNPX protocol continued on the next page.)

GE 90-30 SNPX Protocol – PLC Error Code Tables (cont'd)

PLC Errors for GE 90-30 SNPX Protocol (Minor-Major) (cont'd)	
Panel Error Code PLC-499 Hex Value	Description
0x8D0A	Bad DOS Version. Must have DOS 2.0, or later, to support the SNP DOS Driver.
0x8E0A	PC Serial port configured for SNP Master driver is not open; no communication can take place.
0x8F0A	Out-of-Sequence SNP message. SNP message type received was not the type expected.
0x900A	Bad SNP BCC encountered. Transmission was aborted after maximum retries due to a bad Block Check Code.
0x910A	Bad SNP communication. Transmission was aborted after maximum retries due to serial errors (that is, parity, overrun, or framing errors).
0x920A	No SNP communication. Either communication has been lost or a communication session has not been established.
0xC105	Invalid block state transition.
0xC205	The OEM key is NULL (inactive).
0xC305	Text length does not match traffic type.
0xC405	Verify with FA Card or EEPROM failed.
0xC505	No task-level Rack/Slot configuration to read or delete.
0xC605	Control Program (CP) tasks exist but requestor not logged into main CP.
0xC705	Passwords are set to inactive and cannot be enabled or disabled.
0xC805	Password(s) already enabled and can not be forced inactive.
0xC905	Login using non-zero buffer size required for block commands.
0xCA05	Device is write-protected.
0xCB05	A comm or write verify error occurred during save or restore.
0xCC05	Data stored on device has been corrupted and is no longer reliable.
0xCD05	Attempt was made to read a device but no data has been stored on it.
0xCE05	Specified device has insufficient memory to handle request.
0xCF05	Specified device is not available in the system (not present).
0xD005	One or more PLC modules configured have unsupported revision.
0xD105	Packet size or total program size does not match input.
0xD205	Invalid write mode parameter.
0xD305	User Program Module (UPM) read or write exceeded block end.
0xD405	Mismatch of configuration checksum.
0xD505	Invalid block name specified in datagram.
0xD605	Total datagram connection memory exceeded.
0xD705	Invalid datagram type specified.
0xD805	Point length not allowed.
0xD905	Transfer type invalid for this Memory Type selector.
0xDA05	Null pointer to data in Memory Type selector.
0xDB05	Invalid Memory Type selector in datagram.
0xDC05	Unable to find connection address.
0xDD05	Unable to locate given datagram connection ID.
0xDE05	Size of datagram connection invalid.
0xDF05	Invalid datagram connection address.

(PLC generated error codes for the GE 90-30 SNPX protocol continued on the next page.)

GE 90-30 SNPX Protocol – PLC Error Code Tables (cont'd)

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PLC Errors for GE 90-30 SNPX Protocol (Minor-Major) (cont'd)	
Panel Error Code PLC-499 Hex Value	Description
0xE005	Service in process cannot login.
0xE105	No I/O configuration to read or delete.
0xE205	IOS could not delete configuration, or bad type.
0xE305	CPU revision number does not match.
0xE405	Memory Type for this selector does not exist.
0xE505	DOS file area not formatted.
0xE605	CPU model number does not match.
0xE705	Configuration is not valid.
0xE805	No user memory is available to allocate.
0xE905	Memory Type selector not valid in context.
0xEA05	Not logged in to process service request.
0xEB05	Task unable to be deleted.
0xEC05	Task unable to be created.
0xED05	VME bus error encountered.
0xEE05	Could not return block sizes.
0xEF05	Programmer is already attached.
0xF005	Request only valid in stop mode.
0xF105	Request only valid from programmer.
0xF205	Invalid program cannot log in.
0xF305	I/O configuration mismatch.
0xF405	Invalid input parameter in request.
0xF505	Invalid password.
0xF605	Invalid sweep state to set.
0xF705	Required to log in to a task for service.
0xF805	Invalid Task Name referenced.
0xF905	Task address out of range.
0xFA05	Cannot replace I/O module.
0xFB05	Cannot clear I/O configuration.
0xFC05	I/O configuration is invalid.
0xFD05	Unable to perform auto configuration.
0xFE05	No privilege for attempted operation.
0xFF05	Service Request Error has been aborted.

Mitsubishi FX Protocol – PLC Error Codes

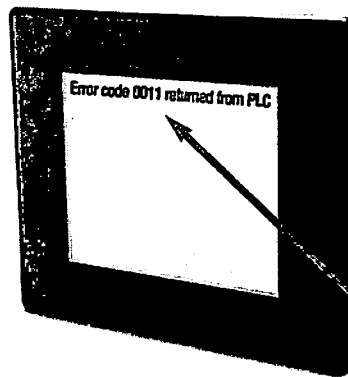
Only errors as listed in the Touch Panel Error Code Table shown on page A-3 can occur when using the Mitsubishi FX protocol, there are no PLC generated errors.

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Omron – Panel Error Code PLC-499 Explanation

The PLC-499 error code is used to show any errors that are generated by the connected PLC. The PLC-499 error message includes a four digit hexadecimal value embedded in the message. This value can be looked up in the specific PLC's error tables to determine the cause of the error. The possible PLC generated error codes for the Omron Host Link and FINS communication protocol is represented by a hexadecimal value as shown in the following message example.

Omron Error Code PLC-499 Message Example:



Panel error code PLC-499 showing a hexadecimal value of 0011 indicates an "Framing error." PLC error when using the Omron Host Link protocol.

Omron Host Link Protocol – PLC Error Code Table

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The following table lists the errors that can be generated by the Omron PLC when using the Host Link protocol.



Note: The following errors can be generated from the designated PLC, are monitored by the C-more touch panel, and displayed on the touch panel's screen as a hexadecimal value in panel error code PLC-499 message, if active. Please refer to the PLC manufacturer's documentation for additional information.

PLC Error Codes for Omron Host Link	
Panel Error Code PLC-499 Hex Value	Description
0x0000	Normal Completion.
0x0001	Not executable in RUN mode.
0x0002	Not executable in MONITOR mode.
0x0003	Not executable with PROM mounted.
0x0004	Address over (data overflow).
0x000B	Not executable in PROGRAM mode.
0x000C	Not executable in DEBUG mode.
0x000D	Not executable in LOCAL mode.
0x0010	Parity error.
0x0011	Framing error.
0x0012	Overrun.
0x0013	FCS error.
0x0014	Format error (parameter length error).
0x0015	Entry number data error (parameter error, data code error, data length error).
0x0016	Instruction not found.
0x0018	Frame length error.
0x0019	Not executable (due to Un-executable error clear, non-registration of I/O table, etc.).
0x0020	I/O table generation impossible (unrecognized remote I/O unit, channel over, duplication of optical transmitting I/O unit).
0x00A0	Abort due to parity error in transmit data under process.
0x00A1	Abort due to framing error in transmit data under process.
0x00A2	Abort due to overrun in transmit data under process.
0x00A3	Abort due to FCS error in transmit data under process.
0x00A4	Abort due to format error in transmit data under process.
0x00A5	Abort due to frame length error in transmit data under process.
0x00A8	Abort due to entry number data error in transmit data under process.
0x00B0	Un-executable due to program area capacity other than 16k bytes.

Omron FINS Protocol – PLC Error Code Table

The following table lists the errors that can be generated by the Omron PLC when using the FINS protocol.



Note: The following errors can be generated from the designated PLC, are monitored by the C-more touch panel, and displayed on the touch panel's screen as a hexadecimal value in panel error code PLC-499 message, if active. Please refer to the PLC manufacturer's documentation for additional information.

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PLC Error Codes for Omron FINS	
Panel Error Code PLC-499 Hex Value	Description
0x0000	Normal Completion.
0x0001	Service Canceled.
0x0101	Local Error: Local node not in network.
0x0102	Local Error: Token Timeout.
0x0103	Local Error: Retries Failed.
0x0104	Local Error: Too many send frames.
0x0105	Local Error: Node address range error.
0x0106	Local Error: Node Address Duplication.
0x0201	Destination Node Error: Destination Node not in network.
0x0202	Destination Node Error: Unit Missing.
0x0203	Destination Node Error: Third Node missing.
0x0204	Destination Node Error: Destination Node busy.
0x0205	Destination Node Error: Response Timeout.
0x0301	Controller Error: Communications Controller Error.
0x0302	Controller Error: CPU Unit Error.
0x0303	Controller Error: Controller Error.
0x0304	Controller Error: Unit number Error.
0x0401	Service Unsupported: Undefined Command.
0x0402	Service Unsupported: Not supported by Model/Version.
0x0501	Routing Table Error: Destination address setting error.
0x0502	Routing Table Error: No routing tables.
0x0503	Routing Table Error: Routing table error.
0x0504	Routing Table Error: Too many delays.
0x1001	Command Format Error: Command too long.
0x1002	Command Format Error: Command too short.
0x1003	Command Format Error: Elements/Data don't match.
0x1004	Command Format Error: Command format error.
0x1005	Command Format Error: Header Error.
0x1101	Parameter Error: Area classification missing.
0x1102	Parameter Error: Access Size Error.
0x1103	Parameter Error: Address range error.

(PLC generated error codes for the Omron FINS protocol continued on the next page.)

Omron FINS Protocol – PLC Error Code Table (cont'd)

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PLC Error Codes for Omron FINS	
Panel Error Code PLC-499 Hex Value	Description
0x1104	Parameter Error: Address range exceeded.
0x1106	Parameter Error: Program Missing.
0x1109	Parameter Error: Relational Error.
0x110A	Parameter Error: Duplicate Data Access.
0x110B	Parameter Error: Response too long.
0x110C	Parameter Error: Parameter Error.
0x2002	Read Not Possible: Protected.
0x2003	Read Not Possible: Table missing.
0x2004	Read Not Possible: Data missing.
0x2005	Read Not Possible: Program missing.
0x2006	Read Not Possible: File missing.
0x2007	Read Not Possible: Data mismatch.
0x2101	Write Not Possible: Read Only.
0x2102	Write Not Possible: Protected - cannot write data link table.
0x2103	Write Not Possible: Cannot register.
0x2105	Write Not Possible: Program missing.
0x2106	Write Not Possible: File missing.
0x2107	Write Not Possible: File name already exists.
0x2108	Write Not Possible: Cannot change.
0x2201	Not executable in current mode: Not possible during execution.
0x2202	Not executable in current mode: Not possible while running.
0x2203	Not executable in current mode: Wrong PLC mode (Program).
0x2204	Not executable in current mode: Wrong PLC mode (Debug).
0x2205	Not executable in current mode: Wrong PLC mode (Monitor).
0x2206	Not executable in current mode: Wrong PLC mode (Run).
0x2207	Not executable in current mode: Specified node not polling node.
0x2208	Not executable in current mode: Step cannot be executed.
0x2301	No such device: File device missing.
0x2302	No such device: Missing memory.
0x2303	No such device: Clock missing.
0x2401	Cannot Start/Stop: Table missing.
0x2502	Unit Error: Memory Error.
0x2503	Unit Error: I/O setting Error.
0x2504	Unit Error: Too many I/O points.
0x2505	Unit Error: CPU bus error.
0x2506	Unit Error: I/O Duplication.

(PLC generated error codes for the Omron FINS protocol continued on the next page.)

Omron FINS Protocol – PLC Error Code Table (cont'd)

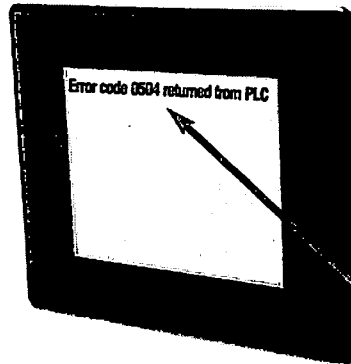
A

PLC Error Codes for Omron FINS	
Panel Error Code PLC-499 Hex Value	Description
0x2507	Unit Error: I/O bus error.
0x2509	Unit Error: SYSMAC BUS/2 error.
0x250A	Unit Error: CPU Bus Unit Error.
0x250D	Unit Error: SYSMAC BUS No. duplication.
0x250F	Unit Error: Memory Error.
0x2510	Unit Error: SYSMAC BUS terminator missing.
0x2601	Command Error: No protection.
0x2602	Command Error: Incorrect password.
0x2604	Command Error: Protected.
0x2605	Command Error: Service already executing.
0x2606	Command Error: Service stopped.
0x2607	Command Error: No execution right.
0x2608	Command Error: Settings not complete.
0x2609	Command Error: Necessary items not set.
0x260A	Command Error: Number already defined.
0x260B	Command Error: Error will not clear.
0x3001	Access Right Error: No access right.
0x4001	Abort: Service aborted.

Omron – Panel Error Code P495 Explanation

A

The PLC-495 error code is used to show any errors that are generated by the connected PLC. The PLC-495 error message includes a four digit hexadecimal value embedded in the message. This value can be looked up in the specific PLC's error tables to determine the cause of the error. The possible PLC generated error codes for the Omron CS/CJ FINS ethernet communication protocol is represented by a hexadecimal value as shown in the following message example.



Panel error code PLC-495 showing a hexadecimal value of 0504 indicates a "Routing table error: Too many relays" PLC error.

Omron CS/CJ FINS Ethernet Protocol – PLC Error Code Table

The following table lists the errors that can be generated by the Omron PLC when using the CS/CJ FINS Ethernet protocol.



Note: The following errors can be generated from the designated PLC, are monitored by the C-more touch panel, and displayed on the touch panel's screen as a hexadecimal value in panel error code PLC-495 message, if active. Please refer to the PLC manufacturer's documentation for additional information.

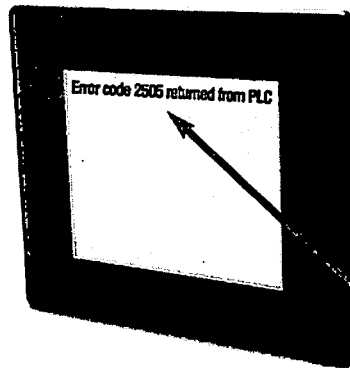
PLC Error Codes for Omron CS/CJ FINS Ethernet	
Panel Error Code PLC-495 Hex Value	Description
0103	Local Error: Send Error from lack of buffer space. Try reducing Ethernet load to the module.
0201	Destination Node Error: IP address of remote node not set correctly.
0202	Destination Node Error: No node with the specified unit address found.
0205	Destination Node Error: Packet corrupted or Response timeout. Try increasing timeout.
0301	Controller Error: Communications controller error.
0302	Controller Error: CPU Unit error. Check error LEDs on PLC. Refer to documentation for that CPU.
0304	Controller Error: Unit number error. Make sure Unit number is not used twice.
0401	Service unsupported: Undefined command.
0501	Routing table error: Destination address setting error. Routing table incorrect.
0502	Routing table error: No routing tables.
0503	Routing table error: Routing table error.
0504	Routing table error: Too many relays.
1001	Command format error: Command too long. Bad packet: check for electrical noise and grounding.
1002	Command format error: Command too short. Bad packet: check for electrical noise and grounding.
1003	Command format error: Elements/data don't match. Bad packet: check for electrical noise and grounding.
1005	Command format error: Header error. This is the error received when station # set in the command does not match the station # of the Ethernet module.
1100	Parameter error: UDP socket number bad.
1101	Parameter error: Address requested does not exist in PLC.
1103	Parameter error: Address area requested in not accessible.
220F	Status error: Duplicate Socket error.
2210	Status error: Specified socket not open.
2305	Environment Error: IP address conversion failed. Only encountered when using routing tables.
2307	Environment Error: IP address conversion set for automatic.
2503	Unit error: I/O setting error.
2505	Unit error: CPU bus error.
250A	Unit error: CPU Bus Unit error.

Siemens – Panel Error Code P499 Explanation

A

The PLC-499 error code is used to show any errors that are generated by the connected PLC. The PLC-499 error message includes a four digit hexadecimal value displayed at the end of the message. This value can be looked up in the specific PLC's error tables to determine the cause of the error. The possible PLC generated error codes for the Siemens PPI communication protocols breakdown into a four digit hexadecimal value as shown in the following message example.

Siemens Error Code PLC-499 Message Example:



Panel error code PLC-499 showing a hexadecimal value of 2505 indicates an "Unit error: CPU bus error." PLC error.

Siemens PPI Protocol – PLC Error Code Table

A

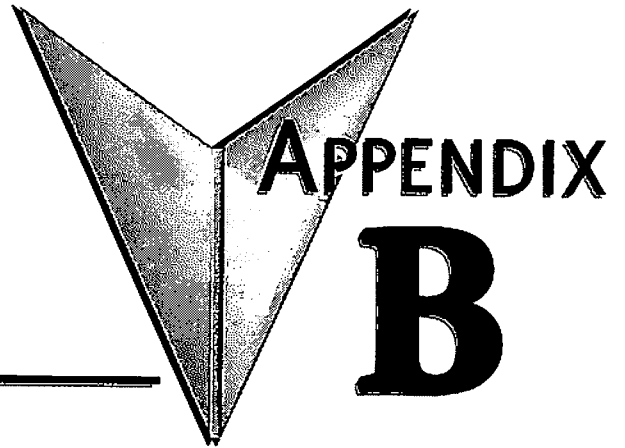
PLC PDU Header Errors for S7-200 PPI	
Panel Error Code PLC-499 Hex Value	Description
0x0001	Hardware Fault.
0x0003	Object access not allowed: Occurs when access to Timer and Counter data type is set to Signed Integer and not BCD.
0x0004	Context not supported.
0x0005	Address out of range: Occurs when requesting an address within a Data Block that does not exist or is out of range.
0x0006	Address out of range.
0x0007	Write Data size mismatch.
0x000A	Object does not exist: Occurs when trying to request a Data Block that does not exist.
0x8000	Function being used.
0x8001	Action is not allowed in current mode.
0x8101	Hardware fault.
0x8103	Access not allowed.
0x8104	Function not supported.
0x8105	Address invalid.
0x8106	Data Type not supported.
0x8107	Data Type is not consistent with size.
0x810A	Object does not exist.
0x8500	PDU Size is incorrect.
0x8702	Address is invalid.
0xD201	Block name syntax error.
0xD202	Error with function parameter.
0xD203	Error with block type.
0xD204	No linked block.
0xD205	Object already exists.
0xD206	Object already exists.
0xD207	Block already used in EPROM.
0xD209	Block does not exist.
0xD20E	No Block does not exist.
0xD210	Block number incorrect.

Siemens ISO over TCP Protocol – PLC Error Code Table

A

PLC PDU Header Errors for S7-300 Ethernet	
Panel Error Code PLC-499 Hex Value	Description
0x0001	Hardware Fault.
0x0003	Object access not allowed: Occurs when access to Timer and Counter data type is set to Signed Integer and not BCD.
0x0004	Context not supported.
0x0005	Address out of range: Occurs when requesting an address within a Data Block that does not exist or is out of range.
0x0006	Address out of range.
0x0007	Write Data size mismatch.
0x000A	Object does not exist: Occurs when trying to request a Data Block that does not exist.
0x8000	Function being used.
0x8001	Action is not allowed in current mode.
0x8101	Hardware fault.
0x8103	Access not allowed.
0x8104	Function not supported.
0x8105	Address invalid.
0x8106	Data Type not supported.
0x8107	Data Type is not consistent with size.
0x810A	Object does not exist.
0x8500	PDU Size is incorrect.
0x8702	Address is invalid.
0xD201	Block name syntax error.
0xD202	Error with function parameter.
0xD203	Error with block type.
0xD204	No linked block.
0xD205	Object already exists.
0xD206	Object already exists.
0xD207	Block already used in EPROM.
0xD209	Block does not exist.
0xD20E	No Block does not exist.
0xD210	Block number incorrect.

TOUCH PANEL RUNTIME ERRORS



In This Appendix...

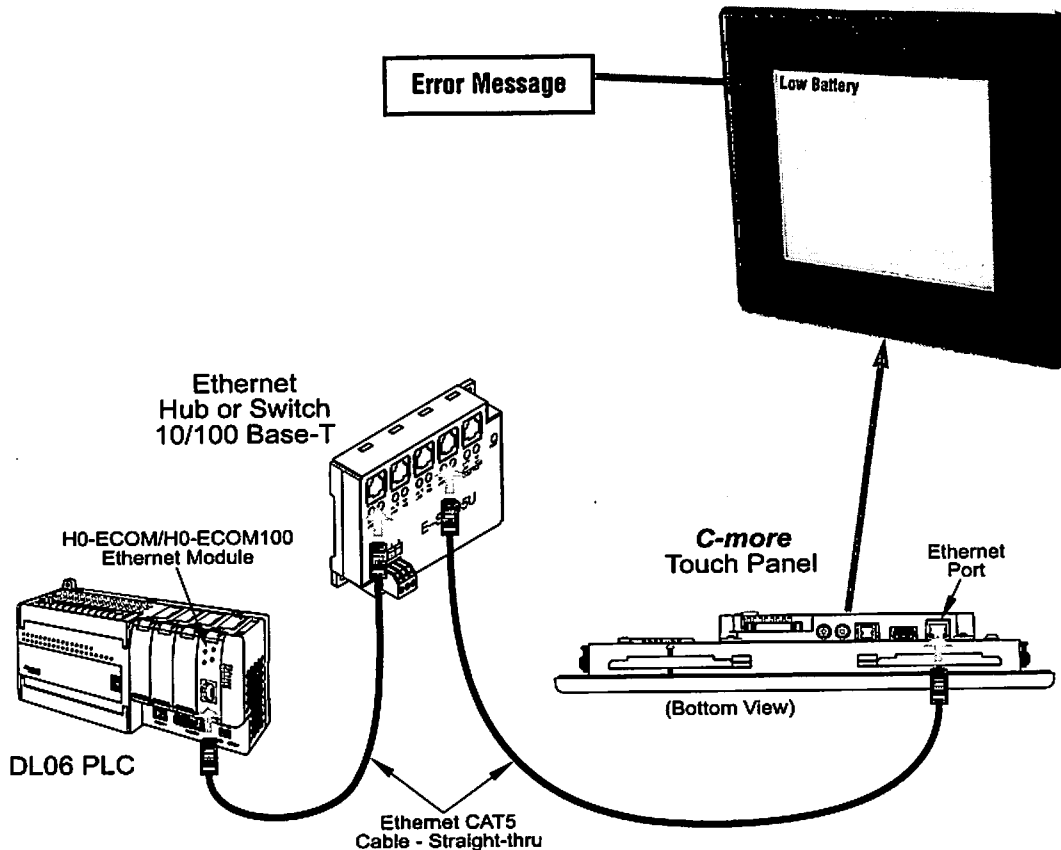
IntroductionB-2
Runtime ErrorsB-3

Introduction

The *C-more* touch panels have diagnostics built-in to the operating system that monitor various runtime functions that will display an error message on the panel's display indicating that a particular error has occurred and what the error represents. The Error Message(s) is displayed in the upper left area of the display screen. The Runtime Errors are also logged into the panel's Error log under the Information tab in the panel's System Setup Screens. The Error Log Code, such as RTE-031, is how the error is identified in the error log. See Chapter 5: System Setup Screens for additional details. The tables that follow show the possible Runtime Errors and include the error message, log error code, tag error code value, cause, etc.

The user can include in their touch panel project the use of this diagnostic information by using the system tag name `SYS ERR ERRORCODE` to control displayed screens, operator messages, etc., and also communicate error information to the PLC or controlling device. If a runtime error occurs, the `SYS ERR ERRORCODE` system tag will contain the numeric value shown under the Tag Code Error Value. For example, if a Low Battery runtime error is indicated, then the screen display will show Low Battery and the `SYS ERR ERRORCODE` system tag will contain the value 2031. The value of the last runtime error detected will remain in the `SYS ERR ERRORCODE`.

If you have difficulty determining the cause of the error, refer to Chapter 8: Troubleshooting for additional help or contact our technical support group at 770-844-4200



Runtime Errors

If there is more than one Runtime Error, then the Error Message displayed at the top of the panel's screen will display for 3 seconds, then be off for 2 seconds. The next Error Message will display for the same time increments, continue through any other active runtime error messages, and then start over. When only one Runtime Error is active, then that message will continuously be displayed until it is no longer active.

B

No.	Error Log Code	Error Message Located at upper left of screen	Error Message Tag	Tag Error Code Value	System Screen Info > Error	Cause
Log Error						
1	RTE-001	Log Failed. Not enough Memory Space in %Device%	SYS ERR ERRORCODE	2001	MM/DD/YY HH/MM/SS Error Code RTE-001	The size of the destination memory is not large enough to store the data.
2	RTE-002	Log Failed. %Device% cannot be found	SYS ERR ERRORCODE	2002	MM/DD/YY HH/MM/SS Error Code RTE-002	No device available or the device is defective.
3	RTE-003	Log Failed. Can not write file - %file%	SYS ERR ERRORCODE	2003	MM/DD/YY HH/MM/SS Error Code RTE-003	Logging the data has failed due to a problem such as the memory write protect is enabled.
4	RTE-004	Log cache memory is full	SYS ERR ERRORCODE	2004	MM/DD/YY HH/MM/SS Error Code RTE-004	The data log buffer in the SRAM memory is full.
Screen Capture						
1	RTE-011	Capture Failed. Not enough Memory Space in %Device%	SYS ERR ERRORCODE	2011	MM/DD/YY HH/MM/SS Error Code RTE-011	The size of the destination memory is not large enough to store the data.
2	RTE-012	Capture Failed. %Device% cannot be found	SYS ERR ERRORCODE	2012	MM/DD/YY HH/MM/SS Error Code RTE-012	No device available or the device is defective.
3	RTE-013	Capture Failed. Can not write file - %file%	SYS ERR ERRORCODE	2013	MM/DD/YY HH/MM/SS Error Code RTE-013	Logging the data has failed due to a problem such as the memory write protect is enabled.
Table continued on next page.						

Runtime Errors (cont'd)

B

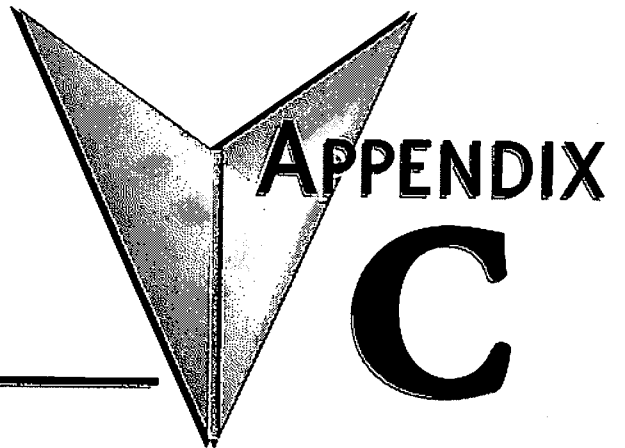
No.	Error Log Code	Error Message Located at upper left of screen	Error Message Tag	Tag Error Code Value	System Screen Info > Error	Cause
Handshake						
1	RTE-021	Handshake Timeout Error	SYS ERR ERRORCODE	2021	MM/DD/YY HH/MM/SS Error Code RTE-021	A communications timeout occurred when either a Recipe or Numeric Entry Object, in which Notification and Handshake signals are used, failed to complete the responses.
Battery						
1	RTE-031	Low Battery	SYS ERR ERRORCODE	2031	MM/DD/YY HH/MM/SS Error Code RTE-031	The panel's backup battery voltage level has fallen below 1.8 VDC and should be replaced.
e-mail						
1	RTE-041	E-mail Connection Error %Address%	SYS ERR ERRORCODE	2041	MM/DD/YY HH/MM/SS Error Code RTE-041	An incorrect SMTP address has been entered into the Touch Panel Network dialog screen.
2	RTE-042	Send E-mail Error %Address%	SYS ERR ERRORCODE	2042	MM/DD/YY HH/MM/SS Error Code RTE-042	An incorrect email address has been entered into the Address Book.
Send FTP						
1	RTE-051	FTP Connection Error %Address%&%ID%	SYS ERR ERRORCODE	2051	MM/DD/YY HH/MM/SS Error Code RTE-051	An incorrect FTP Service has been assigned into the Touch Panel Network dialog screen.
2	RTE-052	Send FTP Error %Address%&%ID%	SYS ERR ERRORCODE	2052	MM/DD/YY HH/MM/SS Error Code RTE-052	Permission to write to the FTP folder has not been authorized. The FTP site may require a user ID and password.
Sound						
1	RTE-081	Sound Failed. Not enough Memory	SYS ERR ERRORCODE	2081	MM/DD/YY HH/MM/SS Error Code RTE-081	The sound file failed to play due to insufficient memory.
Conflict						
1	RTE-091	IP Address Conflict - Corrcct IP Address and Power Cycle	SYS ERR ERRORCODE	2091	MM/DD/YY HH/MM/SS Error Code RTE-091	Conflict of IP Address

Runtime Errors (cont'd)

B

No.	Error Log Code	Error Message Located at upper left of screen	Error Message Tag	Tag Error Code Value	System Screen Info > Error	Cause
Multiple Recipe						
1	RTE-101	Record doesn't exist	SYS ERR ERRORCODE	2101	MM/DD/YY HH/MM/SS Error Code RTE-101	The recipe file or data doesn't exist.
2	RTE-102	File cannot open	SYS ERR ERRORCODE	2102	MM/DD/YY HH/MM/SS Error Code RTE-102	The recipe file cannot be opened.
3	RTE-103	E-mail Connection Error %Address%	SYS ERR ERRORCODE	2103	MM/DD/YY HH/MM/SS Error Code RTE-103	Abnormality is found in the numeric character data of the recipe file.
4	RTE-104	Send E-mail Error %Address%	SYS ERR ERRORCODE	2104	MM/DD/YY HH/MM/SS Error Code RTE-104	Abnormality is found in the Tag data of the recipe file.
5	RTE-105	Recipe - Index (%Row%) error	SYS ERR ERRORCODE	2105	MM/DD/YY HH/MM/SS Error Code RTE-105	Recipe was operated by the record number outside the range.
6	RTE-106	Not enough buffer memory	SYS ERR ERRORCODE	2106	MM/DD/YY HH/MM/SS Error Code RTE-106	Memory allocation error
7	RTE-107	File cannot write	SYS ERR ERRORCODE	2107	MM/DD/YY HH/MM/SS Error Code RTE-107	There was an error trying to write the recipe file.
8	RTE-108	Wrong file format	SYS ERR ERRORCODE	2108	MM/DD/YY HH/MM/SS Error Code RTE-108	The recipe file format is incorrect.
9	RTE-109	Not enough Memory Space in %Device%	SYS ERR ERRORCODE	2109	MM/DD/YY HH/MM/SS Error Code RTE-109	Insufficient storage space on media.
Action						
1	RTE-121	Action Overflows	SYS ERR ERRORCODE	2121	MM/DD/YY HH/MM/SS Error Code RTE-121	The number of actions executed in the event exceeded the maximum number.
SRAM Error						
1	RTE-500	SRAM Check Sum Error	SYS ERR ERRORCODE	2500	MM/DD/YY HH/MM/SS Error Code RTE-500	Memory in Panel has been Corrupted by Power Loss, etc.

MOUNTING CLIPS PRIOR APRIL 2006



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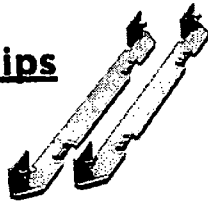
Introduction

The mounting clips supplied with *C-more* touch panels after April 2006 are slightly different than the original clips. Appendix C: Mounting Clips Prior April 2006 has been included in the Hardware User Manual for the end user to have a reference to the drawings and information pertaining to the original mounting clips. The enclosure mounting thickness range and screw torque range has remained the same for each type of touch panel. The basic physical construction and use of the mounting clips remains the same, as does the various touch panel cutout dimensions.

The 6" touch panels use two long style mounting clips. The new 6" mounting clips have been redesigned to increase rigidity and also the screw position height has been increased to allow easier placement in the touch panel slots on thicker enclosures.

The 8"-15" touch panels, depending on the panel's size, use either 6 or 8 smaller style mounting clips. The new 8"-15" mounting clips have been made shorter in height to allow easier installation. Their rigidity remains the same.

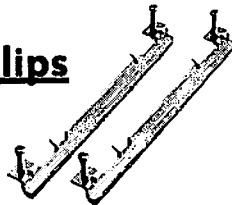
Original
6" Mounting Clips



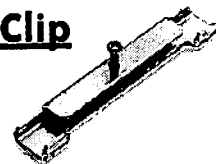
Original
8-15" Mounting Clip



Newer
6" Mounting Clips

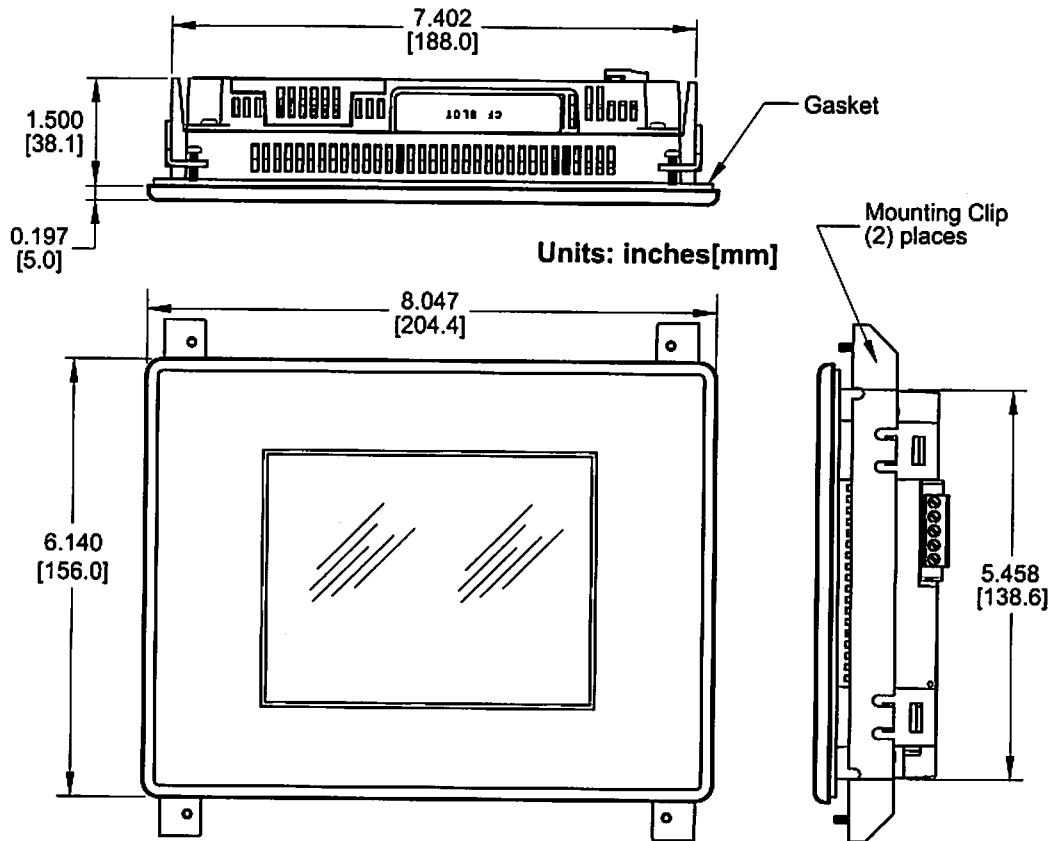


Newer
8-15" Mounting Clip

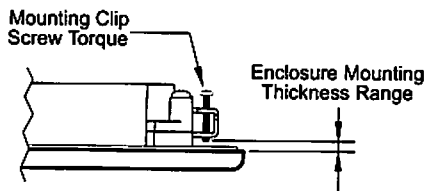


EA7-S6M-R, S6C-R, S6M, S6C and T6C Original Mounting Clips

Dimensions:



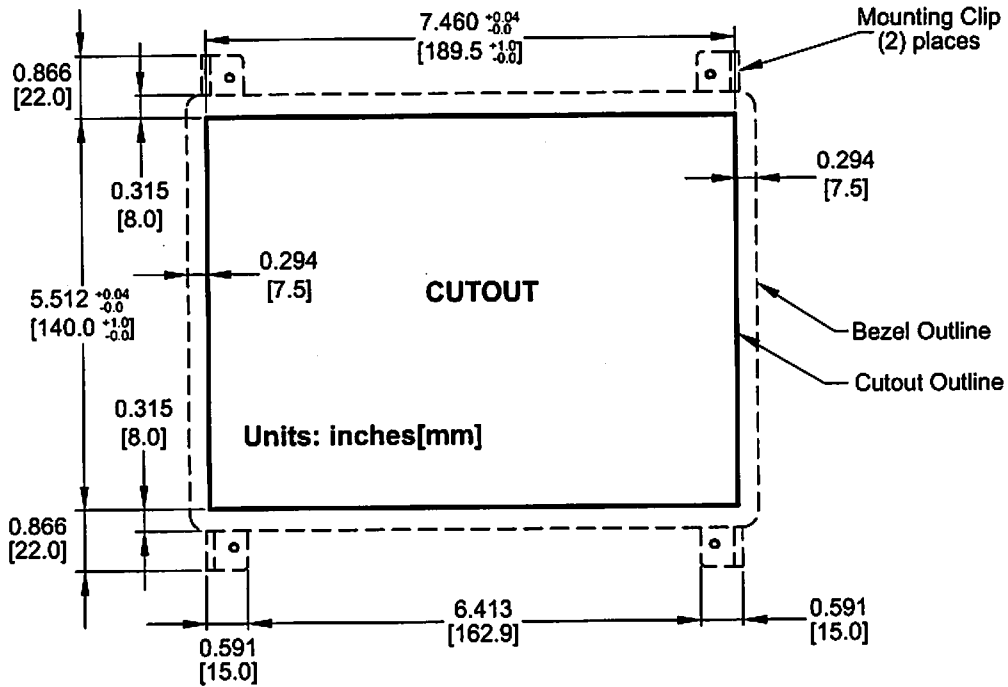
Enclosure Mounting Thickness Ranges and Mounting Clip Screw Torque



Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
6" – lower mounting clip position	0.039 - 0.24 inch [1 - 6 mm]	35 ~ 50 oz-in [0.25 ~ 0.35 Nm]
6" – upper mounting clip position	0.20 - 0.63 inch [5 - 16 mm]	35 ~ 50 oz-in [0.25 ~ 0.35 Nm]

EA7-S6M-R, S6C-R, S6M, S6C and T6C Original Mounting Clips

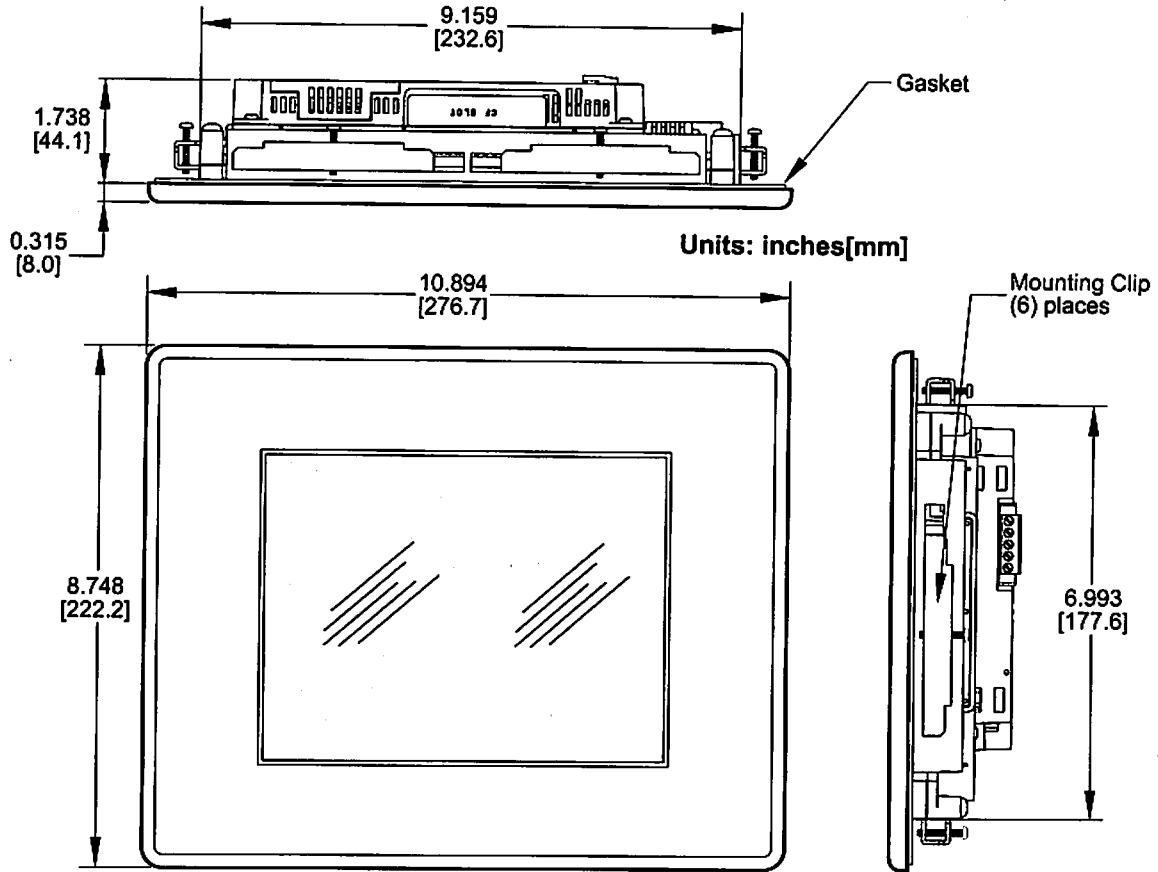
Cutout Dimensions:



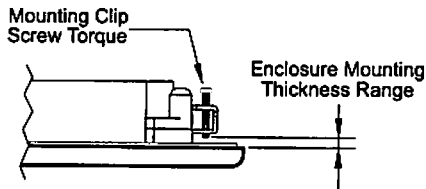
EA7-T8C

Original Mounting Clips

Dimensions:



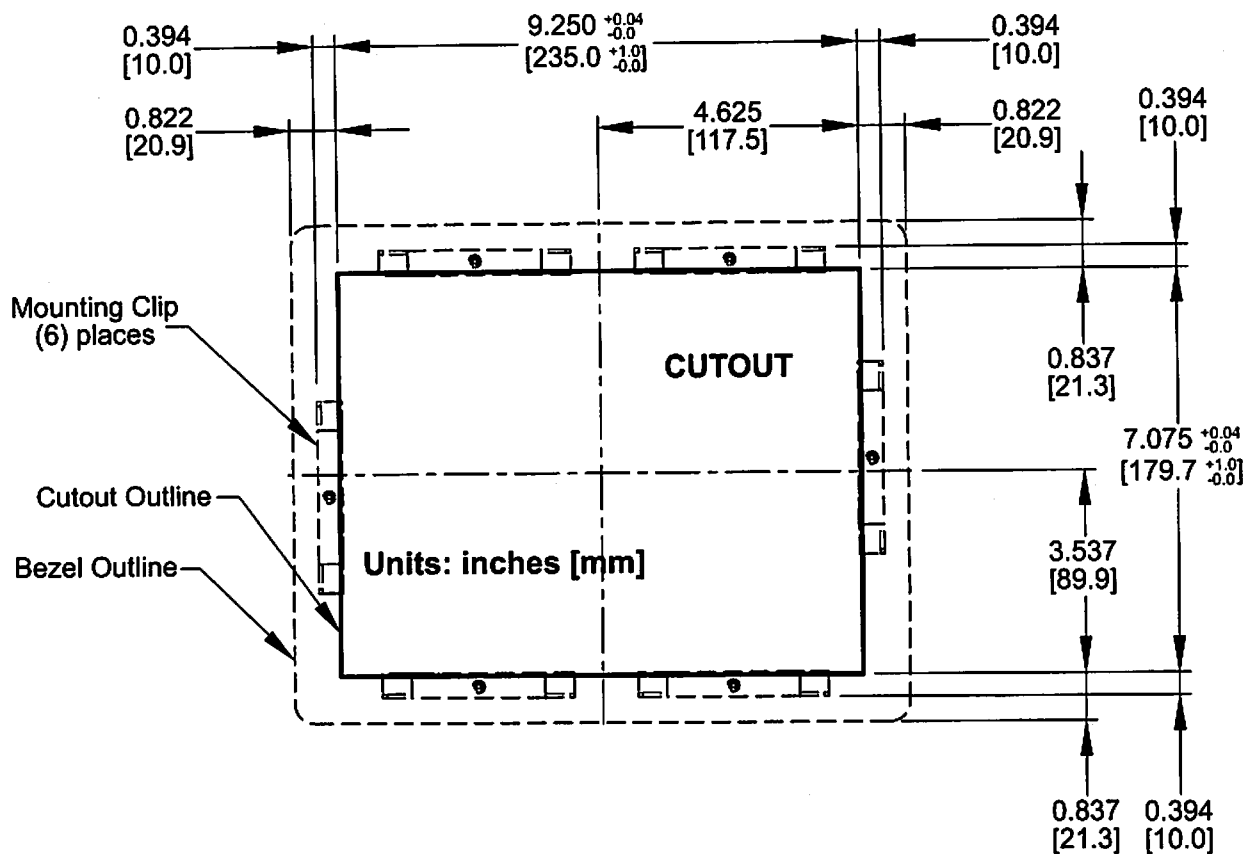
Enclosure Mounting Thickness Ranges and Mounting Clip Screw Torque



Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
8", 10", 12" & 15"	0.039 - 0.20 inch [1 - 5 mm]	42 ~ 57 oz-in [0.3 ~ 0.4 Nm]

EA7-T8C Original Mounting Clips

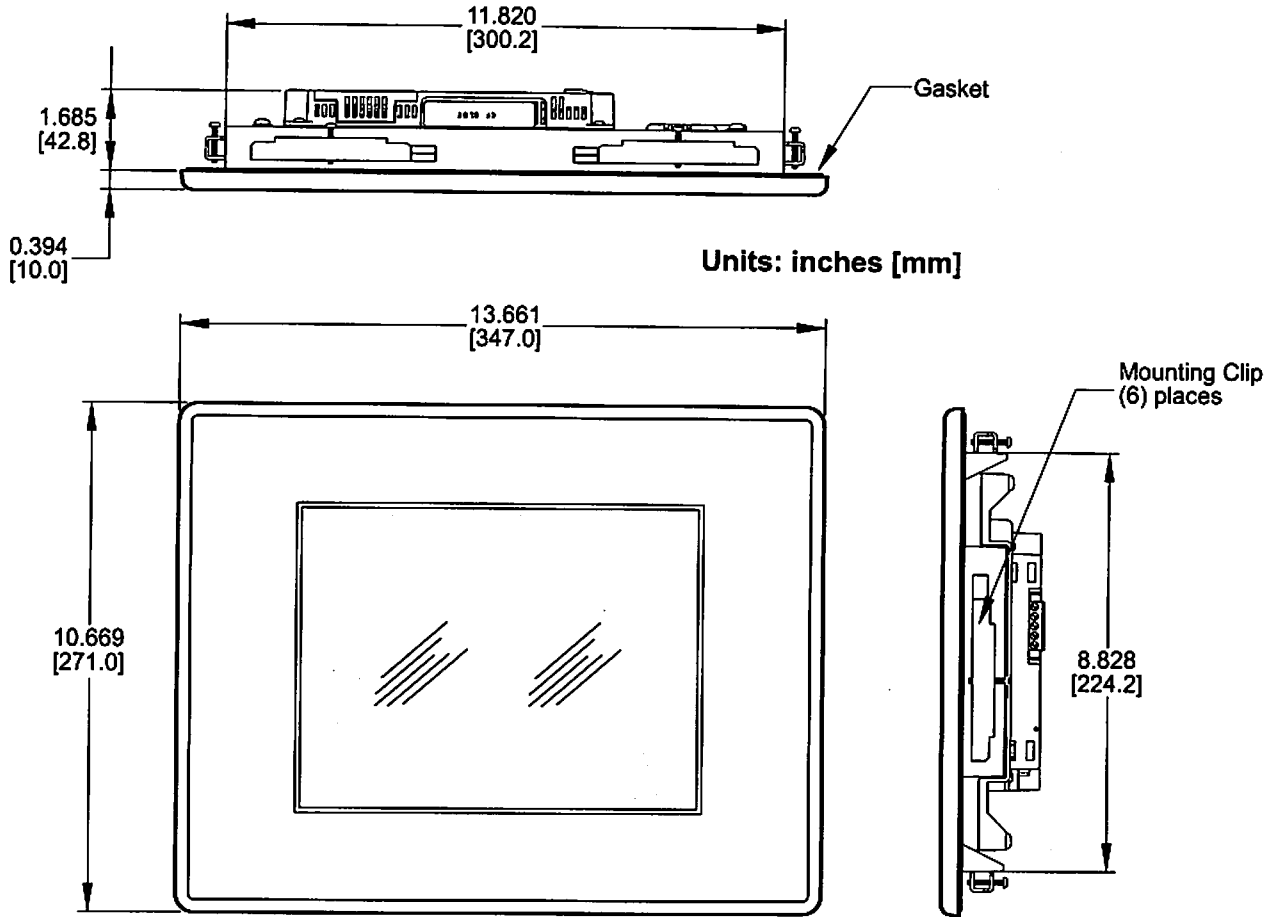
Cutout Dimensions:



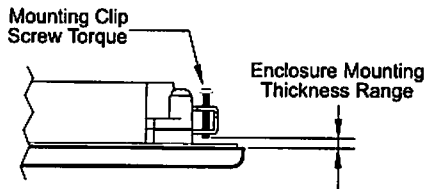
EA7-T10C

Original Mounting Clips

Dimensions:



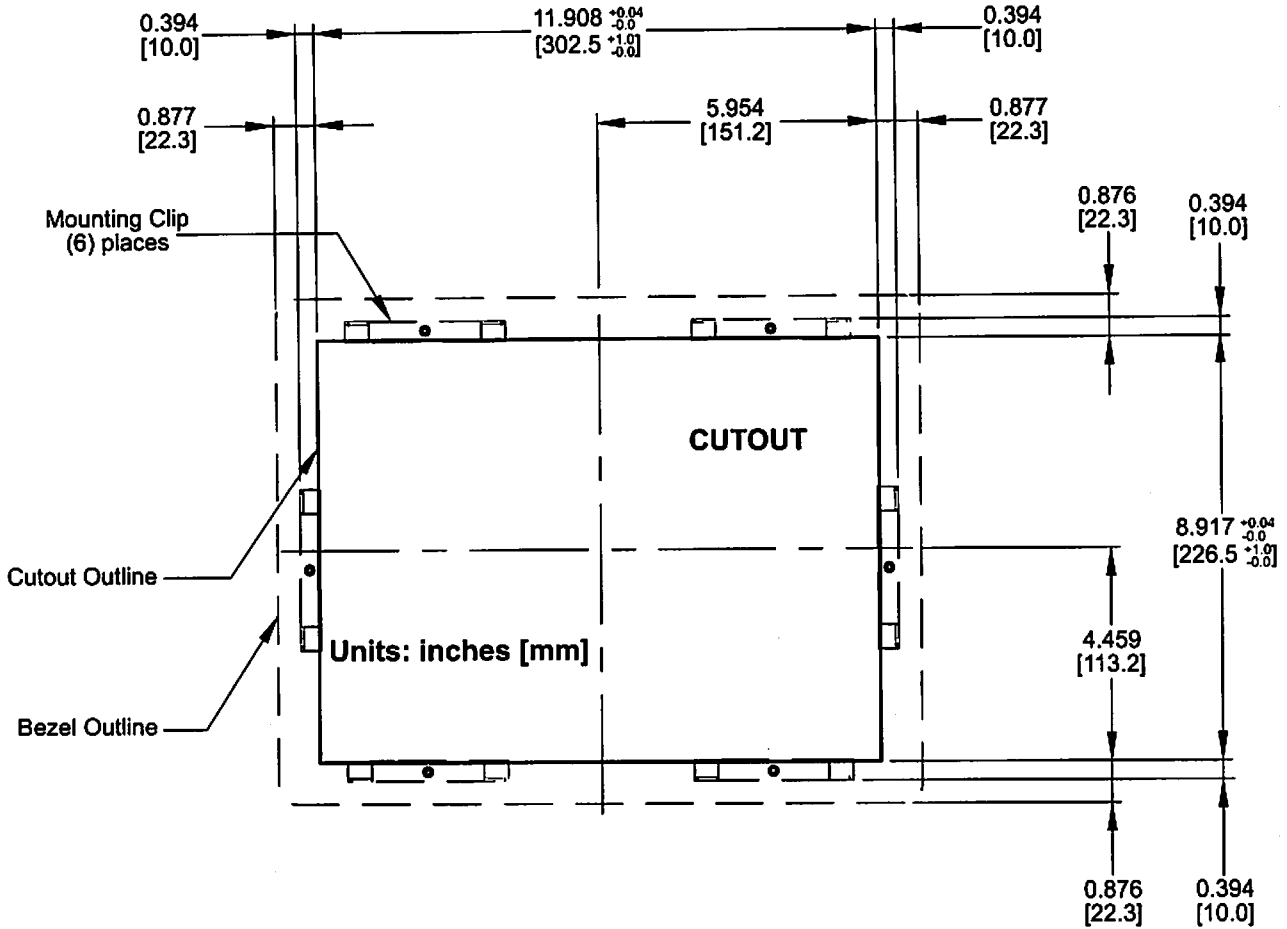
Enclosure Mounting Thickness Ranges and Mounting Clip Screw Torque



Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
8", 10", 12" & 15"	0.039 - 0.20 inch [1 - 5 mm]	42 ~ 57 oz-in [0.3 ~ 0.4 Nm]

EA7-T10C Original Mounting Clips

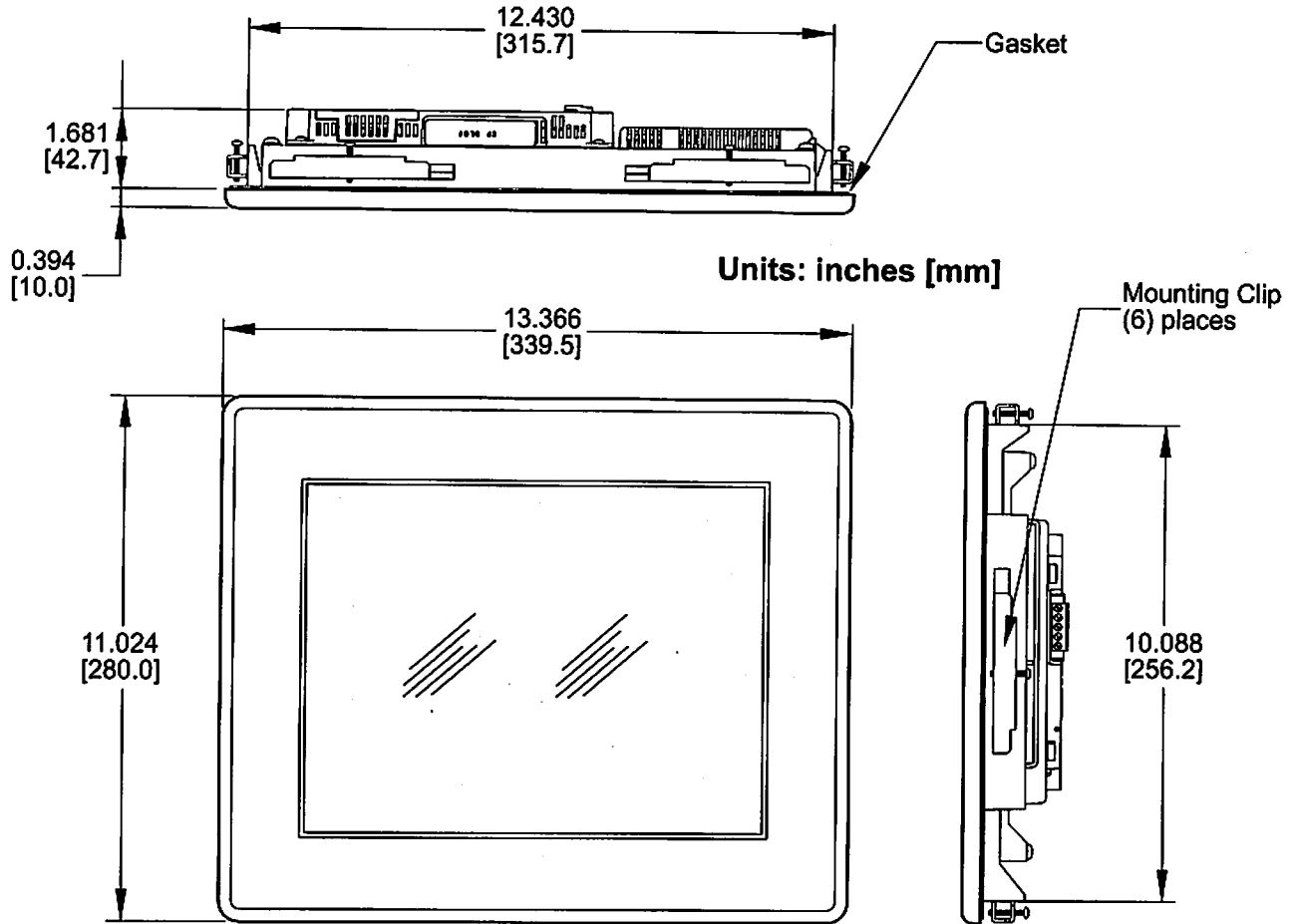
Cutout Dimensions:



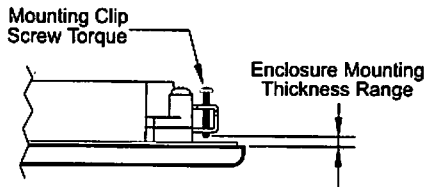
EA7-T12C

Original Mounting Clips

Dimensions:



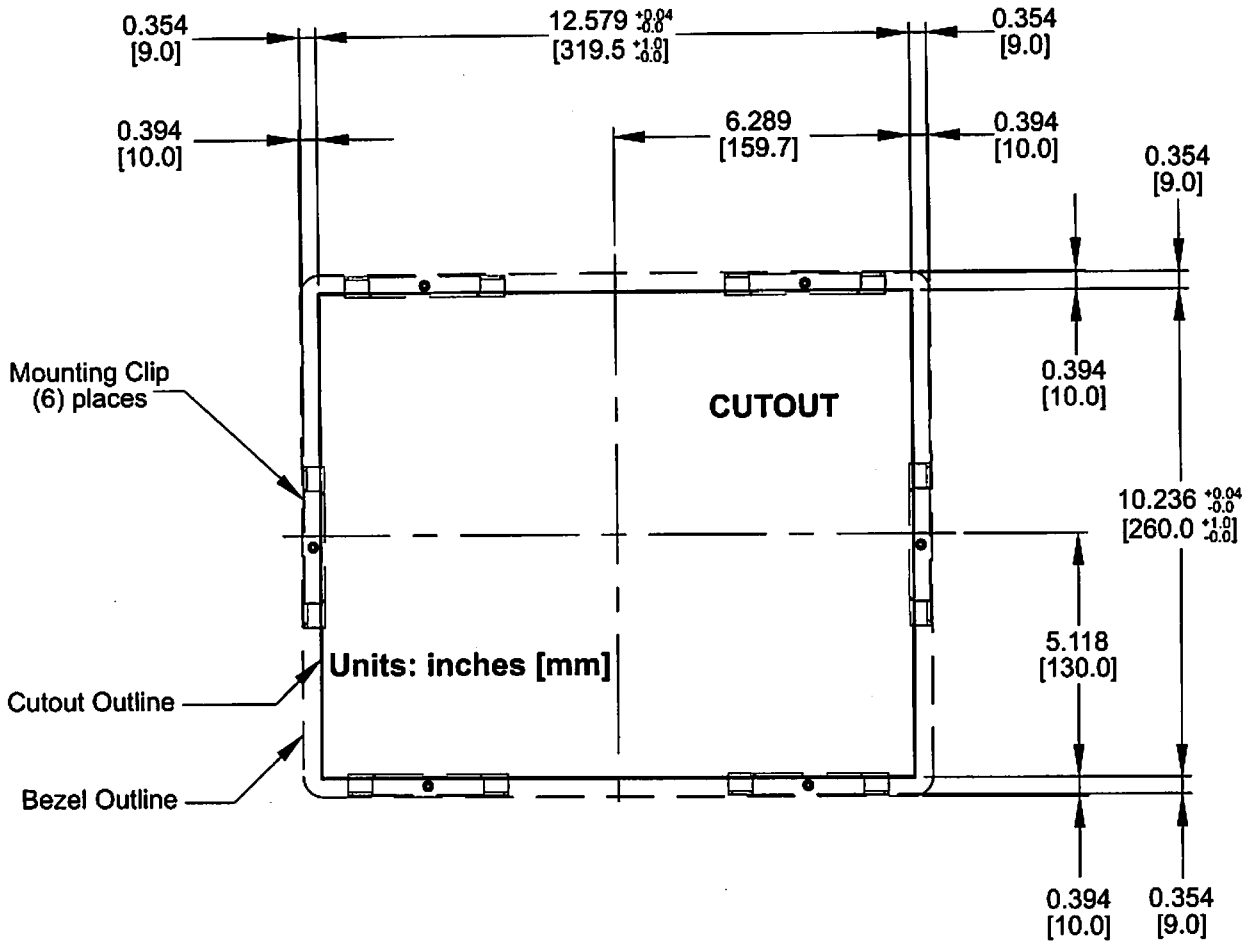
Enclosure Mounting Thickness Ranges and Mounting Clip Screw Torque



Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
8", 10", 12" & 15"	0.039 - 0.20 inch [1 - 5 mm]	42 ~ 57 oz-in [0.3 ~ 0.4 Nm]

EA7-T12C Original Mounting Clips

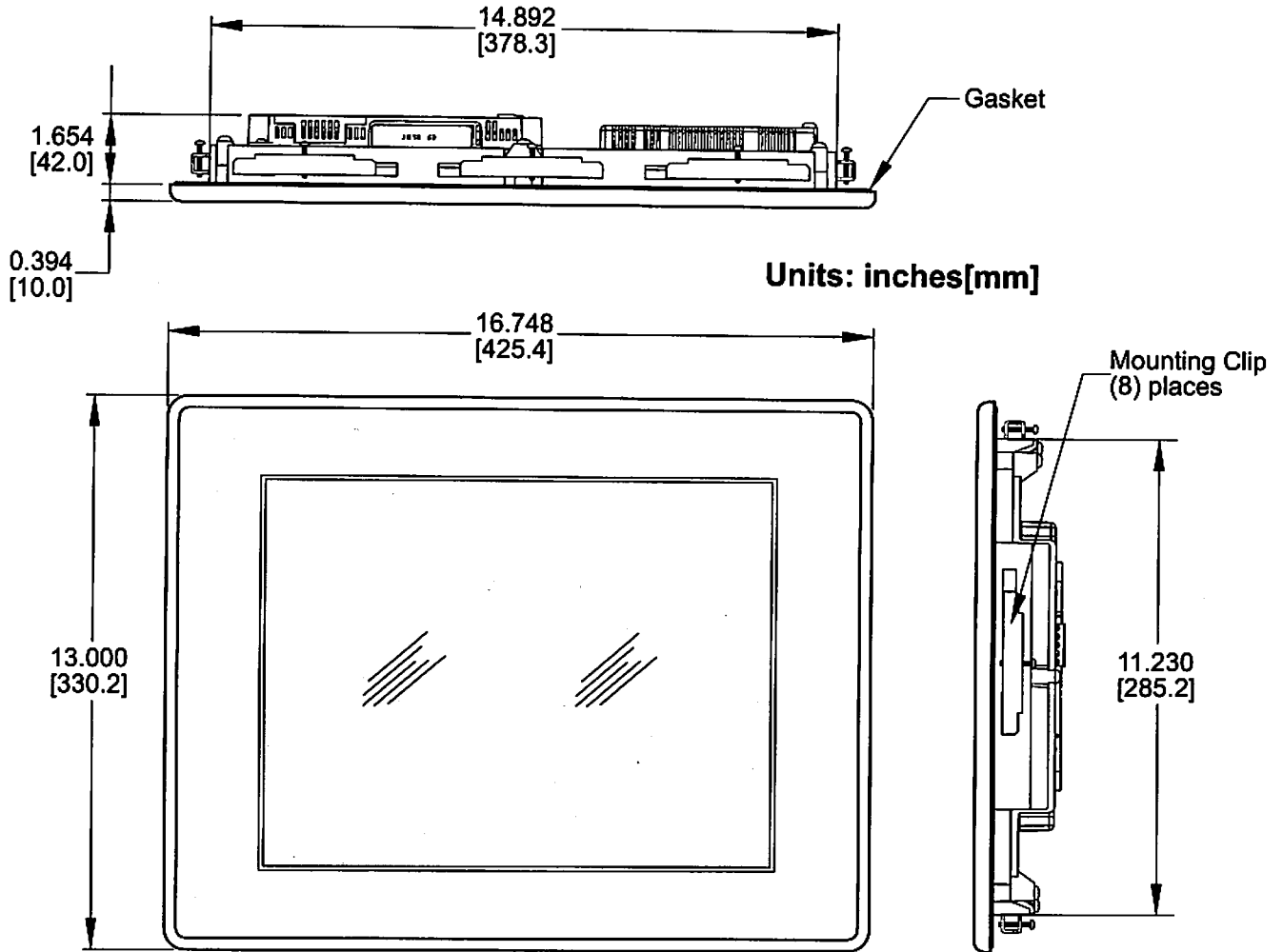
Cutout Dimensions:



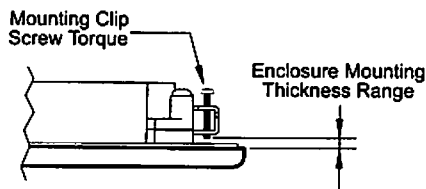
EA7-T15C

Original Mounting Clips

Dimensions:



Enclosure Mounting Thickness Ranges and Mounting Clip Screw Torque

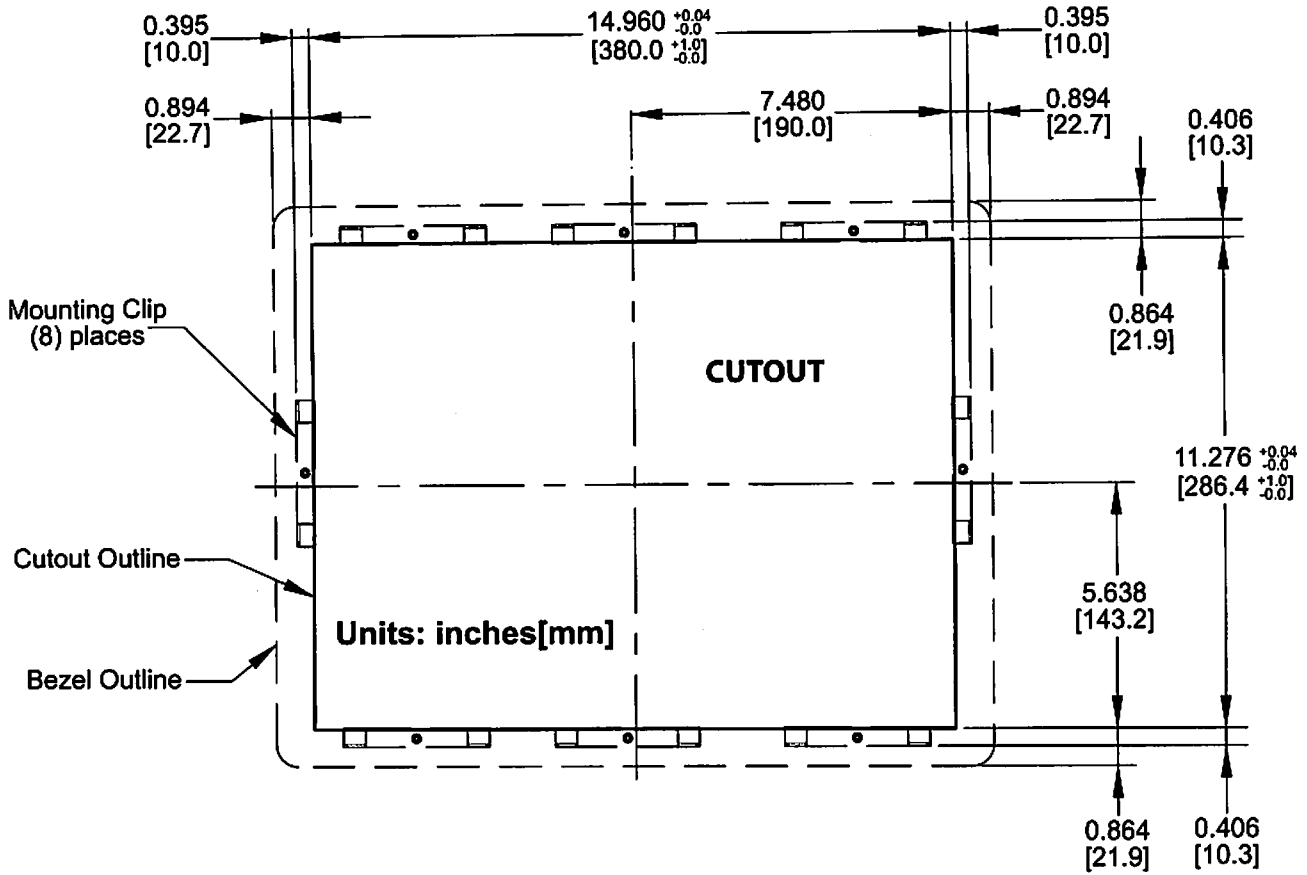


Touch Panel Size	Enclosure Thickness Range	Mounting Clip Screw Torque
8", 10", 12" & 15"	0.039 - 0.20 inch [1 - 5 mm]	42 ~ 57 oz-in [0.3 ~ 0.4 Nm]

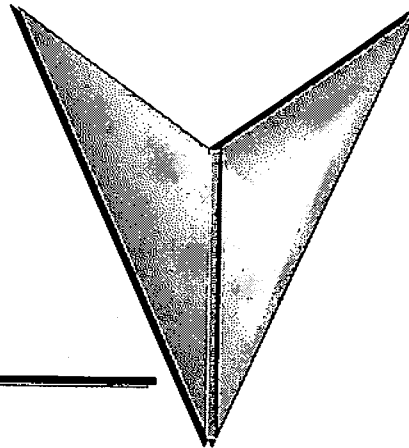
EA7-T15C

Original Mounting Clips

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BETTIS

SERVICE INSTRUCTIONS

DISASSEMBLY AND REASSEMBLY

FOR CBA/CBB-SR (SPRING RETURN)

SERIES PNEUMATIC ACTUATORS

PART NUMBER: 137465E

REVISION: "E"

RELEASE DATE: July 2009

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SECTION 1 - INTRODUCTION

1.1 GENERAL SERVICE INFORMATION

- 1.1.1 This service procedure is offered as a guide to enable general maintenance to be performed on Bettis CBA-SR spring return series actuators. The following is a list of general CBA-SR models numbers

MODEL (1)		MODEL (1)		MODEL (1)
315		315-M3		315-M3HW
420		420-M3		420-M3HW
520		520-M3		520-M3HW
525		525-M3		525-M3HW
725		725-M3		725-M3HW
(1) Also includes actuator models with -10 and -11 as a suffix				

NOTE: When the actuator model number has "-S" as a suffix then the actuator is special and may have some differences that may not be included in this procedure.

- 1.1.2 Normal recommended service interval for this actuator series is five years.

NOTE: Storage time is counted as part of the service interval.

- 1.1.3 This procedure is applicable with the understanding that all electrical power and pneumatic pressure has been removed from the actuator.

- 1.1.4 Remove all piping and mounted accessories that will interfere with the module(s) that are to be worked on.

- 1.1.5 This procedure should only be implemented by a technically competent technician who should take care to observe good workmanship practices.

- 1.1.6 Numbers in parentheses, () indicate the bubble number (reference number) used on the Bettis Assembly Drawing and Actuator Parts List.

- 1.1.7 When removing seals from seal grooves, use a commercial seal removing tool or a small screwdriver with sharp corners rounded off.

- 1.1.8 Use a non-hardening thread sealant on all pipe threads.

CAUTION: Apply the thread sealant per the manufacture's instructions.

- 1.1.9 Bettis recommends that disassembly of the actuator should be done in a clean area on a workbench.

1.2 DEFINITIONS

- WARNING:** If not observed, user incurs a high risk of severe damage to actuator and/or fatal injury to personnel.
- CAUTION:** If not observed, user may incur damage to actuator and/or injury to personnel.
- NOTE:** Advisory and information comments provided to assist maintenance personnel to carry out maintenance procedures.
- M3:** Jackscrew or jackscrew assembly.
- ES:** Extended Stop(s)

1.3 GENERAL SAFETY INFORMATION

- 1.3.1 Products supplied by Bettis, in its "as shipped" condition, are intrinsically safe if the instructions contained within this Service Instruction are strictly adhered to and executed by well trained, equipped, prepared and competent personnel.

WARNING: For the protection of personnel working on Bettis actuators, this procedure should be reviewed and implemented for safe disassembly and reassembly. Close attention should be noted to the **WARNINGS, CAUTIONS** and **NOTES** contained in this procedure.

WARNING: This procedure should not supersede or replace any customer's plant safety or work procedures. If a conflict arises between this procedure and the customer's procedures the differences should be resolved in writing between an authorized customers representative and an authorized Bettis representative.

1.4 BETTIS REFERENCE MATERIALS

- 1.4.1 CBAXXX Assembly Drawing use part number 129738.
- 1.4.2 CBAXXX-M3HW Assembly Drawing use part number 129740.
- 1.4.3 CBBXXX Assembly Drawing use part number 152230
- 1.4.4 CBB-M3HW Assembly Drawing use part number 152608

1.5 SERVICE SUPPORT ITEMS

- 1.5.1 Bettis Service Kit.
- 1.5.2 Commercial leak testing solution.
- 1.5.3 Non-hardening thread sealant.

1.6 LUBRICATION REQUIREMENTS

1.6.1 The actuator should be re-lubricated at the beginning of each service interval using the following recommended lubricants.

NOTE: Lubricants other than those listed in steps 1.6.2 should not be used without prior written approval of Bettis Product Engineering. The lubricant item number on some assembly drawings is item (5) while the Bettis service kits lubricant item number is item number (500).

1.6.2 All temperature services (-50°F to +350°F)/(-45.5°C to 176.6°C) use Bettis ESL-5 lubricant. ESL-5 lubricant is contained in the Bettis Module Service Kit in tubes and the tubes are marked ESL-4,5 & 10 lubricant.

1.7 GENERAL TOOL INFORMATION

1.7.1 All threads on CBA/CBB series actuators are Inch Unified and NPT.

1.7.2 All tools/Hexagons are American Standard inch. Two adjustable wrenches, Allen wrench set, small standard screwdriver with sharp edges rounded off, medium size standard screwdriver, diagonal cutting pliers, external snap ring pliers, flat file, drive ratchet / deepwell socket set and torque wrench (up to 2,000 inch pounds / 226 N-m).

1.8 ACTUATOR WEIGHT

ACTUATOR MODEL CBA/CBB	APPROXIMATE WEIGHT (3)	
	LB	KG
315-SR40 (1)	22	10.0
315-SR60 (1)	23	10.4
315-SR80 (1)	26	11.8
315-SR100 (1)	25	11.4
415-SR40 (1)	27	12.2
415-SR60 (1)	29	13.2
415-SR80 (1)	30	13.6
415-SR100 (1)	31	14.1
420-SR40 (1)	37	16.8
420-SR60 (1)	39	17.7
420-SR80 (1)	40	18.1
420-SR100 (1)	41	18.6

ACTUATOR MODEL CBA/CBB	APPROXIMATE WEIGHT (3)	
	LB	KG
520-SR40 (1)	45	20.4
520-SR60 (1)	48	21.8
520-SR80 (1)	49	22.2
520-SR100 (1)	53	24.0
525-SR40 (2)	62	28.1
525-SR60 (2)	65	29.5
525-SR80 (2)	65	29.5
525-SR100 (2)	67	30.4
725-SR40 (2)	97	44.0
725-SR60 (2)	98	44.5
725-SR80 (2)	104	47.2
725-SR100 (2)	107	48.5

NOTES: (1) When model has -M3HW add 2.0 pounds / 0.9 kilograms.
(2) When model has -M3HW add 4.0 pounds / 1.8 kilograms.
(3) Weight is for bare actuator without accessories or valve adaptation.

SECTION 2 - ACTUATOR DISASSEMBLY

2.1 GENERAL DISASSEMBLY

WARNING: It is possible, that the actuator may contain a dangerous gas and/or liquids. Ensure that all proper measures have been taken to prevent exposure or release of these types of contaminants before commencing any work.

CAUTION: Pressure applied to the actuator is not to exceed the maximum operating pressure rating listed on the actuator name tag.

NOTE: Before starting the general disassembly of the actuator it is a good practice to operate actuator with the pressure used by the customer to operate the actuator during normal operation. Note and record any abnormal symptoms such as jerky or erratic operation.

2.1.1 Remove all operating pressure from actuator, allowing the spring to stroke. The spring will rotate the yoke to its fail position.

2.1.2 Record the settings of stop screw / ES / M3 jackscrew (1-70) and stop screw / ES (4-30) before they are loosened or removed.

NOTE: In place of stop screws the actuator may be equipped with one or two ES (ES = Extended Stops) or one M3/M3HW (1-70) located on outboard end of housing (1-10).

2.2 SPRING CYLINDER DISASSEMBLY

NOTE: Review Section 2 steps 2.1.1 through 2.1.2 before proceeding with spring cylinder disassembly.

CAUTION: The spring in CBA Series Spring Return Actuators are preloaded.

WARNING: Actuator must be disassembled in the following manner.

2.2.1 Remove hex nut (1-80) as follows: CBA/CBB 315 through 725 standard housing stop screw or extended stop (ES) use step 2.2.1.1. CBA/CBB 315-SR-M3/M3HW through CBA/CBB725-SR-M3/M3HW use step 2.2.1.2.

2.2.1.1 CBA/CBB 315 through 725 housing stop screw or extended stop screw (ES)

2.2.1.1.1 Loosen and remove hex nut (1-80) and washer (1-90) from stop screw (1-70) located in housing (1-10).

2.2.1.1.2 Remove stop screw (1-70) from the end of housing (1-10).

2.2.1.2 CBA/CBB420, 520, 525, 725-SR-M3 or M3HW

2.2.1.2.1 Remove retainer ring (12-30) and groove pin (12-20) from optional hex drive hub or from handwheel (12-10).

2.2.1.2.2 Remove optional hex drive hub or handwheel (12-10) from M3 jackscrew (1-70).

2.2.1.2.3 Loosen and remove hex nut (1-80) from M3 jackscrew (1-70).

NOTE: CBX420,520,525,725-SR-M3 or M3HW models: the M3 jackscrew (1-70) can not be removed now. The M3 jackscrew used in these models can be removed later in this procedure per step 2.3.7.

2.2.2 Loosen and remove hex nut (4-40) and washer (4-90) from end cap stop screw (4-30) or from end cap extended stop (4-30).

NOTE: Extended stop or end cap stop screw (4-30) does not require removal from end cap (4-20) unless replacing with a new extended stop or stop screw.

2.2.3 Remove breather (30) from end cap (4-20).

2.2.4 Remove acorn nut (8-20) and gasket seal (5-50) from end cap (4-20).

2.2.5 Use a ratchet and socket on the welded nut, located on the housing end of center bar assembly (8-10), rotate center bar assembly (8-10) counter-clockwise (CCW). This will cause end cap (4-20) to gradually unscrew from center bar assembly (8-10).

NOTE: The end cap (4-20) can be held in position by holding the end cap (4-20) with an adjustable wrench.

2.2.6 Continue to rotate center bar assembly (8-10) counter-clockwise (CCW) until the spring preload is eliminated. As preload is reduced it may be necessary to keep end cap (4-20) from turning.

2.2.7 After the spring preload is eliminated, unscrew and remove end cap (4-20) from center bar assembly (8-10).

2.2.8 Remove spring (4-70) from within spring cylinder (4-10).

2.2.9 Hold torque shaft (1-30) and pull spring cylinder (4-10) away from housing (1-10); slide spring cylinder over piston (4-50) and remove.

2.2.10 Remove spacer (1-110) from center bar assembly (8-10).

2.2.11 Pull piston (4-50) out of housing (1-10) and carefully slide piston off of center bar assembly (8-10).

NOTE: Piston (4-50) is an assembly made up of one roll pin and one yoke pin; do not attempt to disassemble the piston assembly.

2.2.12 On models CBA/CBB415-SR, CBA/CBB520-SR, and CBA/CBB725-SR remove cylinder adapter (4-15).

2.3 HOUSING DISASSEMBLY

2.3.1 Remove center bar assembly (8-10) from housing (1-10).

2.3.2 Remove both retaining rings (1-60) from torque shaft (1-30). On the CBB, remove washers (1-65) from housing.

2.3.3 The following steps may be required before disassembly can continue.

2.3.3.1 If torque shaft (1-30) has any raised burrs or sharp edges they should be removed.

NOTE: When removing burrs and sharp edges, remove as little metal as possible.

2.3.3.2 If there is excessive paint build-up on torque shaft (1-30) it should be removed. On CBB models, this paint must be removed in order to remove the washers

2.3.4 Remove the torque shaft (1-30) by pushing it out one side of housing (1-10).

2.3.5 Remove yoke key (1-40) and yoke key spring (1-50) from torque shaft (1-30).

2.3.6 Remove yoke (1-20) from housing (1-10).

2.3.7 Actuator models CBA/CBB315-SR with a M3 or M3HW mounted in the outboard end of housing (1-10) remove M3 jackscrew (1-70) from housing (1-10). NOTE: The M3 jackscrew (1-70) will be removed from the inside of housing (1-10).

2.3.8 Actuator models CBA/CBB420, 520, 525, 725 with a M3 or M3HW mounted in the outboard end of housing (1-10) complete steps 2.3.8.1 and 2.3.8.2.

2.3.8.1 Remove retainer ring (2-40) from M3 adapter (1-90).

2.3.8.2 Remove M3 adapter (1-90) from housing (1-10). NOTE: The M3 adapter will be removed from the inside of housing (1-10) with the M3 jackscrew.

SECTION 3 - ACTUATOR REASSEMBLY

3.1 GENERAL REASSEMBLY

CAUTION: Only new seals, that are still within the seals expectant shelf life, should be install into actuator being refurbished.

3.1.1 Remove and discard all old seals and gaskets.

3.1.2 All parts should be cleaned to remove all dirt and other foreign material prior to inspection.

3.1.3 All parts should be thoroughly inspected for excessive wear, stress cracking, galling and pitting. Attention should be directed to threads, sealing surfaces and areas that will be subjected to sliding or rotating motion. Sealing surfaces of the cylinder, torque shaft and center bar assembly must be free of deep scratches, pitting, corrosion and blistering or flaking coating. On the CBB models, there are two O-Rings on the torque shaft and two extra O-Rings beneath the washers on the housing. These items **MUST** be replaced upon re-assembly

NOTE: Prior to installing new seals: Fit the torque shaft snap ring groove with installation rings that come with the CBA service kits. These rings help guide the torque-shaft through the housing and seals which will prevent seal damage. First, take out both old seals, then install the rings onto the shaft, and then install seals in housing. Once this is done, remove install rings and proceed. See CBA LCD PAK installation instructions, Part Number 153955, for details.

NOTE: Coat torque shaft LCD PAK seals (2-20) with lubricant and install in one of the grooves located in the torque shaft bore of the housing (1-10). **NOTE:** The cup/lip of torque shaft seal will be installed facing inward into the housing. For the CBB, coat the torque-shaft O-Ring (2-25) with grease upon installation.

NOTE: The following steps used to reassemble the following models: CBA/CBB315,420,520,525 and 725. Use assembly drawing part numbers 129738 and 152230 for this section.

CAUTION: Actuator parts that reflect any of the above listed characteristics may need replacement with new parts.

3.1.4 **INSTALLATION LUBRICATION INSTRUCTIONS:** Use the correct lubrication as defined in Section 1 step 1.6.

3.1.4.1 Before installation coat all moving parts with lubricant.

3.1.4.2 Coat all seals with lubricant, before installing into seal grooves.

3.2 HOUSING REASSEMBLY

NOTE: In section 3.2 where the step indicates to "lubricate, coat or apply lubricant", use lubricant as identified in Section 1 step 1.6 for lubricating the part being installed.

NOTE: Review Section 3 steps 3.1.1 through 3.1.4 before proceeding with housing reassembly.

NOTE: Housing M3 jackscrew (1-70) installation: Use steps 3.2.1 for CBA315/415-SR-M3 and steps 3.2.2 for CBA/CBB420/520/525/725-SR-M3 includes M3HW models.

3.2.1 M3 JACKSCREW INSTALLATION FOR CBA315/415-SR-M3.

3.2.1.1 Apply a light coating of lubricant to the threads of M3 jackscrew (1-70).

NOTE: M3 jackscrew (1-70) will be installed from the inside of housing (1-10).

3.2.1.2 Insert and rotate M3 jackscrew (1-70) into housing (1-10). NOTE: Rotate the M3 jackscrew into the housing until the inboard end of the M3 jackscrew is up against the inside of housing (1-10).

3.2.1.3 Install O-ring seal (2-30) onto M3 jackscrew (1-70) until it is flush with the housing.

3.2.1.4 Install hex nut (1-80) onto M3 jackscrew (1-70) until hand tight.

3.2.2 M3 JACKSCREW INSTALLATION FOR CBA/CBB420/520/525/725-SR-M3.

3.2.2.1 Apply a coating of lubricant to outer diameter and inner diameter threads of M3 adapter (1-90).

3.2.2.2 Coat O-ring seal (2-45) with lubricant and install into outer diameter seal groove located in the M3 adapter (1-90).

3.2.2.3 Apply a light coating of lubricant to the threads of M3 jackscrew (1-70).

3.2.2.4 Install and rotate the M3 jackscrew (1-70) into M3 adapter (1-90). NOTE: Rotate the M3 jackscrew into the adapter until the inboard end of the jackscrew is up against the adapter.

3.2.2.5 Install M3 adapter (1-90) into housing (1-10). NOTE: The M3 adapter will be installed from the inside of housing (1-10).

3.2.2.6 Install retainer ring (2-40) onto groove in M3 adapter (1-90).

3.2.2.7 Install o-ring seal (2-30) onto M3 jackscrew (1-70). NOTE: Move the o-ring seal (2-30) down the M3 jackscrew until it is next to the M3 adapter.

3.2.2.8 Install hex nut (1-80) onto M3 jackscrew (1-70). NOTE: Rotate the hex nut down the M3 jackscrew until it is next to the M3 adapter.

3.2.3 Apply a coating of lubricant to the torque shaft holes located on each side of housing (1-10).

3.2.4 Coat torque shaft wiper seals (2-20) with lubricant and install in one of the grooves located in the torque shaft bore of the housing (1-10). NOTE: The cup of torque shaft wiper seal will be installed facing down into the housing.

3.2.5 Coat yoke (1-20) with lubricant and install into housing (1-10). Apply a generous amount of lubricant to the slots in the arms of yoke (1-20).

3.2.6 Insert the yoke key spring (1-50), with the ends pointing down, into the slot in the torque shaft (1-30) and place the yoke key (1-40) on top of the spring with the tapered side outward.

WARNING: If the yoke key (1-40) is installed incorrectly the housing may be damaged when next disassembly occurs. Refer to assembly drawing for correct yoke key spring and yoke key orientation.

3.2.7 Hold the yoke key (1-40) down with your thumb; insert the torque shaft (1-30) by gently rotating it into the housing (1-10) and yoke (1-20) on the opposite side of the installed torque shaft wiper seal (2-20) (NOTE: Torque Shaft should be installed with key rotated 180 degrees opposite yoke key slot). When the torque shaft (1-30) is flush with the housing (1-10) push the torque shaft (1-30) through until the empty seal groove is exposed. Install the other torque shaft wiper seal (2-20) into the groove NOTE: The cup of the torque shaft wiper seal again needs to be installed facing inward into the housing.

NOTE: Two new retaining rings (1-60) are contained in the Bettis CBA Service Kits.

3.2.8 Install one of the new retaining rings (1-60) onto the exposed end of the torque shaft, making certain it is properly seated in the groove of the torque shaft (1-30). Gently push and rotate the torque shaft (1-30) until the retaining ring (1-60) is pressed against the housing (1-10). Install the other retaining ring (1-60) to the other side of the torque shaft (1-30).

CAUTION: Rotate the torque shaft until the yoke key snaps into the yoke keyway.

3.2.9 Rotate the torque shaft (1-30) so that the arms of yoke (1-20) point outward.

3.2.10 Coat O-ring seal (5-20) with lubricant and install into inner diameter seal groove located in the center bar hole of housing (1-10).

3.2.11 Coat entire length of center bar (8-10) with lubricant including the threads.

3.2.12 Insert center bar assembly (8-10) into the center hole of housing (1-10). Slide center bar assembly through housing until center bar assembly nut is flush against the housing (1-10).

WARNING: Care should be taken during installation of center bar assembly so as to not scratch it.

3.2.13 Re-coat center bar assembly (8-10) with lubricant.

3.2.14 Coat one o-ring seal (5-10) with lubricant and install onto outer diameter flange located on housing adapter end of housing (1-10).

3.2.15 Actuators equipped with cylinder adapter (4-15), models CBA/CBB415-SR, CBA/CBB520-SR and CBA/CBB725-SR, do steps 3.2.15.1 and 3.2.15.2.

3.2.15.1 Install cylinder adapter (4-15) onto housing flange, with the stepped outer diameter, of cylinder adapter (4-15), facing away from housing (1-10).

3.2.15.2 Install one o-seal (5-15) onto stepped diameter of cylinder adapter (4-15).

3.3 SPRING CYLINDER REASSEMBLY

3.3.1 Coat piston (4-50) outer diameter seal groove, inner diameter seal groove, head of piston and exposed ends of yoke pin with lubricant.

- 3.3.2 Coat o-ring seal (5-20) with lubricant and install in the internal seal groove in the head of piston (4-50).
 - 3.3.3 Coat seal (5-40) with lubricant and install into outer diameter seal groove of piston (4-50). The piston seal will fit very loosely in the outer diameter seal groove.
 - 3.3.4 Install bushing (1-100) between the two arms of yoke (1-20).
 - 3.3.5 With the piston head facing away from housing (1-10) and with yoke pin up, install piston (4-50) onto center bar assembly (8-10).
 - 3.3.6 Carefully slide piston (4-50) along center bar (8-10) until yoke pin engages the yoke slots.
- NOTE: While holding the center bar assembly flush against the housing, push piston (4-50) into housing (1-10) as far as the piston will go.
- 3.3.7 Apply a coating of lubricant to entire bore of spring cylinder (4-10).
 - 3.3.8 Spring cylinder installation:
 - 3.3.8.1 For CBA/CBB415-SR, CBA/CBB520-SR and CBA/CBB725-SR models install the lubricated spring cylinder (4-10) over the piston and up-against the o-ring seal on the stepped diameter flange of cylinder adapter (4-15).
 - 3.3.8.2 For CBA/CBB315-SR, CBA/CBB420-SR and CBA/CBB525-SR models install the lubricated spring cylinder (4-10) over the piston and up-against the o-ring seal on the flange of housing (1-10).
 - 3.3.9 Install spacer (1-110) onto center bar assembly (8-10).
 - 3.3.10 Apply a coat of lubricant to the spring (4-70). Install the spring into the spring cylinder by carefully sliding the spring into the open spring cylinder end until the spring contacts the head of piston (4-50).
 - 3.3.11 End cap seal installation.
 - 3.3.11.1 For CBA/CBB415-SR, CBA/CBB520-SR and CBA/CBB725-SR models install o-ring seal (5-15) onto end cap (4-20).
 - 3.3.11.2 For CBA/CBB315-SR, CBA420-SR and CBA525-SR models install O-ring seal (5-10) onto end cap (4-20).
 - 3.3.12 If removed install stop screw / ES (4-30) into end cap (4-20) and set stop screw to the approximated setting recorded in Section 2 step 2.1.2.
- NOTE: Position spring cylinder (4-10) so that spring tag (4-60) will be adjacent to accessory mounting pads located on the actuator housing.
- 3.3.13 Install end cap (4-20) onto center bar assembly (8-10) by rotating the end cap in a clockwise direction.
 - 3.3.14 Position the end cap (4-20) so that the breather port is at the bottom and the stop screw / ES (4-30) is at the top.

WARNING: Do not allow end cap (4-20) to rotate during center bar assembly tightening. The end cap must maintain the position as described in step 3.3.14.

- 3.3.15 Keep end cap (4-20) from turning by holding end cap with an adjustable wrench.
- 3.3.16 Using a ratchet and socket on the center bar assembly nut, rotate center bar assembly clockwise (CW). This will cause end cap (4-20) to gradually screw further onto center bar assembly (8-10).
- 3.3.17 Continue to rotate center bar assembly (8-10) clockwise until spring (4-70) is fully compressed, the spring cylinder is seated against the flange of housing (1-10) or adapter (4-15) and end cap (4-20) is properly seated in spring cylinder (4-10).
- 3.3.18 Tighten center bar assembly (8-10) to the proper torque as specified in the following chart.

ACTUATOR MODEL CBA/CBB	MAXIMUM TORQUE	
	FT. LBS.	N-m
315-SR and 415-SR	55	75
420-SR and 520-SR	100	136
525-SR and 725-SR	130	176

- 3.3.19 Place seal gasket (5-50) on the exposed end of the center bar assembly (8-10).
- 3.3.20 Place acorn nut (8-20) on the exposed outboard end of center bar assembly (8-10) and tighten securely.
- 3.3.21 Install the stop screw / ES / M3 jackscrew (1-70) for CBA/CBB315/415-SR-M3 and non M3 model actuators as follows:
- 3.3.21.1 Install stop screw / ES / M3 jackscrew (1-70) into housing (1-10) and screw in until stop screw contacts the piston.
- 3.3.21.2 Install o-ring seal (2-30) onto stop screw / ES / M3 jackscrew (1-70) until it is flush with the housing.
- 3.3.21.3 Install hex nut (1-80) onto stop screw (1-70) until hand tight.
- 3.3.22 Install o-ring seal (5-30) onto the stop screw / ES (4-30) until it is flush with the end cap.
- 3.3.23 Install new washer (4-90) onto the stop screw / ES (4-30) until it is close to the end cap
- 3.3.24 Install hex nut (4-40) onto stop screw / ES (4-30) until hand tight.
- 3.3.25 Adjust stop screw / ES / M3 jackscrew (1-70) and stop screw / ES (4-30) back to setting recorded in Section 2 step 2.1.2 under General Disassembly. Tighten both stop screw hex nuts (4-40) and (1-80) securely, while holding stop screw (1-70) and (4-30).
- 3.3.26 M3 hex drive hub or handwheel installation as follows:
- 3.3.26.1 Install hex drive hub (12-10) or handwheel (12-10) onto M3 jackscrew (1-70) and align the "hole" of the drive hub with the "hole" located in the M3 jackscrew.

3.3.26.2 Install retainer ring (12-30) and groove pin (12-20) into the hex drive hub (12-10) or handwheel (12-10).

SECTION 4 - ACTUATOR TESTING

4.1 ACTUATOR TESTING

- 4.1.1 **Leak Test - General** - A small amount of leakage may be tolerated. Generally, a small bubble which breaks about three seconds after starting to form is considered acceptable.
- 4.1.2 All areas, where leakage to atmosphere may occur, are to be checked using a commercial leak testing solution.

WARNING: Pressure is not to exceed the maximum operating pressure rating listed on the serial number tag (20).

- 4.1.3 All leak testing will use the customer normal operating pressure or the actuator name tag normal operating pressure (NOP). NOTE: When testing the actuator use a proper adjusted regulator to apply pressure to the actuator.
- 4.1.4 Before testing for leaks, apply and release the pressure listed in step 4.1.3 to the housing side of the piston. Repeat this cycle approximately five times. This will allow the new seals to seek their service condition.
- 4.1.5 Apply the pressure listed in step 4.1.3 to the housing side of the piston and allow the actuator to stabilize.
- 4.1.6 Apply a leak testing solution to the following areas:
 - 4.1.6.1 Spring cylinder to housing joint on CBA/CBB315-SR, CBA/CBB420-SR, and CBA/CBB525-SR or spring cylinder to cylinder adapter to housing joints on CBA/CBB415-SR, CBA/CBB520-SR, and CBA/CBB725-SR actuators.
 - 4.1.6.2 On the out board end of housing (1-10) at the center bar assembly nut. Checks the center bar to housing o-ring seal (5-20).
 - 4.1.6.3 Housing stop screw O-ring seal (2-30).
 - 4.1.6.4 Torque shaft (1-30) to housing (1-10) interface. Check rod wiper seals (2-20).
 - 4.1.6.5 End cap (4-20) port hole. Check the piston to cylinder seal (5-40) and piston to center bar seal (5-20).
 - 4.1.6.6 Remove pressure from pressure inlet port in the housing (1-10).
- 4.1.7 If an actuator was disassembled and repaired as a result of this procedure, the above leakage test must be performed again.

4.1.8 Operational (Functional) Test: This test is used to verify proper function of the actuator.

NOTE: This test is to be done off of the valve or when valve stem is not coupled to the actuator torque shaft.

4.1.8.1 Adjust the pressure regulator to the pressure rating that the customer uses to operate the actuator during normal service.

4.1.8.2 Apply the above pressure to the actuator and allow the actuator to stabilize. The actuator should stroke a full 90° travel with the stops properly set.

4.2 RETURN TO SERVICE

4.2.1 Install breather (30) into end cap (4-20).

4.2.2 After the actuator is installed back on the valve all accessories should be hooked up and tested for proper operation and replaced, if found defective.

4.3 PRESSURE REQUIREMENT & LIMITATIONS FOR CBA-SR ACTUATORS

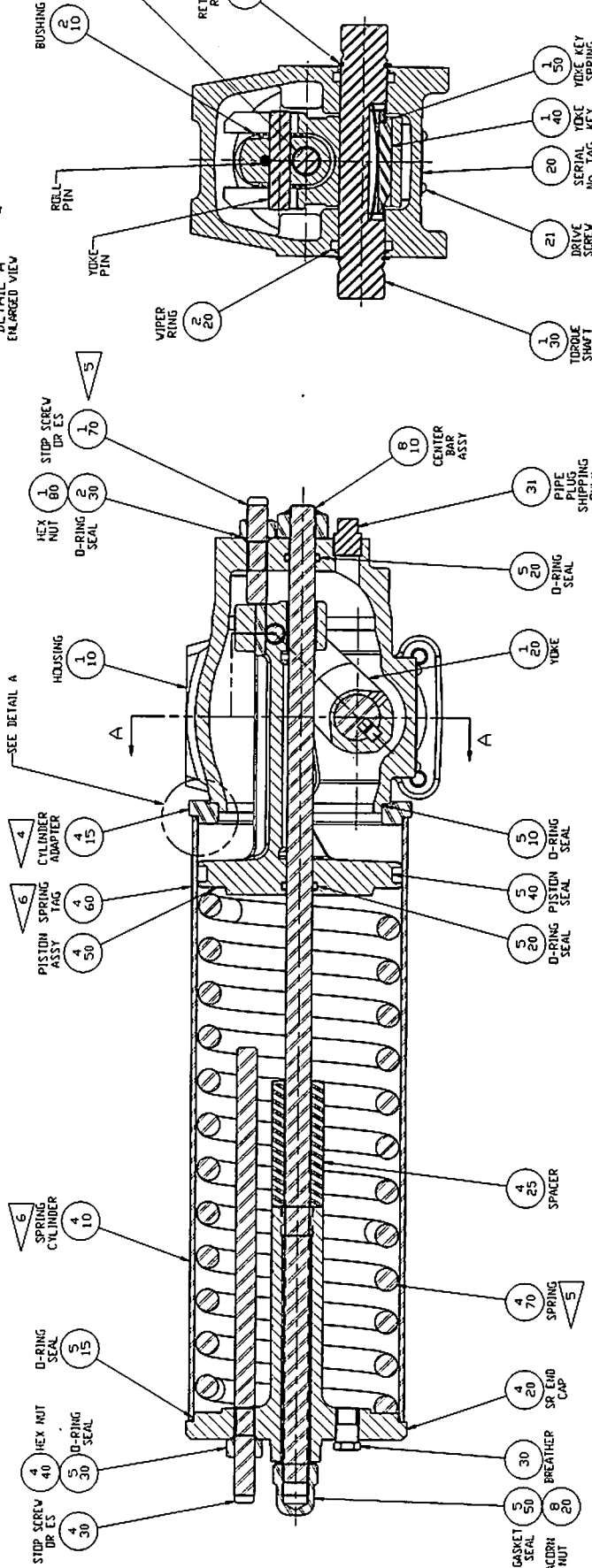
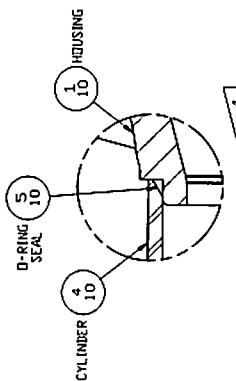
ACTUATOR MODEL CBA/CBB	NOMINAL OPERATING PRESSURE		MAXIMUM OPERATING PRESSURE	
	Psig	Barg	psig	barg
315-SR40	40	2.76	155	10.69
315-SR60	60	4.14	152	10.48
315-SR80	80	5.52	150	10.34
315-SR100	100	6.89	164	11.31
415-SR40	40	2.76	100	6.89
415-SR60	60	4.14	112	7.72
415-SR80	80	5.52	117	8.07
415-SR100	100	6.89	114	7.86
420-SR40	40	2.76	157	10.83
420-SR60	60	4.14	156	10.76
420-SR80	80	5.52	161	11.10
420-SR100	100	6.89	166	11.45

ACTUATOR MODEL CBA/CBB	NOMINAL OPERATING PRESSURE		MAXIMUM OPERATING PRESSURE	
	psig	Barg	psig	barg
520-SR40	40	2.76	110	7.59
520-SR60	60	4.14	116	8.00
520-SR80	80	5.52	120	8.27
520-SR100	100	6.89	132	9.10
525-SR40	40	2.76	146	10.07
525-SR60	60	4.14	151	10.41
525-SR80	80	5.52	159	10.96
525-SR100	100	6.89	163	11.24
725-SR40	40	2.76	102	7.03
725-SR60	60	4.14	115	7.95
725-SR80	80	5.52	124	8.55
725-SR100	100	6.89	124	8.55

ECN	DATE	REV	BY *	DATE
19527	April 2007	C	COMPILED D.Blahnik	6/30/09
40548	12 May 2009	D	CHECKED B. Jumawan	6/30/09
40677	6/30/09	E	APPROVED K.Chin	6/30/09

* Signatures on file Bettis Actuator & Controls, Waller, Texas

REVISIONS		
LTB	CON	DATE
D	1784	01/17/82



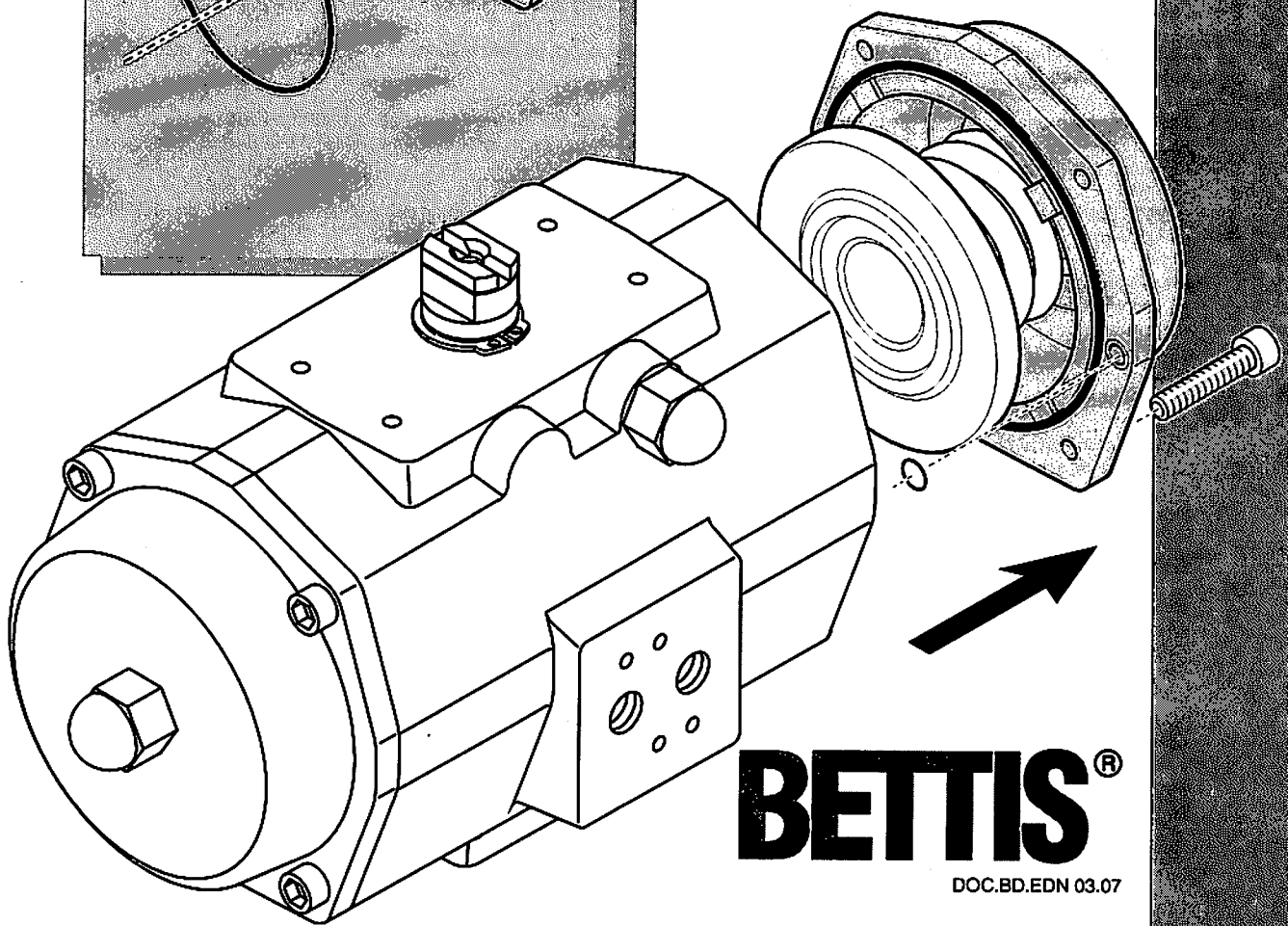
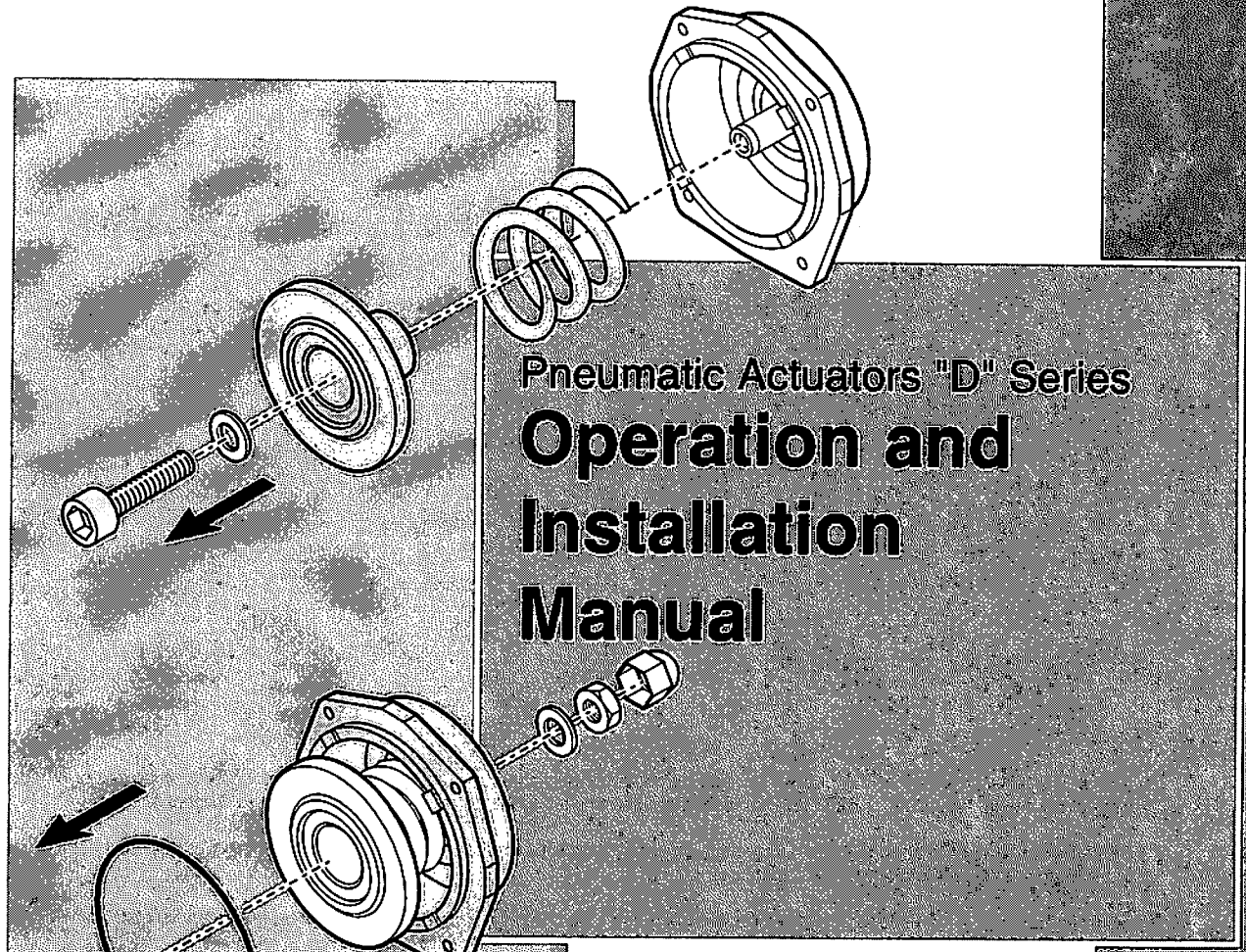
- NOTE:
- ALL PARTS SHOULD BE INSPECTED AND CAREFULLY CLEANED TO REMOVE ALL DIRT AND FOREIGN MATTER.
 - APPLY LUBRICANT (500) TO ALL COMPONENTS BEFORE ASSEMBLY.
 - INSPECT PER ES-6.
 - CYLINDER ADAPTER (4-15) NOT REQUIRED ON ALL MODELS.
 - IF EQUIPPED WITH EXTENDED STOP (ES) ITEM 1-70, FULLY RETRACT TRAVEL STOP TO INSURE SPRING (4-70) IS IN THE FULL SPRING RETURN POSITION BEFORE DISASSEMBLY.
 - LOCATE SPRING TAG (4-60) ON CENTERLINE OF CYLINDER (4-10) ADJACENT TO ACCESSORY MOUNTING PADS ON TOP OF HOUSING.

DRAWN BY		DATE		TITLE		PART NO	
1	2/12/79	1	12/24/79	CBAXXX-SRX ASSEMBLY DWG		129739	
1	1/2/80	1	12/24/79	ASSEMBLY DWG		129739	
1	1/2/80	1	12/24/79	ASSEMBLY DWG		129739	

DRAWN BY		DATE		TITLE		PART NO	
1	2/12/79	1	12/24/79	CBAXXX-SRX ASSEMBLY DWG		129739	
1	1/2/80	1	12/24/79	ASSEMBLY DWG		129739	
1	1/2/80	1	12/24/79	ASSEMBLY DWG		129739	

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1	3/4	1	1	1	1

Pneumatic Actuators "D" Series
**Operation and
Installation
Manual**



BETTIS®

DOC.BD.EDN 03.07

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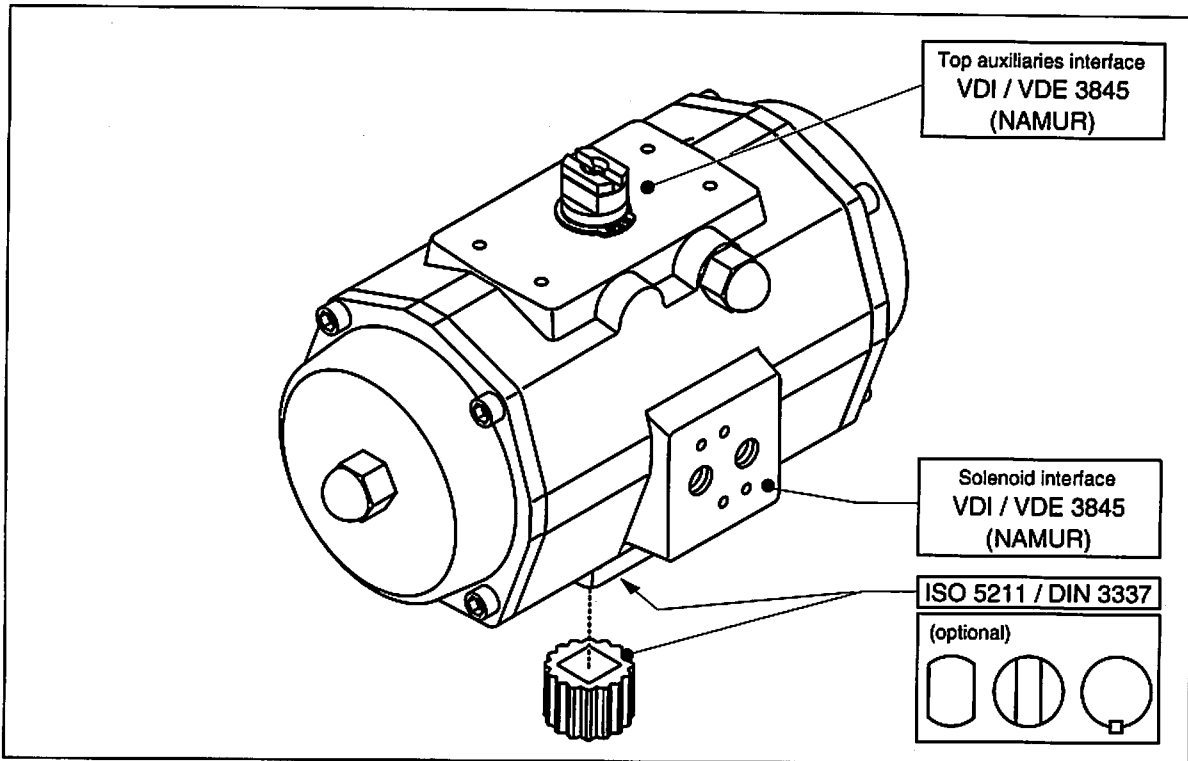
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1 INTRODUCTION / EINLEITUNG / INLEIDING

1.1 Identification / Unterscheidung / Identificatie



1.1



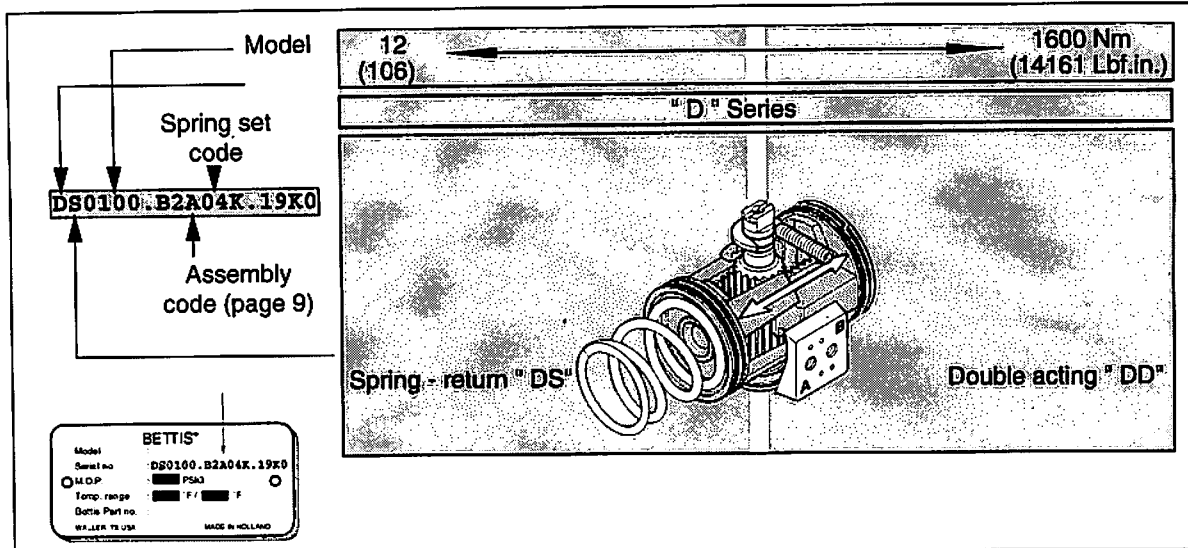
Warning! Actuator must be isolated both pneumatically and electrically before any (dis)assembly is begun. Before mounting or (dis)assembling the actuator consult the relevant sections of this manual.



Warnung! Der Antrieb muß vor jedem Ausbau sowohl pneumatisch, als elektrisch von allen Anschlüssen abgekoppelt werden. Lesen Sie vor dem Einbau oder Ausbau des Antriebs die entsprechenden Kapitel dieses Handbuchs aufmerksam durch.



Waarschuwing! Aandrijving moet zowel pneumatisch als elektrisch afgekoppeld worden, voordat met (de)monteren begonnen kan worden. Raadpleeg de desbetreffende paragrafen van deze handleiding alvorens te (de)monteren of toebehoren te bevestigen.



1.2


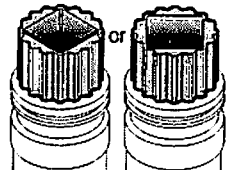
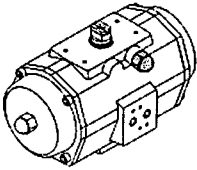
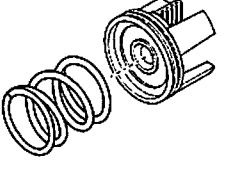
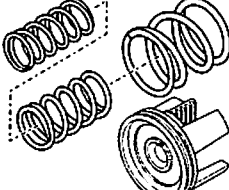
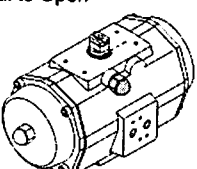
Model	- Typ	- model
Spring set code	- Federsatzcodnummer	- code verenset
Assembly code (page 9)	- Bezeichnung der Drehrichtung (s. 9)	- montagecode (pag. 9)
"D"- Series	- "D"-Serie	- "D"-serie
Spring return DS	- Federrückstellend DS	- veerretour DS
Double acting DD	- doppelwirkend DD	- dubbelwerkend DD

1.2 PRODUCT MATRIX / PRODUKT MATRIX / PRODUKT MATRIX

DS0040 . B 2 A 04 K . 14 K 0

Code Actuator action & size	_____		
DD	= D-series Double acting.		
DS	= D-series Spring return		
XXXX	= 0012, 0025, 0040, 0065, 0100, 0200, 0350, 0600, 0950, 1600.		
Code Flange / Corrosion resistance	_____		
A	= ISO/UNC thread Metric NAMUR Steel pinion		
B	= ISO/UNC thread Metric NAMUR Aluminum pinion		
Code Limitstops	_____		
0	= No limit stops (only D12)		
2	= Double Stroke adjustment		
Code Assembly code Double acting	Code Single acting	Mounting	_____
A	= B-port pressurized to close-CW Spring to close	Fail-CW	Mounted in line
B	= B-port pressurized to close-CW Spring to close	Fail-CW	Mounted across line
C	= B-port pressurized to open-CCW Spring to open	Fail-CCW	Mounted across line
D	= B-port pressurized to open-CCW Spring to open	Fail CCW	Mounted in line
Code Number of springs	_____		
00	= No springs (Double acting)		
XX	= 01, 02, 03, 04, 05 & 06 Spring set	Spring Return only	
Code Future expansion (color - actuator only)	_____		
K	= Bettis orange		
Code Insert code/Inner square (Optional)	_____		
00	= No insert applied (D 0012)	22	= square 22mm for D 0200
11	= square 11mm for D 0025	27	= square 27mm for D 0350 or D 0600
14	= square 14mm for D 0040 or D0065	36	= square 36mm for D 0950
19	= square 19mm for D 0100	46	= square 46mm for D 1600
Code Indication knob	_____		
K	= Visual indicator (knob)	D	= Visual indication Disk
N			= No visual indication
Code Temperature range	_____		
0	= Std temp. range	-20° / +80°C	(-4° / +176°F)
1	= High temp. range	-20° / +120°C	(-4° / +250°F)
2	= Low temp. range	-40° / +80°C	(-40° / +176°F)

2 CONSTRUCTION DETAILS / KONSTRUKTIVE EINZELHEITEN / CONSTRUCTIEDETAILS

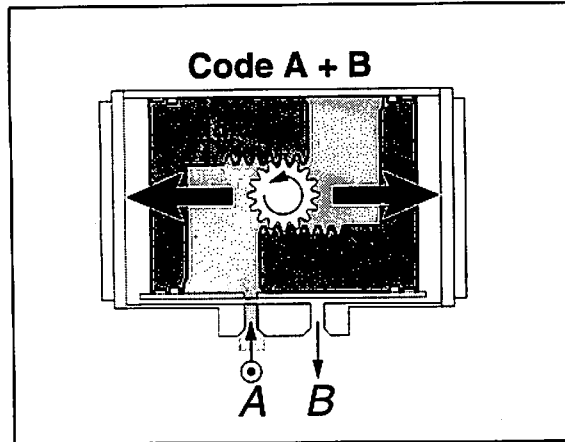
" D " SERIES			
MODEL Double acting	DD12	DD25 / DD40 / DD65 DD100 / DD200 / DD350 DD600 / DD950 / DD1600	DD25 / DD40 / DD65 DD100 / DD200 / DD350 DD600 / DD950 / DD1600
MODEL Spring return	DS12	DS25 / DS40 / DS65 DS100 / DS200 / DS350 DS600 / DS950 / DS1600	DS25 / DS40 / DS65 DS100 / DS200 / DS350 DS600 / DS950 / DS1600
Drive ISO or DIN	or 	with insert 	Fail to Close 
Spring return each piston			Fail to Open 

2.1

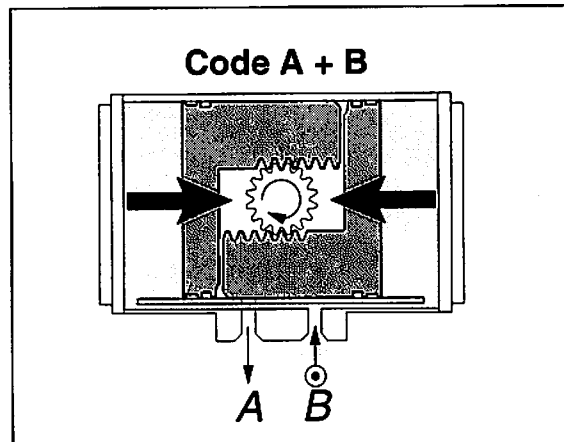
"D" Series	-	"D"-SERIE	-	"D"-serie
MODEL double acting	-	doppeltwirkender TYP	-	MODEL dubbelwerkend
MODEL spring return	-	TYP mit Federrückstellung	-	MODEL veerretour
Drive ISO or DIN	-	Antrieb gemäß ISO oder DIN	-	Aandrijving ISO of DIN
Spring return each piston	-	beideseits Federrückstellung	-	Veerset per zuiger
with insert	-	mit Insert	-	met insert
Fail to Open	-	Bei Luftausfall Öffnend	-	Bij wegvallen luchtdruk open
Fail to Close	-	Bei Luftausfall Schließend	-	Bij wegvallen luchtdruk dicht

3 PRINCIPALS OF OPERATION / LUFTANSCHLÜSSE DOPPELTWIRKEND / BEDIENING

3.1 Air connections double acting / Doppeltwirkende Luftanschlüsse / Luchtaansluitingen, dubbelwerkend



3.1.1



3.1.2

Check the assembly code before connecting air supply (see page 4). Reverse air supply in case of assembly codes C and D (see page 9).

3.1.1

Air to port A: counterclockwise / open.

3.1.2

Air to port B: clockwise / close.

Vor dem anschließen des Zufuhrluft die Aufbau code kontrollieren (siehe Seite 4).

Bei Aufbaucode C und D die Luftzufuhr verwechseln (siehe Seite 9).

3.1.1

Luft zufuhr zur Öffnung A: gegen den Uhrzeigersinn / offen.

3.1.2

Luft zufuhr zur Öffnung B: im Uhrzeigersinn / geschlossen.

Controleer de montagecode voor het aansluiten van de luchttoevoer (zie pagina 4). Verwissel de luchttoevoer in geval van montagecodes C en D (zie pagina 9).

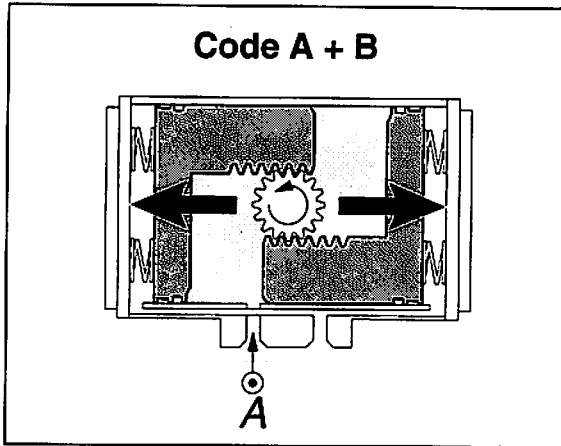
3.1.1

Lucht naar poort A: tegen de wijzers van de klok in / open

3.1.2

Lucht naar poort B: met de wijzers van de klok mee / dicht.

3.2 Air connections spring return / Luftanschlüsse mit Federrückstellung / Luchtaansluitingen, veerretour



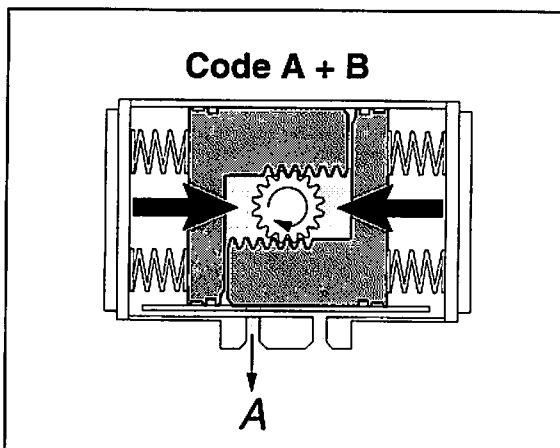
3.2.1

Check the assembly code before connecting air supply (see page 4). Reverse air supply in case of assembly codes C and D (see page 9).

3.2.1
Air to port A: counterclockwise / open.

3.2.2
Spring return: clockwise / close.

Vor dem anschließen des Zufuhrluft die Aufbau code kontrollieren (siehe Seite 4). Bei Aufbau code C und D die Luftzufuhr verwechseln (siehe Seite 9).



3.2.2

3.2.1
Luft zufuhr zur Öffnung A: gegen den Uhrzeigersinn / offen.

3.2.2
Federrückstellung: im Uhrzeigersinn / geschlossen.

Controleer de montagecode voor het aansluiten van de luchttoevoer (zie pagina 4). Verwissel de luchttoevoer in geval van montagecodes C en D (zie pagina 9).

3.2.1
Lucht naar poort A: tegen de wijzers van de klok in / open

3.2.2
Veerretour: met de wijzers van de klok mee / dicht.

3.3 Recommended tubing sizes / Empfohlene Rohrabmessungen /
Aanbevolen buisafmetingen

Actuator Model no.	Runs up to 1.2 mtr / 4ft	Runs over 1.2 mtr. / 4ft
Antriebstyp	Bis 1,20 m / 4ft	Über 1,20 m / 4ft
Aandrijving modelnr.	Tot 1,2 m / 4ft	Meer dan 1,2 m / 4ft
D-12, 25, 40, 65	6 mm ~ 1/4"	6 mm ~ 1/4"
D-100, 200, 350, 600, 950	6 mm ~ 1/4"	8 mm ~ 5/16"
D1600	6 mm ~ 1/4"	10 mm ~ 3/8"

3.4 Air consumption per stroke at atmospheric pressure /
Luftverbrauch pro Hub bei Atmosphärendruck /
Luchtverbruik per slag bij atmosferische druk

at 1 atm (litres)		Model								
Air chamber	D12	D25	D40	D65	D100	D200	D350	D600	D950	D1600
A	0.05	0.1	0.16	0.33	0.35	0.8	1.8	1.9	3.2	4.2
B	0.06	0.11	0.22	0.36	0.49	1	1.9	2.5	4.2	5.4
at 1 atm (cu./in.)										
A	3.1	6.1	9.8	20	21	49	110	177	287	445
B	3.7	6.7	13.4	22	30	61	116	189	299	488

- Model
- Air chamber

- Modell
- Luft-kammer

- Model
- Luchtkamer

4 INSTALLATION / AUFBAU / INSTALLATIE

4.1 ASSEMBLY CODES / AUFBAUCODE / MONTAGECODES

Spring to Close

Warning
Assembly code conversion requires a conversion kit

Warnung
Zur Aufbau-code umbau soll ein Umbausatz verwendet werden.

Waarschuwing
Om een andere montage code te bouwen in een conversie kit nodig

X= Shaft Welle As	Y= Piston Kolben Zuiger	Z= Valve Armatur Afsluiter
Standard	Standard	Closed
+90°	Standard	Closed

4.1 Spring to close (rotation CW, topview) / Schließfeder (Drehung im Uhrzeigersinn, Obenansicht) / Veersluitend (rotatie met de wijzers van de klok mee, bovenaanzicht)

Spring to Open

Warning
Assembly code conversion requires a conversion kit

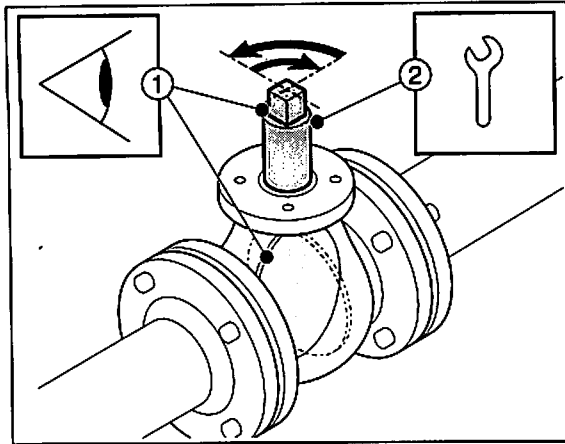
Warnung
Zur Aufbau-code umbau soll ein Umbausatz verwendet werden.

Waarschuwing
Om een andere montage code te bouwen in een conversie kit nodig

X=	Y=	Z=
Standard	+180	Open
+90	+180	Open
Shaft rotation	Wellen verdrehung	As verdraaiing
1 = Pressure on A-port 2 = Pressure on B-port / Springstroke	1 = A-Kammer belufter / Federhub 2 = B-Kammer belufter / Federhub	1 = Druk op A-poort 2 = Druk op B-poort / Veerslag

4.2 Spring to open (rotation CCW) / Federkraftöffnend (Drehung gegen den Uhrzeigersinn) / Veeropenend (rotatie tegen de wijzers van de klok in)

4.1.1 Valve installation / Armaturenaufbau / Afsluiterinstallatie



4.1.1

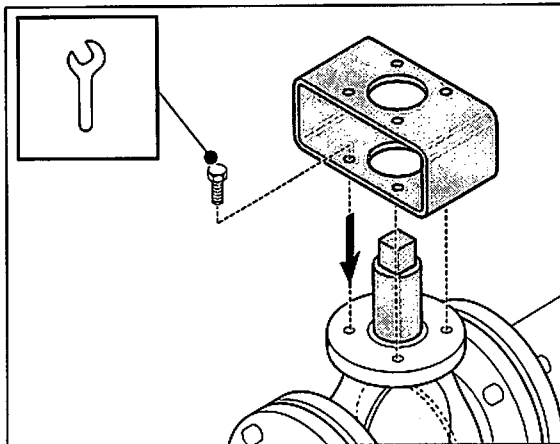
4.1.1

Remove handle nut, handle, lockwasher, etc. from valve if required.



Warning! Actuator must be isolated both pneumatically and electrically before any (dis)assembly is begun. Before mounting or (dis)assembling the actuator consult the relevant sections of this manual.

Caution! When mounting do not hit with hammer on shafttop.



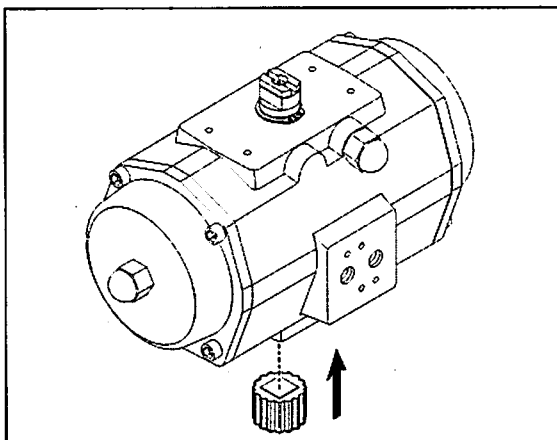
4.1.2

Mutter der Handbetätigung, Handbetätigung, Sicherungsscheibe usw., falls erforderlich, von der Armatur entfernen.



Warnung! Der Antrieb muß vor jedem Ausbau sowohl pneumatisch, als elektrisch von allen Anschlüssen abgekoppelt werden. Lesen Sie vor dem Einbau oder Ausbau des Antriebs die entsprechenden Kapitel dieses Handbuchs aufmerksam durch.

Achtung! Bei Montage nicht mit Hammer auf Wellenspitze schlagen.



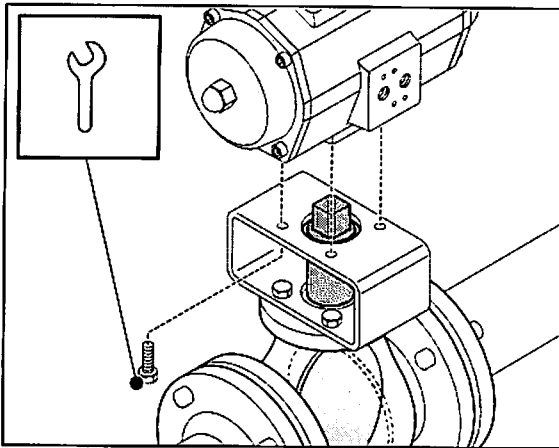
4.1.3

Verwijder indien nodig hendelmoer, hendel, veerring etc. van de afsluiter.

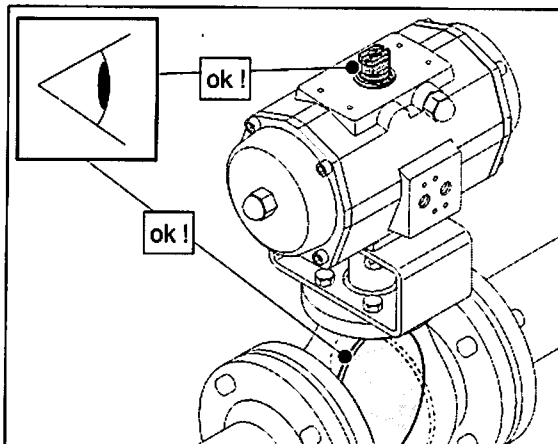


Waarschuwing! Aandrijving moet zowel pneumatisch als elektrisch afgekoppeld worden, voordat met (de)monteren begonnen kan worden. Raadpleeg de desbetreffende paragrafen van deze handleiding alvorens te (de)monteren of toebehoren te bevestigen.

Voorzichtig! Bij montage niet met hammer op de astop slaan.



4.1.4



4.1.5

4.1.4 / 4.1.5.



Valves are manufactured so that they operate in only one 90 degree segment. The actuator should be mounted for counterclock-wise rotation to open and clockwise to close the valve.

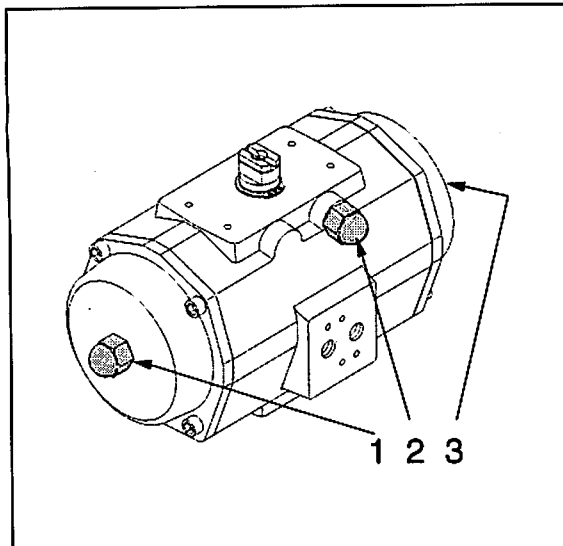


Die Armaturen sind so konstruiert, daß sie nur innerhalb eines 90°-Winkels wirksam sind. Der Antrieb sollte so montiert werden, daß eine Drehung gegen den Uhrzeigersinn die Armatur öffnet und daß eine Drehung im Uhrzeigersinn die Armatur schließt.



Afsluiters zijn zodanig geconstrueerd dat deze alleen in een segment van 90 graden werken. Bevestig de aandrijving zo dat bij rotatie tegen de wijzers van de klok in de afsluiter wordt geopend en bij rotatie met de wijzers van de klok mee de afsluiter wordt gesloten.

4.2 Stroke adjustment / Hubbegrenzung / Slagbegrenzing



4.2.1

4.2.1

To achieve stroke adjustment, there are three limit stop bolts available.

4.2.2

Maximum stroke and adjustable stroke range.

4.2.1

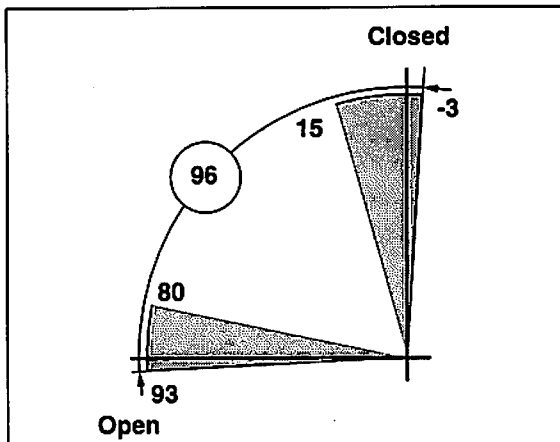
Für die Hubbegrenzung gibt es drei Hubbegrenzungsschrauben.

4.2.2

Der Bereich des maximalen Hubs und des verstellbaren Hubs.

4.2.1

Ten behoeve van de slaginstelling zijn er drie slagbegrenzingsschroeven beschikbaar.

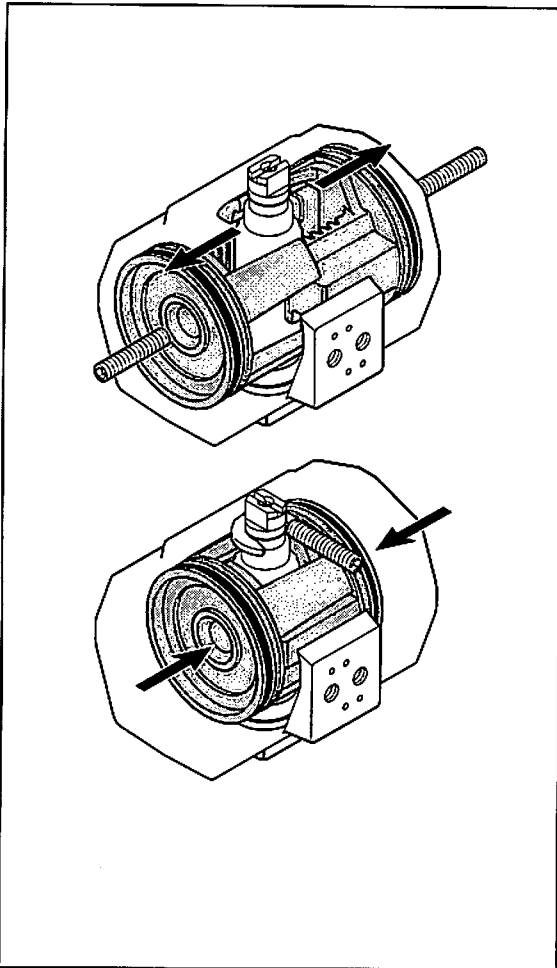


4.2.2

4.2.2

Maximale slag en het bereik van de in te stellen slag.

4.2.1 Two way stroke adjustment / Einstellen der doppelten Hubbegrenzung / Instellen van dubbelzijdige slagbegrenzing



4.2.8

The two way stroke adjustment limits the outward and the inward movement of the pistons (see fig. 4.2.8). The double acting and the single acting actuators both have limit stop bolts in the end caps to limit the outward stroke. The bolt above the air connection interface limits the inward stroke.

Procedure:

1. Mount the actuator on the valve (see chapter 4).

Die Einstellung der doppelten Hubbegrenzung begrenzt die Bewegung der Kolben beim Aus- und Einfahren (siehe Abb. 4.2.8). Die Begrenzungsschrauben für den doppelwirkenden und den einfachwirkenden Antrieb, die den Ausgangshub begrenzen, befinden sich jeweils in den Endkappen. Die Schraube über der Luftanschlusspannung begrenzt den Eingangshub.

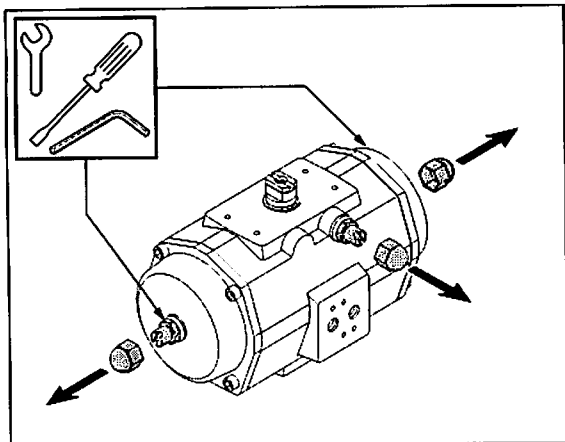
Verfahren:

1. Montieren Sie den Antrieb auf das Ventil (siehe Kapitel 4).

De dubbelzijdige slagbegrenzing begrenst de buitenwaartse en de binnenwaartse beweging van de zuigers (zie afb. 4.2.8). De dubbelwerkende en de enkelwerkende aandrijvingen hebben beiden slagbegrenzingsbouten in de deksels ter begrenzing van de buitenwaartse slag. De bout boven het luchtaansluitvlak begrenst de binnenwaartse slag.

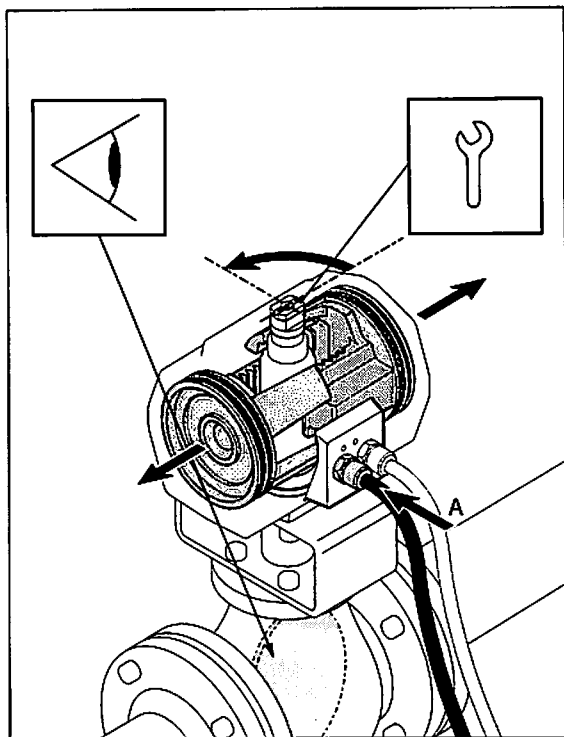
Handelwijze:

1. Bevestig de aandrijving op de afsluiter (zie hoofdstuk 4).



4.2.9

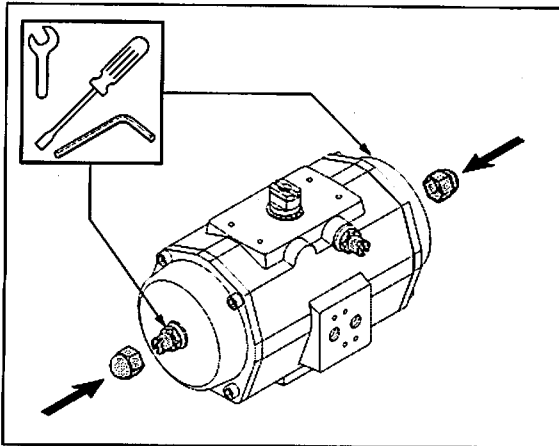
2. Remove nut covers, loosen the lock nuts and turn out the limit stop bolts 4 turns (see fig. 4.2.9).
3. Turn actuator shaft until the valve is in the desired position (see fig. 4.2.10). Use some pressure on the "A" port. Use a wrench for accurate positioning.



4.2.10

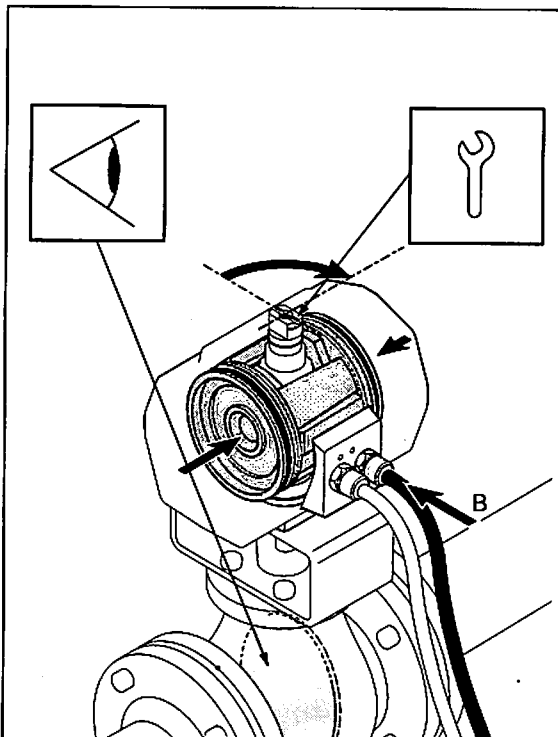
2. Entfernen Sie die Schutzkappen, lockern Sie die Verriegelungsschrauben und drehen Sie die Begrenzungsschrauben 4 Umdrehungen heraus (siehe Abb. 4.2.9).
3. Drehen Sie die Antriebswelle, bis sich das Ventil in der gewünschten Position befindet (siehe Abb. 4.2.10). Üben Sie einen gewissen Druck auf Anschluß "A" aus. Verwenden Sie zur genauen Positionierung einen Gabelschlüssel.

2. Verwijder de moerbeschermkappen, draai de borgmoeren los en draai de slagbegrenzingsbouten 4 omwentelingen naar buiten (zie afb. 4.2.9).
3. Draai de aandrijvingsas, totdat de afsluiter op de gewenste positie staat (zie afb. 4.2.10). Zet een beetje druk op de "A"-poort. Gebruik een steeksleutel voor nauwkeurige positionering.



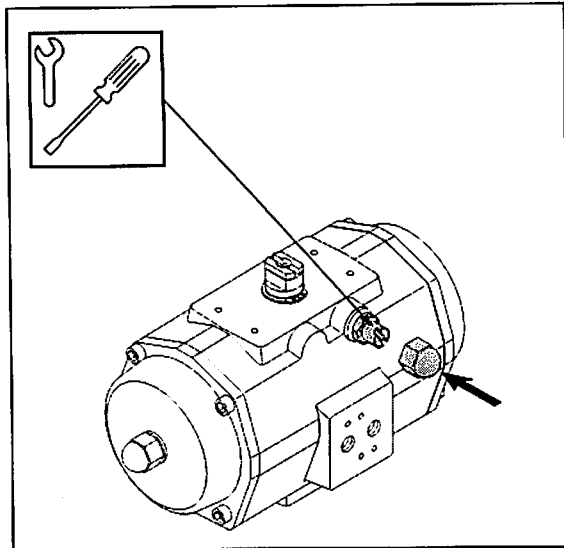
4.2.11

4. Turn in both the limit stop bolts until an obstruction is felt (do not force) and lock the lock nut and place the nut covers (see fig 4.2.11). The outward stroke is now set.
5. Turn actuator shaft until the valve is in the desired position (see fig. 4.2.12). Use some pressure on the "B" port. Use a wrench for accurate positioning.



4.2.12

4. Drehen Sie die beiden Begrenzungsschrauben hinein, bis Sie einen gewissen Widerstand verspüren (keine übermäßige Kraft aufwenden), verriegeln Sie die Sicherungsmutter und setzen Sie die Schutzkappen wieder auf (siehe Abb. 4.2.11). Jetzt ist der Ausgangshub eingestellt.
 5. Drehen Sie die Antriebswelle, bis sich das Ventil in der gewünschten Position befindet (siehe Abb. 4.2.12). Üben Sie einen gewissen Druck auf Anschluß "B" aus. Verwenden Sie zur genauen Positionierung einen Gabelschlüssel.
4. Draai de beide slagbegrenzingsbouten naar binnen, totdat u weerstand voelt (gebruik geen kracht), zet de borgmoer vast en plaats de moerbeschermkappen (zie afb. 4.2.11). De buitenwaartse slag is nu ingesteld.
 5. Draai de aandrijvingsas, totdat de afsluiter op de gewenste positie staat (zie afb. 4.2.12). Zet een beetje druk op de "B"-poort. Gebruik een steeksleutel voor nauwkeurige positionering.



4.2.13

6. Turn in the limit stop bolt until an obstruction is felt (do not force), lock the lock nut and place the nut covers (see fig 4.2.13). The inward stroke is now set.

6. Drehen Sie die Begrenzungsschraube hinein, bis Sie einen gewissen Widerstand verspüren (keine übermäßige Kraft aufwenden), verriegeln Sie die Sicherungsmutter und setzen Sie die Schutzkappe wieder auf (siehe Abb. 4.2.13). Jetzt ist der Eingangshub eingestellt.

6. Draai de slagbegrenzingsbout naar binnen, totdat u weerstand voelt (gebruik geen kracht), zet de borgmoer vast en plaats de moerbeschermkap (zie afb. 4.2.13). De binnenwaartse slag is nu ingesteld.

Tool / Werkzeughtabelle / Gereedschapstabel

Limit stop bolts (in endcaps)					
Actuator type	Nut	Bolt	Actuator type	Nut	Bolt
DD25	W 10 mm	AK 3 mm	DD600 / 950	W 24 mm	W 11 mm
DD40 / 65	W 13 mm	AK 4 mm	DD1600	W 30 mm	W 11 mm
DD100 / 200	W 17 mm	AK 5 mm			
DD350	W 19 mm	AK 6 mm			

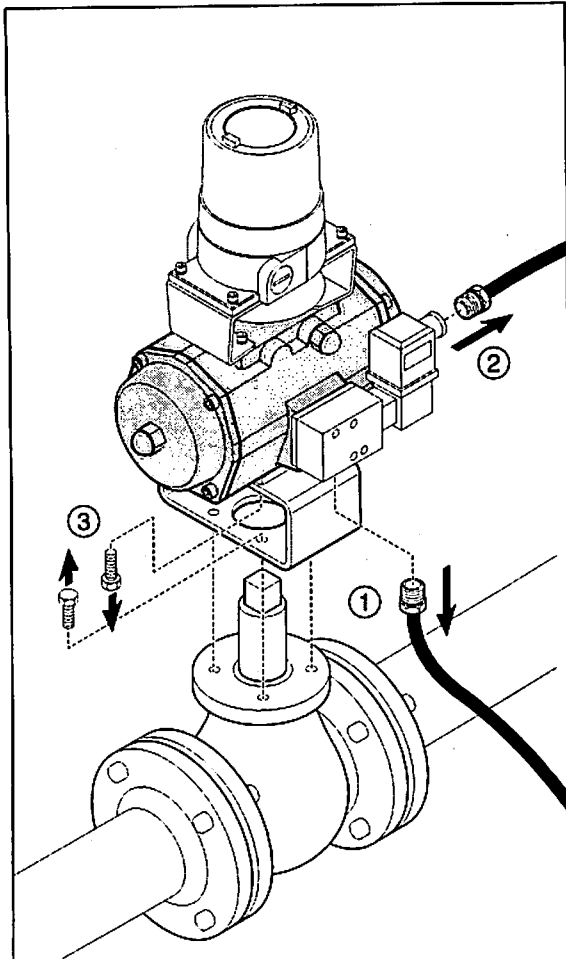
DS25 / 40	W 10 mm	SD 1.0x5.5 mm	DS600 / 950	W 24 mm	W 11 mm
DS65 / 100	W 13 mm	SD 1.0x5.5 mm	DS1600	W 30 mm	W 11 mm
DS200	W 17 mm	SD 1.2x8.0 mm			
DS350	W 19 mm	SD 1.2x8.0 mm			

Limit stop bolt (above air connection interface)					
Actuator type	Nut	Bolt	Actuator type	Nut	Bolt
D25	W 10 mm	SD 1.0x5.5 mm	D200 / 350	W 19 mm	SD 1.2x8.0 mm
D40 / 65	W 13 mm	SD 1.0x5.5 mm	D600 / 950	W 24 mm	W 11 mm
D100	W 17 mm	SD 1.2x8.0 mm	D1600	W 30 mm	W 11 mm

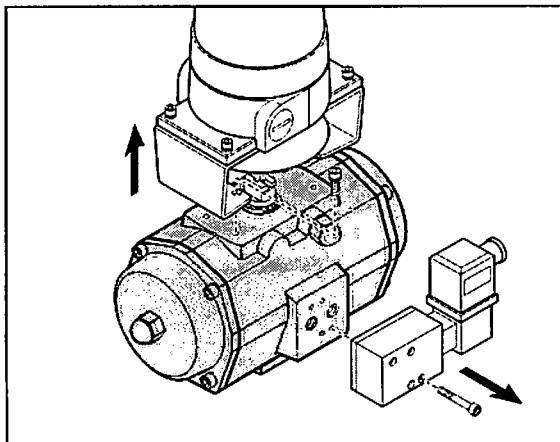
Limit stop bolt	: Hubbegrenzungsschraube	: Slagbegrenzingbout
Endcap	: Endkappe	: Deksel
Actuator type	: Antriebstyp	: Type aandrijving
Nut	: Mutter	Moer
Bolt	: Schraube	: Schroef
AK = Allen key	: AK = Innensechskantschraube	: AK = Imbus sleutel
SD = Screwdriver	: SD = Schraubendreher	: SD = Schroevendraaier
W = Wrench	: W = Schlüssel	: W = Sleutel

5 DISASSEMBLY / DEMONTAGE / DEMONTEREN

5.1 Before starting / Vor der Demontage / Alvorens te beginnen



5.1.1



5.1.2

5.1.1

Caution! Never disassemble a valve that is under pressure!



Caution! Ball valves and plug valves can trap pressurized media in the cavity. Isolate the piping system in which the actuator valve assembly is mounted and relieve any pressure on the valve.

Achtung! Niemals eine unter Druck stehende Armatur demonstrieren!



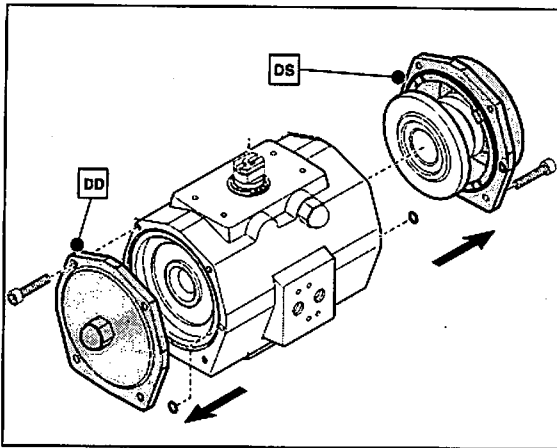
Achtung! Kugel- und Kükenhähne können das Druckmedium in der Kammer einschließen. Das Rohr system, in das das Stellglied eingebaut ist, ist drucklos zu machen, um den an der Armatur anliegenden Restdruck zu entspannen.

Voorzichtig! Demonteer nooit een afsluiter die onder druk staat!



Voorzichtig! Kogelafsluiters en plugafsluiters kunnen drukmedia in de kamer vasthouden. Isoleer het buizensysteem, waarin de aandrijving en afsluiter zijn gemonteerd, en haal de druk van de afsluiter.

5.2 Removing endcaps type DS/DD 25 to 350 / Endkappen Typ DS/DD 25 bis 350
ausbauen / Deksel verwijderen type DS/DD 25 tot 350



5.2.1

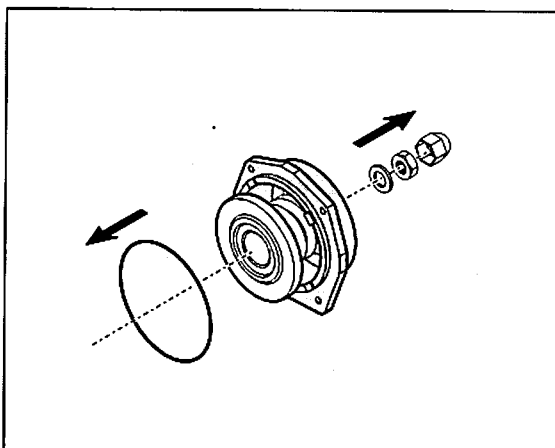
5.2.1/5.2.2/5.2.3

Be careful not to damage the endcap O-rings.



Caution! If the actuator is a "spring return" model, uniformly loosen all endcaps screws, two to three turns at a time, in sequence, to relieve pre-load of the springs. On all actuators with springs use caution when removing endcaps.

Beim Ausbauen darauf achten, daß die O-Ringe der Endkappen nicht beschädigt werden.

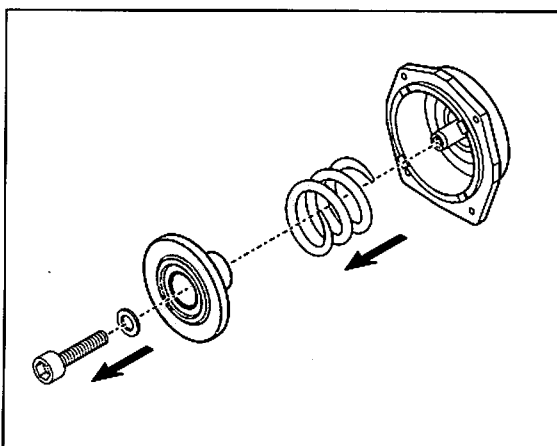


5.2.2



Achtung! Wenn es sich beim Antrieb um ein Typ mit Feder-rückstellung handelt, alle Endkappenschrauben gleichmäßig lösen. Jeweils immer nur zwei bis drei Schraubendrehungen gleichzeitig und nacheinander, um die Vorspannung der Federn zu senken.

Seien Sie bei federrückstellenden Antrieben während der Demontage der Endkappen besonders vorsichtig.



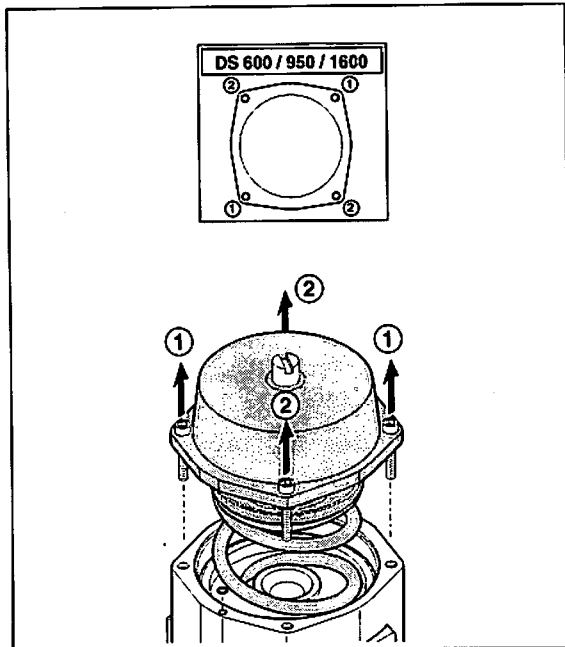
5.2.3

Let erop dat u de O-ringen van de sluitkap niet beschadigt.

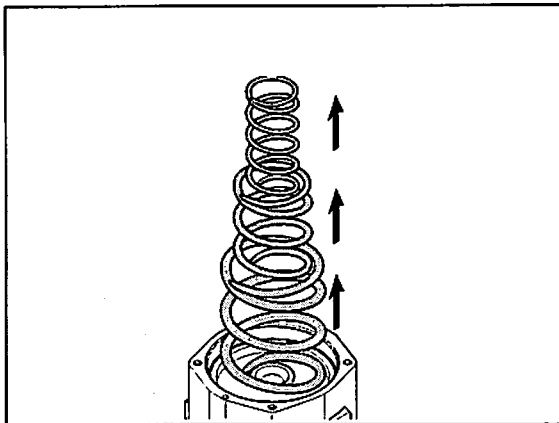


Voorzichtig! Als de aandrijving een "veerretour"-model is: draai alle schroeven van de deksels gelijkmatig los, twee tot drie slagen per keer en kruislings, om de voorspanning van de veren af te halen. Wees bij alle aandrijvingen met veren voorzichtig bij het verwijderen van deksels.

5.3 Removing endcaps type DS 600 to 1600 / Endkappen Typ DS 600 bis 1600 ausbauen / Deksel verwijderen type DS 600 tot 1600



5.3.1



5.3.2

5.3.1 / 5.3.2



Caution! If the actuator is a "spring return" model, first loosen screws 1, then uniformly loosen all endcap screws 2, two to three turns at a time, in sequence, to relieve pre-load of the springs. On all actuators with springs use caution when removing endcaps.

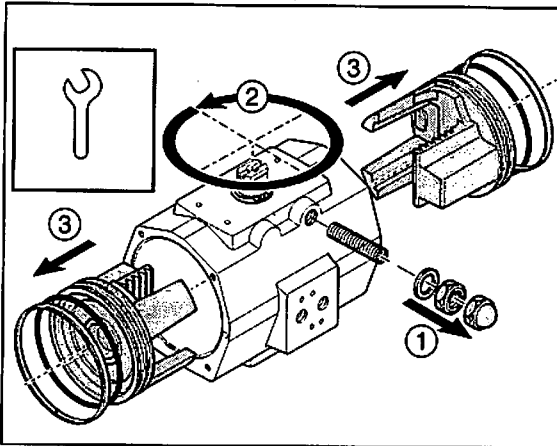


Achtung! Wenn es sich beim Antrieb um ein Typ mit Feder-rückstellung handelt, zuerst die Schrauben mit der Nummer 1 lösen, danach gleichmäßig alle Endkappenschrauben mit der Nummer 2 lösen. Dabei jeweils immer nur zwei bis drei Schraubendrehungen gleichzeitig und nacheinander, um die Vorspannung der Federn zu senken. Seien Sie bei federrückstellenden Antrieben während der Demontage der Endkappen besonders vorsichtig.




Voorzichtig! Als de aandrijving een "veerretour"-model is: draai eerst schroeven 1 los, draai vervolgens alle schroeven 2 van de deksels gelijkmatig los, twee tot drie slagen per keer en kruislings, om de voorspanning van de veren af te halen. Wees bij alle aandrijvingen met veren voorzichtig bij het verwijderen van deksels.


5.4 Removing pistons and spindle / Kolben und Wellen ausbauen / Zuigers en spindel verwijderen




5.4.1

5.4.1

 The two pistons can now be removed by rotating the actuator shaft.

 Die beiden Kolben werden nun durch Drehen der Antriebswelle ausgebaut.

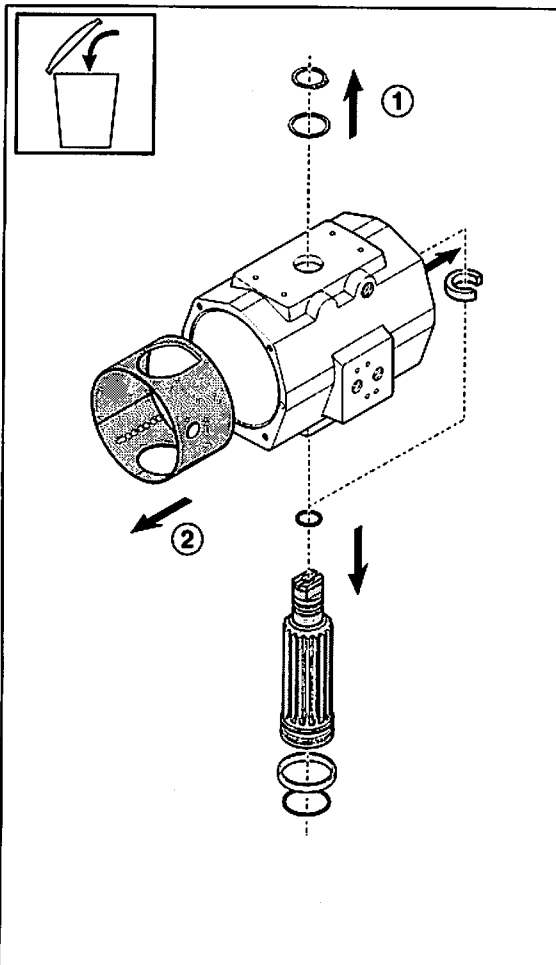
 De twee zuigers kunnen nu verwijderd worden door de as van de stelaandrijving te draaien.

5.4.2

Remove the DSA-cam through the bore of the housing. Then take out the shaft.

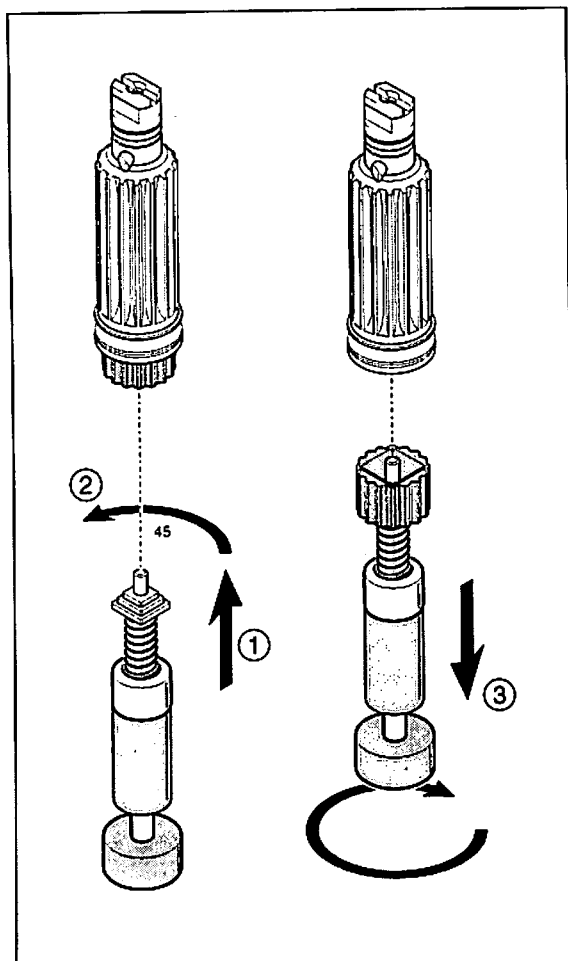
Zuerst den DSA-Nocken entfernen durch die Bohrung des Gehäuses. Dann die Welle ausnehmen.

Eerst de DSA-nok verwijderen door de boring van het huis. Dan de as verwijderen.



5.4.2

5.5 Removing insert / Insert ausbauen / Insert verwijderen



5.5.1

5.5.1



Insert removal requires the use of the extractor part No. 590.00.001 for square sizes 11, 14 and 17. Part No 590.00.002 is used for square sizes 19, 22 and 27.



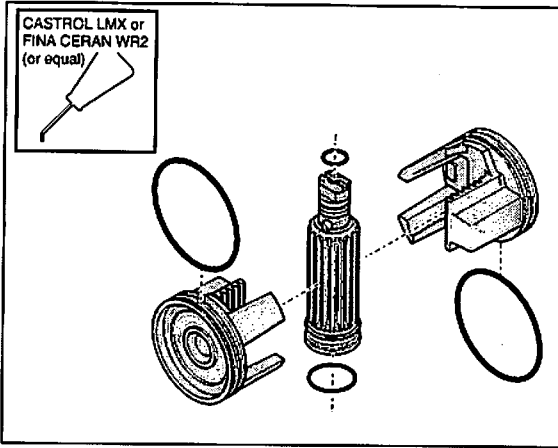
Für den Ausbau der Inserts benötigen Sie das Werkzeug Artikelnr. 590.00.001 für die Vierkantgrößen 11, 14 und 17. Werkzeug Artikelnr. 590.00.002 wird für die Vierkantgrößen 19, 22 und 27 benötigt.



Om de insert te verwijderen moet u gebruik maken van de extractor art.nr. 590.00.001 voor vierkantaftmetingen 11, 14 en 17. Art.nr. 590.00.002 wordt gebruikt voor vierkantaftmetingen 19, 22 en 27.

6 REASSEMBLY / ZUSAMMENBAU / OPNIEUW MONTEREN

6.1 Reassembly guide band and shaft / Zusammenbau von Führungsband und Antriebswelle / Opnieuw monteren van geleideband en as



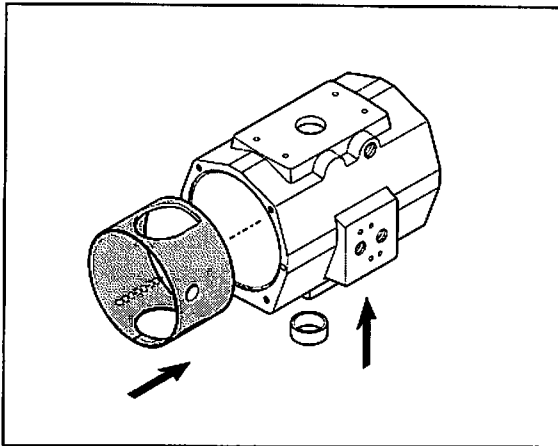
6.1.1

⚠ Before reassembly check the requested assembly code (see chapter 4).

6.1.1 Apply a light film of grease to all O-Rings and on the gear teeth.

6.1.3 Mount the DSA-cam through the bore of the housing on top of the shaft.

⚠ Kontrollier vor dem Zusammenbau der gewünschte aufbaucode (siehe Kapitel 4).

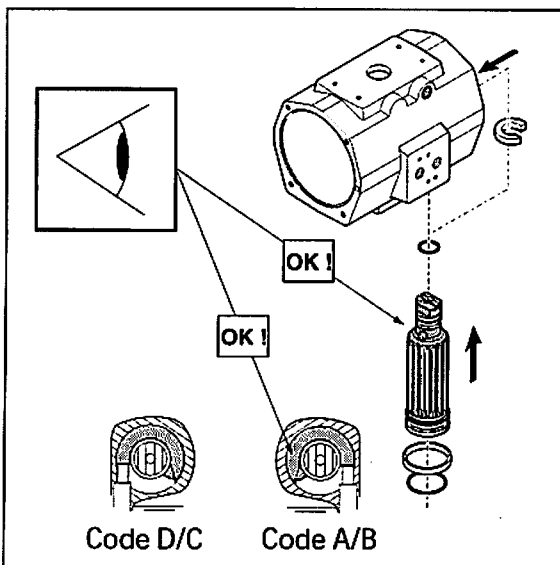


6.1.2

6.1.1 Alle O-Ringe und Verzahnungen einfetten.

6.1.3 Den DSA-Nocken durch die Bohrung des Gehäuses auf die Welle montieren.

⚠ Controleer voor het opnieuw monteren de gewenste montagecode (zie hoofdstuk 4).

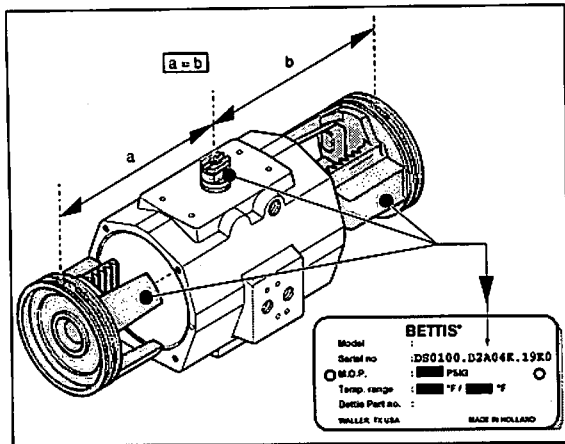


6.1.3

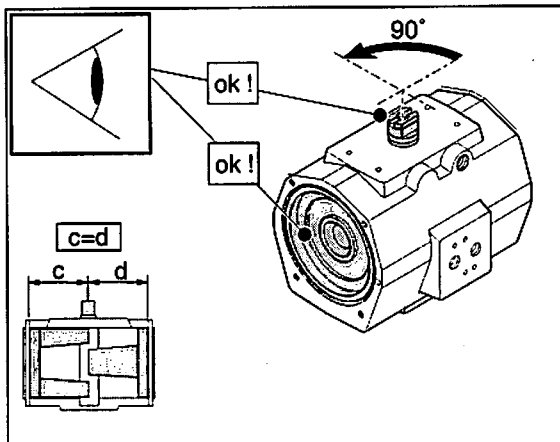
6.1.1 Breng op alle O-ringen en de tanden van de overbrenging een dunne laag smeervet aan

6.1.3 De DSA-nok door de boring van het huis op de as monteren.

6.2 Reassembly pistons / Zusammenbau von Kolben / Opnieuw monteren van zuigers



6.2.2



6.2.3

6.2.1

Align the pinion gear so that the teeth on the center gear will "pick-up" the pistons assembly's rack teeth when turning the top extension of the center gear clockwise (CW) or counter clockwise (CCW) according assembly code (see page 9).

6.2.3

Ensure that smooth movement and 90 degree operation can occur without moving the pistons out of the actuator body.

6.2.1

Die verzahnte Welle so ausrichten, daß die Zähne die Innenverzahnung der beiden Kolben erfaßt. Wobei das obere Wellenende entweder im Uhrzeigersinn oder gegen den Uhrzeigersinn (je nach Aufbau-code, siehe Seite 9) gedreht wird. Beachten Sie bitte, daß die Schlüssel-fläche bzw. Nut am oberen Wellenende entweder parallel oder um 90° versetzt um Antrieb steht.

6.2.3

Beachten Sie, daß eine reibungslose Bewegung im 90°-Winkel möglich ist, ohne, daß dabei die Kolben aus dem Antriebsgehäuse herausragen.

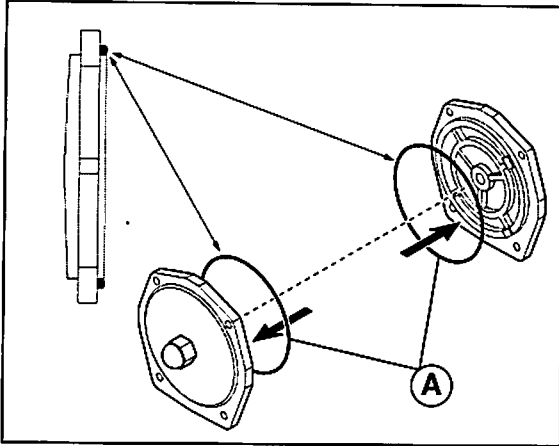
6.2.1

Richt de tandoverbrenging zodanig uit dat de tanden op de as de heugeltanden van de zuiger zullen "oppakken", als het bovenstuk van de as met de wijzers van de klok mee of tegen de klok in wordt gedraaid naar gelang de montage code (zie pagina 9).

6.2.3

Controleer op een soepele beweging en een verdraaiing van 90 graden, zonder dat de zuigers uit de behuizing van de aandrijving naar buiten komen.

6.3 Reassembly endcaps double acting actuators / Zusammenbau Endkappen doppelwirkende Antriebe / Opnieuw monteren deksels van dubbelwerkende aandrijvingen



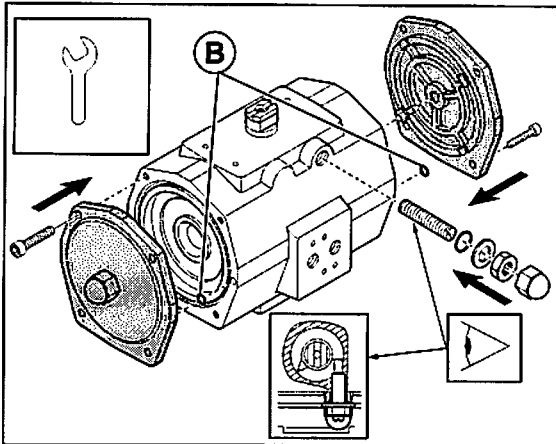
6.3.1

6.3.1 / 6.3.2

Ensure that endcap O-rings (A) and airport O-rings (B) are in place on both sides.

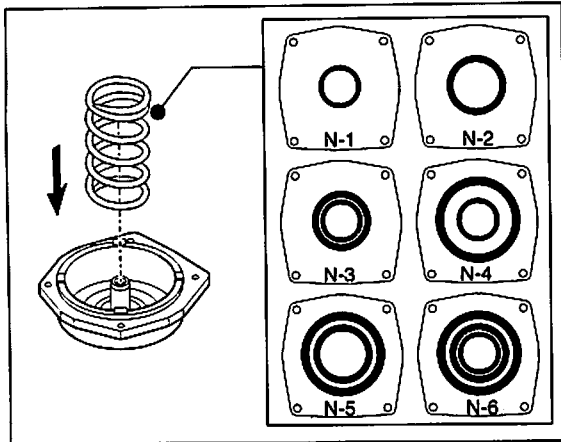
Beachten Sie, daß die O-Ringe in Endkappen (A) und Luftzufuhröffnungen (B) auf beiden Seiten eingesetzt werden.

Plaats de O-ringen van de deksels (A) en de O-ringen van de luchtpoorten (B) aan beide zijden.



6.3.2

6.4 Reassembly endcaps single acting actuators DS25 - DS350 / Zusammenbau Endkappen einfachwirkende Antriebe DS25 - DS350 / Opnieuw monteren deksels van enkelwerkende aandrijvingen DS25 - DS350



6.4.1

6.4.1

When replacing springs in a spring return actuator, ensure that the springs are replaced in their identical position in the spring pack from where they were removed.

6.4.3

Ensure that endcap O-rings and airport O-rings are in place on both sides.

6.4.1

Beachten Sie beim Wechseln der Federn im Antrieb mit Feder-rückstellung, daß die Federn an ihrem ursprünglichen Platz eingebaut werden.

6.4.3

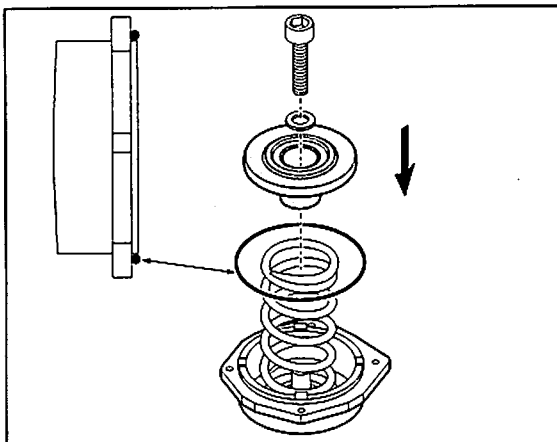
Beachten Sie, daß die O-Ringe der Endkappen und Luftzufuhröffnungen auf beiden Seiten eingesetzt werden.

6.4.1

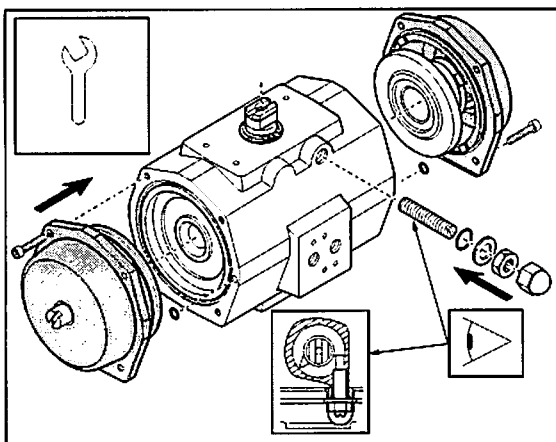
Zorg er bij het vervangen van veren in een veerretour-aandrijving voor dat de veren op exact dezelfde plaats in het verenpakket worden geplaatst, waar ze zijn verwijderd.

6.4.3

Plaats de O-ringen van de deksels en de O-ringen van de luchtpoorten aan beide zijden.

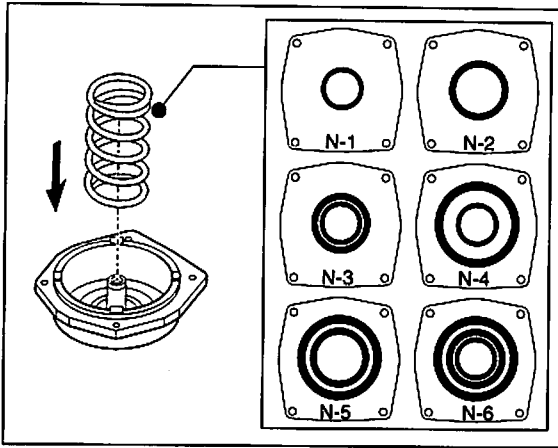


6.4.2



6.4.3

6.5 Reassembly endcaps single acting actuators DS600 - DS1600 / Zusammenbau Endkappen einfachwirkende Antriebe DS6000 - DS1600 / Opnieuw monteren deksels van enkelwerkende aandrijvingen DS600 - DS 1600



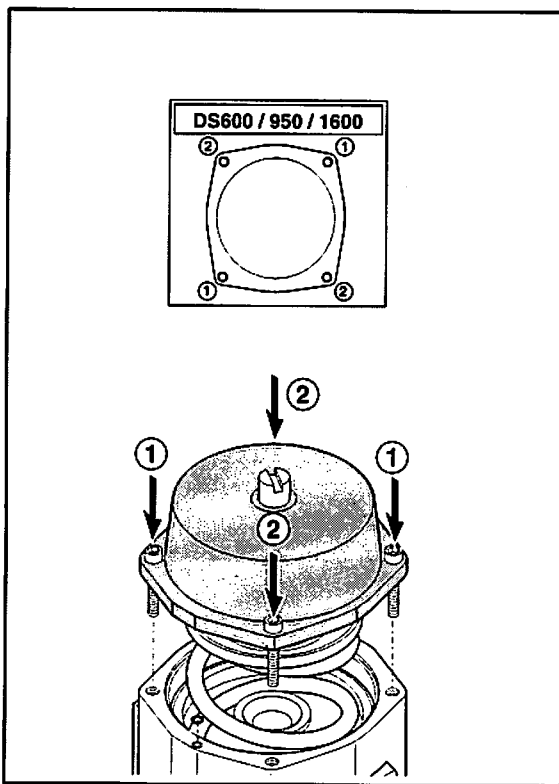
6.5.1

6.5.1

When replacing springs in a spring return actuator, ensure that the springs are replaced in their identical position in the endcap from where they were removed. Before assembling the springs and endcaps, make sure that the pistons are inwards.

6.5.2

Engage the bolts with the tapped holes in the actuator body by forcing down slightly on the cap. Tighten each bolt in small and equal turns.



6.5.2

6.5.1

Beachten Sie, beim Ausbau der Federn im Stellglied mit Feder-rückstellung, daß die Federn an ihrem ursprünglichen Platz in der Endkappe eingebaut werden. Beachten Sie beim Wechseln der Federn im Antrieb mit Federrückstellung, daß die Federn an ihrem ursprünglichen Platz eingebaut werden.

6.5.2

Die Schrauben mit leichtem Druck auf die Endkappe in die Gewindelöcher des Antriebsgehäuses einführen. Jede Schraube mit kurzen und gleichen Schraubendrehungen abwechselnd festschrauben.

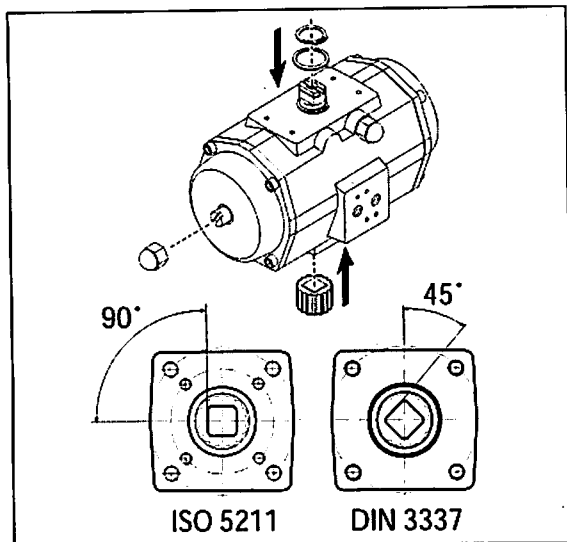
6.5.1

Zorg er bij het vervangen van veren in een veerretour-aandrijving voor dat de veren op exact dezelfde plaats in de deksel worden geplaatst, waar ze zijn verwijderd. Zorg ervoor dat de zuigers naar binnen zijn, voordat u de veren en deksels monteert.

6.5.2


Plaats de bouten in de schroefgaten in de behuizing van de aandrijving door de kap lichtjes naar beneden te drukken. Draai elke bout met kleine en gelijkmatige bewegingen vast.

6.6 Reassembly of springclip and insert / Zusammenbau von Seegerring und Insert / Opnieuw monteren van Seegerring en insert



6.6.1

6.6.1


 Install the new shaft spring clip onto its mating groove on the top shaft extension.

Check proper functioning by applying pressure to the A-port or B-port (see chapter 3).

6.6.2

Apply pressure to the A-port and use some soapsuds around shaft top and shaft bottom to check for air leakage. Apply pressure to the B-port and use some soapsuds around the endcaps to check for air leakage.

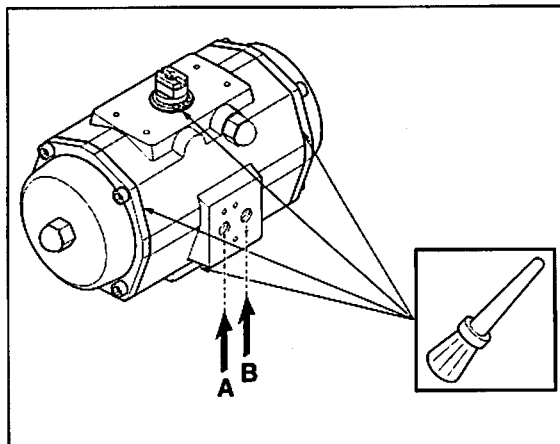
6.6.1

 Der neuen Sicherungsring auf die dafür vorgesehene Rille am oberen Wellenende montieren.

Kontrollier die richtige Funktion des Antriebs durch anschliessen von Luftdruck zur Anschluß A oder B (siehe Kapitel 3).


6.6.2

Luftzufuhr zur Anschluß A anschliessen und verwende Seifenwasser rund Wellenoberseite und Wellenunterseite zur Kontrolle der Luftdichtigkeit. Luftzufuhr zur Anschluß B anschliessen und verwende Seifenwasser rund Endkappen zur Kontrolle der Luftdichtigkeit.



6.6.2

6.6.1

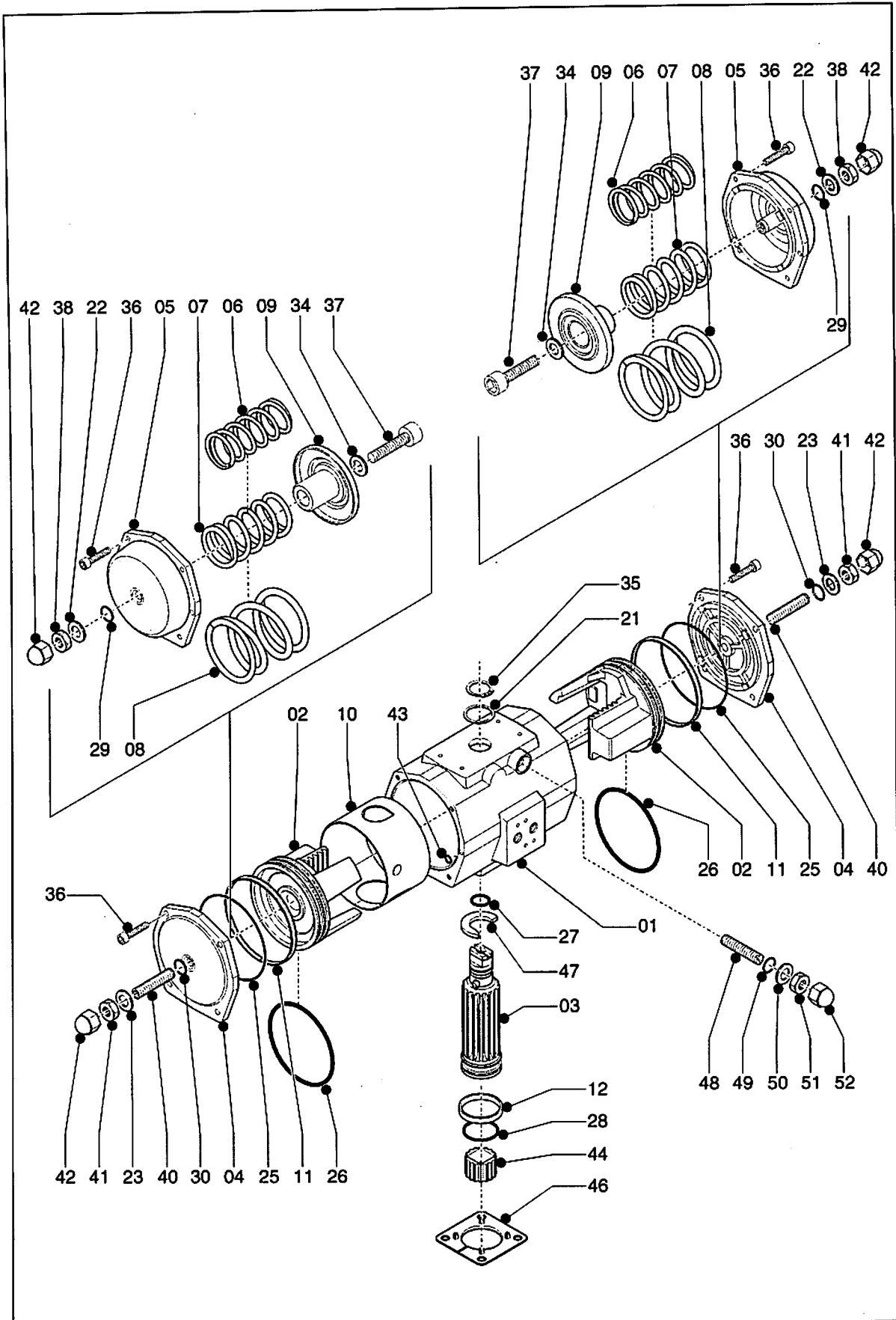
 Installeer de nieuwe veerklem in de corresponderende groef op de astop.

Kontroleer het juist functioneren door luchtdruk aan te sluiten op de A-poort of de B-poort (zie hoofdstuk 3).

6.6.2

Zet luchtdruk op de A-poort en gebruik zeepsop rond as-top en as-einde voor controle van de luchtdichtheid. Zet luchtdruk op de B-poort en gebruik zeepsop rond de deksels voor controle van de luchtdichtheid.

7 PARTS LIST / STÜCKLISTE / STUKLIJSTEN



Pos.	Qty. St.Z. Aant.	Description	Bezeichnung	Benaming	Specification Spezifikation Specificatie
1	1	Body	Gehäuse	Behuizing	GAISI10Mg, DIN 1725/2
2	1	Piston	Kolben	Zuiger	GAISI7Mg, DIN 1725/2
3	1	Drive Shaft	Antriebswelle	Aandrijf-as	AlZnMGCu1.5, DIN 1725/1
4	2	End Cap DD	Endkappe DD	Deksel DD	GDAISI9Cu3, DIN1725/2
5	2	End Cap DS	Endkappe DS	Deksel DS	GDAISI9Cu3, DIN 725/2
6	2	Spring-inner	InnenfDDer	Veer binnen	Class C, DIN 17223
7	2	Spring-mid	MittelfDDer	Veer midden	Class C, DIN 17223
8	2	Spring-outer	AußenfDDer	Veer buiten	Class C, DIN 17223
9	2	Spring Holder	FDDerhalter	Veerhouder	C45, DIN 17200
10*	1	Guide Band	Führungsband	Geleideband	PA66 + MoS2
11*	2	Guide Band	Führungsband	Geleideband	PTFE + 2596 C
12*	1	Bearing Bush	Lagerbuchse	Lagerbus	PA66 + MoS2
20*	1	Bearing Bush	Lagerbuchse	Lagerbus	POM
21*	1	Washer	Unterlegscheibe	Afdichtring	POM
22*	2	Washer DS	Unterlegscheibe DS	Sluitplaat DS	PA6
23*	2	Washer DD	Unterlegscheibe DD	Sluitplaat DD	PA6
25*	2	O-Ring	O-Ring	O-ring	Buna N
26*	2	O-Ring	O-Ring	O-ring	Buna N
27*	1	O-Ring	O-Ring	O-ring	Buna N
28*	1	O-Ring	O-Ring	O-ring	Buna N
29*	4	O-Ring	O-Ring	O-ring	Buna N
30*	2	O-Ring	O-Ring	O-ring	Buna N
34	2	Washer DS	Unterlegscheibe DS	Afdichtring DS	C35
35*	1	Spring Clip	Seegerring	Seegerring	CK75, DIN 17222
36	8	End Cap bolt DD/DS	Endkappenschraube DD/DS	Bout deksel DD/DS	AISI 304
37	2	Limit Stop Bolt DS	Begrenzungsschraube DS	Bout slagbegrenzing DS	AISI 304
38	2	Nut	Mutter	Moer	AISI 304
40	2	Limit Stop bolt DD	Begrenzungsschraube DD	Bout slagbegrenzing DD	AISI 304
41	2	Nut	Mutter	Moer	AISI 304
42	2	Nut cover	Schutzkappe	Moerbeschermkap	PE
43*	2	O-Ring	O-Ring	O-ring	Buna N
44	1	Insert	Insert	Inzetstuk	AlMgSi 1
46	1	Centre-plate (option for DIN3337 actuators)	Zentrierplatte (Option für DIN3337 Antriebe)	Centreeerplaat (optie voor DIN3337)	PA6 + 25% Glass
47	1	stroke adj. cam	Hubbegrenzungs-nocken	Slagbegrenzingsnok	AISI 304
48	1	Limit Stop bolt	Begrenzungsschraube	Bout slagbegrenzing	AISI 304
49*	1	O-Ring	O-Ring	O-ring	Buna N
50*	1	Washer	Unterlegscheibe	Sluitplaat	PA6
51	1	Nut	Mutter	Moer	AISI 304
52	1	Nut cover	Schutzkappe	Moerbeschermkap	PE

* Recommended Spare Parts (contained in Repair Kit).

* Empfohlene Ersatzteile (Teil des Reparatursatzes).

* Aanbevolen reserve-onderdelen (opgenomen in reparatiepakket).

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December 2000

DSF-2000-SB Flame Scanner

User's Manual



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1. General Product Description

The Coen DSF-2000-SB flame scanner is designed for detecting burner flames of fossil fuels such as natural gas, refinery gas, waste gas, fuel oils, and coals. It is suitable for single burner and duct burner applications.

The DSF-2000-SB flame scanner consists of an integrated viewing head and signal processor. No secondary signal processor or amplifier is required. The integrated flame scanner design eliminates much of the cost associated with a flame scanner installation which typically requires amplifier cabinets, amplifier assembly, prefabricated wiring, and custom field wiring.

The DSF-2000-SB flame scanner is microprocessor-based utilizing the latest solid-state signal processing technology. The flame scanner uses a solid-state optical detector to detect the presence of a flame. The optical detector detects both ultraviolet and infrared light spectra.

The flame scanner incorporates a unique solid-state, self-check system that tests all critical components every 10 seconds for fail-safe operation.

The DSF-2000-SB flame scanner includes Coen's patented EASI (Electronically Assisted Sighting Indicator) feature that assists in optimum sighting of the flame. (*Note: Not available on the hazardous location model.*)

There are two models of the DSF-2000-SB flame scanner. In addition to the base model, there is a hazardous location model. Refer to the following table for details on the specific models.

1.1 Technical Specifications

Model	Base	Hazardous Location
Part Number	2653-213-01	2653-213-05
Electrical Classification	NEMA 4X	NEMA 4X, and Class I, Division 1 & 2, Groups B, C, & D
Cable (1)	2 Cables 10 ft (3 m) long	10 individual wires 10 ft (3 m) long
Weight	3.4 lb (1.54 kg)	3.8 lb (1.72 kg)
EASI (4)	Yes	No
Dimensions	Refer to Figure 1.	
Mounting Connection	1" NPT(F)	
Purge Air Flow (2)	5 scfm (0.134 Nm ³ /min)	
Pressure (3)	5" wc (127 mm H ₂ O)	
Optics	Quartz Lens	
Sensor Type	Solid-State	
Sensor Range	Ultraviolet Peak at 350 nm and Infrared Peak at 700 nm	
Digital Communications	Requires Communications Kit Accessory (refer to Section 1.2.3). RS232/RS485 serial communications, up to 127 scanners, up to 5000 ft (1524 m).	
Housing Material	Anodized Aluminum	
Temperature Rating	Ambient: -22°F to 158°F (-30°C to 70°C)	
Humidity	0 to 100% Relative Humidity, Condensing	
Power Requirement	24 ± 4 VDC Filtered 3 VA (120 mA) per Scanner	
Flame Relay Contact	Normally Open Voltage Free Contact (i.e. contact closes when flame is detected) 0.5 A @ 125 VAC Resistive Load 1.0 A @ 24 VDC Resistive Load	
Flame Signal Output (5)	4–20 mA Maximum Current Loop Resistance = 750 ohms	
FFRT	Factory Set (Refer to Section 6.3 on page 18.)	
Approvals	FM, UL (pending), and CSA	
Notes:	<ol style="list-style-type: none"> 1. Refer to Figure 2 on page 11. 2. Purge air should be clean ambient air with a temperature less than 100°F (37.8°C). Flows and pressures shown are <u>minimum</u> requirements. 3. Purge air pressure is the <u>minimum</u> differential pressure required between the purge air supply pressure at the scanner mount and the windbox pressure. 4. Coen's patented (U.S. Patent 48231114) Electronically Assisted Sighting Indicator (LED) on the back of the scanner housing flashes once per second until flame is sighted and then it flashes faster as the flame signal increases. This feature helps sighting the flame scanner. 5. For indication only. Refer to Appendix E to convert to a Vdc output signal. 	

1.2 Accessories

The following accessories are available for the DSF-2000-SB flame scanner:

1.2.1 Mounting Kit

The mounting kit includes a swivel mount, gasket, and an 1" NPT(F) purge air connection. The mounting kit is available without an isolation valve (PN 1203-475-10) or with an isolation valve (PN 1203-475-09).

1.2.2 Power Supply and Display Module (PSDM-2000)

Coen's PSDM-2000 (PN 2643-064-01) is a power supply that provides power for a single DSF-2000-SB scanner. It is also a display module with four light emitting diode (LED) indicators on the top which indicate the following information:

Power: PSDM-2000 has power.

Scanner: Scanner has power.

Flame: Scanner is detecting a flame.

Fault: There is a fault with either the scanner or the PSDM-2000.

The PSDM-2000 also has two outputs that are not directly available from the flame scanner:

Fault Relay Contact (N.C.).

0-10 VDC Flame Signal Output.

The PSDM-2000 utilizes Deutsche Industrie Norm (DIN) rail mounting technology for easy mounting and dismounting. It has a 0.20 ampere slow blow fuse conveniently located on the top of the unit for easy replacement.

1.2.3 Communications Kit

The DSF-2000-SB flame scanner is capable of using digital communications between the flame scanner (RS485) and a personal computer (RS232) to display real-time flame status. Communication is via serial communications over a two wire network. Up to 127 scanners can be connected to one personal computer over a distance up to 5000 ft (\approx 1500 m). Communication is implemented using Coen's Windows¹ based *DsfComm* software.

A communications kit is available to provide this capability. The communications kit includes Coen's *DsfComm* software (PN 2690-872-01) and Coen's RS232/RS485 converter kit (PN 3425-056-01). The converter kit includes a RS232/RS485 converter, a Vac to 9 Vdc power supply, 7 ft of RS232 cable, and a DB9F connector (9-pin). The power supply will accept an input of 100-250 Vac at 47-63 Hz.

Refer to Figure 3 on page 12 to see a wiring diagram. Refer to Appendix D for additional information on the RS232/RS485 converter.

¹ Windows is a registered trademark of the Microsoft Corporation.

2. Installation

2.1 Scanner Mount and Purge Air Connection

The DSF-2000-SB flame scanner has an 1" NPT(F) mounting connection. Use of a swivel type scanner mounting assembly is recommended to permit sighting adjustment of the flame scanner.

If a rigid scanner mount is used, tack weld the scanner mount in place after making initial sighting adjustments as described in Section 2.2. Final welding can be made after final scanner sighting adjustments have been determined from operational testing.

Provision for a continuous supply of purge air is required to keep the scanner lens clean and free from contaminants (e.g. dirt, oil, smoke, etc.). It is recommended that a flexible hose be used for the purge air connection. Refer to Section 1.1 for purge air requirements.

2.2 Initial Sighting

Sighting is important for a successful installation. Adjust the initial flame scanner sighting (i.e. before the burner is started) taking into account the following:

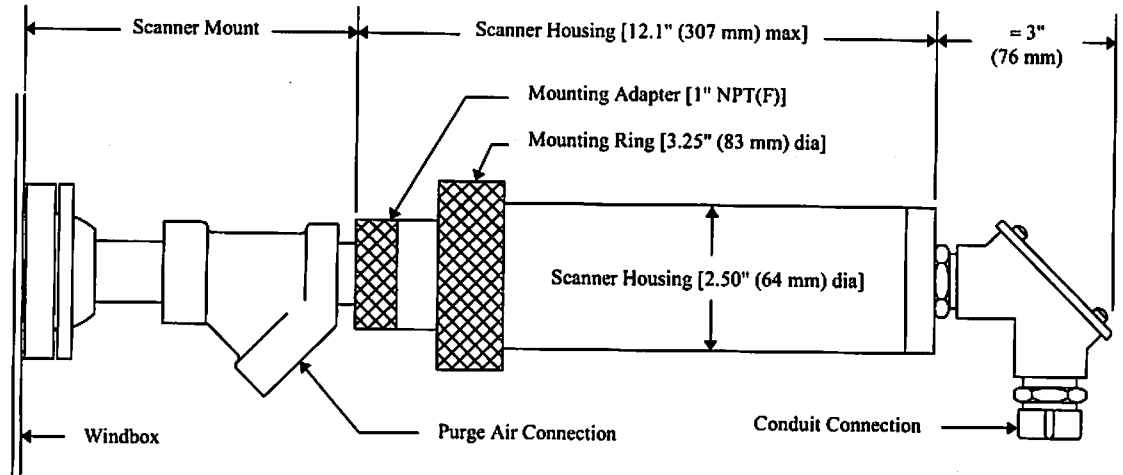
- Sight the flame scanner at the location where the fuel is expected to ignite.
- The flame scanner's line of sight must be free from any obstruction for optimum operation. *(Note: Never trim burner parts without first checking with the burner manufacturer.)*
- Where a single flame scanner is used to monitor both main and pilot flames, the flame scanner must be sighted to view both flames.
- Where separate flame scanners are used to monitor main and pilot flames, the flame scanner for the main flame must be sighted so that it does not detect the pilot flame.

Final sighting is made once the burner is operating. Refer to Section 5 on page 17.

2.3 Mounting Scanner

Refer to Figure 1.

1. Remove the mounting ring and the mounting adapter from the scanner housing by unscrewing the mounting ring. *(Note: The mounting ring should be removed and tightened by hand only.)*
2. Slip the mounting ring over the scanner mount.
3. Thread the mounting adapter onto the scanner mount and tighten **by hand only**.
4. Attach the scanner housing to the mounting adapter with the mounting ring and tighten **by hand only**.



NOTE: Base model shown. Hazardous location model has different conduit connection. Refer to Section 3.1.

Figure 1
Scanner Mounting & Dimensions

3. Wiring

Caution

To reduce the risk of electrical shock and injury, disconnect or shut off electrical power to all connections before making any electrical connections. This includes not only the power supply but also the flame relay contacts which may have up to 120 Vac on them.

3.1 Electrical Connection

The scanner cable should be installed inside grounded flexible conduit to protect it from mechanical damage and to reduce electrical noise interference. All wiring should be in accordance with all applicable local and national codes, standards, and ordinances.

The base model has a 1/2" 90° liquid tight flexible-conduit fitting. (*Note: Earlier scanners have a 3/8" straight flexible-conduit fitting.*) The hazardous location model has a 1/2" NPT(F) connection.

Caution

Refer to Appendix F regarding changing conduit connection..

WIRING ADVISORY

Electrical noise interference from high energy ignition sources can adversely affect the operation of the flame scanner. To minimize the possibility of electrical noise interfering with the operation of the flame scanner:

- Do not install the ignition wire in the same conduit as the scanner wires.
- The ignition wire should be shielded and housed in metal conduit.
- The ignitor should be grounded to the ignition transformer chassis.
- Do not mount the ignition transformer in the same enclosure where the flame scanner wiring is terminated unless the ignition wire is properly shielded and the ignition transformer is spaced a minimum of 6" away from the scanner wiring terminals.

Connections for power (24 VDC and DC Ground), Earth Ground, and Flame Relay (N.O. and Common) are required for all applications. Use the 4-20 mA Flame Signal and Communications connections if required.

Refer to Figure 2 for wiring information.

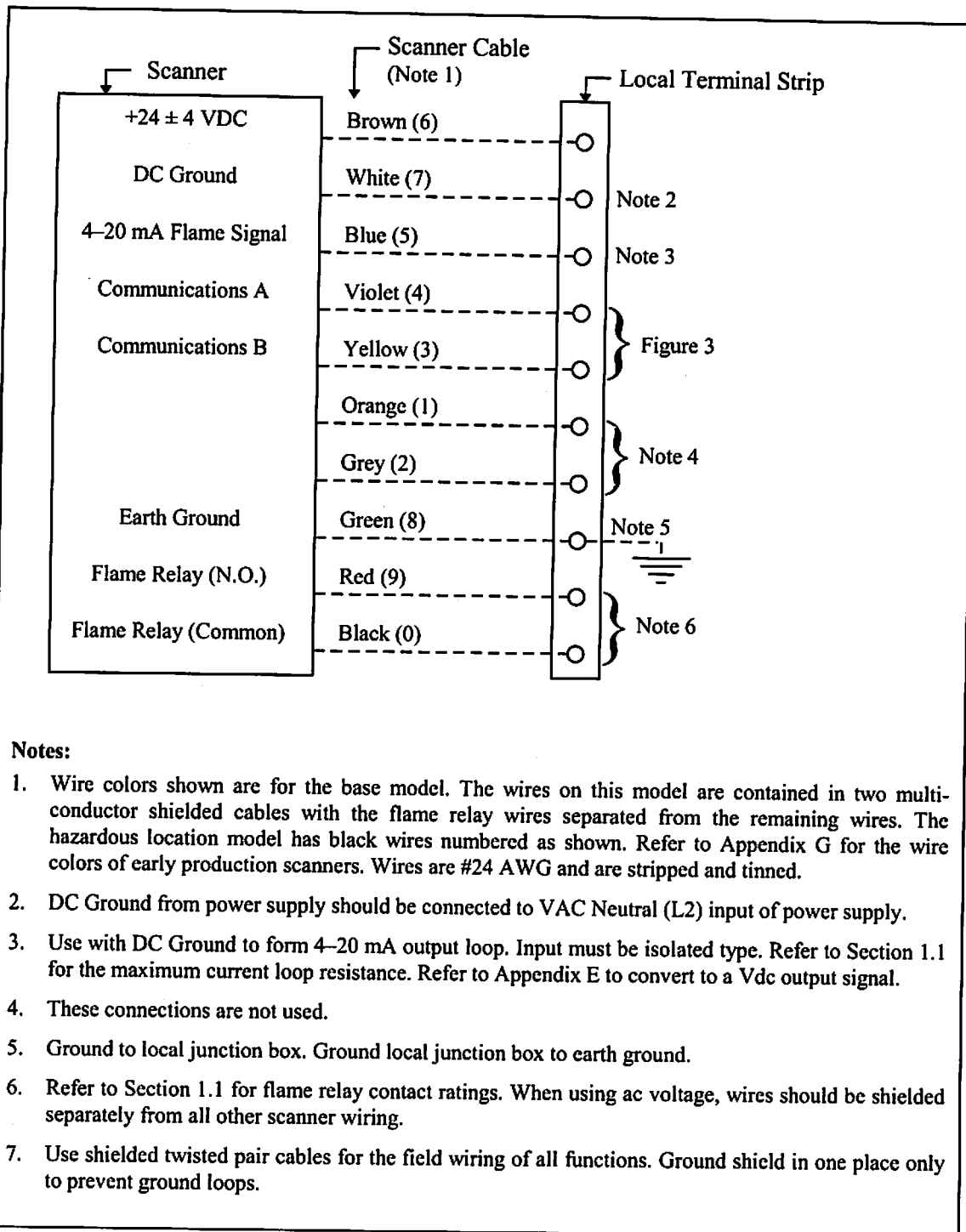


Figure 2
Electrical Connection Diagram

3.2 Communications Wiring – Optional

NOTE:
 This section is applicable only for scanners supplied with the Communications Kit (refer to Section 1.2.3 on page 7).

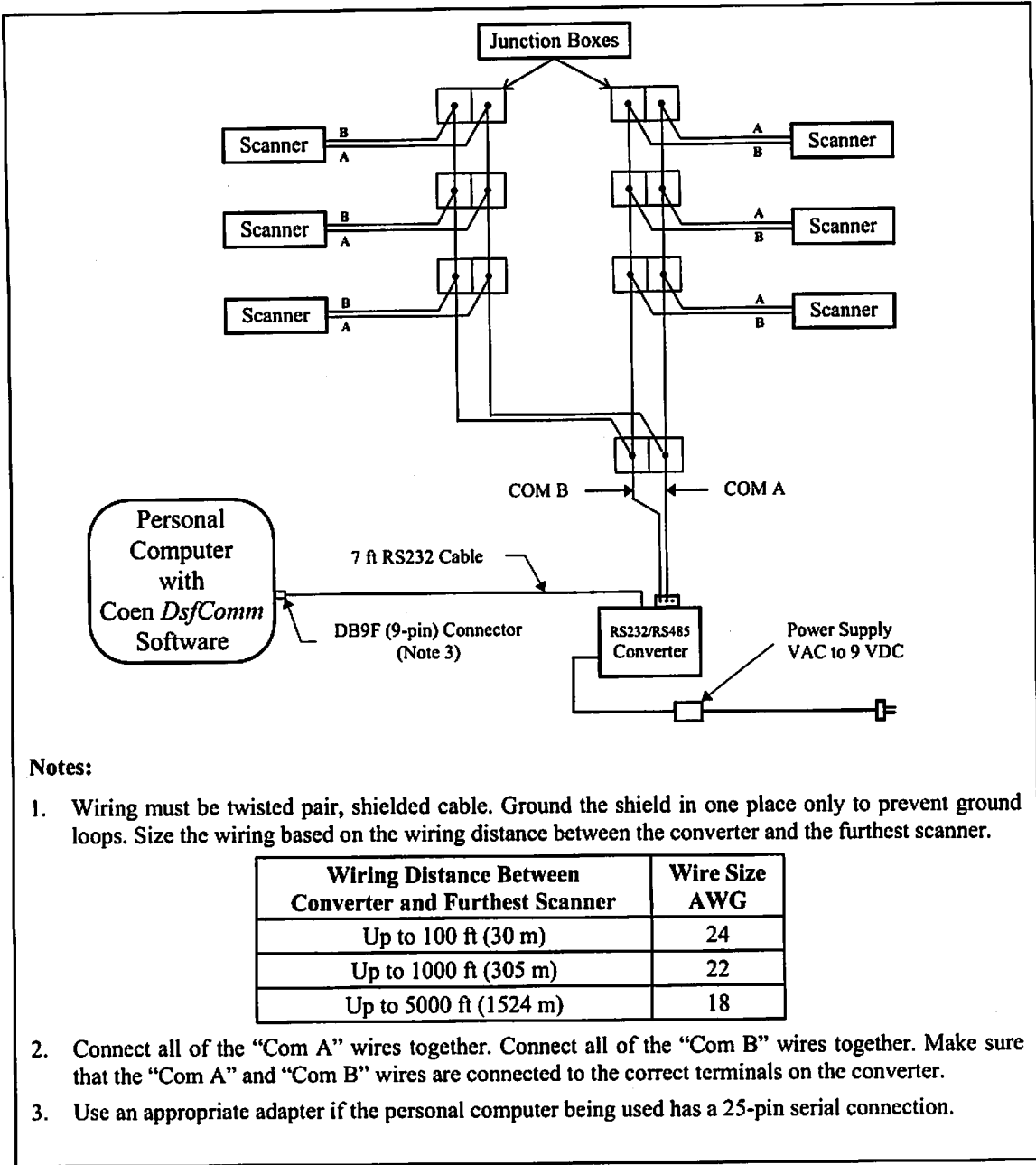


Figure 3
 Communications Wiring Diagram

4. Communications Setup – Optional

NOTE:

This section is applicable only for scanners supplied with the Communications Kit (refer to Section 1.2.3 on page 7).

NOTE:

The scanners must be properly installed and powered before communications can be set up. Refer to Section 2 and Section 3.

4.1 Coen DsfComm Software

Getting Started:

The *DsfComm* software is provided on a 3½" diskette. A backup copy of this diskette should be made and kept in a safe place. The *DsfComm* program can not be run directly from the diskette. It must be installed to the personal computer's hard disk using the "Setup" program on the diskette.

The *DsfComm* software is Windows compliant and requires Windows 95, Windows 98, or Windows NT to operate. The minimum hardware requirement is a personal computer with a SVGA (640 x 480) monitor, mouse, and RS232 serial port.

Installation:

1. Exit all programs before installing the *DsfComm* software.
2. Run the "Setup" program on the program diskette and follow the instructions. (*Note: See Section 10 for a copy of the Software License Agreement.*)
3. When the program is run for first time, it prompts for the following setup information. (*Note: These settings can be changed later from the Setup menu.*)
 - a) **PC Com Port Number:** Select an available serial port address. This port must be solely dedicated to the DSF-2000-SB network.
 - b) **Baud Rate:** Select the default of 19200.
 - c) **Password:** A password is not required when using the *DsfComm* software with the DSF-2000-SB flame scanner. Do not enter a password. Select **OK** to close the Password dialog box.
4. The "Setup" program installs the *DsfComm* program onto the hard disk and creates a shortcut on the Windows Program Menu to run the program.

Running the Program:

NOTE: Refer to Appendix B for a diagram of the menus of the DsfComm program.

Select *DsfComm* from the Windows Program Menu. The main *DsfComm* window will appear.

The remaining parts of Section 4 explain how to set up the program to communicate with the DSF-2000-SB flame scanner(s). Refer to Section 7 for instructions on how to display data.

4.2 Communication Addresses

Each DSF-2000-SB flame scanner is shipped with its communication address set to "Comm 1". Each scanner needs to be configured to its own unique communications address (1-127) before communication can be established with all scanners on the network.

1. Make a list of communication addresses, scanner names, and scanner serial numbers. Start with communication address "Comm 1" and number consecutively. The scanner name is a user selected description (limited to nine characters) of the scanner location. The scanner serial number is a six (6) digit number located on a bar code label on the scanner housing. A sample list is shown below.

Comm Address	Scanner Name	Serial Number
Comm 1	Boiler 1	000125
Comm 2	Boiler 2	000132
Comm 3	Boiler 3	000110
Comm 4	Boiler 4	000116

2. Set the **Comm Address** for each scanner by using the *Setup / Scanner Address* command from the main program menu. Enter the Comm Address and corresponding Scanner Serial Number and click on *Set Address*.
3. Confirm that each scanner has been configured for the correct Comm Address by selecting *View / Who's On The Network* and comparing to the list generated in step 1.

4.3 Graphics Files

Graphics files are used to store scanner icons. The total number of scanner icons that can be displayed and stored in a graphics file is dependent on the monitor size and resolution, and the type of scanner icon. If there is not enough room in one graphics file to display all the scanner icons, then multiple graphics files are required.

To create a new graphics file:

1. Select *File / New* from the main menu. The New window will appear.
2. Select **Graphics File** and **OK**. A new graphics file will appear.
3. Name the graphics file by selecting *File / Save As* from the menu, typing in a name, and selecting **Save**. The name of the graphics file will appear in the title bar of the graphics file window.

4.4 Scanner Icons

Scanner icons permit access to individual flame scanners on the network for monitoring real-time flame status and displaying data.

To create a new Scanner Icon:

1. Make sure the graphics file where the scanner icon will be stored is open.
2. Select *Edit / Add Scanner Icon* from the menu. The Add Scanner Icon dialog box will open.
3. Enter the **Comm Address**, the **Scanner Name**, and the **Scanner Serial Number** from the list made in Section 4.2.

4. Select the **type** of scanner icon. There are two types of scanner icons (Flame Status Icon and Bar Graph Icon). Refer to Sections 4.4.1 and 4.4.2 for a description of each type of scanner icon.
5. Select **OK**. A new scanner icon will appear in the graphics file window.
6. Repeat the above steps for all the flame scanners on the network. Create additional graphics files as required.

NOTE:

The *Scanner Identity* command (refer to Section 7.1.2 on page 20) can be used to check the serial number of the scanner assigned to a particular scanner icon.

4.4.1 Flame Status Icon

The **Flame Status Icon** displays the on/off status of the flame. If the flame signal strength is above the threshold set point, then an animated flame appears in the flame scanner icon.

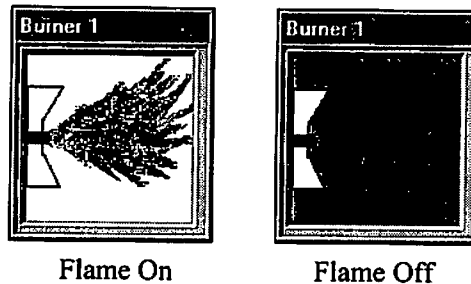


Figure 4
Flame Status Icon

4.4.2 Bar Graph Icon

The **Bar Graph Icon** displays the flame's real-time flicker frequency signal strength. If the flame signal strength is above the threshold set point, then the flame status will indicate "Flame On" and the bar graph will be red. If the flame signal strength is below the threshold set point, then the flame status will indicate "Flame Off" and the bar graph will be blue.

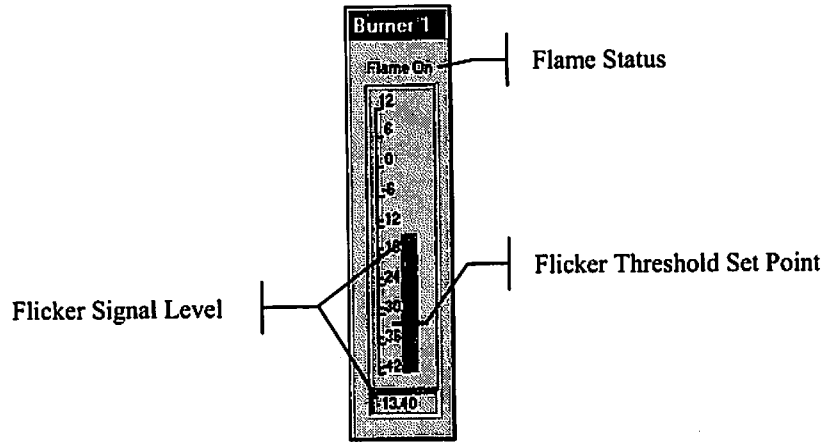


Figure 5
Bar Graph Icon

5. Sighting

WARNING

The flame scanner sighting must ensure the following:

- Scanner must not sense the ignitor spark giving a false flame signal.
- Scanner must not sense a pilot flame that will not ignite the main flame.
- Scanner must detect the pilot flame and the main flame over the full range of operating conditions.
- If separate scanners are used to monitor main and pilot flames, the scanner for the main flame must be sighted so that it does not detect the pilot flame.
- Scanner must be sighted to provide adequate discrimination between the burner flame signal and the background radiation signal.

1. Confirm that each flame scanner has been initially sighted per the instructions given in Section 2.2 on page 8.
2. Perform an *Ignition Interference Test* (refer to Appendix C) to insure that electrical noise from the ignition system does not affect the flame scanner and that the flame scanner is not sighted to see the ignitor spark.
3. Perform a *Normal Pilot Flame Detection Test* and a *Main Flame Detection Test* (refer to Appendix C) to insure proper sighting of the flame scanner.
4. Perform a *Minimum Pilot Flame Detection Test* (refer to Appendix C) to insure the pilot flame will always ignite the main flame.
5. Perform a *Flame Discrimination Test* (refer to Appendix C) to insure that the scanner will discriminate between the burner flame signal and the background radiation signal.

6. Configuration

6.1 General

All of the configuration settings on the DSF-2000-SB scanner are factory set and cannot be changed (refer to Appendix A). These settings are chosen to give optimal flame scanning performance on single burner applications. The remaining parts of this section describe some of the configuration settings.

6.2 Automatic Gain Control

The DSF-2000-SB flame scanner has automatic gain control that continuously tracks the flame signal and adjusts the gain so that the unprocessed ac flame signal is kept at the optimum setting.

6.3 Flame Response Times

The DSF-2000-SB flame scanner utilizes the following flame response times:

- **Flame-on Response Time:** The Flame-on Response Time is the amount of time that the flame signal must be above the threshold before the flame relay is energized. This response time is set at 2 seconds.
- **Marginal Flame Failure Response Time:** The Marginal Flame Failure Response Time is the amount of time that the flame signal must be below the threshold before the flame relay is de-energized. This response time is set at 2 seconds.
- **Total Flame Failure Response Time:** The Total Flame Failure Response Time is the amount of time that there is no flame signal before the flame relay is de-energized. This response time is set at 1 second.

6.4 Flame Detection Rules

The flame detection rules attempt to prevent unsafe operation of the flame scanner. If any one of these four rules is violated, then the flame relay will de-energize.

- **Mains Rule:** The Mains Rule requires that the flicker signal is not dominated by a 50, 60, 100, or 120 Hz signal. This rule prevents the flame scanner relay from being energized by an incandescent lamp or ac power line noise.
- **Rail Rule:** The Rail Rule requires that the ac signal be below +12 dB. This rule prevents the flame scanner from saturation.
- **Solar Rule:** The Solar Rule prevents the flame relay from energizing due to solar radiation. This feature prevents the flame scanner being adversely effected from the sun when installed outdoors in a very bright sunny area.
- **Flame Rule:** The Flame Rule requires that several frequencies are present simultaneously and that the signal strength decreases as the frequency increases. These characteristics are evident in all flame signals.

7. Displaying Data – Optional

NOTE:

This section is applicable only for scanners supplied with the Communications Kit (refer to Section 1.2.3 on page 7).

All of the data displays are accessed through the individual scanner icons.

Double-click inside a scanner icon and several menu choices relating to that flame scanner appear:

- Setup/Program:** Displays real-time status information. Refer to Section 7.1.
- Flame Frequency:** Displays the real-time flame flicker frequency. Refer to Section 7.2.
- Flame Signal:** Displays the real-time raw (unprocessed) flame signal. Refer to Section 7.3.
- Current Status:** Displays the flame scanner's configuration settings, real-time status information, and scanner faults. Refer to Section 7.4.

7.1 Setup/Program

This command displays the Setup/Program window (refer to Figure 6).

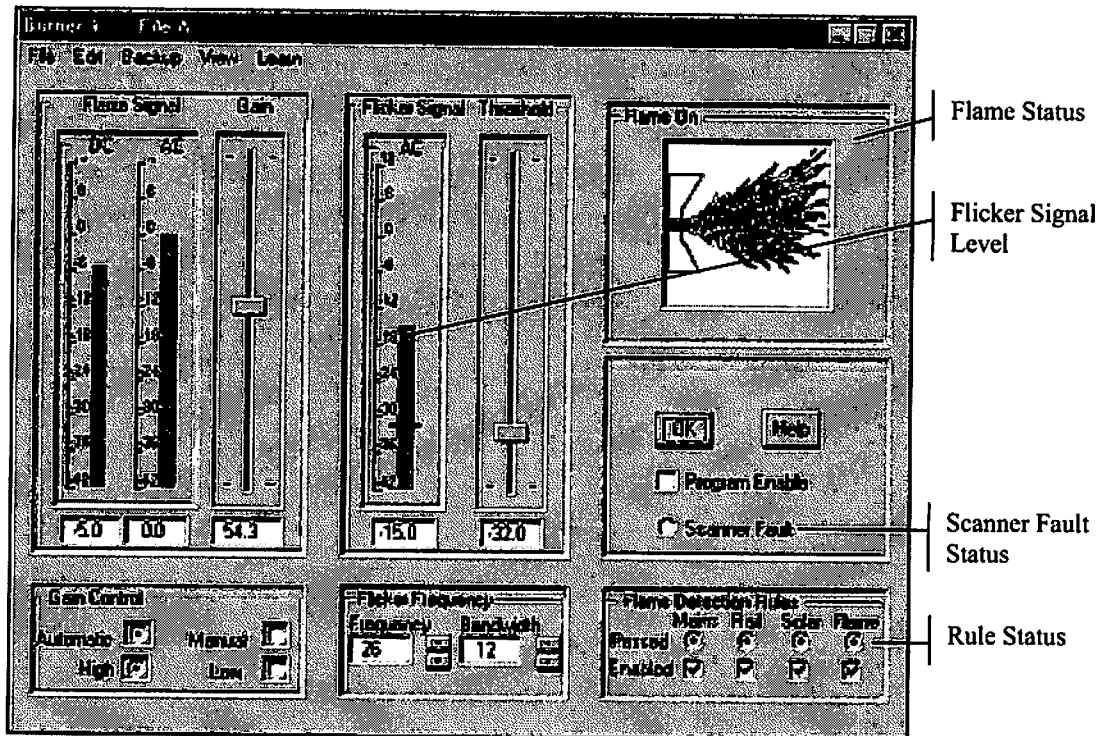


Figure 6
Setup/Program Window

This window displays real-time status of the flame signal and scanner fault status. It also allows access to some additional information as described below.

7.1.1 Flame Out Messages

View / First Out Message. This command displays the reason for the last flame out. The reason for the last flame out will be one of the following:

- Flame signal below threshold.
- Total Flame Failure. Flame signal below minimum.
- Violation of any one of the four Flame Detection Rules. (Refer to Section 6.4 on page 18.)
 - Power Mains Signal Detected (50/60 or 100/120 Hz).
 - Flame Signal at Maximum or Rail Condition.
 - Strong 1/f or solar-like signal.
 - Non Flame-Like Signal
- Critical Fault in Scanner. (Refer to Section 8.3.)

7.1.2 Scanner Identity

View / Scanner Identity. This command displays the Comm Address, Serial Number, Product Code, and Firmware Revision Level of the scanner.

7.1.3 Rule Counts

View / Rule Counts. This command displays diagnostic information to be used by Coen Company.

7.1.4 Scanner Fault

Scanner Fault is an indicator (refer to Figure 6) that comes on if any fault condition is present in the scanner.

Select *View Faults* from the Scanner Status window (refer to Section 7.4) to view a description of any scanner faults.

7.2 Flame Frequency

This command displays a real-time graph of the flame signal strength versus the flame flicker frequency.

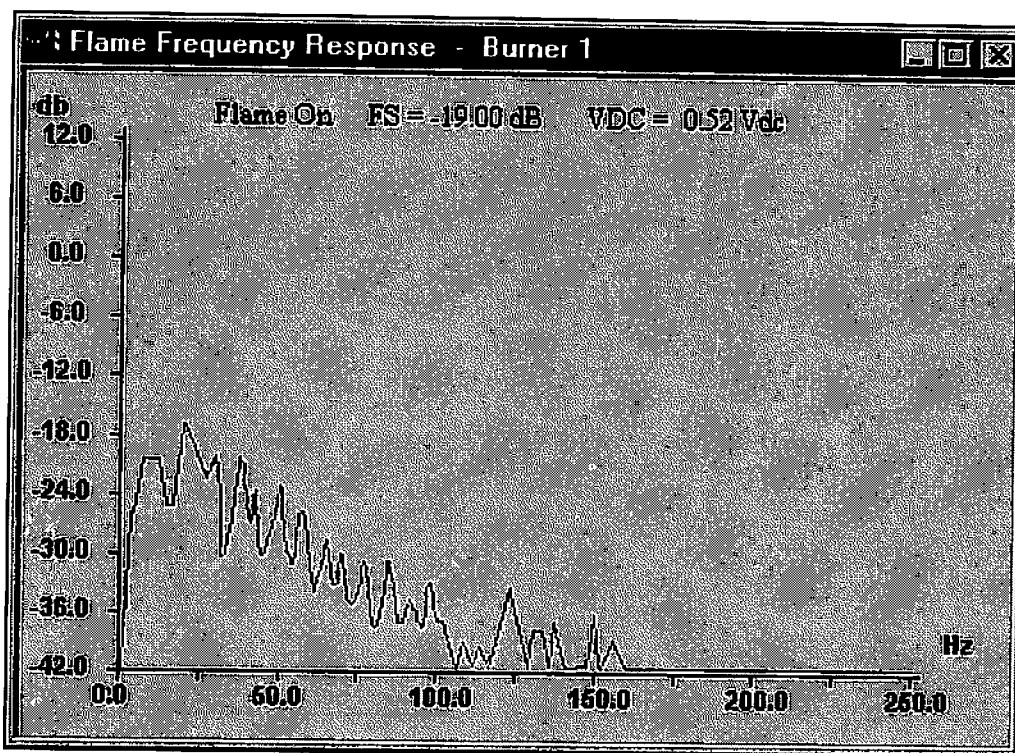


Figure 7
Flame Frequency Response Graph

7.3 Flame Signal

This command displays a real-time graph of the raw (unprocessed) flame signal.

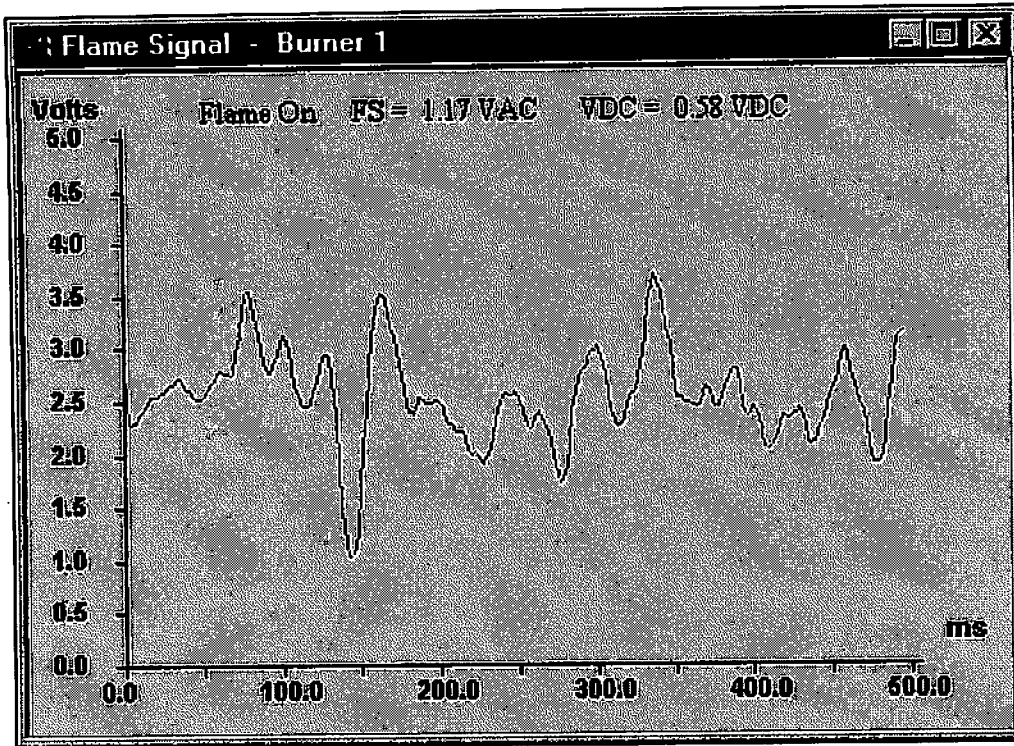


Figure 8
Flame Signal Graph

7.4 Current Status

This command displays the configuration settings and real-time status information.

Select *Print* to print a copy. Select *View Faults* to view a description of any scanner faults.

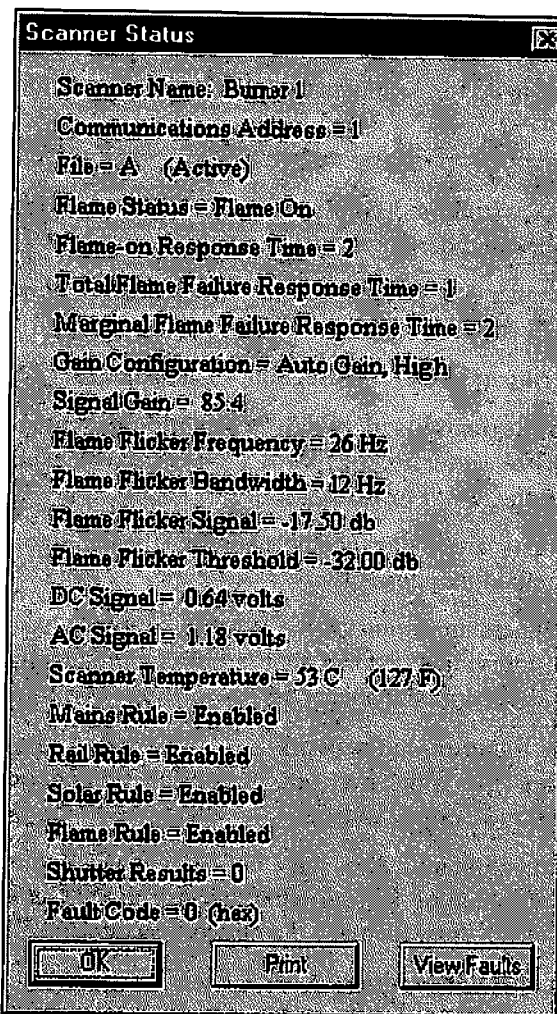


Figure 9
Scanner Status Window

8. Trouble Shooting

8.1 Communications Wiring and Configuration – Optional

NOTE:

This section is applicable only for scanners supplied with the Communications Kit (refer to Section 1.2.3 on page 7).

Check the communications wiring and configuration as follows. Proceed step by step until the problem has been determined and corrected.

1. Confirm that each scanner has power. (*Note: On models with an EASI LED on back of scanner, the LED will be on.*)
2. **Run the DsfComm program.** (Refer to Section 4.1 on page 13.)
3. **Check that the communications network is functioning correctly** by selecting *View / Who's On The Network* (refer to Section 4.2 on page 14). This command will test the communications for each Comm Address.
 - a) If all of the scanners are found on the network, then the communications wiring and configuration is functioning correctly.
 - b) If some of the scanners are found on the network, then the basic network is functioning. In that case, each individual scanner that is not communicating will need to be trouble shot individually as described in step 7.
 - c) If no scanners are found on the network (i.e. all Comm Addresses show "Timeout, Not Responding"), then either the network is not functioning or all of the scanners are configured to the same Comm Address.
 - i) If the communication addresses have not been configured or it is unsure if they have been configured, then do so following the instructions in Section 4.2 on page 14. If an error message occurs, then test the network as described beginning in step 4.
 - ii) If the communication addresses have been configured to each scanner (refer to Section 4.2 on page 14), then test the network as described beginning in step 4.
4. **Confirm that the converter has power.** The converter has power if one or more of its status lights are on (blinking or steady). If the converter has power then continue on to step 5.
 - a) If there are no lights on, then disconnect the RS232, RS485, and power cables from the converter. Wait for a minute, then reconnect the power cable first, then reconnect the RS232 and RS485 cables.
 - b) If there are still no lights on, check the power supply to the converter. If the power supply is working, then replace the converter. If the power supply is not working then replace the power supply.
 - c) When power to the converter is confirmed by one or more of its status lights being on, return to step 3 to test the communications.
5. **Confirm that the personal computer (PC) is communicating with the converter.** Select *View / Who's On The Network* and observe the GREEN light next to the RS232 cable while

the *DsfComm* software is checking each Comm Address. The converter is receiving communications from the PC if the GREEN light next to the RS232 cable is blinking. If the PC is communicating with the converter then continue on to step 6.

- a) If the PC and converter are not communicating, then 1) check the wiring from the PC to the converter, 2) check that the PC Com Port Number being using is the same as selected in the *DsfComm* software, and 3) check that the selected PC Com Port is working. If all these items checkout, then replace the converter.
 - b) When communication between the PC and converter has been confirmed, return to step 3 to test the communications.
6. **Confirm that the converter is communicating with the scanners.** If one or more scanners are communicating with the converter, then the RED and GREEN lights next to the RS485 connection (COM A and COM B) will be blinking. If only the RED light is ON and steady (i.e. not blinking), then the converter and scanners are not communicating.
- a) If there is communication with at least one scanner then the basic network is functioning. Repeat step 3 to confirm which scanners are and are not communicating with the *DsfComm* software. If all of the scanners are communicating then stop here. If any of the scanners are not communicating then continue on to step 7.
 - b) If none of the scanners are communicating, then check the communications wiring (refer to Section 3.2 on page 12).
7. **Check individual scanner.**
- a) Check the communications wiring (refer to Section 3.2 on page 12) for the individual scanner.
 - b) If there is still no communication, then substitute the scanner with one that is known to be functioning properly. Set up communication with this scanner (refer to Section 4 on page 13). If communication now occurs, then replace the original scanner. If there is still no communication then there is a problem with the individual scanner's wiring.

8.1.1 Operating System Error Messages – Optional

The following are operating system error messages that may occur.

Error Message	Possible Cause	Remedies
Cyclic Redundancy Check (CRC)	Communication signal is corrupted.	Check communications wiring and configuration. Check for proper grounding. Check for electrical noise. Refer to Section 0
Debug MSG Thread error. Struct Still Active.	The program could not close the port.	Too many windows or programs are open. Close the other programs.
Port Error Communications Port Error!	This error will appear if more than one copy of <i>DsfComm</i> is running.	Check Windows Taskbar to see if more than one copy of <i>DsfComm</i> is running. Close all but one copy of <i>DsfComm</i> .
	The requested port was not available.	Check the personal computer for available ports. Check the communications setup for the correct port.
Port Error Communications Thread Error!	The requested port was not available.	Check the personal computer for available ports. Check the communications setup for the correct port.
Timeout	Scanner not responding.	Check communications wiring and configuration.

8.2 Flame Signal

8.2.1 No Flame Signal

1. Confirm that the scanner wiring is connected per Figure 2 on page 11.
2. Confirm that the scanner has power. (*Note: On the base model, that has an EASI LED on back of scanner, the LED will be on.*)
3. If the scanner has power and the EASI LED is on but not blinking, then there is a scanner fault. Remove the power for a few seconds to try to clear the fault and then reconnect. If the LED is still not blinking, then replace the scanner.

If the scanner has power and does not have an EASI LED, then remove the power for a few seconds and then reconnect.

4. Confirm the scanner lens is clean. Refer to Section 9 on page 28.
5. Confirm the scanner is sighted properly. Refer to Section 5 on page 17.

8.2.2 Low Flame Signal

Low signal levels may be caused by improper sighting. Refer to Section 5 on page 17.

Low signal levels may also be caused by a dirty or wet lens. Refer to Section 9 on page 28.

8.3 Scanner Faults

On the base model a scanner fault is indicated by a nonblinking EASI LED.

NOTE: When using the optional communications kit (refer to Section 1.2.3), a scanner fault will be indicated on the Setup/Program window (refer to Figure 6 on page 19).

If a scanner fault occurs:

1. Try clearing the fault by disconnecting the power for a few seconds and then reconnecting the power. If the fault does not clear, then try replacing the scanner.
2. If using the communications software, record the fault number and message (refer to Section 7.1.4 on page 20). If the fault is listed in the following table, then resolve the problem as described in the table.

Error Message	Possible Cause	Remedies
bit 7: Critical Error	Indicates that a critical error occurred. The specific error(s) will be listed. Critical errors will cause the scanner to default to a flame-off state.	If the critical error is one of the errors shown in this table, then correct the error as described below.
bit 16: DC Flame Signal Error	May indicate that the flame signal is too strong.	Use an orifice to reduce the flame signal to the scanner.
bit 19: Over-temp Error	<i>This is not a critical error.</i> Internal temperature of the scanner is greater than design limit.	Check that the scanner purge air supply meets design requirements (refer to Section 1.1). Provide shield or other means of external cooling.
bit 20: Under-temp Error	Internal temperature of the scanner is less than design limit. This will only occur with outdoor installations in a very cold environment and with the scanner powered off.	Apply power for several minutes allowing scanner to warm up.
bit 25: Serial Receive Buffer Over Run Error	Buffer overloaded.	Check communications wiring. Check for proper grounding. Check for possible induced or conducted electrical noise.

9. Maintenance

The scanner is a rugged, high temperature device, and contains no moving parts. There are no adjustments inside the scanner. **The scanner housing should not be opened. Doing so may damage the scanner and will void the warranty.**

The only maintenance that may be required is periodic cleaning of the **outside** of the quartz glass lens. To clean the lens: 1) unscrew the mounting ring and remove the scanner from the scanner mount, 2) clean the lens with a clean cloth, and 3) reinstall. **Do not remove the lens from the scanner housing. Doing so will void the warranty.**

▲ Caution

To reduce the risk of electrical shock and injury, disconnect or shut off electrical power to all connections before replacing the scanner. This includes not only the power supply for the scanner but also the flame relay contacts which may have up to 120 Vac on them.

10. Software License Agreement

NOTE:

This section is applicable only for scanners supplied with the Communications Kit (refer to Section 1.2.3 on page 7).

COEN FLAME SCANNER SINGLE USER SOFTWARE AGREEMENT

This is a Contract. By installing this Software you accept all of the Terms and Conditions of this Agreement.

This Coen Company Inc. ("Coen") *End User License Agreement* accompanies the Coen Flame Scanner and its applicable configuration and/or display software ("Software"). The term Software also shall include any upgrades, modified versions or updates of the Software, licensed to you by Coen. Please read this agreement carefully. At the end, you will have the choice of either accepting this Agreement and continuing to install the Software or returning the scanner equipment, with its supporting Software, subject to a restocking charge for returning equipment which may have been customized for a specific application and/or for equipment which is no longer considered new.

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11. Warranty Statement

WARRANTIES AND EXCLUSIVE REMEDIES

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DESIGN

Coen reserves the right at any time to discontinue the manufacture of any model or make changes in design to add improvements to products or Software without incurring any obligations to furnish or install the same on products previously manufactured. All data and dimensions provided in bulletins are to be considered reasonably accurate at the time of printing. Where exact dimensions and data are required Coen can provide certified drawings and specification sheets to reflect the product specifications at the time of manufacture.

A. Configuration Settings

DSF-2000-SB scanners are shipped with the following settings. These settings are factory set and can not be changed.

Flame-on Response Time	2 sec
Total Flame Failure Response Time	1 sec
Marginal Flame Failure Response Time	2 sec
Gain Configuration	Auto
Gain Channel	High
Flame Flicker Frequency	26 Hz
Flame Flicker Bandwidth	12 Hz
Flame Flicker Threshold	-32 dB
Communications Address	Comm 1

B. DsfComm Menus – Optional

NOTE:

This section is applicable only for scanners supplied with the Communications Kit (refer to Section 1.2.3 on page 7).

Main Menu

- File
 - New
 - Graphics File
 - Scanner File
 - Open...
 - Print Setup...
 - Exit
- Setup
 - Communications
 - Scanner Address
 - Password
- View
 - Who's On The Network
- Help
 - About DsfComm...

Graphics File Menu

- File
 - New
 - Graphics File
 - Scanner File
 - Open...
 - Close
 - Save
 - Save As...
 - Print Setup...
 - Exit
- Edit
 - Add Scanner Icon
 - Delete Scanner Icon
- View
 - Comm Status
 - Who's On The Network
- Configure
 - Background Color
- Window
 - New Window
 - Cascade
 - Tile
 - Arrange Icons
- Help
 - About DsfComm...

Scanner Icon Menu

- Menu Bar
 - Setup/Program
 - File
 - Exit
 - View
 - First Out Message
 - Scanner Identity
 - Rule Counts
 - Help
 - Flame Frequency
 - Flame Signal
 - Current Status

C. Checkout Test Procedures and Sighting Adjustments

Important

Always test the flame scanner for proper operation and discrimination after any change in sighting.

There are five test procedures that should be completed to ensure proper installation and operation of the flame scanner:

- Ignition Interference Test
- Normal Pilot Flame Detection Test
- Main Flame Detection Test
- Minimum Pilot Flame Detection Test
- Flame Discrimination Test

Setup for Checkout Testing

A current meter is required to perform the checkout testing. The meter needs to be installed locally at each scanner as it is tested. If the scanner's 4–20 mA output is already wired to a remote device, then temporarily disconnect until the testing is complete. Connect the meter to the scanner's 4–20 mA output. After testing is complete remove the meter. If the scanner's 4–20 mA output was wired to a remote device, then reconnect.

1. Ignition Interference Test

The purpose of this test is to determine if the scanner is affected by ignition noise. Although the electronics inside the flame scanner includes noise suppressers, it is possible for electrical noise to get into the flame scanner and create a false flame-on condition.

CAUTION

Before performing the *Ignition Interference Test*, manually shut off the fuel supply to the main burner and pilot to prevent a flame from igniting.

1. Confirm that the main and pilot fuel supply have been manually shut off.
2. Confirm that there is no flame signal (i.e. meter reads 4 ± 0.5 mA).
3. Initiate a normal start of the ignitor.
4. When the ignition system energizes, the flame scanner should not give a false signal indicating flame detected. The flame relay should remain de-energized (i.e. contacts open) and the flame signal should remain at 4 ± 0.5 mA.
5. If a false flame signal is generated, then check the wiring, shielding, and grounding for the cause of the electrical noise interference. Refer to Section 3 on page 10.

Also, check the scanner sighting to make sure that the scanner is not viewing the spark of the ignitor.

6. **Eliminate the ignition noise or sighting problems before proceeding.**

2. Normal Pilot Flame Detection Test

NOTE: This test is not required for direct spark ignition systems.

The purpose of this test is to check for sufficient flame signal when the pilot fuel is firing and for proper flame failure response time.

▲ CAUTION

Before performing the *Normal Pilot Flame Detection Test*, manually shut off the fuel supply to the main burner to prevent the main burner flame from igniting.

NOTES:

1. This test should be done with minimum background radiation (i.e. make sure that the scanner is not sighted at any hot refractory or hot burner parts).
 2. Where a single scanner is used to monitor both the pilot and main flames, the scanner must be sighted to view both flames.
-
1. The *Ignition Interference Test* should have been performed before doing this test.
 2. Confirm that the main fuel supply to the burner has been manually shut off and that the fuel supply is available to the pilot.
 3. Confirm that there is no flame signal (i.e. meter reads 4 ± 0.5 mA). On models equipped with EASI, the EASI LED at the back of the scanner should be blinking slowly (flame-off indication).
 4. Start the pilot per the manufacturer's instructions allowing only the pilot flame to ignite. After the pilot has ignited and after the spark ignition has stopped, slowly adjust the flame scanner sighting to obtain the maximum flame signal. The flame signal should be greater than 8 mA and the flame relay should be energized (i.e. contacts closed). On models equipped with the EASI feature, the EASI LED should be flashing quickly (flame-on indication).
 5. If the scanner is sensing a flame, but the flame signal is less than 8 mA and the flame relay is not energized, then confirm that the scanner lens is clean (refer to Section 9), and/or increase the size of the pilot flame until the flame signal is greater than 8 mA and the flame relay is energized.
 6. Check the scanner's *Total Flame Failure Response Time*. Turn off the pilot and time how long it takes for the scanner to signal "Flame Off" after the flame is extinguished. This is the *Total Flame Failure Response Time*. The flame relay should de-energize (i.e. contact opens) and the flame signal should return to 4 ± 0.5 mA. The actual *Total Flame Failure Response Time* should be less than or equal to one second (refer to Section 6.3 on page 18). If it is not, then replace the scanner.

CAUTION

Do not operate the burner unless the actual *Total Flame Failure Response Time* is less than or equal to one second.

3. Main Flame Detection Test

The purpose of this test is to check for sufficient flame signal when the main fuel is firing at its minimum flame signal strength.

NOTES:

1. This test should be done with minimum background radiation (i.e. make sure that the scanner is not sighted at any hot refractory or hot burner parts).
2. Where a single scanner is used to monitor both main and pilot flames, the scanner must be sighted to view both flames.
3. Where separate scanners are used to monitor main and pilot flames, the scanner for the main flame must be sighted so that it does not detect the pilot flame.

1. The *Normal Pilot Flame Detection Test* should have been performed before doing this test.
2. Start the burner per the manufacture's instructions.
3. Operate the burner through its complete firing range.
4. The flame scanner's flame relay should be energized (i.e. contacts closed) and the flame signal should be greater than 10 mA through the complete operating range of the burner. If not, then resight the flame scanner to achieve more flame signal. (*Note: If the flame scanner is resighted then the Normal Pilot Flame Detection Test must be redone also.*)

4. Minimum Pilot Flame Detection Test

NOTE: This test is not required for direct spark ignition systems.

The purpose of this test is to insure that the flame scanner will not signal a flame-on condition if the pilot flame is not sufficiently large to reliably ignite main fuel under all startup conditions.

CAUTION

Before performing the *Minimum Pilot Flame Detection Test*, manually shut off the fuel supply to the main burner to prevent the main burner flame from igniting.

This test must be carried out by a qualified combustion technician.

1. The *Normal Pilot Flame Detection Test* and the *Main Flame Detection Test* should have been performed before doing this test.
2. Confirm that the main fuel supply to the burner has been manually shut off and that the fuel supply is available to the pilot.
3. Start the pilot per the manufacturer's instructions allowing only the pilot flame to ignite.

4. Decrease the pilot flame size to the point where the flame scanner's flame relay just remains energized (the meter is reading about 8 mA).
5. Open main fuel manual shutoff valve and observe the light off of the main fuel. The fuel light off should be immediate, smooth, and normal.

CAUTION

If the light off is not immediate, smooth, and normal, then

- Immediately shut off the main fuel.
- Increase the pilot flame size until light off is immediate, smooth, and normal.
- Resight the scanner so that the flame relay just remains energized. This will be minimum pilot flame required to reliably light off the main fuel.
- Redo the *Normal Pilot Flame Detection Test* and the *Main Flame Detection Test* .

5. For applications with multiple fuels, repeat the test for each fuel, finding the minimum pilot capacity that will work for all fuels.
6. When the test has been satisfactorily completed, increase the pilot flame back to the original size.

5. Flame Discrimination Test

The purpose of this test is to check that the scanner can discriminate between the minimum burner flame signal and the maximum background radiation signal. The background radiation signal can be from hot refractory or hot burner parts. These sources can generate false flame signals that will hold in the flame relay beyond the *Marginal Flame Failure Response Time* setting of the scanner.

CAUTION

Do not operate the burner until the flame scanner has been sighted so that it can discriminate between the burner flame signal the background radiation signal.

1. The *Main Flame Detection Test* should have been performed before doing this test.
2. Start the burner and allow time for the furnace it to reach its operating temperature. This will maximize the background radiation signal.
3. Check scanner's *Marginal Flame Failure Response Time*. Turn off the burner and time how long it takes for the scanner to signal "Flame Off" after the flame is extinguished. The flame relay should de-energize (i.e. contact opens) and the flame signal should return to 4 ± 0.5 mA. The flame scanner should signal "Flame Off" within its two second *Marginal Flame Failure Response Time* setting (refer to Section 6.3 on page 18).
 - a) If the flame scanner does detect the flame-off condition within its two second *Marginal Flame Failure Response Time* setting, then the scanner is properly discriminating between the burner flame signal and the background radiation signal.

- b) If the flame scanner does not detect flame-off within the its two second *Marginal Flame Failure Response Time*, then the scanner is falsely sensing a flame. Resight (refer to Section 5) the scanner until the *Flame Discrimination Test* passes.

D. RS232/RS485 Converter Kit – Optional

NOTE:

This section is applicable only for scanners supplied with the Communications Kit (refer to Section 1.2.3 on page 7).

NOTE: Refer to Section 1.2.3 for additional information.

Dimensions:

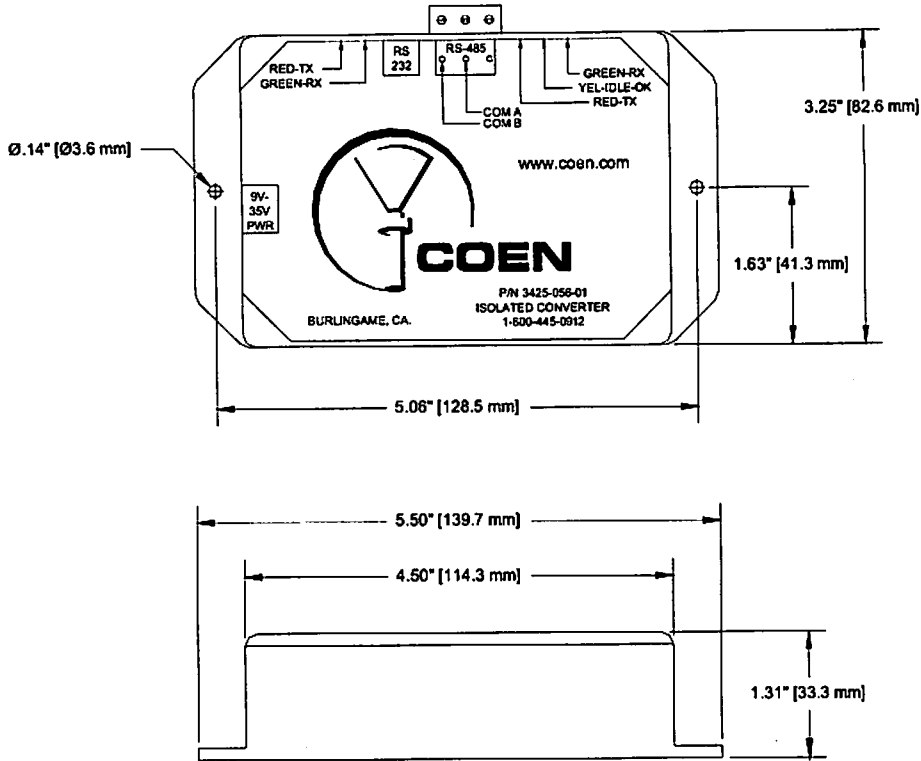


Figure 10
RS232/RS485 Converter

Connections:

The RS485 and RS232 connections and indicator lights are located on the top side of the converter. The RS485 connections are screw type terminals. The RS232 connection is a RJ11 connector. *(Note: The converter kit includes 7 ft of RS232 cable with a RJ11 connector on one end and a DB9F connector on the other end.)*

The power supply connection is located on the left side of the converter. The converter requires a 9–35 Vdc power source. There is a 2.1 mm diameter connector that can be used for the supplied ac to dc power supply. Power can also be supplied to lever operated clamp type terminals. The maximum wire size that this terminal can accept is #20 AWG.

When installing, allow space for access to these connections.

E. Flame Signal Output in VDC

The flame signal output from the DSF-2000-SB flame scanner is a current output (typically 4–20 mA).

This current output can be converted to a dc voltage output by creating a voltage drop across a fixed resistor as shown in the figure below. Select the resistor based on the required voltage output.

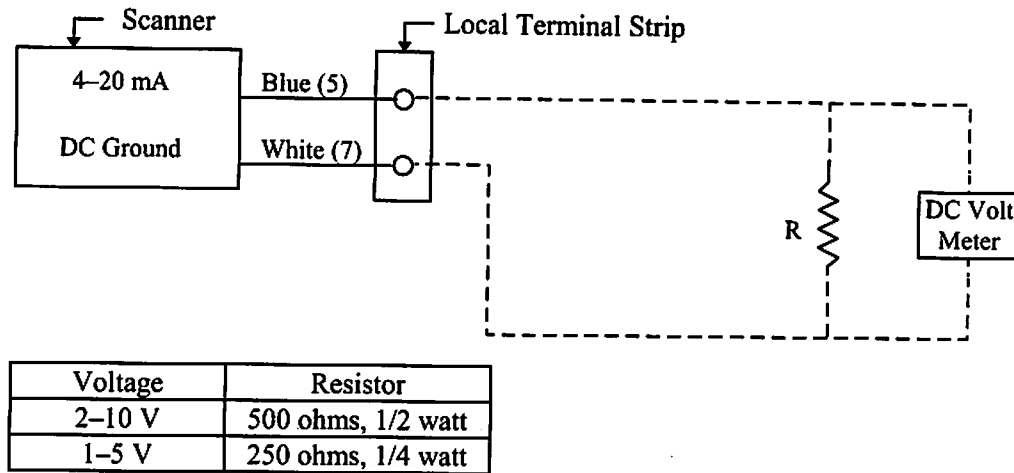


Figure 11
Flame Signal Output in VDC

NOTES:

1. The resistor can be located anywhere in the circuit.
2. The maximum current loop resistance is 750 ohms. Make sure that the wiring is sized so that this maximum loop resistance is not exceeded.

F. Changing Conduit Fitting

Caution

The base model is supplied with a factory installed 90° flexible-conduit fitting. **It is recommended that the conduit fitting not be removed.** Doing so may damage the cable connection inside the scanner and will void the warranty.

If installation with the 90° flexible-conduit fitting creates a difficult installation problem, then the 90° fitting can be replaced with a straight flexible-conduit fitting following the instructions below.

To change to a straight flexible-conduit fitting:

1. Remove the two screws on the 90° fitting and remove the cover over the opening.
2. Carefully feed the scanner cable through the opening so that it extends straight away from the scanner. Do not pull on cable, or the internal connection may be damaged, requiring it to be returned to the factory for repair.
3. Remove the 90° fitting and nipple from the scanner by rotating it counterclockwise, ensuring that the scanner cable does not rotate.
4. Slide the 1/2" NPT 90° fitting off the cable and remove the 1/2" NPT straight fitting from it.
5. Slide the 1/2" NPT straight fitting over the cable and tighten.

G. Wire Colors for Early Production Scanners

Early production scanners used the wire colors shown below. When replacing an early production scanner with a newer scanner, be sure to wire the scanner following the electrical connection diagram shown in Figure 2 on page 11.

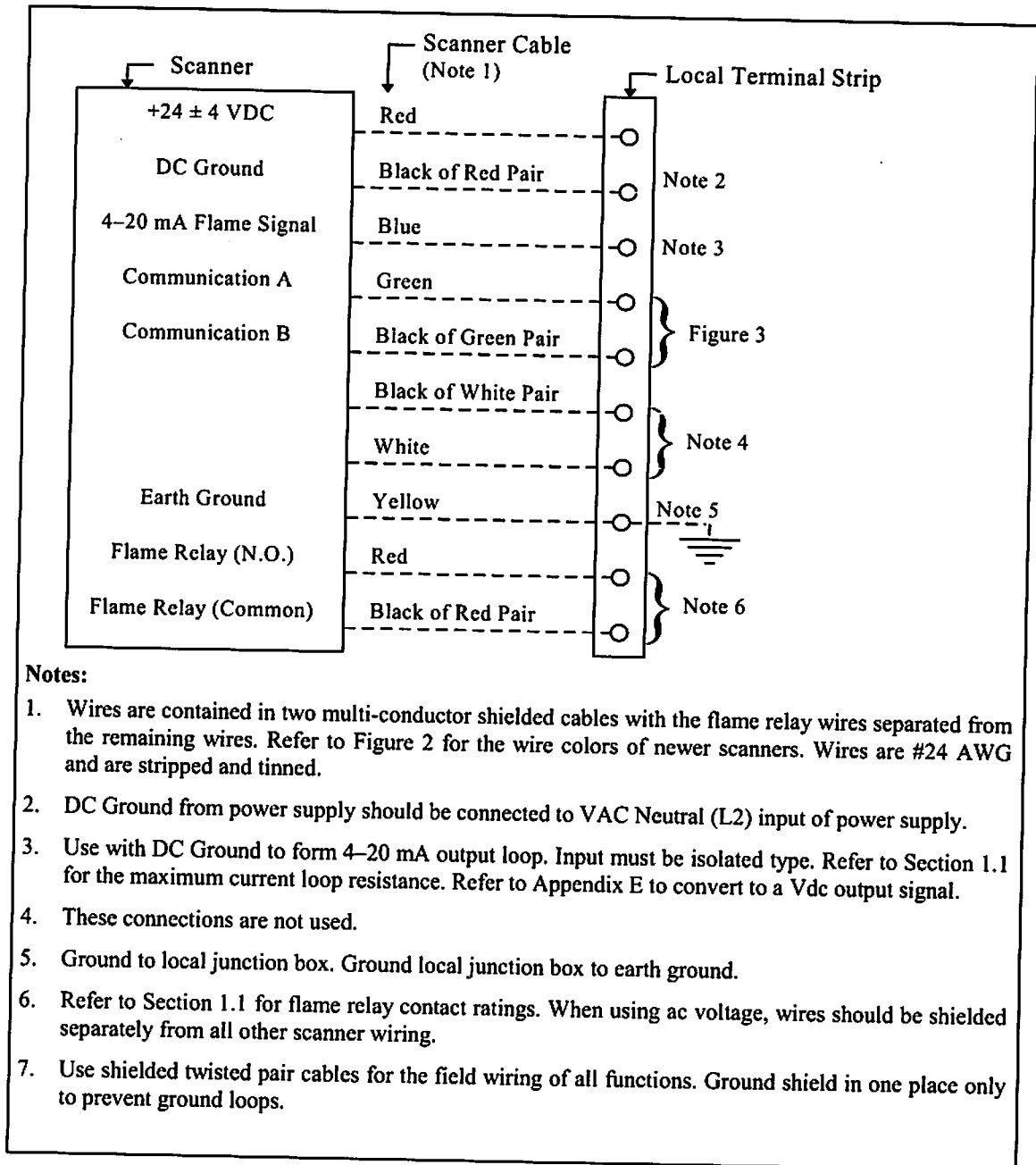


Figure 12
Electrical Connection Diagram for Early Production Scanners



Series 1950 Explosion-Proof Differential Pressure Switches

Specifications - Installation and Operating Instructions

UL and CSA Listed, FM Approved For
CL. I GR. C, D - CL. II GR. E, F, G - CL. III

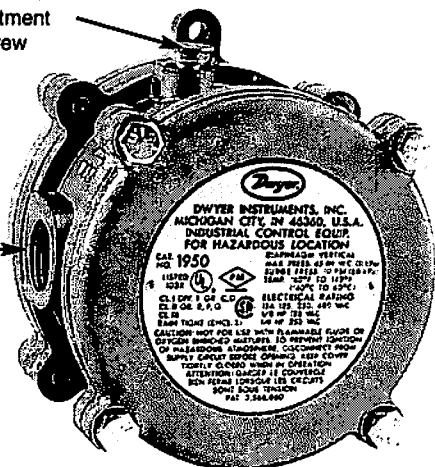
Series 1950 Switches

Operating ranges and deadbands

To order specify Model Number	Operating Range: Inches, W.C.	Approximate Dead Band	
		At Min. Set Point	At Max. Set Point
1950-02-2S	0.03 to 0.10	0.025	0.05
1950-00-2F	0.07 to 0.15	0.04	0.05
1950-0-2F	0.15 to 0.5	0.10	0.15
1950-1-2F	0.4 to 1.6	0.15	0.20
1950-5-2F	1.4 to 5.5	0.3	0.4
1950-10-2F	3.0 to 11.0	0.4	0.5
1950-20-2F	4.0 to 20.0	0.4	0.6
Model Number	Operating Range: PSI	Approximate Dead Band	
		Min. Set Point	Max. Set Point
1950P-2-2F	0.5 to 2.0	0.3 psi	0.3 psi
1950P-8-2F	1.5 to 8.0	1.0 psi	1.0 psi
1950P-15-2F	3.0 to 15.0	0.9 psi	0.9 psi
1950P-25-2F	4.0 to 25.0	0.7 psi	0.7 psi
1950P-50-2F	15.0 to 50	1.0 psi	1.5 psi

Set Point Adjustment Screw

1/2" (12.7) female NPT Electrical Conduit Connection



Series 1950 Explosion-Proof Differential Pressure Switches combine the best features of the Dwyer Series 1900 Pressure Switch with an integral explosion-proof and weather-proof housing. Each unit is UL & CSA listed; FM approved for use in Class I, Groups C & D; Class II, Groups E, F, & G; and Class III atmospheres (NEMA 7 & 9). They are totally rain-tight for outdoor installations. Twelve models allow set-points from .03 to 20 inches w.c. and from .5 to 50 psi (3.4 to 345 kPa).

Easy access to the SPDT switch for electrical hook-up is provided by removing the top plate of the three-part aluminum housing. Adjustment to the set point of the switch can be made without disassembling the housing. The unit is very compact, about half the weight and bulk of equivalent conventional explosion-proof switches.

CAUTION

For use only with air or compatible gases. Use of the Model 1950 switch with explosive media connected to the Low pressure port (including differential pressure applications in such media) is not recommended. Switch contact arcing can cause an explosion inside the switch housing which, while contained, may render the switch inoperative. If switch is being used to sense a single positive pressure relative to atmosphere, run a line from the low pressure port to a non-hazardous area free of combustible gases. This may increase response time on -0 and -00 models.

NOTE: The last number-letter combination in the model number identifies the switch's electrical rating (number) and diaphragm material (letter). The 2F combination is standard as described in the physical data above. In case of special models, a number 1 rating is the same as 2; a number 3 or 4 rating is 10A 125, 250, 480 VAC; 1/8 H.P. 125 VAC; 1/4 H.P. 250 VAC; a number 5 or 6 rating is 1A 125 VAC. Letter B indicates a Buna-N diaphragm; N = Neoprene; S = Silicone; and V = Viton®.

SPECIFICATIONS

Service: Air and non-combustible, compatible gases.

Wetted Materials: Consult factory.

Temperature Limits: -40 to 140°F (-40 to 60°C); 0 to 140°F (-17.8 to 60°C) for 1950P-8, 15, 25, and 50. -30 to 130°F (-34.4 to 54.4°C) for 1950-02.

Pressure Limits:

Continuous: 1950's - 45" w.c. (0.11 bar);
1950P's - 35 psi (2.41 bar); 1950P-50 only - 70 psi (4.83 bar).
Surge: 1950's - 10 psi (0.69 bar), 1950P's - 50 psi (3.45 bar),
1950P-50 only - 90 psi (6.21 bar).

Enclosure Rating: IP64, NEMA 3, 7 and 9.

Switch Type: Single-pole double-throw (SPDT).

Electrical Rating: 15 A @, 125, 250, 480 VAC, 60 Hz. Resistive
1/8 HP @ 125 VAC, 1/4 HP @ 250 VAC, 60 Hz.

Electrical Connections: 3 screw type, common, normally open and normally closed.

Process Connections: 1/8" female NPT.

Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.

Set Point Adjustment: Screw type on top of housing.

Weight: 3.25 lb (1.5 kg); 1950-02 model, 4.4 lb (2 kg).

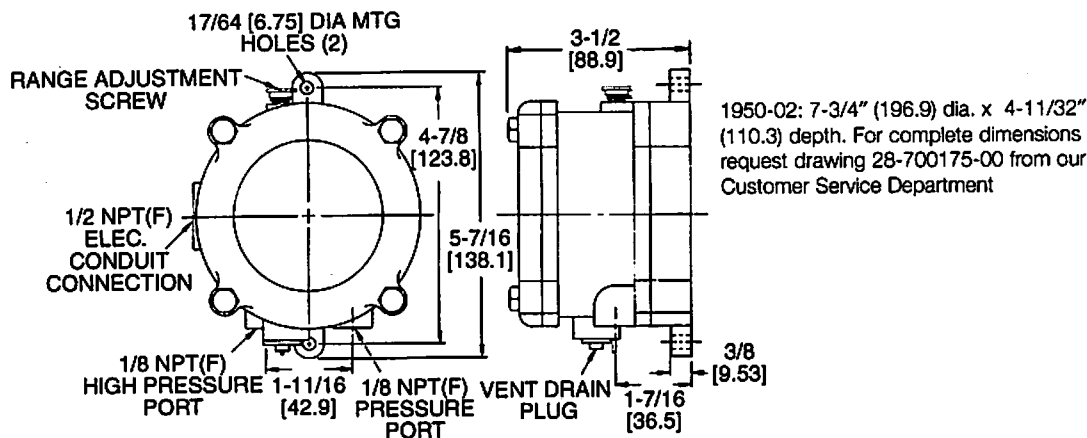
Agency Approvals: CE, UL, CSA, FM.

RESPONSE TIME: Because of restrictive effect of flame arrestors, switch response time may be as much as 10-25 seconds where applied pressures are near set point.

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e-mail: info@dwyer-inst.com



1950 Switch Outline Dimensions

INSTALLATION

1. Select a location free from excess vibration and corrosive atmospheres where temperatures will be within the limits noted under Specifications on reverse. Switch may be installed outdoors or in areas where the hazard of explosion exists. See reverse for specific types of hazardous service.

2. Mount standard switches with the diaphragm in a vertical plane and with switch lettering and Dwyer nameplate in an upright position. Some switches are position sensitive and may not reset properly unless they are mounted with the diaphragm vertical.

3. Connect switch to source of pressure, vacuum or differential pressure. Metal tubing with 1/4" O.D. is recommended, but any tubing which will not restrict the air flow can be used. Connect to the two 1/8" female NPT pressure ports as noted below:

- A. Differential pressures - connect pipes or tubes from source of greater pressure to high pressure port marked HIGH PRESS, and from source of lower pressure to low pressure port marked LOW PRESS.
- B. Pressure only (above atmospheric pressure) - connect tube from source of pressure to high pressure port. The low pressure port is left open to atmosphere.
- C. Vacuum only (below atmospheric pressure) - connect tube from source of vacuum to low pressure port. The high pressure port is left open to atmosphere.

4. To make electrical connections, remove the three hex head screws from the cover and after loosening the fourth captive screw, swing the cover aside. Electrical connections to the standard single pole, double throw snap switch are provided by means of terminals marked "COM" (common), "NO" (norm open), "NC" (norm closed). The normally open contacts close and the normally closed contacts open when pressure increases beyond the set point. Switch loads for standard models should not exceed the maximum specified current rating of 15 amps resistive. Switch capabilities decrease with an increase in ambient temperature, load inductance, or cycling rate. Whenever an

application involves one or more of these factors, the user may find it desirable to limit the switched current to 10 amps or less in the interest of prolonging switch life.

ADJUSTMENT: To Change the Set point

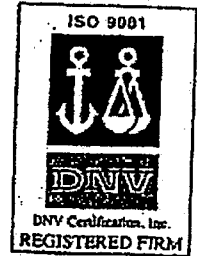
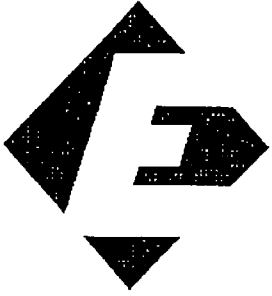
1. Remove the plastic cap and turn the slotted Adjustment Screw at the top of the housing clockwise to raise the set point pressure and counter-clockwise to lower the set point. After calibration, replace the plastic cap and re-check the set point.

2. The recommended procedure for calibrating or checking calibration is to use a "T" assembly with three rubber tubing leads, all as short as possible and the entire assembly offering minimum flow restriction. Run one lead to the pressure switch, another to a manometer of known accuracy and appropriate range, and apply pressure through the third tube. Make final approach to the set point very slowly. Note that manometer and pressure switch will have different response times due to different internal volumes, lengths of tubing, fluid drainage, etc. Be certain the switch is checked in the position it will assume in use, i.e. with diaphragm in a vertical plane and switch lettering and Dwyer nameplate in an upright position.

3. For highly critical applications check the set point adjustment and if necessary, reset it as noted in step A.

MAINTENANCE

The moving parts of these switches need no maintenance or lubrication. The only adjustment is that of the set point. Care should be taken to keep the switch reasonably clean. Periodically the vent drain plug should be rotated, then returned to its original position. This will dislodge deposits which could accumulate in applications where there is excessive condensation within the switch. The Series 1950 Explosion-Proof Differential Pressure Switch is not field serviceable and should be returned if repair is needed (field repair should not be attempted and may void warranty). Be sure to include a brief description of the problem plus any relevant application notes. Contact customer service to receive a return goods authorization number before shipping.



ENARDO

SERIES 7 FLAME ARRESTOR

***INSTALLATION & MAINTENANCE
INSTRUCTIONS***

Enardo, Inc.* 4470 S. 70th E. Ave. * Tulsa, OK 74145

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I. MODEL NUMBER IDENTIFICATION:

Blank = Concentric E = Eccentric	7 Series 7	Housing Size 04 = 4" through 72 = 72"	Connection Size 01 = 1" through 36 = 36"	NEC Gas Group B C D	Housing Material A = Aluminum C = C. Steel 4 = 304 SS 6 = 316 SS H = Hastelloy E = Exotic	Element Material A = Aluminum 4 = 304 SS 6 = 316 SS H = Hastelloy E = Exotic	Connection Type F = Flat face flange R = Raised face flange	Options 1 = Drain Plug 2 = Pressure Tap 3 = Temp. probe tap 4 = Miscellaneous 5 = Protective coating 6 = Special feature
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II. FACTORS AFFECTING FLAME ARRESTOR PERFORMANCE

A. Gas Group

The type of gas in the system determines its gas grouping and therefore predetermines the type of arrestor element required. The element must be designed to accommodate the specific gas group that could possibly ignite and propagate in the system. The more explosive gases require the flame cell to absorb the heat more quickly and efficiently. The National Electrical Code (NEC) groups gases into A, B, C, D and G.M. categories depending on the MESG (Maximum Experimental Safe Gap) of the gas.

WARNING!

Methanol is classified by the NEC as a Group-D vapor. However, our lab tests indicate that methanol exhibits characteristics unlike other Group-D vapors under certain conditions. We therefore recommend that an arrestor rated for Group-C vapors be specified for methanol service.

B. MESG (Maximum Experimental Safe Gap)

The measurement of the maximum gap between two equatorial flanges on a metal sphere that will prevent a flame from being transmitted from the sphere to the surrounding flammable mixture. MESG is dependent on gas composition. The stoichiometric mixture (the ideal air/fuel ratio for the most efficient combustion) is used to determine the minimum MESG for a given gas.

NEC	MESG (millimeters)	TEST GAS LIST
Group B	0.28	Hydrogen
Group C	0.65	Ethylene
Group D	0.90	Propane

G.M.	1.12	Methane
------	------	---------

Table 1

WARNING!

Verify that the Flame Arrestor being installed has the appropriate gas group rating for your process. This information is shown on the nameplate attached to the element housing. **Do not remove or alter this nameplate.**

C. Maximum initial operating pressure

This is the pressure of the system at or near static flow conditions. High pressure deflagrations can occur more easily at higher system operating pressures than at pressures near atmospheric. Elevated pressures condense the ignitable gas giving the flame more matter and energy to release thereby boosting the flame heat intensity. Verify that your system pressure at or near static flow conditions does not exceed the maximum pressure shown on the arrestor's name tag.

D. Endurance Burn Time

Definition of endurance burn: The time it takes for a stabilized flame, at greatest heat saturation conditions, to heat the arrestor element above the auto-ignition temperature of the process gas stream resulting in flame propagation through the arrestor.

Series 7 Flame Arrestors, all sizes		
Gas Group	Maximum Initial Pressure, psia (kPa)	Endurance Burn Time
D	15.4 (106)	30 Minutes (steel and stainless steel models up to 12" and under)
D	15.4 (106)	5 Minutes (all other Group-D)
C	15.4 (106)	5 Minutes
B	15.4 (106)	2 Minutes

Table 2

CAUTION

Unlimited burning should not be allowed in any flame arrestor, regardless of its burn time rating. If burning can occur for a period exceeding 2 minutes starting at ambient temperature, it is recommended that a temperature alarm and shutdown system be installed.

E. Pipe Length

Extended lengths of pipe allow the flame to advance into more severe states of flame propagation such as high pressure deflagrations or detonations. Series 7 Flame Arrestors should be installed in accordance with the table 3:

F. Bends and/or flow obstructions

Bends in piping, pipe expansions, and/or contractions, valves, orifice plates or flow obstructing devices of any kind contribute to turbulent flow. Turbulent flow enhances mixing of the combustible gases, greatly increasing the combustion intensity. This can result in increased flame speeds, higher flame temperatures, and higher flame front pressures than would occur in normal flow conditions.

Series 7 Flame Arrestors, all sizes			
	Gas Group "D"	Gas Group "C"	Gas Group "B"
Maximum length of pipe between the flame arrestor and the ignition source without bends or other obstructions.	20 feet (6 meters)	6 feet (2 meters), open ended pipe	4 feet (1.2 meters), open ended pipe
Maximum length of pipe between the flame arrestor and the ignition source with a maximum of one 90° bend. Multiple bends or any additional obstructions are not recommended.	20 feet (6 meters)	6 feet (2 meters), open ended pipe	Not Recommended With a Bend.

Table 3

CAUTION

For maximum safety, avoid bends and flow obstructions within 10 pipe diameters on the protected side of the flame arrestor.

III. INSTALLATION AND MAINTENANCE INSTRUCTIONS:

A. Installation Instructions

WARNING!

Always make sure that the system is at atmospheric pressure and there is no ignitable gas that could flash when either installing or maintaining the unit.

1. Connections

Enardo Flame Arrestors are normally provided with 150 lb. ANSI raised or flat face flanges. Other flange patterns are available upon request. Make sure the companion flanges installed in adjacent piping match the flanges on the flame arrestor.

Standard compressed fiber gaskets that will withstand temperatures of 450 F degrees are standard. Graphite gaskets with higher temperature ratings are available as an option.

2. Positioning

- a) The flame arrestor should be positioned such that the element is accessible for removal. The tension studs are supplied with jacking nuts on one half of the bolting circumference. Install the unit so that the jacking nuts (on the inside of the studs) are positioned on the opposite side from the direction that the element assembly will be removed. Models that have drain plugs are designed for horizontal installation and should be installed with the drain plugs aligned at the bottom of the unit. Models that have pressure taps are designed to allow pressure gauges to be installed on both sides of the flame cell assembly to determine blockage. The pressure taps should be aligned at the top to allow easy viewing of the gauges. Units that are equipped with optional internal cleaning systems should be connected to a source of cleaning media such as water, steam, or other suitable solvent.

3. Flow Direction

The Enardo Flame Arrestor is bi-directional and can be installed either vertically or horizontally. Consideration should be given to non-symmetrical assemblies that include features such as clean-out ports, temperature monitoring device, or other options that might have a preferred installation direction to suit the needs of the customer.

4. Lifting

CAUTION

The flame arrestor is fitted with lugs for lifting the element assembly during servicing operations. These lugs are not intended for lifting the entire unit during installation. Damage to the flame arrestor may result from improper lifting. Heavy units should be lifted using appropriately rated nylon straps rigged on the outside of the tension studs.

5. Piping Expansions and Reductions Adjacent to Flame Arrestors

An Enardo Flame Arrestor may be installed in any vapor control line that is smaller than or equal to the nominal pipe diameter of the arrestor's connection flanges.

When it is necessary to increase the diameter of the piping on the down stream side of the flame arrestor, a length of pipe at least 120 pipe diameters must be installed between the flame arrestor and the expansion. A pipe diameter is considered as the inside diameter of pipe having a nominal size equal to the flame arrestor's connecting flanges.

WARNING!

No instrument, tubing or other device whatsoever shall circumvent the flame arrestor in such a manner to allow a flame path to exist around the flame element of the arrestor. When instrumentation is installed in such a manner that it creates a path circumventing the flame element of an arrestor, measures must be taken to prevent passage of flame through the instrumentation device and/or system. Instrumentation must be capable of withstanding the maximum and minimum pressures and temperatures to which the device may be exposed.

B. Maintenance Instructions

It is important to keep the element openings clean to prevent loss of efficiency in absorbing heat. The element assembly should be removed and the elements cleaned to prevent the openings from becoming clogged with particulate matter. Clean the element with a suitable cleaning media (solvent, soap, water, or steam) then blow dry using compressed air. Special care should be taken not to damage or dent the cell openings as this would hamper the effectiveness of the unit. Arrestor elements shall not be cleaned by rodding to remove blockages, as this practice could damage the elements and seriously impair the arrestor's performance. If the arrestor element cannot be cleaned satisfactorily, it must be replaced.

For best cleaning results, a high pressure sprayer with spray wand should be used (1,500 psig to 3,000 psig) to clean the entire element surface. The spray nozzle should be held perpendicular to the surface being cleaned to maximize spray media penetration into the element. Alternately spray each side of the element surface until clean.

The cleaning interval should be governed by the amount and type of particulate in the system to which it is installed and must be determined by the user. To determine the maintenance interval the user should check the element in the first few months of operation to find how quickly particulate accumulates in the cells. After cleaning, the element should be thoroughly inspected for damage. If damaged, it must be replaced. **Under no circumstance should the element bank be disassembled from its shell for cleaning or replacement.** The element section must be replaced as a complete assembly.

Optional internal cleaning system: Cleaning of units equipped with this system may be accomplished in several ways including periodic cleaning using manually operated valves, by use of an automated cycle timing method, or by having the cleaning operation initiated whenever the pressure loss across the arrestor element exceeds a predetermined value.

C. Element Assembly Disassembly & Reassembly Instructions

WARNING!

Isolate gas supply and bring system to atmospheric pressure to prevent ignitable gas from flashing while performing maintenance.

1. Loosen all jacking (inside) nuts on tension studs between conical sections of the flame arrestor.
2. Tighten the inside jacking nuts on the tension studs forcing the two conical sections apart. When the two flange faces have separated, remove the tension studs that do not have inside jacking nuts, so that the element assembly can be removed. The inside jacking nuts are installed on all tension studs that facilitate jacking the unit apart. The inside jacking nuts are not installed on tension studs that are taken out, for ease of removal.

CAUTION

Element assemblies are heavy and will require the use of adequate equipment and manpower to prevent injury.

3. Thoroughly clean the gasket sealing faces being careful not to damage the sealing surface. For re-assembly lightly grease one side of a new gasket and place it in the machined recess of each interior flange on the two conical sections.
4. Replace the flame element assembly with a new assembly or properly cleaned and inspected existing unit.

5. Loosen the jacking nuts on the tension rods until the flame cell assembly seats onto the gaskets.
6. Replace all tensioning studs and tighten the outer nuts hand tight only. Check to be sure that all the jacking nuts are completely loose and not making contact with the flange face.

D. Torquing Instructions:

1. Tools/Supplies Required

- Torque wrench appropriate for the specified torque.
- Socket wrenches of the proper size to fit the hex nuts being tightened.
- Molydisulfide based lubricating paste. Molykote G-n or equivalent.
- Brush suitable for applying lubricant to the studs.
- Wiping rags necessary for the clean up of excessive lubricant.

2. Procedure

- Use studs and nuts that are free of visible contamination and corrosion.
- Apply lubricant to the threads of the stud protruding outboard of the interior flanges and to the face of the hex nuts which will contact the flange.
- Assemble the nuts to the studs such that the amount of thread extending outboard beyond the nut is approximately equal on both ends.
- Tighten the nuts to the values shown in table 5 following the designated sequence, repeating the sequence as shown. Flange pattern tightening sequences are shown in figure 1.

a) Bolt Lubrication

Lubrication will affect required torque of clean fasteners in good condition more than any other factor. In fact, 90% of applied torque goes to overcome friction while only 10% actually stretches the bolt. The chart above assumes that only machine oil is used as a lubricant. Below is a list of several common lubricants and their affect on torque required to stretch bolts to 50% of their yield strength. Most are available from local bearing distributors.

Description	Coefficient of friction	Multiply torque values in chart by
Machine Oil	f = .15	1.00
API SA2 Grease	f = .12	.80
Neverseez (Ni base)	f = .11	.73
Neverseez (Cu base)	f = .10	.67
Molykote G-n Paste	f = .06	.40

Table 4

Series 7 Flame Arrestors with aluminum end sections only		TIGHTENING STEPS AND TORQUE (FT-LB)	
MODEL(S)	PATTERN	Step 1	Step 2
70802-A, 70803-A, 70804-A	1	Snug	25
71006-A, 71206-A, 71408-A	2	Snug	25
71608-A	3	Snug	25
72010-A	3	Snug	50
72212-A, 72412-A, 72414-A, 72614-A, 72616-A	5	Snug	50
73016-A	7	Snug	50
73216-A	8	Snug	50

Table 5

Series 7 Flame Arrestors with steel or stainless steel end sections only.		TIGHTENING STEPS AND TORQUE (FT-LB)				
MODEL(S)	PATTERN	Step 1	Step 2	Step 3	Step 4	Step 5
70401, 70401.5, 70602, 70603, 70604, 70802, 70803, 70804	1	Snug	20	50		
71006, 71206	2	Snug	20	50		
71408	2	Snug	25	60		
71608	3	Snug	25	50	80	
71810	3	Snug	25	50	90	
72010	3	Snug	25	50	75	100
72212	4	Snug	25	50	85	
72412	4	Snug	35	70	100	130
72614, 72616	4	Snug	35	70	100	140
72814	5	Snug	35	70	100	125
73016	5	Snug	35	70	100	130

Series 7 Flame Arrestors with steel or stainless steel end sections only.		TIGHTENING STEPS AND TORQUE (FT-LB)				
MODEL(S)	PATTERN	Step 1	Step 2	Step 3	Step 4	Step 5
73216	6	Snug	35	70	105	
73420	6	Snug	35	70	115	
73620	6	Snug	35	70	100	120
74020, 74024, 74824	7	Snug	35	70	130	
77036	8	Snug	35	70	130	200

Table 6

CAUTION

Excessive or uneven torquing can cause permanent damage to gaskets and housing.

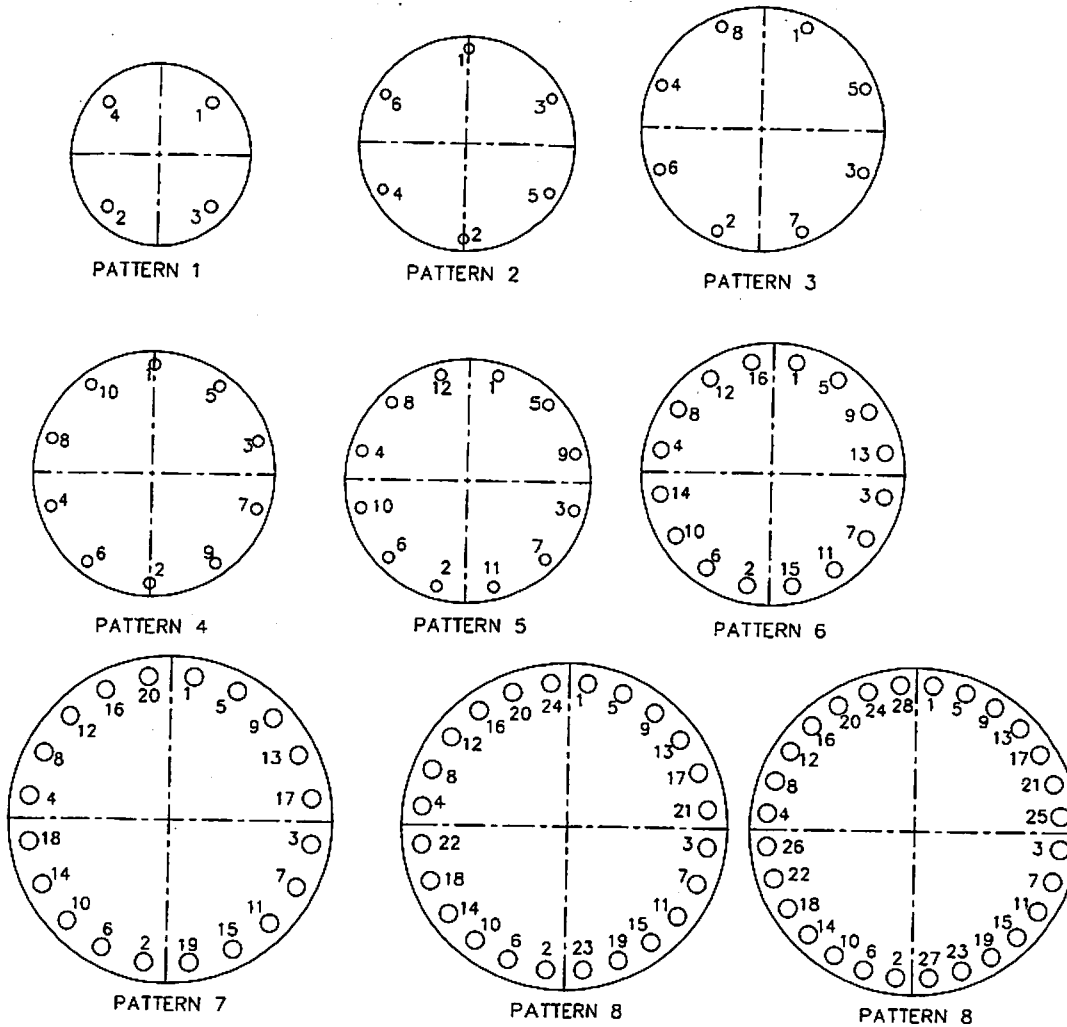


Figure 1

E. Recommended Spare Parts

For installations that require frequent maintenance and minimum downtime it is recommended that the user purchase a spare element assembly and several spare element gaskets. The spare element assembly can be installed immediately and the dirty assembly can then be cleaned and be stored as a spare for the next maintenance interval. **Element gaskets should be replaced each time the cell assembly is loosened and removed to insure a gas tight seal.**

GASKETS (FOR CAST ALUMINUM END SECTIONS)		
Replacement Element Assembly Gasket Part Numbers (2 required per assembly)		
Model Number	Standard Gasket (Compressed Fiber)	High Temperature Gasket (Graphite Base)
70802-A 70803-A 70804-A	7008102	7049202
71004-A	7008135	7049235
71206-A	7008136	7049236
71408-A	7008124	7049224
71608-A	7008107	7049207

Table 7

GASKETS (FOR ALL FABRICATED END SECTIONS)		
Replacement Element Assembly Gasket Part Numbers (2 required per assembly)		
Model Number	Standard Gasket (Compressed Fiber)	High Temperature Gasket (Graphite Base)
70400	7008153	7049253
70600	7008134	7049234
70800	7008123	7049223
71000	7008135	7049235
71200	7008136	7049236
71400	7008124	7049224
71600	7008107	7049207
71800	7008108	7049208
72000	7008109	7049209
72200	7008110	7049210
72400	7008111	7049211
72600	7008112	7049212
72800	7008113	7049213
73000	7008114	7049214
73200	7008115	7049215
73400	7008116	7049216
73600	7008117	7049217
73800	7008152	7049252
74000	7008118	7049218
74800	7008133	7049233
77000	7083300	

Table 8

Replacement Element Assembly Part Numbers: Group D Gas							
Housing:	Aluminum	Aluminum	Carbon Steel	Carbon Steel	304 SS	Carbon Steel	316 SS
Flame Cell:	Aluminum	304 SS	Aluminum	304 SS	304 SS	316 SS	316 SS
Model							
70400	7011741	7011742	7002246	7002261	7002275	7048509	7002201
70600	7011734	7011735	7048514	7048515	7002279	7048516	7002266
70800	7011704	7011712	7002253	7002203	7002217	7002211	7002202
71000	7011705	7011713	7002254	7002204	7002291	7002214	7002292
71200	7011706	7011702	7002256	7002239	7002233	7002283	7002293
71400	7011707	7011714	7002263	7002228	7002223	7002262	7002268
71600	7011708	7011715	7002248	7002247	7002234	7002280	7002297
71800	7011736	7011737	7002252	7002251	7002289	7002250	7048518
72000	7011709	7011716	7002213	7002249	7048519	7002218	7002296
72200	7011710	7011717	7002240	7002207	7048520	7048510	7048521
72400	7011711	7011718	7002258	7002265	7002232	7002264	7002276
72600	7011703	7011738	7048522	7048523	7048524	7048525	7048526
72800	7011726	7011739	7048505	7048527	7048528	7002281	7048529
73000	7011721	7011740	7002243	7002270	7048530	7048531	7048532
73200	7011732	7011733	7002230	7048533	7048534	7048535	7048536
73400	7011743	7011744	7048537	7002226	7048538	7048539	7048540
73600	7011745	7011746	7048541	7002241	7048542	7048543	7002274
73800	7011747	7011748	7048544	7048545	7048546	7048547	7048548
74000	7011749	7011750	7048549	7002273	7048550	7048551	7002209
74800	7011751	7011752	7048552	7002288	7048553	7048554	7048555

Table 9

Replacement Element Assembly Part Numbers: Group C Gas							
Housing:	Aluminum	Aluminum	Carbon Steel	Carbon Steel	304 SS	Carbon Steel	316 SS
Flame Cell:	Aluminum	304 SS	Aluminum	304 SS	304 SS	316 SS	316 SS
Model							
70400	7011753	7011754	7048556	7048557	7048502	7048558	7048559
70600	7011755	7011756	7048560	7048561	7048562	7048563	7002231
70800	7011729	7011731	7048507	7002255	7002295	7002206	7048564
71000	7011757	7011758	7048506	7002259	7048501	7048565	7048566
71200	7011759	7011760	7048567	7002260	7048569	7048570	7048571
71400	7011761	7011762	7048572	7048573	7048574	7048575	7002245
71600	7011763	7011764	7048576	7048577	7048578	7048504	7048579
71800	7011765	7011766	7048580	7048581	7048582	7048583	7048584
72000	7011767	7011768	7048585	7002299	7048586	7048587	7048588
72200	7011769	7011770	7048589	7048590	7048591	7048592	7048593
72400	7011771	7011772	7048594	7048595	7048596	7048597	7002244

Table 10

Replacement Element Assembly Part Numbers: Group B Gas							
Housing:	Aluminum	Aluminum	Carbon Steel	Carbon Steel	304 SS	Carbon Steel	316 SS
Flame Cell:	Aluminum	304 SS	Aluminum	304 SS	304 SS	316 SS	316 SS
Model							
70400	7011773	7011774	7048598	7048513	7002212	7048512	7002210
70600	7011775	7011776	7048599	7056501	7056502	7056503	7056504
70800	7011725	7011777	7056505	7002216	7002286	7048511	7002215
71000	7011778	7011779	7056506	7002205	7056507	7002290	7056509
71200	7011780	7011781	7056510	7002257	7002282	7056511	7002298
71400	7011782	7011783	7056512	7048508	7056513	7056514	7056515
71600	7011784	7011785	7056508	7056516	7056517	7056518	7056519
71800	7011786	7011787	7056520	7056521	7056522	7056523	7056524
72000	7011727	7011788	7056525	7056526	7056527	7056528	7056529
72200	7011789	7011790	7056530	7056531	7056532	7056533	7056534
72400	7011791	7011792	7056535	7056536	7056537	7056538	7056539

Table 11

IV. PRODUCT LIMITED WARRANTY

WARRANTY - Enardo warrants, to the extent stated herein, all products manufactured by it are free from original defects in workmanship or material for a period of twelve (12) months. Seller at its option will repair or replace any products returned to the factory in Tulsa, Oklahoma, transportation charges prepaid. Upon inspection, seller shall determine any defect in material and/or workmanship. There are no further warranties either express or implied in connection with the design, sale, merchantability or use of the items of sale and/or services. The rights and remedies of buyer hereunder

(i) Are exclusive and in substitution for and buyer hereby waives, all other warranties, guaranties, obligations, liabilities, rights and remedies, express or implied, arising by law or otherwise, including, but not limited to, the implied warranty of merchantability, any implied warranty of fitness and any obligation or liability of seller arising from tort or for loss of use, revenue or profit, or for incidental or consequential damages, and

(ii) Shall not be modified except by written agreement, date even herewith or subsequent hereto, signed on behalf of buyer and Enardo by the respective duly authorized representatives.

Enardo, Inc.

4470 S. 70th E. Ave.

Tulsa, OK 74145

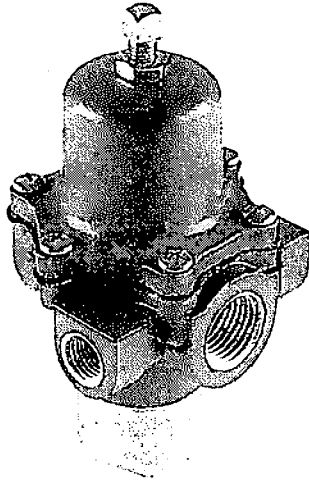
(918) 622-6161* FAX (918) 622-0004

(800) 336-2736 US and Canada

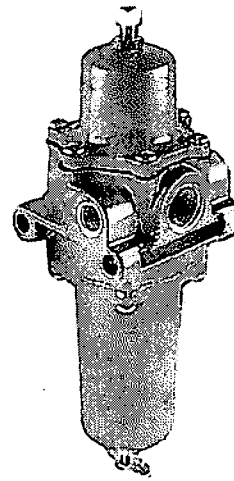
sales@enardo.com

April 2010

67D Series Pressure Reducing Regulators



TYPE 67D OR 67DR REGULATOR



TYPE 67DF OR 67DFR FILTERED REGULATOR

Figure 1. 67D Series Pressure Reducing Regulators



WARNING

Failure to follow these instructions or to properly install and maintain this equipment could result in an explosion, fire and/or chemical contamination causing property damage and personal injury or death.

Fisher® regulators must be installed, operated, and maintained in accordance with federal, state, and local codes, rules and regulations, and Emerson Process Management Regulator Technologies, Inc. instructions.

If the regulator vents gas or a leak develops in the system, service to the unit may be required. Failure to correct trouble could result in a hazardous condition.

Installation, operation, and maintenance procedures performed by unqualified

personnel may result in improper adjustment and unsafe operation. Either condition may result in equipment damage or personal injury. Use qualified personnel when installing, operating, and maintaining the 67D Series Pressure Reducing Regulators.

Introduction

Scope of the Manual

This manual provides instructions for the installation, maintenance, and parts ordering information for 67D Series regulators. Instructions and parts lists for other equipment mentioned in this instruction manual, as well as for other 67 Series regulators, are found in separate manuals.

Specifications

Some general 67D Series ratings and other specifications are given on page 2. A label on the spring case gives the control spring range for a given regulator as it comes from the factory.

FISHER

www.fisherregulators.com

EMERSON
Process Management

67D Series

Specifications

Available Configurations

- Type 67D: Direct-operated regulator with aluminum body and without internal relief
- Type 67DR: Aluminum body with internal relief
- Type 67DS: Stainless steel body without internal relief
- Type 67DSR: Stainless steel body with internal relief
- Type 67DF: Aluminum body with filter and without internal relief
- Type 67DFR: Aluminum body with filter and internal relief
- Type 67DFS: Stainless steel body with filter and without internal relief
- Type 67DFSR: Stainless steel body with filter and internal relief

Body Size, Inlet and Outlet Connection Style
1/2 NPT

Maximum Inlet Pressure (Body Rating)⁽¹⁾
All filtered models: 250 psig (17,2 bar)
All unfiltered models: 400 psig (27,6 bar)

Outlet Pressure Ranges
See Table 1

Maximum Emergency Outlet Pressure⁽¹⁾
150 psi (10,3 bar) over outlet pressure setting up to a maximum of 250 psi (17,2 bar)

Wide-Open Flow Coefficients
Main Valve: $C_v: 45.24; C_p: 1.33; C_f: 35.02$
Internal Relief Valve: $C_v: 1.45; C_p: 0.045; C_f: 32.8$

IEC Sizing Coefficient
 $X_i: 0.75$

Types 67DR, 67DSR, 67DFR, and 67DFSR Internal Relief Performance

Low capacity for minor seat leakage only; other overpressure protection must be provided if inlet pressure can exceed the maximum pressure rating of downstream equipment or exceeds maximum outlet pressure rating of the regulator.

Approximate Weights

- Types 67D and 67DR: 1.2 pounds (0,5 kg)
- Types 67DF and 67DFR: 2.0 pounds (1 kg)
- Types 67DS and 67DSR: 2.8 pounds (1 kg)
- Types 67DFS and 67DFSR: 4.6 pounds (2 kg)

Smart Bleed™ Check Valve Setpoint
6 psi (0,41 bar) differential

Temperature Capabilities⁽¹⁾

- With Nitrile (NBR)**
Standard Bolting: -20° to 180°F (-29° to 82°C)
Stainless Steel Bolting: -40° to 180°F (-40° to 82°C)
- With Fluorocarbon (FKM):**
Polyethylene Filter⁽⁴⁾ (Standard):
0° to 180°F (-18° to 82°C)
Polyvinylidene (PVDF), SST, or Glass Filter (Optional):
0° to 300°F (-18° to 149°C)
- With Silicone (VMQ)⁽²⁾ Diaphragm, Low Temperature Nitrile (NBR) O-rings, and Low Temperature Bolting:** -60° to 180°F (-51° to 82°C)
- With Gauges:** -20° to 180°F (-29° to 82°C)
- With Automatic Drain:** 40° to 175°F (4° to 79°C)

Types 67DF, 67DFR, 67DFS, and 67DFSR Filter Capabilities

- Micron Rating:**
Polyethylene Filter⁽⁴⁾ (Standard): 5 microns
Glass Fiber Filter (Optional): 5 microns
PVDF or Stainless Steel Filter (Optional): 40 microns

Spring Case Vent Location

Aligned with inlet standard, other positions optional

Drain Valve Location

Aligned in the center of the dripwell

Pressure Registration

Internal

Options

- All Types**
 - Handwheel adjusting screw
 - NACE International MR0175 or MR0103⁽³⁾ construction
 - Panel mount (includes spring case with 1/4 NPT vent, handwheel, and panel mounting nut)
 - Closing cap (available on spring case with 1/4 NPT vent)
 - Fluorocarbon (FKM) elastomers for high temperatures and/or corrosive chemicals
 - Silicone (VMQ) elastomers for cold temperatures
 - Fixed Bleed Restriction
 - Triple scale outlet pressure gauge (brass or stainless steel)
 - Stainless steel stem and valve plug
 - Pipe plug in second outlet
- Types 67DFR and 67DFSR**
 - Smart Bleed internal check valve
- Types 67DF, 67DFR, 67DFS, and 67DFSR**
 - Stainless steel drain valve

1. The pressure/temperature limits in this Instruction Manual and any applicable standard or code limitation should not be exceeded.
2. Silicone (VMQ) is not compatible with hydrocarbon gas.
3. Product complies with the material requirements of NACE International MR0175 or MR0103. Environmental limits may apply.
4. Do not use in high aromatic hydrocarbon service.

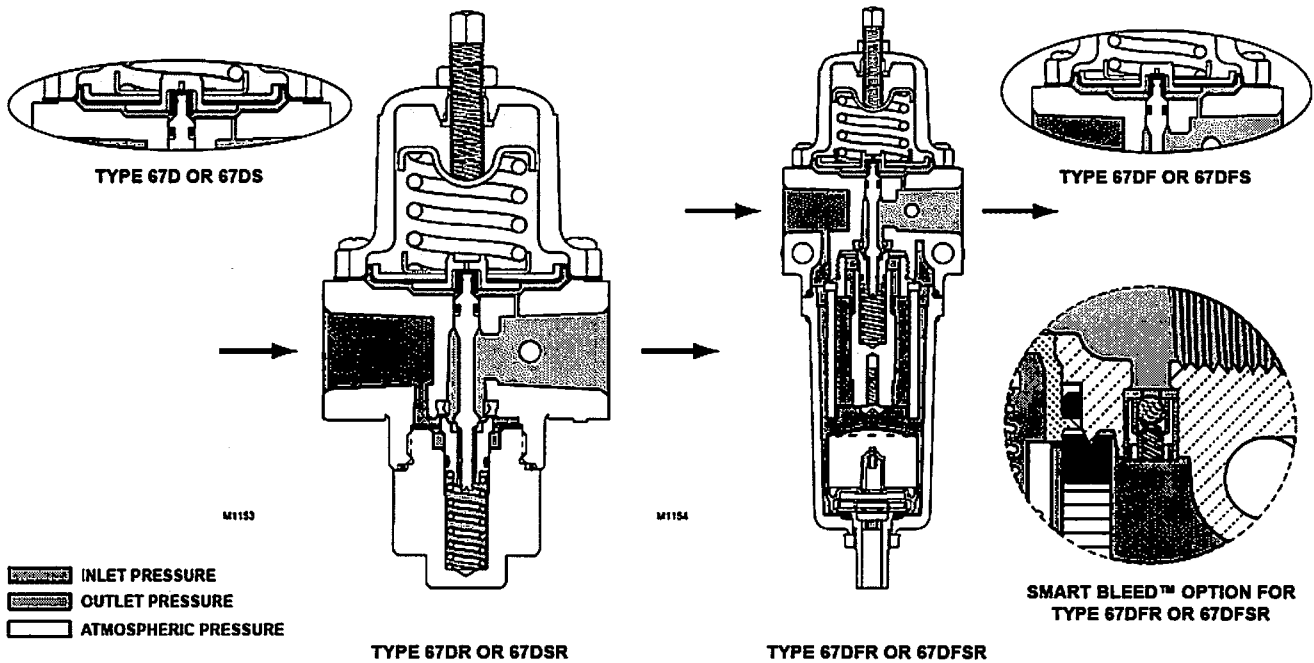


Figure 2. 67D Series Operational Schematics

Product Descriptions

The 67D Series direct-operated regulators are typically used to provide constantly controlled, reduced pressures. They are suitable for most air or gas applications.

- The Types 67D and 67DS are the standard instrument supply regulators without a filter or internal relief.
- The Types 67DF and 67DFS are equipped with a filter for removing particles from the supply gas.
- The Types 67DR and 67DSR have an internal relief valve with a soft seat for reliable shutoff with no discernible leakage.
- The Types 67DFR and 67DFSR have a filter and internal relief valve with a soft seat for reliable shutoff with no discernible leakage.

Principle of Operation

Downstream pressure is registered internally on the lower side of the diaphragm. When the downstream pressure is at or above the set pressure, the valve plug is held against the orifice and there is no flow through the regulator. When demand increases, downstream pressure drops slightly allowing the spring to extend, moving the stem down and the valve plug away from the orifice. This allows flow through the regulator.

Internal Relief (Types 67DR, 67DSR, 67DFR, and 67DFSR)

If for some reason, outside of normal operating conditions, the downstream pressure exceeds the setpoint of the regulator, the force created by the downstream pressure will lift the diaphragm until the diaphragm is lifted off the relief seat. This allows flow through the token relief. The relief valve on the Type 67DR, 67DSR, 67DFR, or 67DFSR is an elastomer plug that prevents leakage of air from the downstream to atmosphere during normal operation, thereby conserving plant air.

Smart Bleed™ Airset

In some cases, it is desired to exhaust downstream pressure if inlet pressure is lost or drops below the setpoint of the regulator. For example, if the regulator is installed on equipment that at times has no flow demand but is expected to backflow on loss of inlet pressure. The Type 67DFR or 67DFSR can be ordered with the Smart Bleed option which includes an internal check valve for this application. During operation, if inlet pressure is lost, or decreases below the setpoint of the regulator, the downstream pressure will back flow upstream through the regulator and check valve. This option eliminates the need for a fixed bleed downstream of the regulator, thereby conserving plant air.

67D Series

Table 1. Outlet Pressure Ranges and Control Spring Data

TYPES	OUTLET PRESSURE RANGES, PSIG (bar)	CONTROL SPRING DATA				
		Part Number	Color	Material	Wire Diameter, Inch (mm)	Free Length, Inch (mm)
67D, 67DR, 67DF, 67DFR	0 to 20 (0 to 1,4)	GE07809T012	Green stripe	Music Wire	0.135 (3,43)	1.43 (36,2)
	0 to 35 (0 to 2,4)	T14059T0012	Unpainted		0.156 (3,96)	1.43 (36,2)
	0 to 60 (0 to 4,1)	T14058T0012	Blue stripe		0.170 (4,32)	1.43 (36,2)
	0 to 125 (0 to 8,6)	T14060T0012	Red stripe		0.207 (5,26)	1.43 (36,2)
	0 to 35 (0 to 2,4)	T14113T0012	Silver stripe	Inconel®	0.156 (3,96)	1.43 (36,2)
	0 to 60 (0 to 4,1)	T14114T0012	Blue		0.172 (4,37)	1.43 (36,2)
	0 to 125 (0 to 8,6)	T14115T0012	Red		0.207 (5,26)	1.43 (36,2)
	67DS, 67DSR, 67DFS, 67DFSR	0 to 20 (0 to 1,4)	10C1729X012	Green	Inconel®	0.135 (3,43)
0 to 35 (0 to 2,4)		T14113T0012	Silver stripe	0.156 (3,96)		1.43 (36,2)
0 to 60 (0 to 4,1)		T14114T0012	Blue	0.172 (4,37)		1.43 (36,2)
0 to 125 (0 to 8,6)		T14115T0012	Red	0.207 (5,26)		1.43 (36,2)
0 to 150 (0 to 10,3)		10C1730X012	Black	0.250 (6,35)		1.77 (44,9)

Installation

Note

If the regulator is shipped mounted on another unit, install that unit according to the appropriate Instruction Manual.



WARNING

Personal injury, property damage, equipment damage, or leakage due to escaping gas or bursting of pressure-containing parts may result if this regulator is overpressured or is installed where service conditions could exceed the limits given in the Specifications section, or where conditions exceed any ratings of the adjacent piping or piping connections. To avoid such injury or damage, provide pressure-relieving or pressure-limiting devices (as required by the appropriate code, regulation, or standard) to prevent service conditions from exceeding those limits.

The internal relief valve of the Type 67DR, 67DSR, 67DFR, or 67DFSR does not provide full overpressure protection. The internal relief valve is designed for minor seat leakage only. If maximum inlet pressure to the regulator exceeds maximum pressure ratings of the downstream equipment or exceeds maximum allowable outlet pressure of the regulator, additional overpressure protection is required.

A regulator may vent some gas to the atmosphere. In hazardous or flammable gas service, vented gas may accumulate and cause personal injury, death, or property damage due to fire or explosion. Vent a regulator in hazardous gas service to a remote, safe location away from air intakes or any hazardous area. The vent line or stack opening must be protected against condensation or clogging.

Before installing a Type 67D, 67DR, 67DS, 67DSR, 67DF, 67DFR, 67DFS, or 67DFSR regulator, be sure the installation complies with the following installation guidelines:

1. Regulator operation within ratings does not preclude the possibility of damage from debris in the lines or from external sources. Regulators should be inspected for damage periodically and after any overpressure condition.
2. Only personnel qualified through training and experience should install, operate, and maintain the regulator. Make sure that there is no damage to or foreign material in the regulator. Also ensure that all tubing and piping is free of debris.
3. Install the regulator so that flow is from the IN to the OUT connection as marked on the regulator body.
4. A clogged spring case vent hole may cause the regulator to function improperly. To keep this vent hole from being plugged (and to keep the spring case from collecting moisture, corrosive chemicals, or other foreign material) orient the vent to the lowest possible point on the spring case or otherwise protect it.

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Inspect the vent hole regularly to make sure it is not plugged. Spring case vent hole orientation may be changed by rotating the spring case with respect to the body. A 1/4 NPT spring case vent may be remotely vented by installing obstruction-free tubing or piping into the vent. Protect the remote vent by installing a screened vent cap on the remote end of the vent pipe.

5. For use in regulator shutdown, install upstream block and vent valves and downstream block and vent valves (if required), or provide some other suitable means of properly venting the regulator inlet and outlet pressures. Install a pressure gauge to monitor instruments on startup.
6. Apply a good grade of pipe compound to the external pipe threads before making connections, making sure not to get the pipe compound inside the regulator.
7. Install tubing fitting or piping into the 1/2 NPT inlet connection on the body (key 1) and into the 1/2 NPT body outlet connection.
8. The two 1/4 NPT outlets can be used for a gauge or other use. If not used, they must be plugged.

Overpressure Protection

The 67D Series regulators have maximum outlet pressure ratings that are lower than their maximum inlet pressure ratings. A pressure relieving or pressure limiting device is needed if inlet pressure can exceed the maximum outlet pressure rating.

Types 67DR, 67DSR, 67DFR, and 67DFSR have a low capacity internal relief valve for minor seat leakage only. Other overpressure protection must be provided if the maximum inlet pressure can exceed the maximum pressure rating of the downstream equipment or exceeds the maximum outlet pressure rating of the regulator.

Startup and Adjustment

Key numbers are referenced in Figures 3 through 8.

1. With proper installation completed and downstream equipment properly adjusted, slowly open the upstream and downstream block valve (when used) while using pressure gauges to monitor pressure.



WARNING

To avoid personal injury, property damage, or equipment damage caused by bursting of pressure containing parts or explosion of accumulated gas, never adjust the control spring to produce an outlet pressure higher than the upper limit of the outlet pressure range for that particular spring. If the desired outlet pressure is not within the range of the control spring, install a spring of the proper range according to the diaphragm parts maintenance procedure.

2. If outlet pressure adjustment is necessary, monitor outlet pressure with a gauge during the adjustment procedure. The regulator is adjusted by loosening the locknut (key 19), if used, and turning the adjusting screw or handwheel (key 18) clockwise to increase or counterclockwise to decrease the outlet pressure setting. Retighten the locknut to maintain the adjustment position.

Shutdown

First, close the nearest upstream block valve and then close the nearest downstream block valve (when used). Next, open the downstream vent valve. Since the regulator remains open in response to the decreasing downstream pressure, pressure between the closed block valves will be released through the open vent valve.

Maintenance

Regulator parts are subject to normal wear and must be inspected and replaced as necessary. The frequency of inspection and replacement of parts depends on the severity of service conditions and applicable codes and government regulations. Open the Type 67DF, 67DFR, 67DFS, or 67DFSR drain valve (key 2) regularly to empty accumulated liquid from the dripwell (key 5).

Note

If sufficient clearance exists, the body (key 1) may remain mounted on other equipment or in a line or panel during maintenance unless the entire regulator will be replaced.

67D Series



WARNING

To avoid personal injury, property damage, or equipment damage caused by sudden release of pressure or explosion of accumulated gas, do not attempt any maintenance or disassembly without first isolating the regulator from system pressure and relieving all internal pressure from the regulator.

Types 67D, 67DR, 67DS, and 67DSR

Trim Maintenance

Key numbers are referenced in Figures 3 and 4.

1. Unscrew the spring retainer (key 48) and separate the spring retainer and O-ring (key 14) from the body (key 1).
2. Remove the valve plug (key 57) from the spring retainer (key 48). Inspect the removed parts for damage and debris. Replace any damaged parts. Apply a high quality lubricant to the O-ring (key 49) before reassembling.
3. To remove the valve stem (key 11), grasp the end and pull it straight out of the body (key 1). Inspect the parts for damage and debris. Replace any damaged parts. The valve stem may be cleaned or replaced. If the soft seat (key 15) was removed, make sure it is properly snapped into place before installing the valve stem. Apply a high quality lubricant to the O-ring (key 50) before reinstalling the valve stem.
4. Slide valve plug (key 57) onto valve stem (key 11). Apply lubricant to O-ring (key 14) and thread in spring retainer (key 48). Torque spring retainer to 10 to 12 foot pounds (14 to 16 N·m).

Diaphragm Maintenance

Key numbers are referenced in Figures 3 and 4.

1. Back out the adjusting screw or handwheel (key 18) until compression is removed from the spring (key 17).
2. Remove the spring case screws (key 3) to separate the spring case (key 7) from the body (key 1). Remove the upper spring seat (key 20) and spring (key 17).
3. Remove the diaphragm assembly (key 16), inspect the diaphragm, and replace the assembly, if necessary.

4. Place the diaphragm assembly (key 16) on the body (key 1) as shown in Figure 3 or 4. Push down on the diaphragm assembly to make sure the valve plug (key 57) strokes smoothly and approximately 1/16-inch (1,6 mm).

Note

In step 5, if installing a control spring of a different range, be sure to delete the spring range originally appearing on the label and indicate the new spring range.

5. Stack the control spring (key 17) and upper spring seat (key 20) onto the diaphragm assembly (key 16).
6. Install the spring case (key 7) on the body (key 1) with the vent oriented to prevent clogging or entrance of moisture. Install the six spring case screws (key 3) using a crisscross pattern and torque to 15 to 30-inch-pounds (1,9 to 3,9 N·m).

Note

On Types 67DS and 67DSR, lubricate the adjusting screw (key 18) thread to reduce galling of the stainless steel.

7. When all maintenance is complete, refer to the Startup and Adjustment section to put the regulator back into operation and adjust the pressure setting. Tighten the locknut (key 19) if used, and install the closing cap (key 33) if used.

Types 67DF, 67DFR, 67DFS, and 67DFSR

Filter Element and Trim Maintenance

Key numbers are referenced in Figures 5 and 6.

1. Remove four dripwell screws (key 3) from the dripwell (key 5) and separate the dripwell and O-ring (key 4) from the body (key 1). Remove the screw (key 65) that retains the filter (key 6) and remove the filter and filter gasket (key 66).
2. Inspect the removed parts for damage and debris. Replace any damaged parts. If a replacement is not available, the filter element may be cleaned.
3. To inspect the valve plug (key 57), valve stem (key 11) and the valve seat (key 58), unscrew the spring retainer (key 48) and separate from the body (key 1). To remove the valve plug, grasp the valve plug and pull it straight out of the spring retainer. To remove the valve stem (key 11), grasp the end and pull it straight out of the body (key 1). Inspect the parts for damage and debris. Inspect

the valve seat (key 58) for damage or wear. Replace part if damaged. The valve stem may be cleaned or replaced. If the soft seat (key 15) was removed, make sure it is properly snapped into place before installing the valve stem. Apply a high quality lubricant to the O-ring (key 50) before reinstalling the valve stem.

- Slide valve plug (key 57) onto valve stem (key 11). Apply lubricant to O-ring (key 14) and thread in spring retainer (key 48). Torque spring retainer to 10 to 12 foot pounds (14 to 16 N•m). Reinstall the filter gasket (key 66) and filter (key 6) and secure it with the filter retainer (key 9) and screw (key 65) and torque to 15 to 30-inch-pounds (1,7 to 3,4 N•m). Reinstall the O-ring (key 4), secure the dripwell with screws (key 3), and torque to 15 to 30-inch-pounds (1,7 to 3,4 N•m).

Diaphragm Maintenance

Key numbers are referenced in Figures 5 and 6.

- Back out the adjusting screw or handwheel (key 18) until compression is removed from the spring (key 17).
- Remove the six spring case screws (key 3) to separate the spring case (key 7) from the body (key 1). Remove the upper spring seat (key 20) and spring (key 17).
- Remove the diaphragm assembly (key 16), inspect the diaphragm, and replace the assembly, if necessary.
- Place the diaphragm assembly (key 16) on the body (key 1) as shown in Figure 5. Push down on the diaphragm assembly to make sure the valve plug (key 57) strokes smoothly and approximately 1/16-inch (1,6 mm).

Note

In step 5, if installing a control spring of a different range, be sure to delete the spring range originally appearing on the label and indicate the new spring range.

- Stack the control spring (key 17) and upper spring seat (key 20) onto the diaphragm assembly (key 16).
- Install the spring case (key 7) on the body (key 1) with the vent oriented to prevent clogging or entrance of moisture. Install the six spring case screws (key 3) using a crisscross pattern and torque to 15 to 30-inch-pounds (1,7 to 3,4 N•m).

Note

On Types 67DFS and 67DFSR, lubricate the adjusting screw (key 18) thread to reduce galling of stainless steel.

- When all maintenance is complete, refer to the Startup and Adjustment section to put the regulator back into operation and adjust the pressure setting. Tighten the locknut (key 19) if used, and install the closing cap (key 33) if used.

Parts Ordering

When corresponding with the local Sales Office about this regulator, include the type number and all other pertinent information printed on the label. Specify the eleven-character part number when ordering new parts from the following parts list.

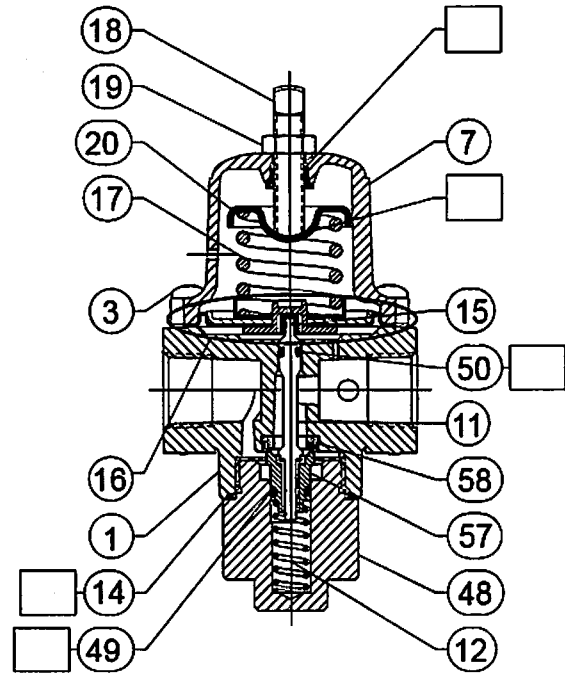
When ordering replacement parts, reference the key number of each needed part as found in the following parts list. Separate kit containing all recommended spare parts is available.

Parts List

Key	Description	Part Number
	Parts Kits	
	Types 67D, 67DR, 67DS, 67DSR - Includes seat (key 58), O-rings (keys 14, 49, 50), soft seat (key 15), and diaphragm assembly (key 16)	
	Type 67D (without relief)	
	Brass and Nitrile (NBR) seat	R67DX00012
	Type 67DR (with relief)	
	Brass and Nitrile (NBR) seat	R67DRX00012
	Types 67D NACE, 67DS, and 67DS NACE (without relief)	
	316L Stainless steel and Nitrile (NBR) seat	R67DSX00N12
	Types 67DR NACE, 67DSR, and 67DSR NACE (with relief)	
	316L Stainless steel and Nitrile (NBR) seat	R67DSRX0N12
	Types 67DF, 67DFR, 67DFS, 67DFSR - Includes seat (key 58), O-rings (keys 14, 49, 50), soft seat (key 15), diaphragm assembly (key 16), 5 micron polyethylene filter (key 6), filter gasket (key 66), dripwell O-ring (key 4), and four screws (key 3).	
	Type 67DF (without relief)	
	Brass and Nitrile (NBR) seat	R67DFX00012
	Type 67DFR (with relief)	
	Brass and Nitrile (NBR) seat	
	Standard kit	R67DFRX0012
	Low temperature kit (-60°F)	R67DFRX0022
	Types 67DF NACE, 67DFS, and 67DFS NACE (without relief)	
	316L Stainless steel and Nitrile (NBR) seat	R67DFSX0N12
	Types 67DFR NACE, 67DFSR, and 67DFSR NACE (with relief)	
	316L Stainless steel and Nitrile (NBR) seat	R67DFSRXN12

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Key	Description	Part Number
1	Body	
	Type 67D or 67DR, Aluminum	GE31800X012
	Type 67DS or 67DSR, CF8M Stainless steel	GE31802X012
	Type 67DF or 67DFR, Aluminum	GE31786X012
	Type 67DFS or 67DFSR, CF8M Stainless steel	GE31788X012
2	Drain Valve	
	Type 67DF or 67DFR	
	Brass	1K418918992
	18-8 Stainless steel	AH3946X0012
	Type 67DFS or 67DFSR	
3	Flange Screw	
	for Type 67D, 67DR, 67DF, or 67DFR	
	Standard spring case and spring case with 1/4 NPT vent (6 or 10 required)	T13526T0012
	Standard spring case for low temperature service (6 required)	T13526T0042
	For wire seal	
4*	O-ring (Dripwell)	
	for Type 67DF, 67DFR, 67DFS or 67DFSR	
	Nitrile (NBR)	T14057T0042
	Fluorocarbon (FKM)	T14057T0022
	Silicone (VMQ)	T14057T0032
5	Dripwell	
	for Type 67DF, or 67DFR, Aluminum	
	Manual	GE34605X012
	Auto-drain	GE34606X012
	for Type 67DFS, or 67DFSR, Stainless steel	
6*	Filter Element	
	for Types 67DF, 67DFR, 67DFS, and 67DFSR	
	Polyethylene (5 microns) (standard)	GE31794X012
	Glass fiber (5 microns)	GE31795X012
	Polyvinylidene fluoride (PVDF) (40 microns)	GE31794X022
7	Spring Case	
	for Type 67D, 67DR, 67DF, or 67DFR, Aluminum	
	Drilled hole vent (standard)	T14070T0012
	1/4 NPT vent	T14070T0022
	for Type 67DS, 67DSR, 67DFS, or 67DFSR, Stainless steel	20C1727X012
9	Filter Retainer, 316 Stainless steel	
	for Type 67DF, 67DFR, 67DFS, or 67DFSR	GE31796X012
11*	Valve Stem	
	for Types 67D, 67DR, 67DF, and 67DFR	
	Brass	GE35519X012
	Aluminum	GE35519X022
	for All	
	Stainless steel	GE35519X032

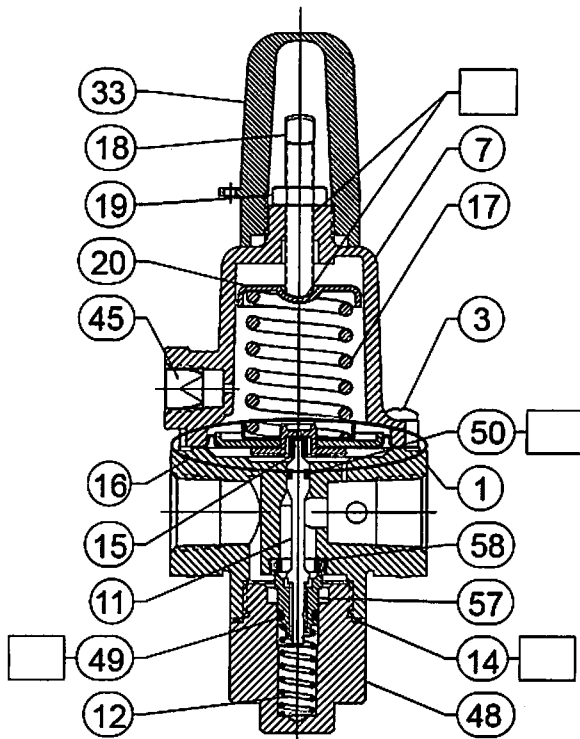


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Figure 3. Type 67D or 67DR Assembly

Key	Description	Part Number
12*	Valve Spring	
	Stainless steel	GE31783X012
	Inconel® (NACE)	GG00430X012
14*	O-ring (Spring Retainer)	
	for Type 67D, 67DR, 67DS, or 67DSR	
	Nitrile (NBR)	10A3803X092
	Fluorocarbon (FKM)	10A3803X112
	Silicone (VMQ)	10A3803X102
15*	Soft Seat	
	Nitrile (NBR)	T14055T0012
	Fluorocarbon (FKM)	T14055T0022
16*	Diaphragm Assembly	
	for Type 67D or 67DF (without relief)	
	Nitrile (NBR)	T14119T0022
	Fluorocarbon (FKM)	T14119T0042
	for Type 67DR or 67DFR (with relief)	
	Nitrile (NBR)	T14119T0012
	Fluorocarbon (FKM)	T14119T0032
	Silicone (VMQ)	T14119T0052
	for Type 67DS or 67DFS (without relief)	
	Nitrile (NBR)	T14119T0062
Fluorocarbon (FKM)	T14119T0072	
for Type 67DSR or 67DFSR (with relief)		
Nitrile (NBR)	T14119T0082	
Fluorocarbon (FKM)	T14119T0092	
	Silicone (VMQ)	T14119T0102

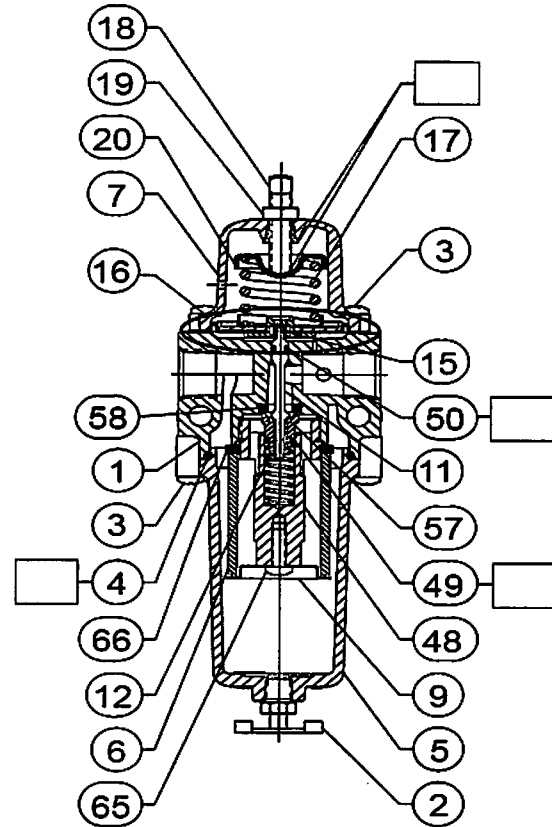
*Recommended Spare Parts
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Figure 4. Type 67DS or 67DSR Assembly



GE32850_B

PARTS NOT SHOWN: 25
 □ APPLY LUBRICANT/SEALANT

Figure 5. Type 67DF or 67DFR Assembly

Key	Description	Part Number
17	Spring for Type 67D, 67DR, 67DF, or 67DFR, Music wire (standard)	
	0 to 20 psig (0 to 1,4 bar), Green stripe	GE07809T012
	0 to 35 psig (0 to 2,4 bar), Unpainted	T14059T0012
	0 to 60 psig (0 to 4,1 bar), Blue stripe	T14058T0012
	0 to 125 psig (0 to 8,6 bar), Red stripe	T14060T0012
	for Type 67DR, 67DF, or 67DFR (NACE), Inconel® (NACE)	
	0 to 35 psig (0 to 2,4 bar), Silver stripe	T14113T0012
	0 to 60 psig (0 to 4,1 bar), Blue	T14114T0012
	0 to 125 psig (0 to 8,6 bar), Red	T14115T0012
	for Type 67DS, 67DSR, 67DFS, or 67CFSR, Inconel® (NACE)	
	0 to 20 psig (0 to 1,4 bar), Green	10C1729X012
	0 to 35 psig (0 to 2,4 bar), Silver stripe	T14113T0012
0 to 60 psig (0 to 4,1 bar), Blue	T14114T0012	
0 to 125 psig (0 to 8,6 bar), Red	T14115T0012	
0 to 150 psig (0 to 10,3 bar), Black	10C1730X012	
18	Adjusting Screw for Type 67D, 67DR, 67DF, or 67DFR For standard spring case, Zinc-plated steel	
	Square head (standard)	T14061T0012
	Handwheel	T14102T0012
	Wire seal (not shown)	T14104T0012

Key	Description	Part Number
18	Adjusting Screw for Type 67D, 67DR, 67DF, or 67DFR (continued) For spring case with 1/4 NPT vent	
	Square head for closing cap	
	Stainless steel	T14101T0012
	Handwheel	
	Zinc-plated steel	T14103T0012
	Wire seal (not shown)	
	Steel	T14198T0012
	for Type 67DS, 67DSR, 67DFS, or 67DFS	
	Square head with or without closing cap	
	Handwheel	
Stainless steel	T14101T0022	
Zinc-plated steel	T14103T0012	
19	Locknut for Type 67D, 67DR, 67DF, or 67DFR	
	Zinc-plated steel	1A946324122
20	for All	
	Stainless steel	1A9463X0042
20	Upper Spring Seat for Type 67D, 67DR, 67DF, or 67DFR	
	Zinc-plated steel	T14051T0012
	for Type 67DS, 67DSR, 67DFS, or 67DFS	
Stainless steel	10C1725X012	

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67D Series

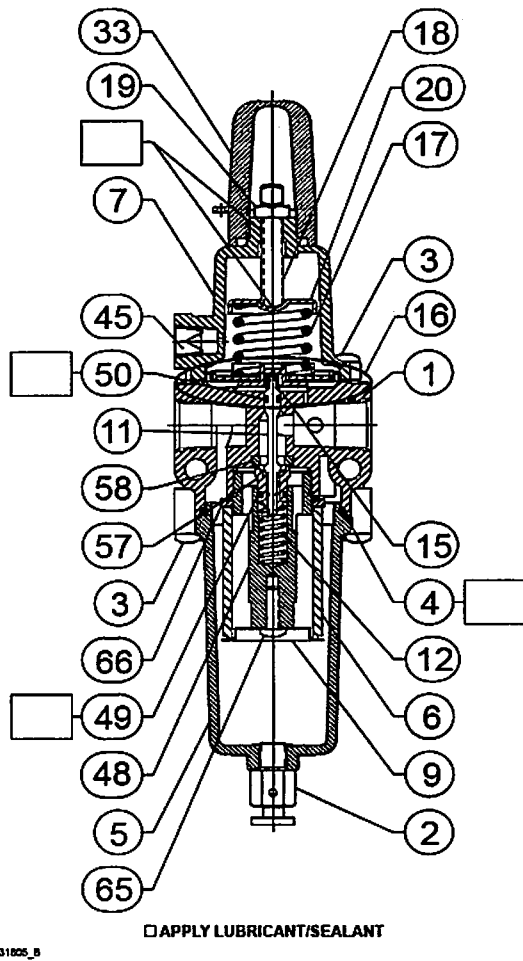


Figure 6. Type 67DFS or 67DFSR Assembly

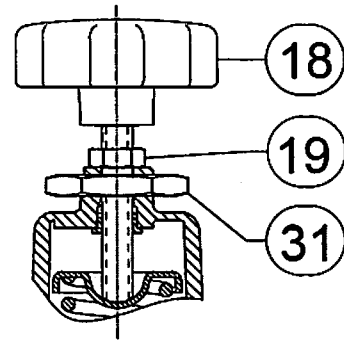


Figure 7. 67D Series Optional Panel Mount

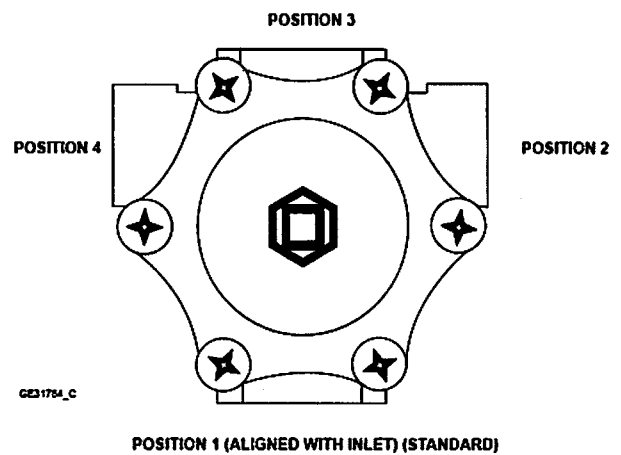
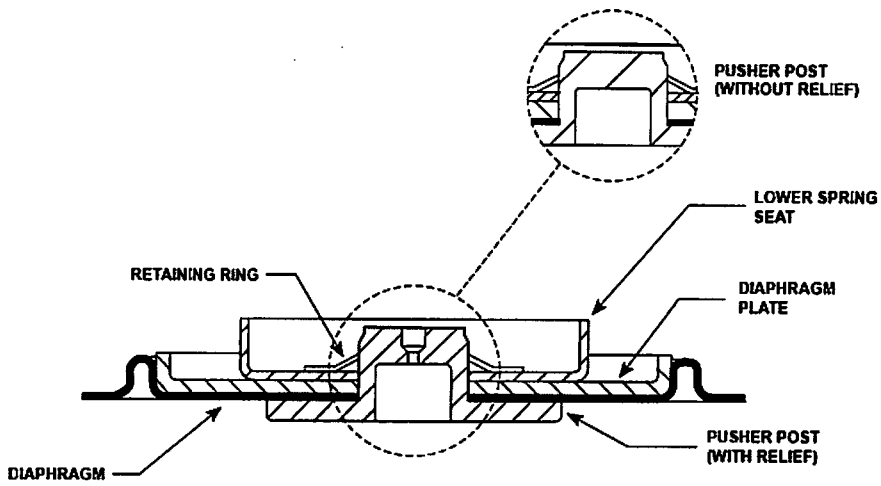
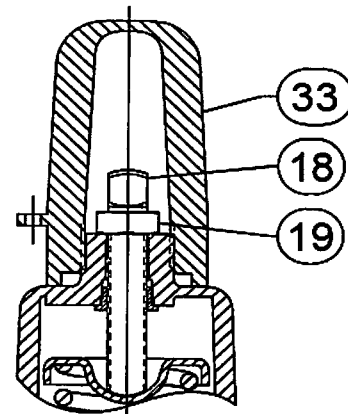


Figure 8. 67D Series Spring Case Vent Positions



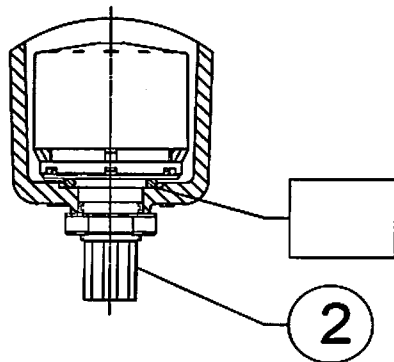
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Figure 9. Key 16, Diaphragm Assembly



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Figure 10. Optional Closing Cap
[Only Available with the 1/4-inch (6,4 mm) Spring Case Vent]



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Figure 11. Automatic Drain Option for Type 67DF, 67DFR, 67DFS, or 67DFSR

67D Series

Key	Description	Part Number	Key	Description	Part Number
22	Pressure Gauge (not shown) for Types 67D, 67DR, 67DF, and 67DFR Brass 0 to 30 psig/0 to 2,1 bar/0 to 0,2 MPa 0 to 60 psig/0 to 4,1 bar/0 to 0,4 MPa 0 to 160 psig/0 to 11,0 bar/0 to 1,1 MPa for All Stainless Steel 0 to 30 psig/0 to 2,1 bar/0 to 0,2 MPa 0 to 60 psig/0 to 4,1 bar/0 to 0,4 MPa 0 to 160 psig/0 to 11,0 bar/0 to 1,1 MPa	11B8579X022 11B8579X032 11B8579X042 11B9639X012 11B9639X022 11B9639X032	49*	O-ring (Plug) Nitrile (NBR) Fluorocarbon (FKM) Low Temperature Nitrile (NBR)	T12946T0012 1C8538X0182 1C8538X0192
23	1/4-inch (6,4 mm) Pipe Plug (not shown) for Types 67D, 67DR, 67DF and 67DFR Socket head, Steel for All types except Types 67DF and 67DFS Hex head, Stainless steel for Types 67DF and 67DFS Hex head, Stainless Steel	1C333528992 1A767535072 1C3335X0012	50*	O-ring (Stem) Nitrile (NBR) Fluorocarbon (FKM) Low Temperature Nitrile (NBR)	1H2926X0052 1H2926X0062 1H2926X0072
30	NACE Tag (not shown)	19A6034X012	57	Valve Plug for Types 67D, 67DR, 67DF, and 67DFR Brass Aluminum for All Stainless steel	GE31779X012 GE31779X022 GE31779X032
31	Panel Mounting Nut, Stainless Steel	10B2657X012	58*	Seat Stainless steel / Nitrile (NBR) Stainless steel / Fluorocarbon (FKM) for Types 67D, 67DR, 67DF, and 67DFR Brass / Nitrile (NBR)	GE31782X012 GE31782X022 GE31782X032
32	Wire Seal (not shown) for Types 67D and 67DR, Stainless Steel for Types 67DF and 67DFR	1U7581000A2 T14088T0012	65	Filter Retainer Screw for Types 67DF, 67DFR, 67DFS, and 67DFSR Stainless Steel for Types 67DF and 67DFR Zinc-plated steel	T13526T0042 T13526T0012
33	Closing Cap, Plastic	23B9152X012	66*	Filter Gasket for Types 67DF, 67DFR, 67DFS, and 67DFSR Nitrile (NBR) Fluorocarbon (FKM)	GG00752X012 GG00752X022
45	Screen Vent (for Types 67DS, 67DSR, 67DFS and 67DFSR only)	0L078343062			
48	Spring Retainer for Type 67D or 67DR, Aluminum for Type 67DS or 67DSR, Stainless steel for Type 67DF or 67DFR, Zinc-plated steel for Type 67DFS or 67DFSR, Stainless steel	GG03555X012 GE31803X022 GE31797X012 GE31797X022			

*Recommended Spare Parts

Industrial Regulators

Emerson Process Management Regulator Technologies, Inc.

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McKinney, Texas 75069-1872 USA
Tel: 1-800-558-5853
Outside U.S. 1-972-548-3574

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Tel: +86 21 2892 9000

Europe
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EMERSON
Process Management

Thermal Instrument Company

217 Sterner Mill Road, Trevose, PA 19053

Telephone No. (215) 355-8400 FAX (215) 355-1789

Website: www.thermalinstrument.com E-mail: office@thermalinstrument.com

Model 9500 Flow Meter

INSTRUCTION MANUAL



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Thermal Instrument Company Model 9500 Installation and Operation

The instructions to follow will cover almost all installations. Refer to the Drawing Appendix at the rear of this manual for calibration data and any special drawings or instructions for applications where special considerations, such as non-standard piping configurations or unusual power or signal requirements are encountered.

Description

General Features

There are two physical parts of the meter; the flow transducer and the electronics assembly. The flow transducer is either a probe (Model 62) or an in-line section (model 600) supplied with fittings to mate with the process plumbing. The flow transducer is connected to the electronics housing.

There are many features incorporated in this meter which are covered in this manual. Please read the manual carefully to prevent accidental damage to the meter in installation and operation.

Thermal Mass Flow Measurement

The basic mechanism of the measurement is implemented by heating one or more spot(s) on the wall of the fluid conduit to a precise temperature and measuring the power required to maintain that temperature. There is a direct relationship between the fluid mass flow rate and the heater operating power. This relationship is determined by actual (or equivalent) flow in duplicate conditions to the application.

The utilization of heat transfer to measure mass flow rates is a technique dating back to the early 1900's. It has been only since 1959 when Thermal Instrument Company pioneered with industrial quality devices for both gas and liquid flows that the method has gathered universal acceptance.

Operation

Please refer to the block diagram Figure 1 as you read through the following description of operation.

Flow Transducer

The Thermal Instrument Company meter uses a unique compound bridge circuit which measures and controls the temperature of a precision RTD (Resistance Temperature Detector) bonded to the dry side of the fluid conduit.

The power required to maintain this temperature is proportional to the mass flow rate of the fluid. Unfortunately, this relationship is highly non-linear. For some liquids over limited flow ranges the relationship is logarithmic. In general though, some form of linearization (curve straightening) is necessary for a practical instrument.

Also, since the heat transfer characteristic of all fluids (and almost any measurement technique) is temperature sensitive, some method of temperature compensation must be included in the instrument.

Electronics

These functions are accomplished on the Bridge Voltage Control Board shown in Figure 2. The output signal is passed to the Logic Control Board (Figure 3) where the non-linear signal is digitized. This digital value is used to look up the corresponding flow value in an EEPROM (Electrically Erasable Programmable Read-Only Memory). The linearized value is then used to drive an LED flow rate display, an 8-digit Totalizer and the 4-20 mA current output flow signal.

The Logic Control Board incorporates a micro-processor which controls the data flow and modifies the calculations according to parameters stored in EEPROM. The microprocessor also controls the communications link between the meter and a PC. This link is used to monitor and change the operating factors mentioned above in the Features section.

Installation Instructions

Flow Transducer

The flow transducer can be mounted in either horizontal or vertical pipe lines. However, when mounted in vertical piping, the flow must be upward (to insure full pipes) and the factory calibration should have been made in this position. Any special piping configurations requested by the customer to be included in the factory calibration must be duplicated for best accuracy.

Normally, an inline meter should be installed in an unobstructed straight line. The flow should enter at the port marked "IN" and exit at the port marked "OUT". This line should preferably be the same diameter as the meter tube or pipe. The straight section should have a minimum of ten (10) diameters ahead of the meter and an unobstructed straight length of five (5) diameters after the meter. **Where physical conditions prevent this, inform us in advance and we will calibrate the meter under actual operating conditions.**

The same installation conditions apply to the Model 62 Probe transducer. The probe must be rotated so that the index arrow etched on the probe faces toward the flow.

Input Power and Output Signals

General Considerations

Mechanical Care - Be careful of the enclosed electronics when removing the conduit cover. **After the initial installation, never open the conduit when power is connected.** Gently lift the cover from the electronic assembly and put it in a safe location where dirt cannot get inside or, if the display option has been selected, where dirt can get on the inside of the viewing window. When replacing the cover take care that the display legend plate is centered on the display and that the cover window lugs do not hit the legend plate in the last two or three turns of the cover.

Electrical Care - Wire size selected for all connections should be the minimum allowed by

plant regulations since power consumption is small and space inside the conduit housing is at a premium. When snaking the wires around the electronic assembly be careful of the protruding parts. The parts are capable of withstanding some abuse but be careful.

Input Power

As shown in Field Wiring Drawing No. TIC-436-1, the input power is fused at ½ ampere (slow blow). Spare fuses are supplied in the installation kit. They are readily available from DigiKey (1-800-344-4539) as Part Number WK4041BK-ND or any other electronic supplier handling Wickmann TR5 Sub-Miniature Fuses (UL 248-14) or equivalent.

110/220 VAC - The electronics may be powered by either 110 VAC or 220 VAC but the selection is made by jumpers not accessible in the field. As shown on the Field Wiring Drawing No. TIC-436-1, the HI line is connected to Terminal Block 1, point 1 at the top. The LO (neutral) line is connected to point 2 and the earth line is connected to point 3. **Take special note that the two two-point terminal blocks are for the output signals. DO NOT CONNECT HIGH VOLTAGE POWER TO THESE BLOCKS.** There are protective PolySwitch breakers on the output signal lines and they will "open" up if overloaded but circuits can still be damaged.

24 VDC - (22 volts DC min, 30 volts DC max) - As shown on the Field Wiring Drawing No. TIC-436-1, the positive line is connected to Terminal Block 1, point 1 at the top. The negative line is connected to point 2 and the earth line (when used) is connected to point 3. **Take special note that the two two-point terminal blocks are for the output signals. DO NOT CONNECT HIGH VOLTAGE POWER TO THESE BLOCKS.** There are protective PolySwitch breakers on the output signal lines and they will "open" up if overloaded but circuits can still be damaged.

The 24 volt version of the Model 9500 can be connected in a three-wire configuration (four-wire with temperature transmission). In this configuration the current signal common to the flowmeter is eliminated and the common line for the output signal is connected at the 24 volt source negative. If plant regulations permit, the three-wire configuration could be two wires plus shield for the common.

Output Signals

Terminals are provided for **local instrument powered two-wire signals** (positive and common). If the Temperature Transmission option has been provided, a single wire common connection may be used or two two-wire cables may be run. There are protective PolySwitch breakers on all output signal lines and they will "open" up if overloaded but circuits can still be damaged. When power is on if there is zero output current (there should be at least four mA even through a current meter) disconnect the field wiring and check the terminal block points for a voltage. Presence of a voltage (typically 20 to 30 volts) with no current flow indicates that the PolySwitch breakers have been tripped. Power must be turned off if the PolySwitch breakers are tripped in order for them to reset. They do not need to be replaced as a fuse. Maximum load resistance is 500 ohms.

Flow - The 4-20 mA flow signal is at Terminal Block 2, the positive connection on point 1 (at the top of Block 2) and the negative on point 2. The output current signal is 4 mA at

zero flow and 20 mA at 100% of rated flow.

Temperature (optional) - The 4-20 mA temperature signal is at Terminal Block 3, the positive connection on point 1 (at the top of Block 3) and the negative on point 2.

Startup Operation

With all connections having been completed and tested, a short but fast flow rate should be obtained in order to clean gas bubbles and impurities from the flow tube.

CAUTION - Flow and transducer must be within 50 °C of operating temperature before power is applied. Sensors may be damaged if transducer temperature is below this limit and/or calibration may not be accurate.

Apply power and allow a ten (10) minute warm-up period.

The Appendix to this manual contains the Flow Calibration Curve which correlates the flow rate versus the indication for this meter. When a factory calibration is provided it should not be necessary to perform a calibration in the field. Field calibration instructions are provided if it should be decided to use the meter with a different fluid.

Electronics Unit Field Service Details

Terminal Board (Figure 1 and Figure 2)

Figure 1 shows the component configuration for the two field wiring boards. Figure 2 depicts the obsolete model and is shown for information purposes only.

All field wiring is made to the terminal board. There are two (optionally 3) terminal blocks. Connect the input power to the three-position block TB1 according to TIC-436-1 the field wiring diagram. Terminal Block TB2 carries the 4-20 mA flow signal and, if optionally ordered, TB3 carries the 4-20 mA signal for the specified temperature range. Both current signals require a loop with a maximum resistance of 500 ohms. The signals are powered by the internal electronics and must not be connected to an external power supply.

Ferrite beads RF1 and RF2, capacitors C3 and C4 and RF3 through RF6 provide EMI (Electro-Magnetic Interference) filtering for all external wiring paths.

Diodes D1 and D2 and Polyswitches PS6 and PS7 (auto reset thermal fuses) provide circuit protection against accidental connection to an external voltage.

Flow Bridge Voltage Control Board (Figure 3)

The flow bridge voltage control board controls the flow transducer sensor and provides the non-linear flow signal to the logic board.

In calibration, potentiometer R2 is set to balance the temperature sensor with the flow sensor at the lowest temperature in the application range. A second pot R11 is set to balance the bridge at the high extreme of the application temperature range. **These two adjustments are determined in calibration and should NOT be changed.**

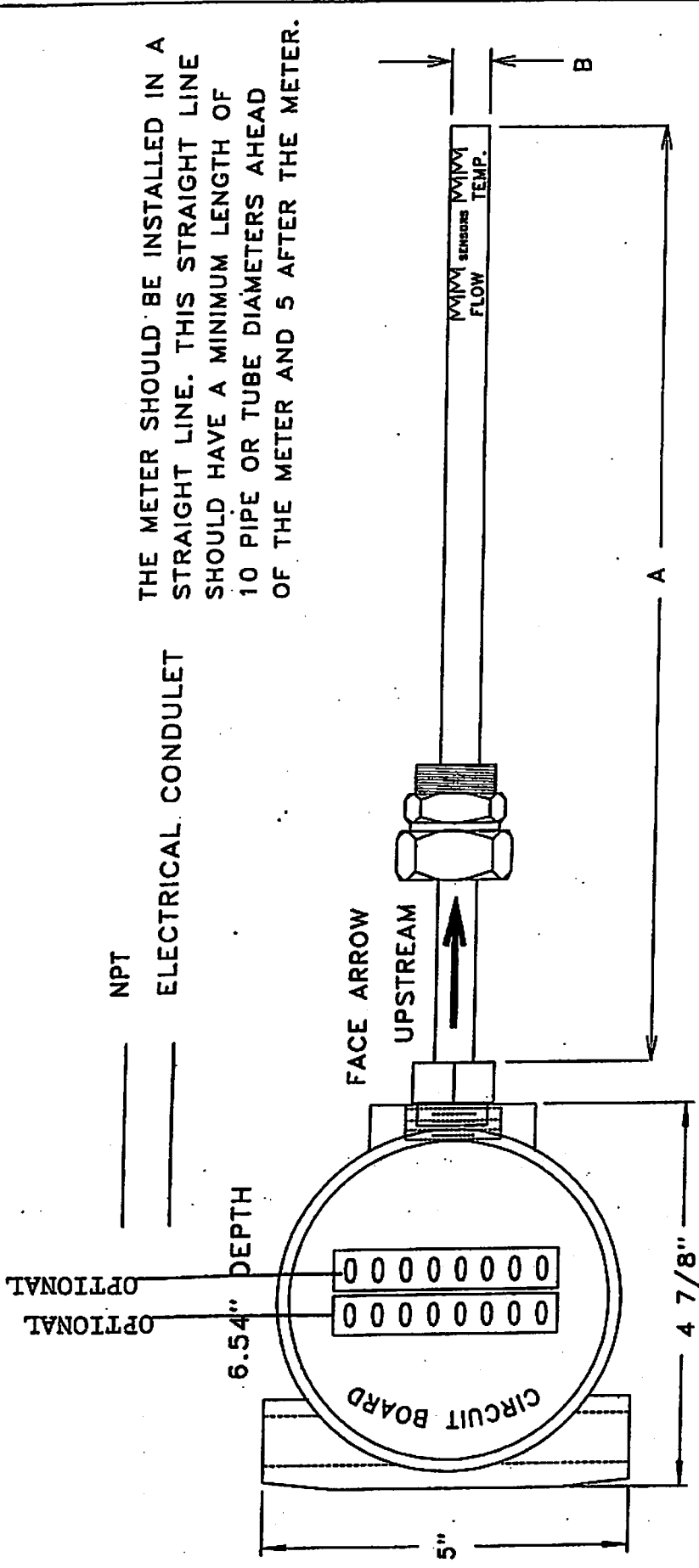
Logic Board (Figure 4)

The logic board converts the non-linear analog flow signal to a digital value, determines the linear equivalent from the data stored in an Electronically Programmable Read Only Memory (EPROM), runs an 8-digit totalizer and outputs the linear flow data as an analog signal (4 to 20 mA) and a 5½ digit flow rate display. The totalizer can be reset with the push-button on the Logic Board or by remote device through the digital programming interface.

R7 is adjusted so that the voltage on TB5 pin 1 is equal to the zero flow voltage from the flow bridge.

Adjustment is then made to R11 so, when the maximum voltage is applied to the S+ input, the voltage at TB5 pin 3 equals 4.096 volts.

Potentiometer R13 provides the 4 mA adjustment for the output current signal while R15 provides the 20 mA adjustment.



THE METER SHOULD BE INSTALLED IN A STRAIGHT LINE. THIS STRAIGHT LINE SHOULD HAVE A MINIMUM LENGTH OF 10 PIPE OR TUBE DIAMETERS AHEAD OF THE METER AND 5 AFTER THE METER.

NPT
ELECTRICAL CONDULET

OPTIONAL
OPTIONAL

6.54" DEPTH

CIRCUIT BOARD

FACE ARROW
UPSTREAM

FLOW
TEMP.

A

B

4 7/8"

5"

DIMENSIONS:

A: 14"

B: 1/2"OD

MATERIAL: 316 SS

PACKING GLAND:

MATERIAL: S.S.

INSERT: TEFLON

THREADS: 3/4"MNPT

MODEL: 62-9/9500

S/N

PHYSICAL DIMENSIONS OF
FLOW PROBE

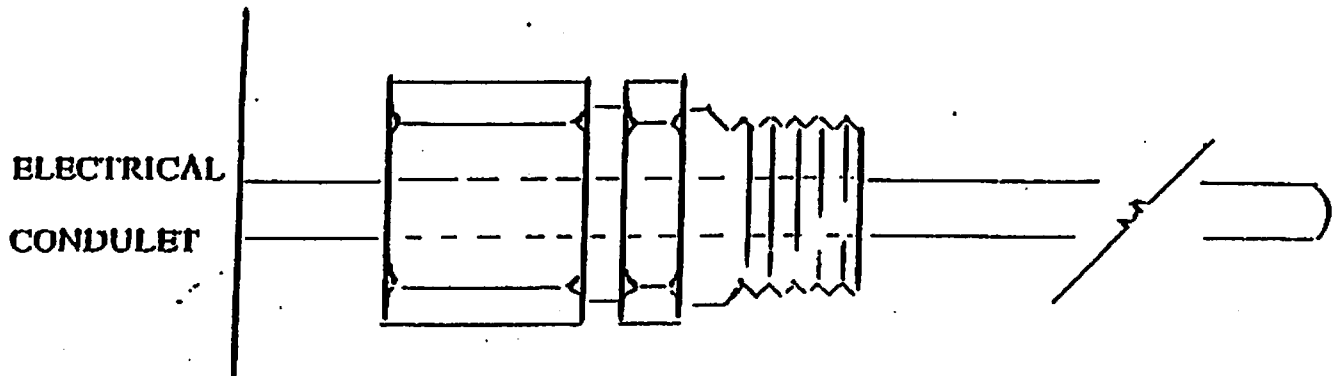
THERMAL INSTRUMENT CO.
TREVOSE, PA.

DATE:

FIG. 1

TIC 341-9

PACKING GLAND FOR MODEL 62 FLOW PROBE



Probe Size	1/2" Pipe	1/2" O.D.	3/4" Pipe	3/4" O.D.	1" Pipe	1" O.D.	1 1/2" Pipe	1 1/2" O.D.	2" O.D.
Packing Gland Thread Size MNPT	1"	3/4"	1 1/4"	3/4"	1 1/2"	1"	2"	1 1/2"	2"

FEATURES:

SIMPLE ASSEMBLY - INSERT TUBES, TIGHTEN CAP

REPLACEABLE SEALANT PERMITS REPEATED USE OF FITTING

TUBE DAMAGE AND STRESS CONCENTRATION ELIMINATED BY "SOFT" SEAL

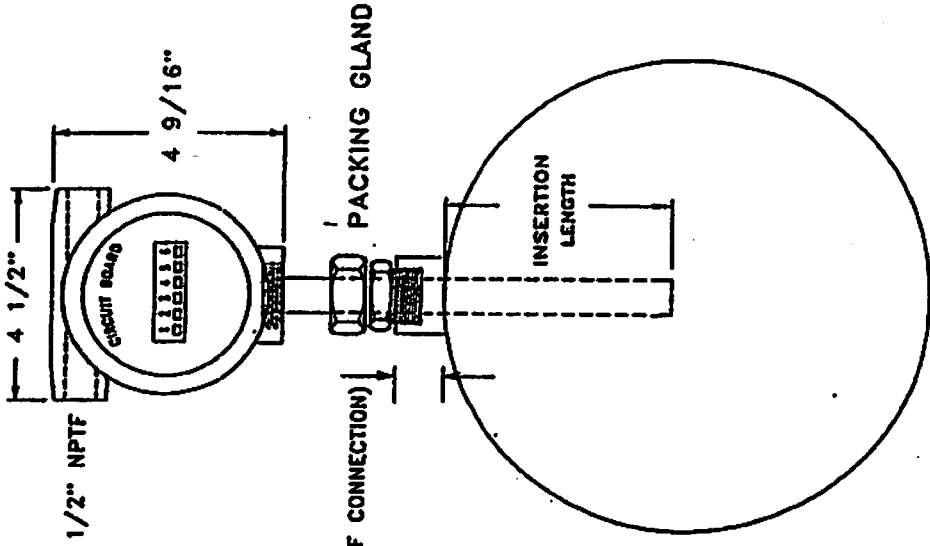
STAINLESS STEEL FITTING

DEL: 62-9/9500		THERMAL INSTRUMENT COMPANY
S/N:		DATE:

STRAIGHT LINE. THIS STRAIGHT LINE SHOULD HAVE A MINIMUM LENGTH OF 10 PIPE OR TUBE DIAMETERS AHEAD OF THE METER AND 5 AFTER THE METER.

FOR GASES

LINE SIZE I.D.
PROBE TIP INSERTION LENGTH



"L" - DIMENSION (HEIGHT OF CONNECTION) SUPPLIED BY CUSTOMER

PACKING GLAND:

MATERIAL: S.S.

INSERT: TEFLON

THREADS: 3/4" MNPT

PROBE DIAMETER: 1/2" OD

PROBE MATERIAL: 316 SS

2"	1 3/4"
3"	2 3/4"
4"	3 3/4"
5"	4 3/4"
6"	5 3/4"
7"	6 3/4"
8"	7 1/2"
10"	8 1/2"
12"	9 1/2"
16"	11 1/2"
18"	12 1/2"
24"	15 1/2"
30"	18 1/2"
36"	21 1/2"
48"	27 1/2"

MODEL: 62-9/9500

S/N:

PROBE INSTALLATION

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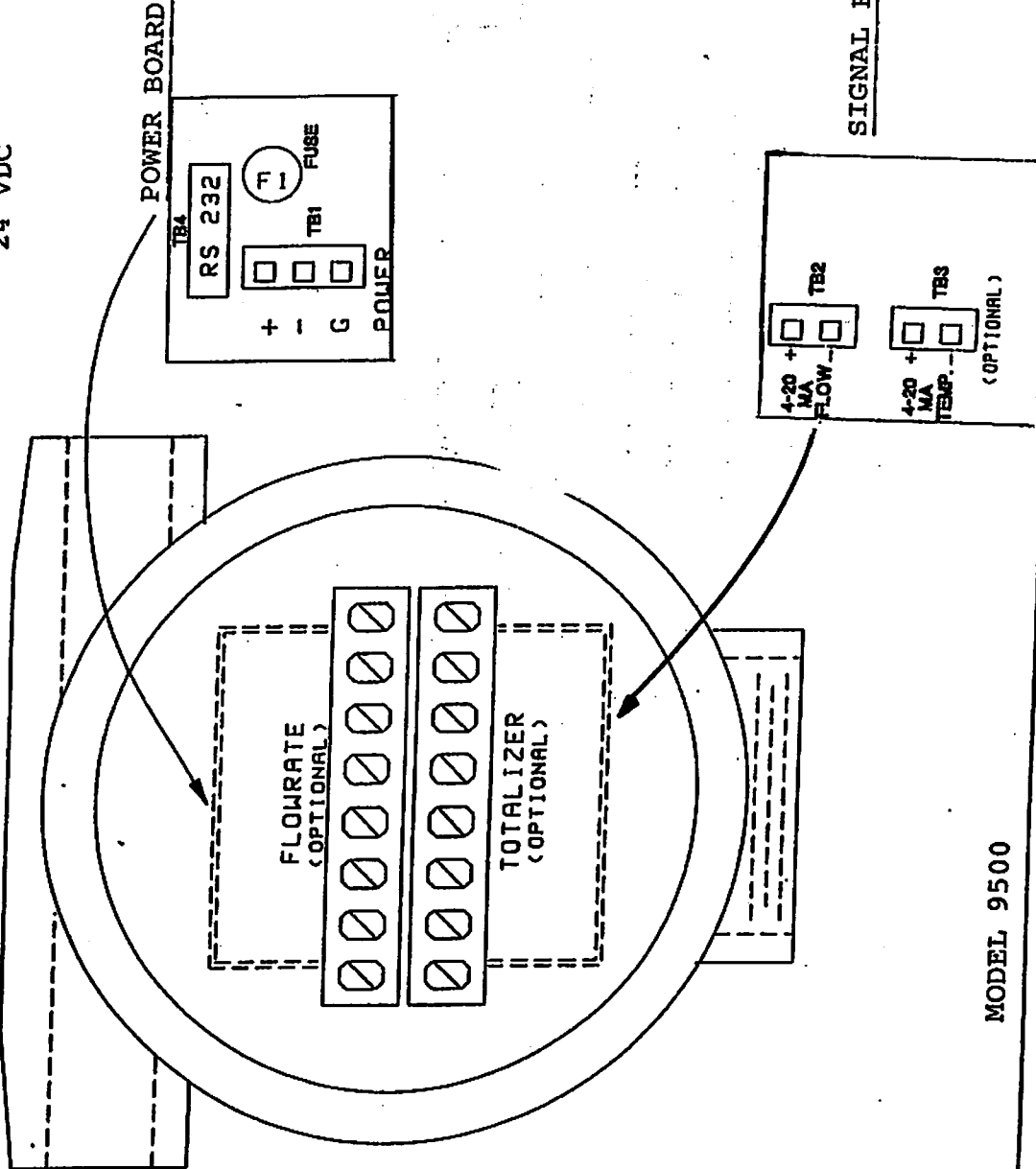
DATE: 5/14/96

TIC-213D-9

ELECTRICAL CONDULET

24 VDC

3/4" NPTF



MODEL 9500

MODEL:

S/N

ELECTRICAL CONDULET CIRCUIT BOARD

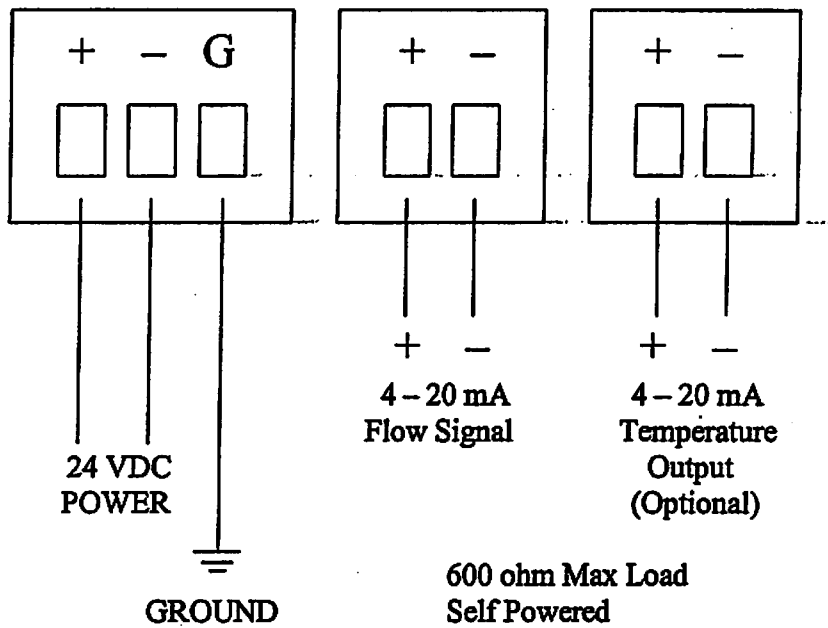
THERMAL INSTRUMENT CO.
TREVINO, PA.

DATE:

TIC-436-1

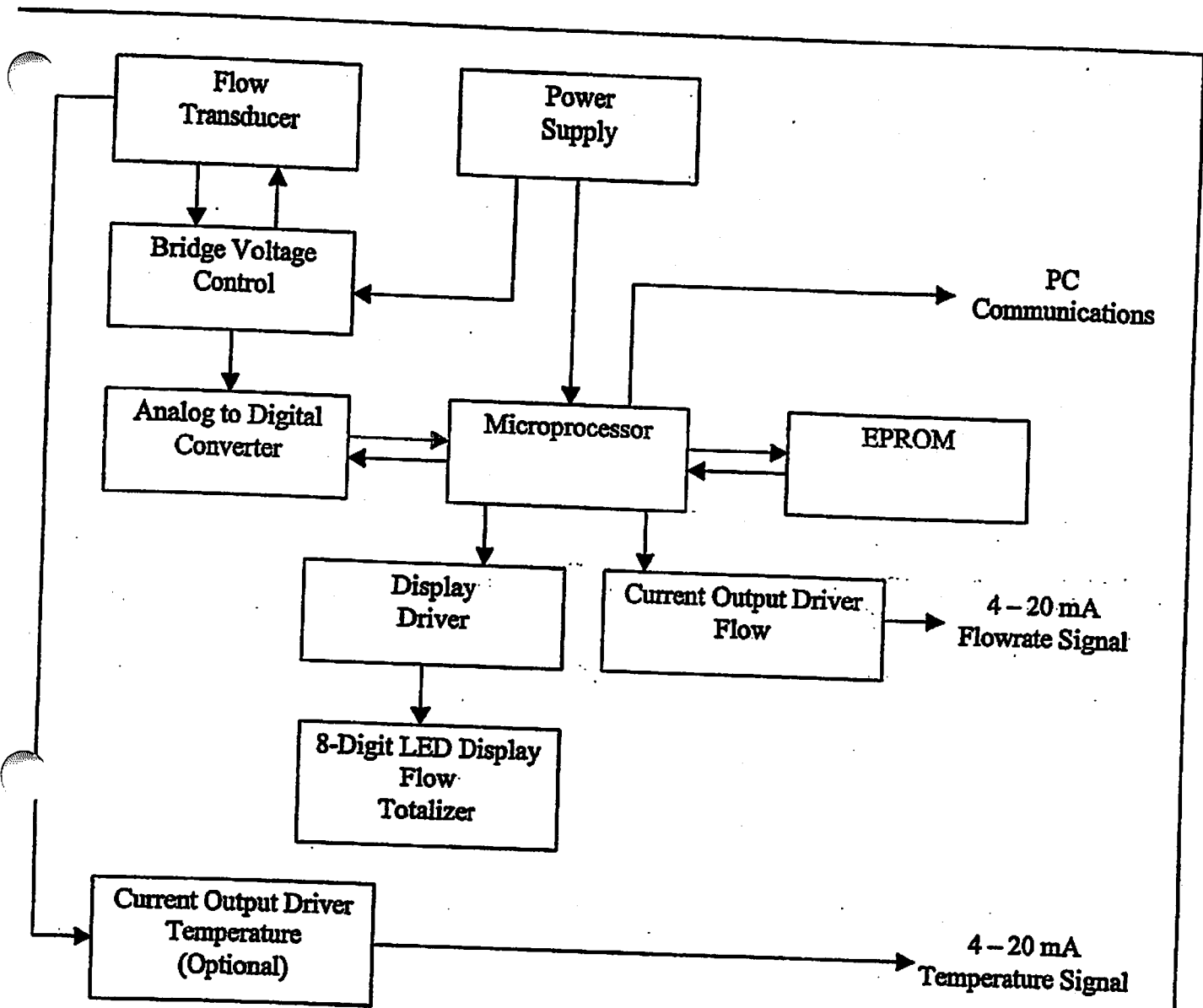
24 VDC
9500 INTEGRAL WIRING DIAGRAM

TERMINAL BOARD



1 Amp maximum power draw on initial power-up

MODEL: 9500	INTEGRAL MODEL 9500 WIRING DIAGRAM	Thermal Instrument Co. Trevose, PA.
S/N		DATE:



MODEL: 9500 / 62-9

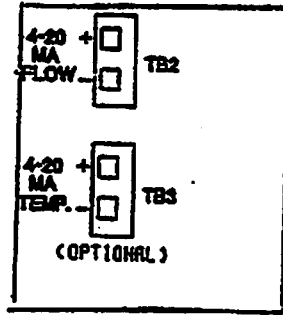
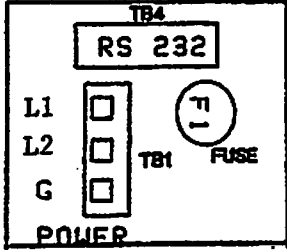
W/N

FIGURE 1
MODEL 9500
BLOCK DIAGRAM

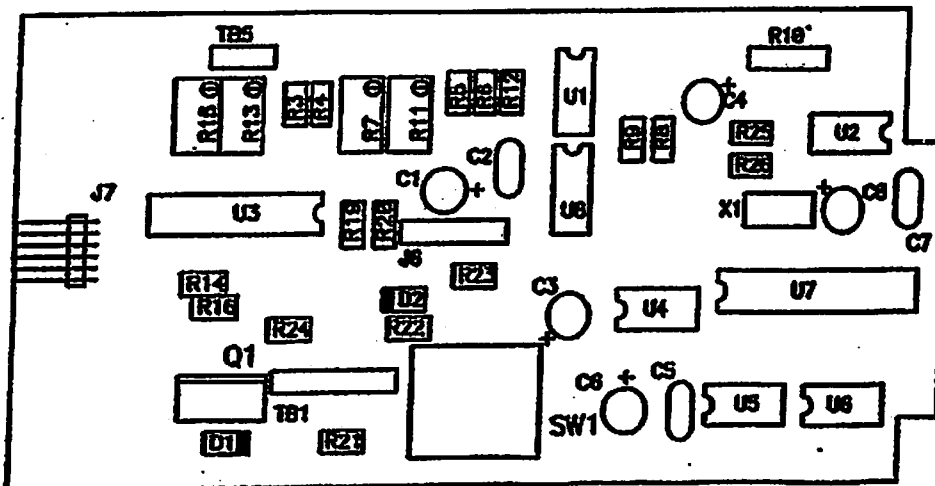
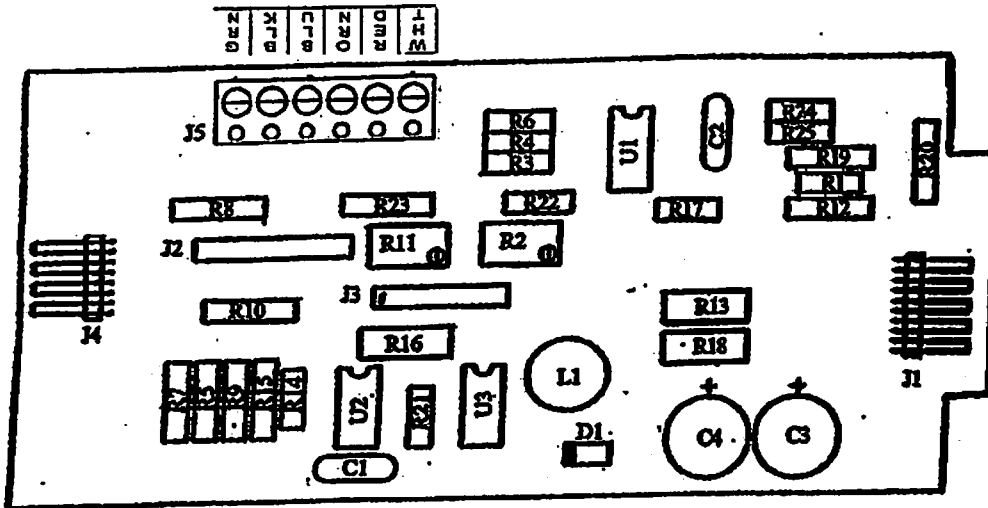
Thermal Instrument Co.
Trevose, PA.

DATE:

POWER BOARD



SIGNAL BOARD



THERMAL INSTRUMENT CO.

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Email: Office@Thermalinstrument.com

FAX No. (215) 355-1789

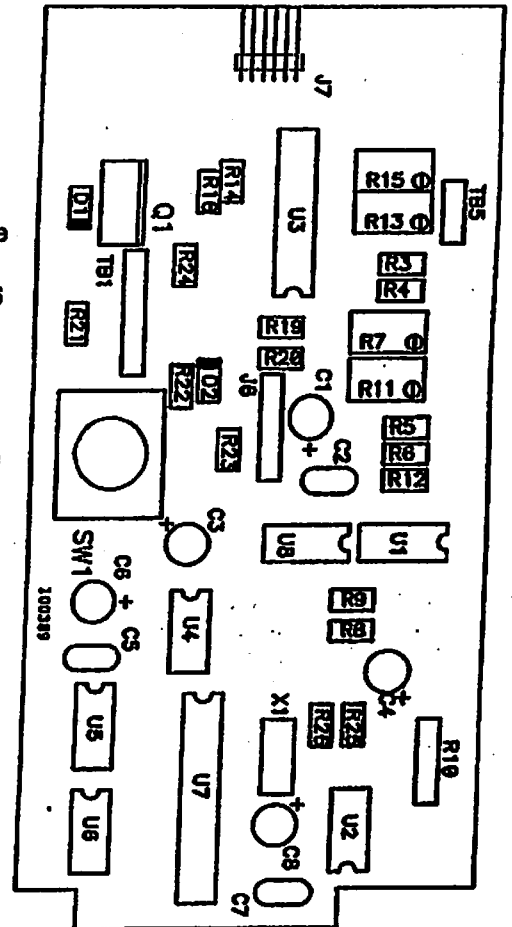
Web: WWW.Thermalinstrument.com

FIELD CALIBRATION CHECK INTEGRAL 9500 ELECTRONICS

The Integral 9500 electronics signal conditioner calibration check depends on which design Logic Board 100389 (which has the yellow push button on it) your meter has. One design has a three pin TB5 while the other design has a six pin TB5. This TB5 is located in the upper corner next to a pair of potentiometers R13 and R15. If you have the three pin TB5 then proceed to section A. If you have the six pin TB5 then proceed to Section B.

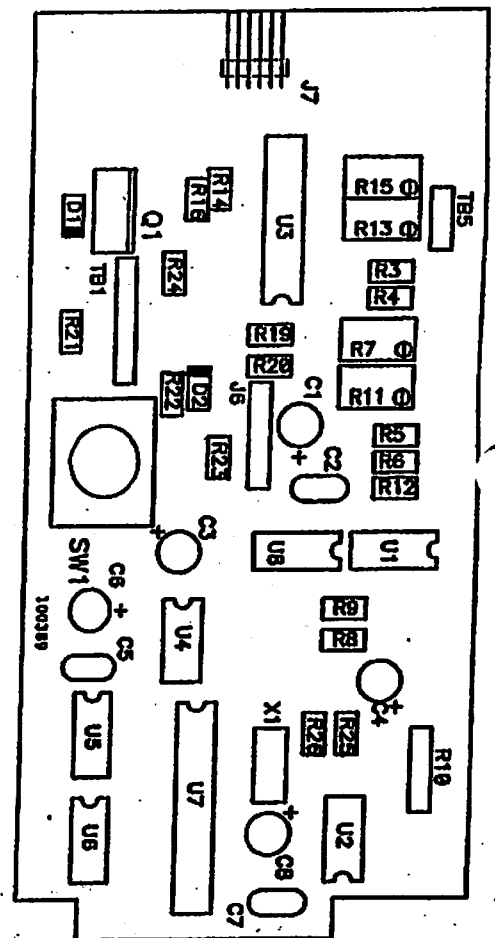
A) The three pin TB5 Integral 9500 electronics signal conditioner output can be calibrated by means of actual steady flowrate flowing through the meter at various flowrates. External means of knowing the flowrates will be needed. The pair of adjustment potentiometers, ZERO and SPAN, is located on the Logic Board (the pair which is not next to TB5).

1. Locate the meter's calibration specification sheet, in the instruction manual, labeled "Component Values Determined at Calibration". This will specify what the full scale flowrate the meter was calibrated to.
2. Adjust the flowrate to 10% of full scale flow. Make sure to have the flowrate as steady as possible. The display, if available, should indicate the 10% of full scale flow rate. The DC mA output should be 5.6 mA (10% of scale). If the mA output is not correct, adjust ZERO potentiometer R7 until 5.6 mA. Potentiometer R7 is adjacent to pin 1 of U3 chip.
3. Adjust the flowrate to 90% of full scale flow. Make sure to have the flowrate as steady as possible. The display, if available, should indicate the 90% of full scale flow rate. The DC mA output should be 18.4 mA (90% of scale). If the mA output is not correct, adjust SPAN potentiometer R11 until 18.4 mA. Potentiometer R11 is located adjacent to capacitor C1. You may have to return to step #2 if any adjustments were made due to the ZERO and SPAN potentiometers adjustments offset each other a little.
4. After the 10% and 90% of full scale flow rates are checked, check 0, 20, 30, 40, 50, 60, 70, 80, and 100% points.
5. If procedure does not prove satisfactory, recheck steps taken and if necessary contact Thermal Instrument Company for further assistance.



B) The six pin TB5 Integral 9500 electronics signal conditioner output can be calibrated by simulating the voltage output of the flow transducer with an external DC voltage source. The pair of adjustment potentiometers, ZERO and SPAN, is located on the Logic Board (the pair which is not next to TB5).

1. Turn off power to meter.
2. Either remove the jumper across pins 4 and 5 of TB5 or remove the solder bridge between the two. Pin 1 is up next to potentiometer R15.
3. Connect an external variable DC voltage source, negative lead to pin 2 and the positive lead to pin 5.
4. Apply power to the electronics.
5. Locate the calibration specification sheet in the instruction manual labeled "Component Values Determined at Calibration"
6. Turn on variable DC voltage source and set DC voltage to the 10% of full scale flow rate transducer voltage (EXC). The display, if available, should indicate the 10% of full scale flow rate. The DC mA output should be 5.6 mA (10% of scale). If the mA output is not correct, adjust ZERO potentiometer R7 until 5.6 mA. Potentiometer R7 is adjacent to pin 1 of U3 chip.
7. Set the DC voltage to the 90% of full scale flow rate transducer voltage (EXC). The display, if available, should indicate the 90% of full scale flow rate. The DC mA output should be 18.4 mA. If the mA output is not correct, adjust SPAN potentiometer R11 until 18.4 mA. Potentiometer R11 is located adjacent to capacitor C1. You may have to return to step #6 if any adjustments were made due to the ZERO and SPAN potentiometers adjustments offset each other a little.
8. After the 10% and 90% of full scale flow rates are checked, check 0, 20, 30, 40, 50, 60, 70, 80, and 100% points.
9. Turn off power to the meter.
10. Disconnect the DC Voltage Source.
11. Place jumper back on across pins 4 and 5 on TB5 or resolder a solder bridge across them.
12. Turn on power to meter.
13. If procedure does not prove satisfactory, recheck steps taken and if necessary contact Thermal Instrument Company for further assistance.



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Troubleshooting

Troubleshooting of a malfunctioning flowmeter is a process of isolating the particular circuit area which is out of range and then finding the components causing the failure. Before looking into possible circuit problems it will be profitable in most cases to first determine that the problem is not internal to the electronics. As odd as it may sound, most apparent flowmeter malfunctions are a result of incorrect installation or changes in process operating conditions.

Typical installation problems are:

Fluid not flowing.

Flow rate or temperature out of calibration range.

Fluid not identical to calibration fluid.

(Ex: Air instead of CO₂ or Water instead of Glycol)

Fluid has coated flow element.

(Ex: Very dirty gas or liquid that leaves a film or layers)

Flow element installed too close to upstream or downstream flow disturbance.
(Minimum 10 pipe diameters upstream and 5 pipe diameters downstream)

Power not on or incorrect voltage.

(Ex: Connecting 24 VDC in place of 110 VAC)

Flow element wiring incorrect.

Output wiring incorrect.

For installations that had been operating correctly it is frequently helpful to review the above list since changes made to process, piping, or wiring have been known to effect flowmeter performance.

If a problem has been identified from the above list and cannot be corrected, it will be helpful to discuss the situation with Thermal Instrument Company for possible solutions (new calibration or meter modifications).

INDUSTRIAL THERMOCOUPLES

INSTALLATION and MAINTENANCE

Thermocouple Installation

1. Carefully select the location and insertion depth at a point where the temperature is most likely representative of the process temperature. It is important to avoid stagnant areas of the measured media which do not have representative temperatures.
2. Locating the thermocouple where the hot end can be seen assures visual confirmation of the junction location.
3. Immerse the thermocouple far enough to ensure that the measuring junction is entirely included in the temperature area to be measured. A depth ten times that of the diameter of the protection tube is recommended. Heat which is conducted away from the hot junction will cause a lower reading due to "stem loss."
4. Keep the connecting head and cold junction in coolest ambient temperature available.
5. To prevent breakage due to thermal shock, never insert a ceramic tube into a hot area rapidly. Preheat gradually while installing.
6. Avoid direct flame impingement on protecting tube. Impingement shortens the tube life and causes temperature readings to be inaccurate.
7. When measuring high temperatures, install the thermocouple vertically, whenever possible. Such installation minimizes sagging of the tube or sheath.

Extension Wire Installation

1. Be sure to select the correct type of extension wire for a given calibration of thermocouple. (See Bulletin 300).
2. Use the color coding of individual wires as a guide for connecting the negative wire to the negative-wire terminal at both the thermocouple connection head and the instrument. Red is always Negative (-).
3. To prevent spurious EMF due to electrostatic and electromagnetic noise, never run thermocouple extension wire in same conduit, parallel to the conduit or near any power source. Keep thermocouple wire at least 12" from power source.
4. In "high noise" areas, use thermocouple extension wire with twisted and shielded conductors and a drainwire.
5. Select the proper insulation to meet the specific conditions under which it must perform. (See Bulletin 300).

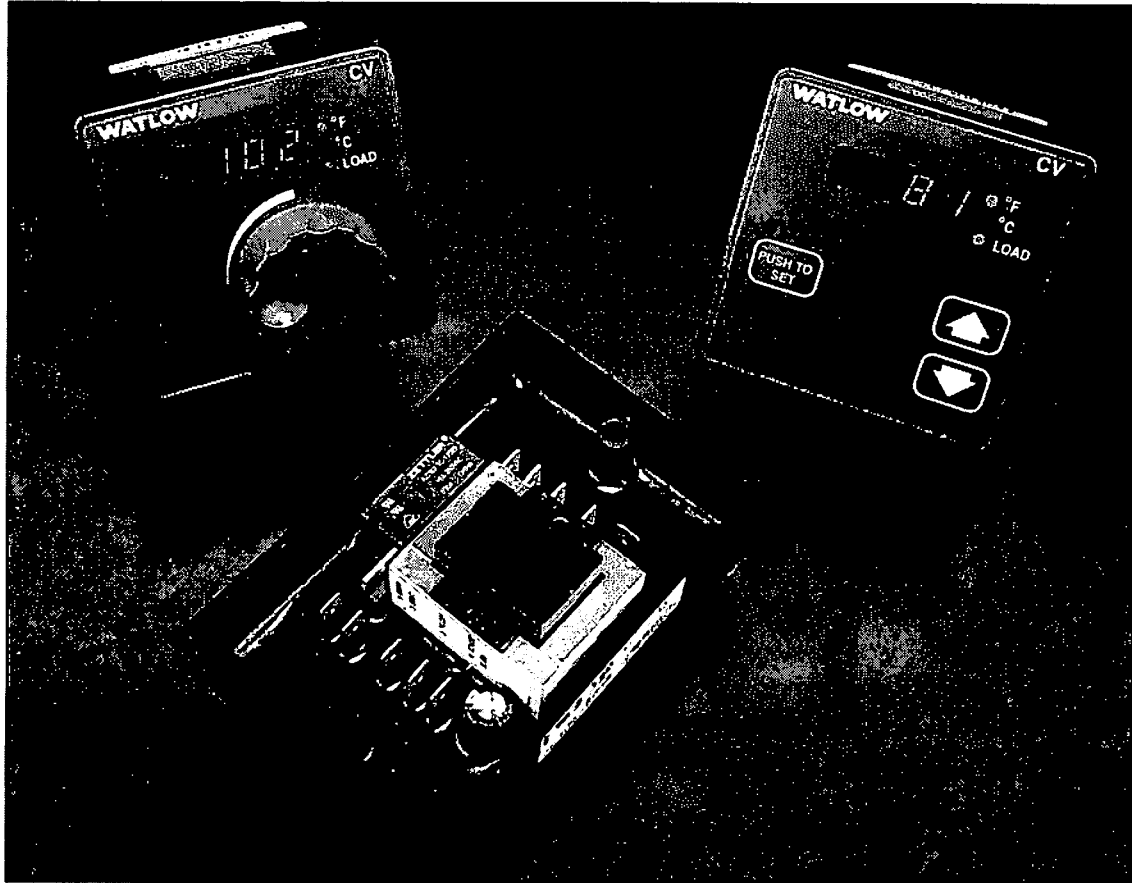
General Maintenance

1. Monthly maintenance checks are usually sufficient for base metal thermocouples. Individual conditions, however, may require more frequent checks.
2. Keep rotary switches clean and free of oxidation at contact points.

3. When reinserting a thermocouple, it is extremely important that the depth of insertion not be changed. Be especially careful not to decrease the depth. Wires which are not homogeneous, due to exposure to the process, will cause errors in regions of temperature gradients.
4. A type K thermocouple should not be exposed to temperatures of 1600° F or higher if it is to be used for accurate measurements below 1000° F.
5. Do not use thermocouples with burned-out protecting tubes. Thermocouples can become damaged with contamination if allowed to remain within tubes of poor condition.
6. If thermocouples are to be connected in series, parallel or differential, refer to the diagrams on Page 3.

Series C & Series TM

User's Manual



Series C - On-Off Temperature Controller
Series TM - Temperature Indicator



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0600-0044-0000 Rev. E



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Safety Information


We use note, caution and warning symbols throughout this book to draw your attention to important operational and safety information.

A “NOTE” marks a short message to alert you to an important detail.

A “CAUTION” safety alert appears with information that is important for protecting your equipment and performance. Be especially careful to read and follow all cautions that apply to your application.

A “WARNING” safety alert appears with information that is important for protecting you, others and equipment from damage. Pay very close attention to all warnings that apply to your application.

The safety alert symbol,  (an exclamation point in a triangle) precedes a general CAUTION or WARNING statement.

The electrical hazard symbol,  (a lightning bolt in a triangle) precedes an electric shock hazard CAUTION or WARNING safety statement.



CAUTION or
WARNING



Electrical
Shock Hazard

CAUTION or WARNING

Technical Assistance

If you encounter a problem with your Watlow controller, review your configuration information to verify that your selections are consistent with your application: inputs, outputs, alarms, limits, etc. If the problem persists, you can get technical assistance from your local Watlow representative (see back cover), by e-mailing your questions to wintechsupport@watlow.com or by dialing +1 (507) 494-5656 between 7 a.m. and 5 p.m., Central Standard Time (CST). Ask for for an Applications Engineer. Please have the following information available when calling:

- Complete model number
- System wiring information
- Basic Controller User's Manual

Warranty

These controllers are manufactured by ISO 9001-registered processes and are backed by a three-year warranty.

Return Material Authorization (RMA)

1. Call Watlow Customer Service, (507) 454-5300, for a Return Material Authorization (RMA) number before returning any item for repair. We need this information:
 - Ship to address
 - Bill to address
 - Contact name
 - Phone number
 - Method of return shipment
 - Your P.O. number
 - Detailed description of the problem
 - Any special instructions
 - Name and phone number of person returning the product.
2. Prior approval and an RMA number, from the Customer Service Department, is needed when returning any unused product for credit. Make sure the RMA number is on the outside of the carton, and on all paperwork returned. Ship on a Freight Prepaid basis.
3. After we receive your return, we will examine it and try to verify the reason for the return.
4. In cases of manufacturing defect, we will enter a repair order, replacement order or issue credit for material returned.
5. To return products that are not defective, goods must be in new condition, in the original boxes and they must be returned within 120 days of receipt. A 20 percent restocking charge is applied for all returned stock controls and accessories.
6. If the unit is unrepairable, it will be returned to you with a letter of explanation.
7. Watlow reserves the right to charge for no trouble found (NTF) returns.

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1

Overview

Watlow's Series C family of basic temperature controllers* provide an economical controller solution for applications where simple on/off control is needed.

These controllers are available with or without an operator interface and can be ordered in square 1/8th DIN panel mount, din rail mount, open board or potted module design configurations. Push-on, quick connect spade terminal or removable screw clamp style terminal block ordering options provide the electrical connections.

The microprocessor design platform provides improvements in the performance, repeatability, and accuracy offered by Watlow's current line of basic temperature control products.

The Series CV includes an operator interface to allow viewing and selection of the control set point. A red four-character, seven-segment LED displays the set point. It is also available with a push-to-show process option. The set point selection is made with a continuous turn, velocity-sensitive rotary encoder. Set point range temperature values are customer definable in the product configuration part number.

The Series CF offers fixed control points. These units are supplied without an operator interface. Operating set point temperature values are customer definable in the product configuration part number.

The Series TM is a temperature indicator only version. It is available in DIN rail or panel mount configurations.

The features and performance of these products make them ideally suited for a wide range of industrial control applications in the food preparation, industrial machinery, packaging and plastic markets.

Watlow's Series C and TM controllers include industry-leading service, support and a 3-year warranty.

*Also available in an FM-approved limit version.

Features and Benefits

Four-Character LED Display

- Improves Set Point adjustment accuracy.

Fixed or Adjustable Set Points

- Tamper Proof Operation.
- Control Flexibility.

Set Point Adjustment Options

- Rotary encoder.
- Tactile increment and decrement keys.

Push to Set Option

- Reduce accidental set point adjustments.

Push to Display Process Option

- Allows viewing of process value.

Multiple Mounting Options

- Minimizes installation time.

Heat or Cool Operation

- Application flexibility.

Fahrenheit or Celsius Operation with Indication

- Application flexibility.

Sensor Break Protection

- Provides positive system shutdown.

Agency Approvals

- Meets requirements for agency certification.
- NEMA 4X/IP65 seal panel-mount versions available.
- W.E.E.E; CE; RoHS

Microprocessor Based Technology

- Accurate and repeatable control.

Stock to Four Day Delivery

2

Installation

Installing the Open Board Controller

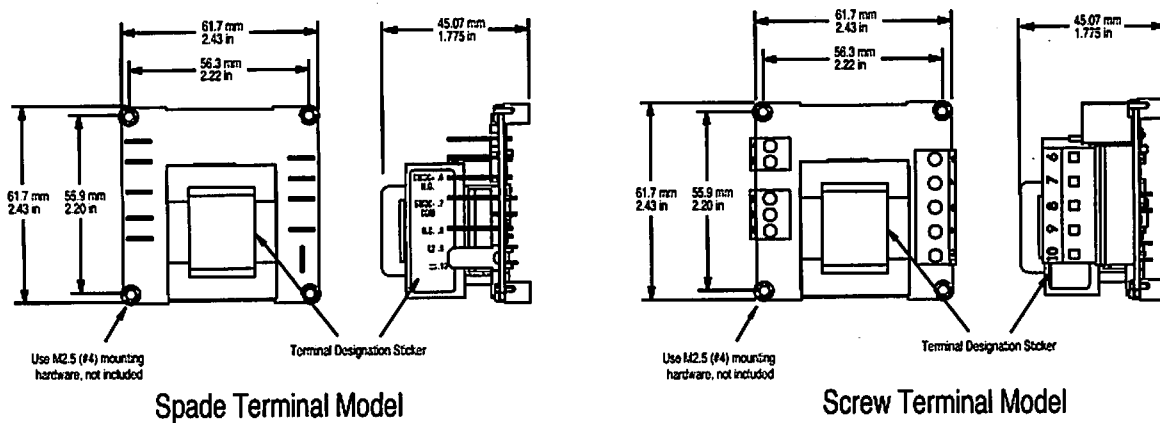


Figure 2a

1. Locate and drill four 3.2 mm (0.125 in) holes in the desired panel location. See Figure 2a for hole locations.
2. Mount the controller using four M2.5 (#4) screws.

Installing the Potted Controller

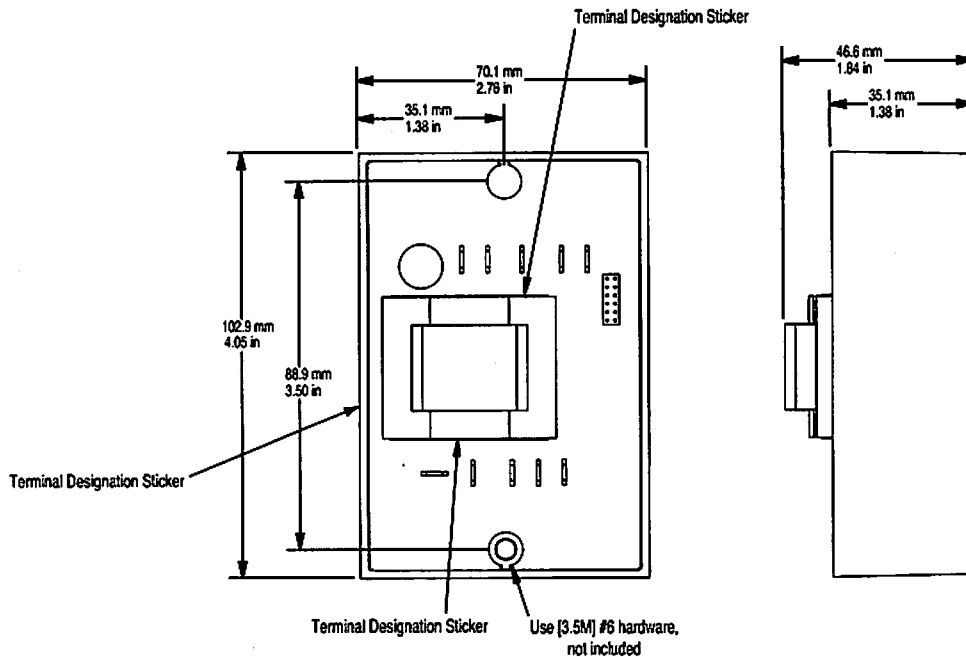


Figure 2b

1. Drill two 5 mm (0.187 in) diameter holes in the desired panel location. See Figure 2b for hole locations.
2. Mount the controller using two M3.5 (#6) screws.

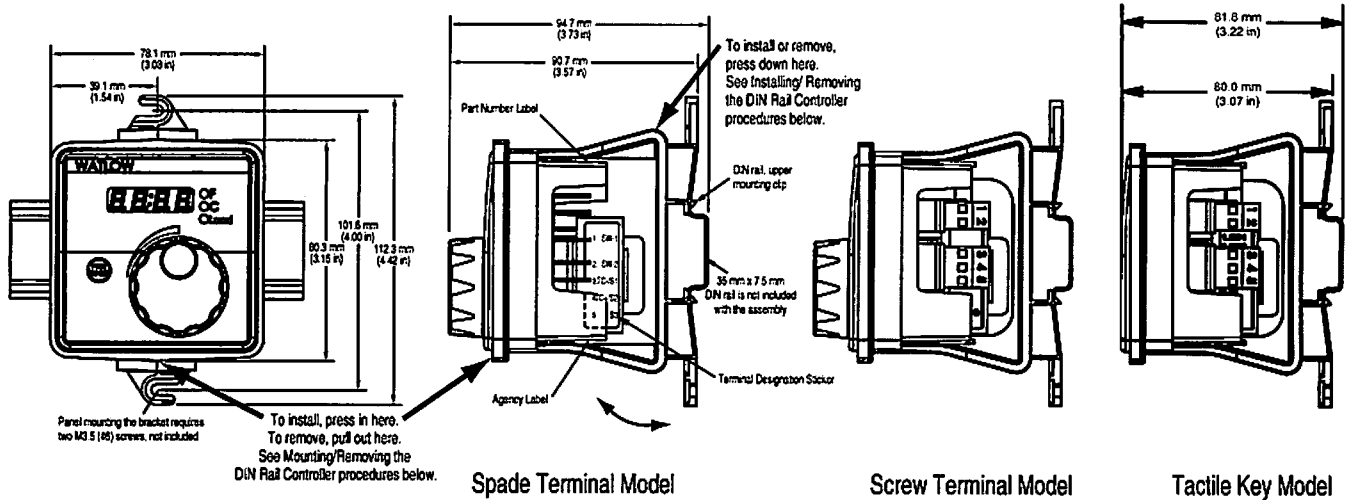


Figure 3a
Sub-Panel Mounting

1. Using the controller as a location template, mark both mounting holes.
2. Drill and tap two 2.7 mm (0.106 in) diameter holes in the desired panel location. See Figure 3a above for hole locations.
3. Mount the controller using two M3.5 (#6) screws.

DIN Rail Mounting

1. Place the DIN rail upper mounting clip on the top edge of the DIN rail. See Figure 3a. DIN rail spec, DIN 50022, 35 mm x 7.5 mm (1.38 in x 0.30 in).
2. Press down firmly on the top back edge of the DIN rail bracket and push in on the bottom, front edge of the bracket. The controller “snaps” securely onto the rail. See Figure 3a. If the controller does not snap on, check to see if the DIN rail is bent. Minimum clipping distance is 34.8 mm (1.37 in), the maximum is 35.3 mm (1.39 in).

Removing the DIN Rail Controller

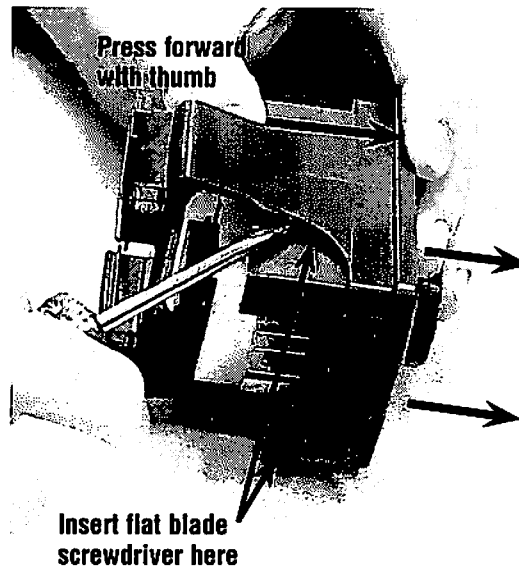
1. Remove power from the system.
2. Remove all the wiring connections from the back of the controller.
3. While pressing down on the top, back edge of the DIN rail bracket, pull forward on the bottom, front edge of the DIN rail bracket. See Figure 3a.

Removing the Controller from the DIN Rail Bracket

1. Remove power from the system.
2. Remove all the wiring connections from the back of the controller.
3. Remove the DIN rail bracket from the DIN rail.
4. Insert a flat blade screwdriver between the DIN

rail bracket and the case. Rotate the screwdriver to release the DIN rail bracket hooks from the ridges on the case, while firmly pushing the controller out the front of the DIN rail bracket. Alternate back and forth between the top and then the bottom. Be sure to support the controller as it comes out of the bracket. See Figure 3b.

Figure 3b



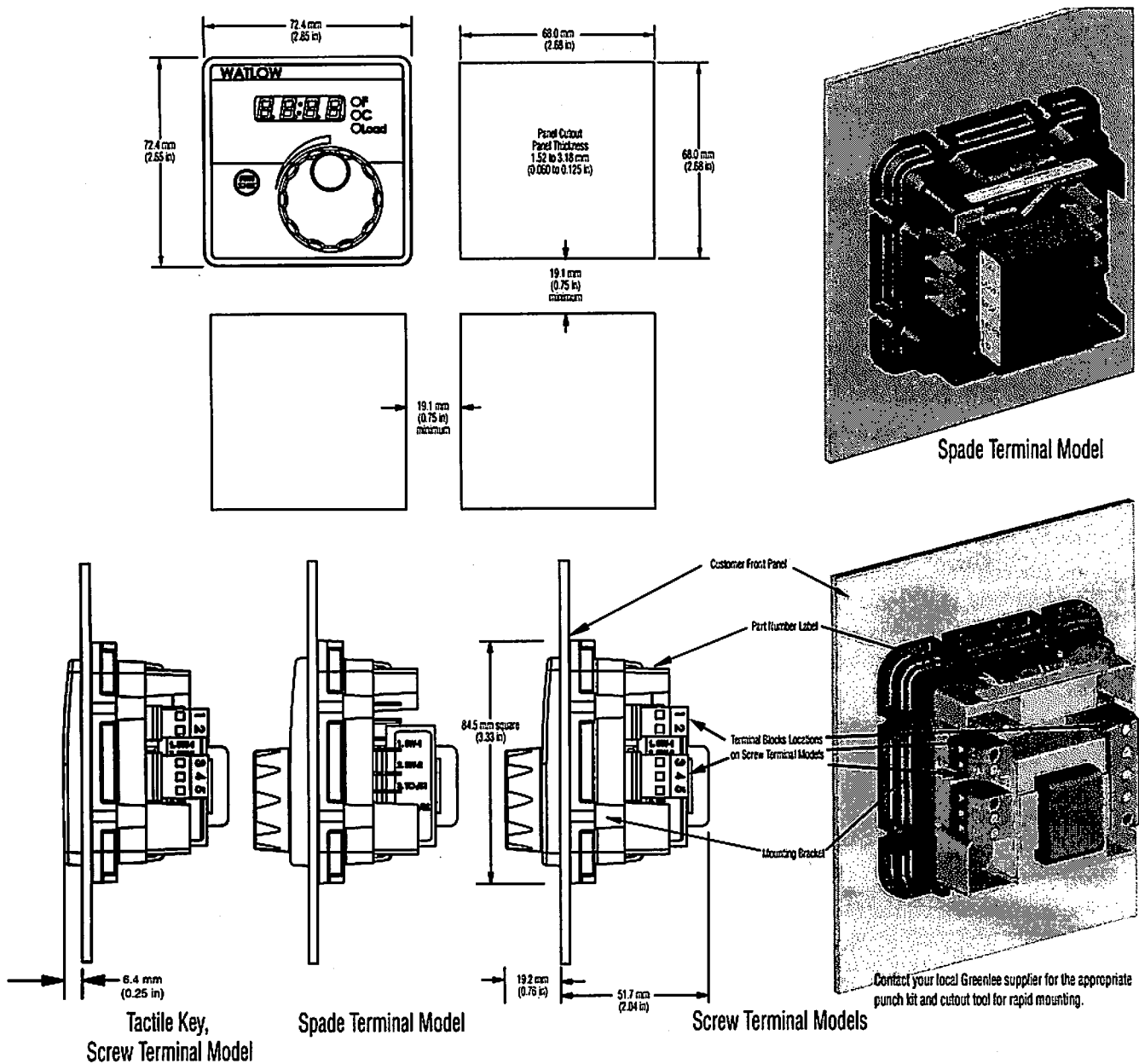


Figure 4

Installing the Square 1/8 DIN Panel Mount Controller

1. Make the panel cutout using the mounting dimensions above.
2. Remove mounting bracket from the back of the controller.
3. If your controller has a gasket, check to see that the gasket is not twisted, and is seated within the case bezel flush with the panel. Place the case in the cutout. Make sure the gasket is between the panel cutout and the case bezel.
4. While pressing the front of the case firmly against the panel, slide the mounting collar over the back of the control. The tabs on the collar must line up with the mounting ridges on the case for secure installation. See Figure 4. Slide the collar firmly against the back of the panel, getting it as tight as possible. To ensure a tight seal, use your thumb to lock the tabs into place while pressing the case from side to side. Don't be afraid to apply enough pressure to install the controller. The tabs on each side of the collar have teeth that latch into the ridges. Each tooth is staggered at a different height, so only one of the tabs on each side are ever locked into the ridges at a time. Confirm that the tabs on one side of the collar correspond with those on the opposite side. Make sure the two corresponding tabs are the only ones locked in the ridges at the same time. If the corresponding tabs are not supporting the case at the same time, you will not have a NEMA 4X seal.
5. Insert the control chassis into its case and press the bezel to seat it. Make sure the inside gasket is also seated properly and not twisted. The hardware installation is complete. Proceed to the wiring section.

2. Insert the controller into the panel cutout.
3. While pressing the bezel firmly against the panel, slide the mounting bracket over the back of the controller. Be sure the levers on the mounting bracket line up with the teeth on the case.
4. Press the bracket up to the back of the panel. The controller should fit tightly in the panel cutout.

Removing the Panel Mount Square 1/8 DIN Controller

1. Remove power from the system.
2. Remove all the wiring connections from the back of the controller.
3. Slide a thin, wide tool (putty knife) under all three mounting tabs, top then bottom, while pushing forward on the back of the case. Be ready to support the controller as it slides out of the panel cutout.

3

Wiring



Warning:

Use National Electric (NEC) or other country-specific standard wiring and safety practices when wiring and connecting this controller to a power source and to electrical sensors or peripheral devices. Failure to do so may result in damage to equipment and property, and/or injury or loss of life.

Note: Insulated terminals required for quick connect style terminals.

For quick connect terminals 1, 2, 6, 7, 8, 9, and 10, AMP P/N 3-520406-2 or equivalent recommended. Use Amp crimp tool P/N 58078-3, insert 90391-3.

For quick connect terminals 3, 4, and 5, AMP P/N 2-520405-2 or equivalent recommended. Amp crimp tool P/N 58078-3, insert 58079-3.

The terminals on the back of the Series C and Series TM controllers are the same for all of the package styles. They are 6.3 mm (0.25 in) quick connect, push on style terminals or removable screw terminal block. The terminal style is an ordering option.

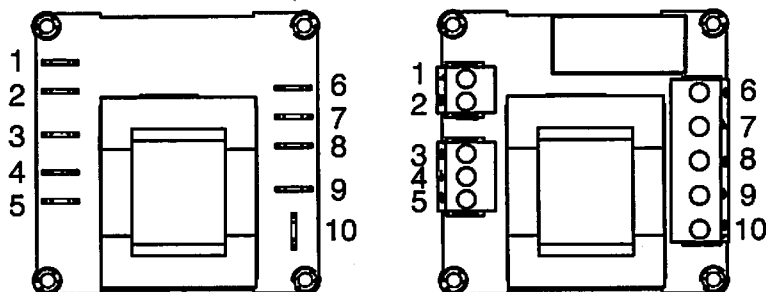
Check the part number to determine your hardware configuration. Refer to the wiring diagrams appropriate for your controller's configuration.

All outputs are referenced to a de-energized state.

Wiring Guidelines

1. Use the correct thermocouple type per the model number on the case sticker of the unit. See dimension drawings for sticker locations.
 - Use correct thermocouple polarity. Red is usually negative.
 - If you must extend thermocouple leads, use thermocouple extension wire to minimize errors.
 - Be sure you have good crimp connections on your thermocouple connections.
 - Insulate the thermocouple mounting from the mounting surface to prevent heat migration input errors.
 - Thermocouple leads should be routed separately from any high voltage lines.
 - Long lead lengths create electrical resistance and there is not any lead resistance compensation. When using a two or three-wire RTDs, there will be an additional 2.6° C (4.7° F) error for every 1Ω of lead length resistance. That resistance when added to the resistance of the RTD element, can result in erroneous input to the temperature controller.
2. In electrically-noisy environments (heavy switching contactors, motors, solenoids, etc.), use shielded thermocouple lead wire with the shield connected at the sensor end only.
3. Use a separate thermocouple to maintain the limit function of this controller; do not parallel thermocouple input from the primary controller.
4. All wiring and fusing must conform to the National Electric Code (NEC) NFPA70 and any other locally applicable codes.
5. Fuse the independent load voltage on the L1 (hot) side and connect it to the common (C) side of the relay.

Note: The model number determines the connection terminal style. See below for terminal locations.





Warning:
Use National Electric (NEC) or other country-specific standard wiring and safety practices when wiring and connecting this controller to a power source and to electrical sensors or peripheral devices. Failure to do so may result in damage to equipment and property, and/or injury or loss of life.



WARNING: If high voltage is applied to a low-voltage controller, irreversible damage will occur.

Note: Insulated terminals required for quick connect style terminals.

For quick connect terminals 1, 2, 6, 7, 8, 9, and 10, AMP P/N 3-520406-2 or equivalent recommended. Use Amp crimp tool P/N 58078-3, Insert 90391-3.

For quick connect terminals 3, 4, and 5, AMP P/N 2-520405-2 or equivalent recommended. Amp crimp tool P/N 58078-3, Insert 58079-3.

Note: To prevent ground loops, isolation needs to be maintained from input to output when using a switched DC output. Un-grounded thermocouples recommended.

Figure 7a — AC Power Wiring

- Nominal voltage options:
 - 24V~ (ac)
 - 120V~ (ac)
 - 230 to 240V~ (ac)

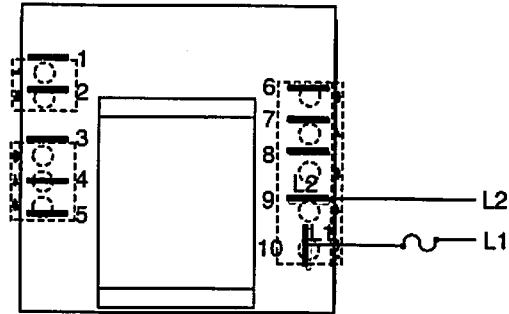


Figure 7b — Thermocouple Input

Thermocouples are polarity sensitive. The negative lead (usually red) must be connected to TC-.

- Input impedance: >10 MΩ

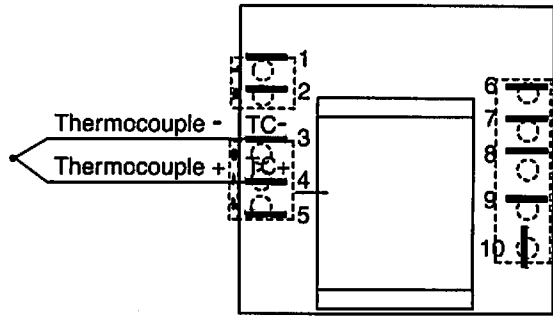
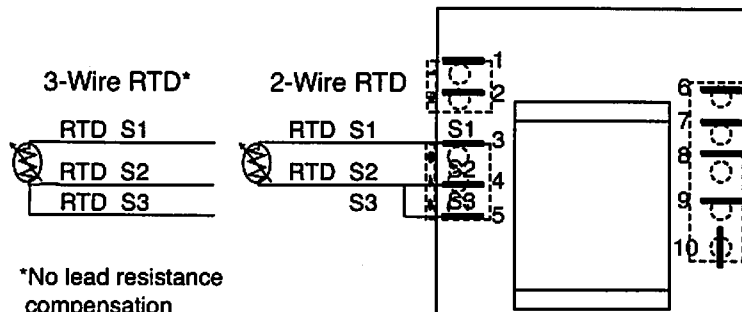


Figure 7c — RTD Input

(100 Ω Platinum DIN curve 0.00385 Ω/Ω°C)

- Terminals S2 and S3 must be shorted for a two-wire RTD
- Nominal excitation current: 125 μA



*No lead resistance compensation



Warning:
Use National Electric (NEC) or other country-specific standard wiring and safety practices when wiring and connecting this controller to a power source and to electrical sensors or peripheral devices. Failure to do so may result in damage to equipment and property, and/or injury or loss of life.

Note: Insulated terminals required for quick connect style terminals.

For quick connect terminals 1, 2, 6, 7, 8, 9, and 10, AMP P/N 3-520406-2 or equivalent recommended. Use Amp crimp tool P/N 58078-3, insert 90391-3.

For quick connect terminals 3, 4, and 5, AMP P/N 2-520405-2 or equivalent recommended. Amp crimp tool P/N 58078-3, insert 58079-3.

Quencharc Note:
Switching pilot duty loads (relay coils, solenoids, etc.) with the mechanical relay output options requires use of an R.C. suppressor.

Watlow carries the R.C. suppressor Quencharc brand name, which is a trademark of ITW Paktron. Watlow Part No. 0804-0147-0000.

Figure 8a — Switched DC Output

- Maximum voltage output into an infinite load, 24V_{DC}
- Minimum output voltage at 10 mA, 5V_{DC}
- Minimum load impedance, 500Ω
- Offstate leakage, 100μA_{DC}
- Not recommended for switching mechanical relays
- Output supplies power

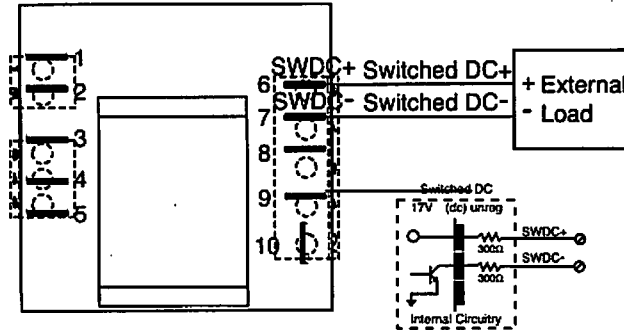
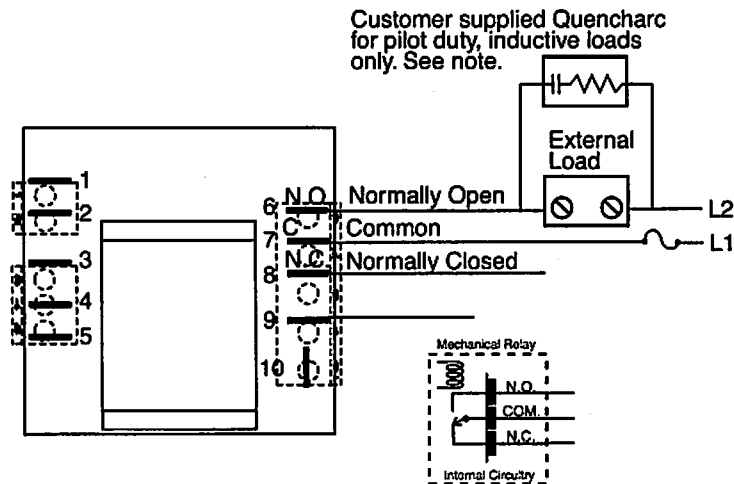


Figure 8b — Mechanical Relay Output

- Form C contacts
- 8 A, resistive
- 250 VA pilot duty, 120/240V_{AC}, inductive
- 240V_{AC} maximum
- 30V_{DC} maximum
- See Quencharc note
- For use with ac or dc
- Minimum load current 100 mA
- Output does not supply power



System Wiring Examples

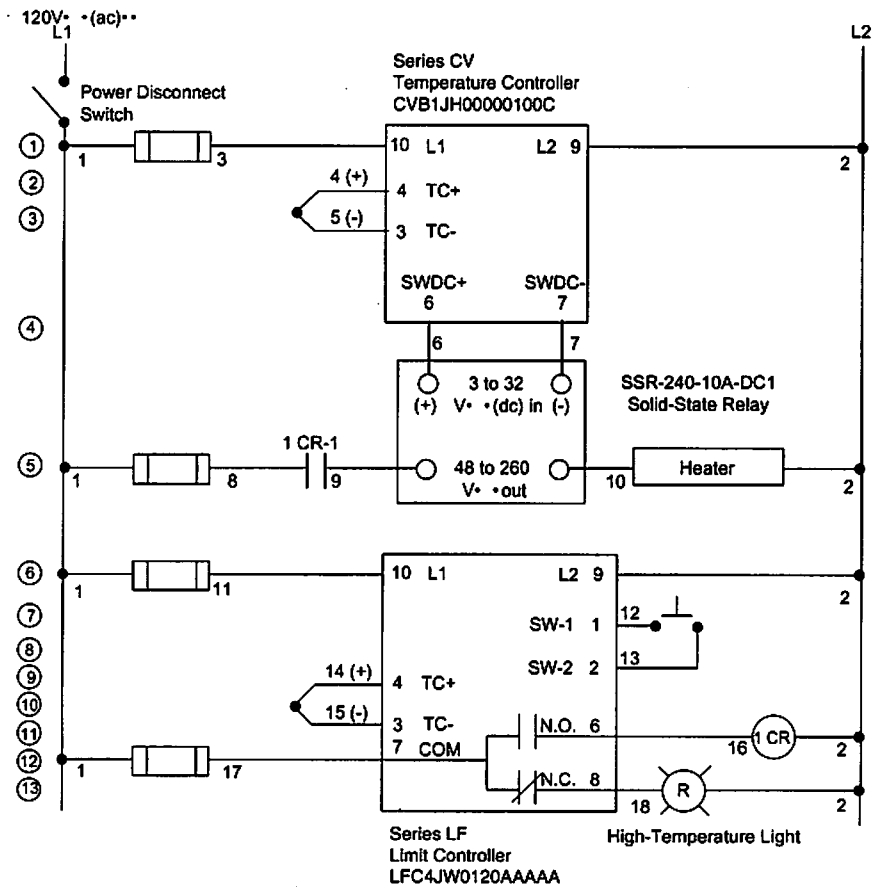
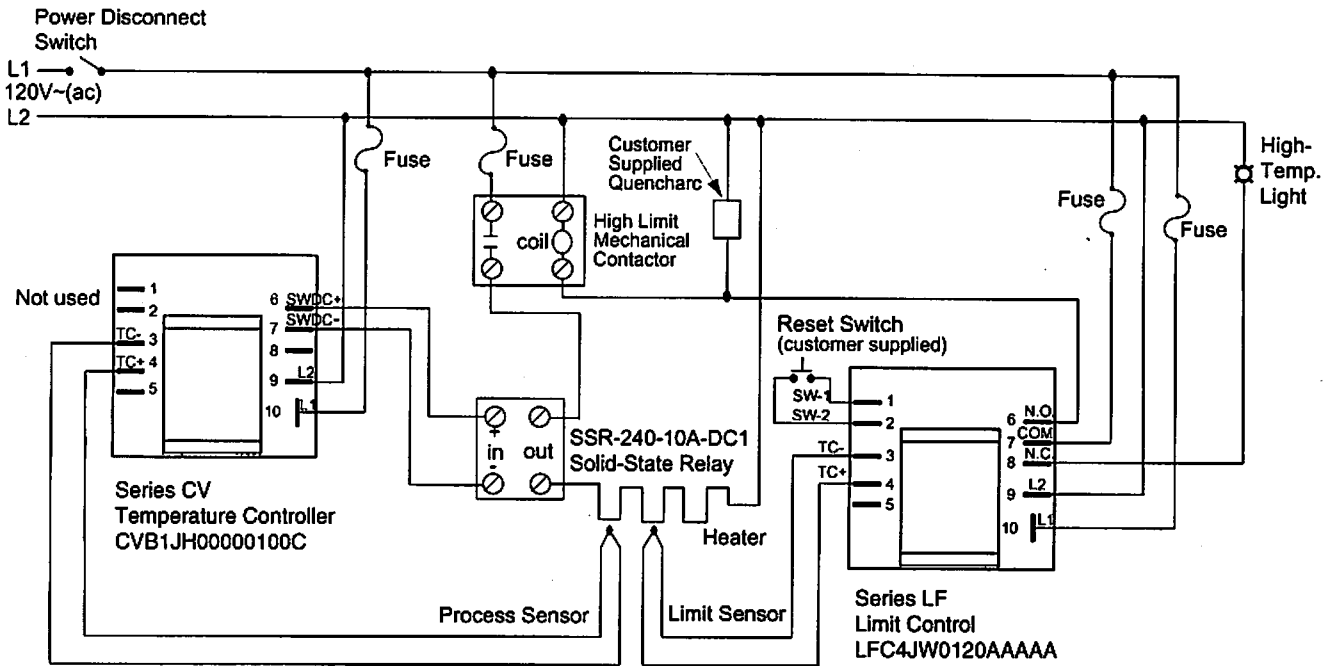


Figure 9 — System Wiring Examples

4

User Interface

Variable Set Point, Standard

CV __ (1, 2, 5 or 6) ----- A

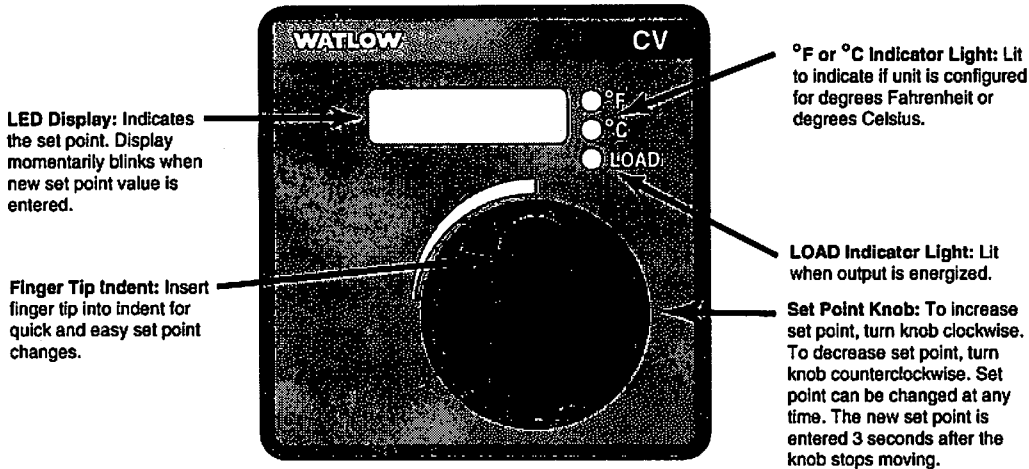


Figure 10a — Variable Set Point Standard Interface

Variable Set Point, Standard

CV __ (A, B, C or D) ----- A

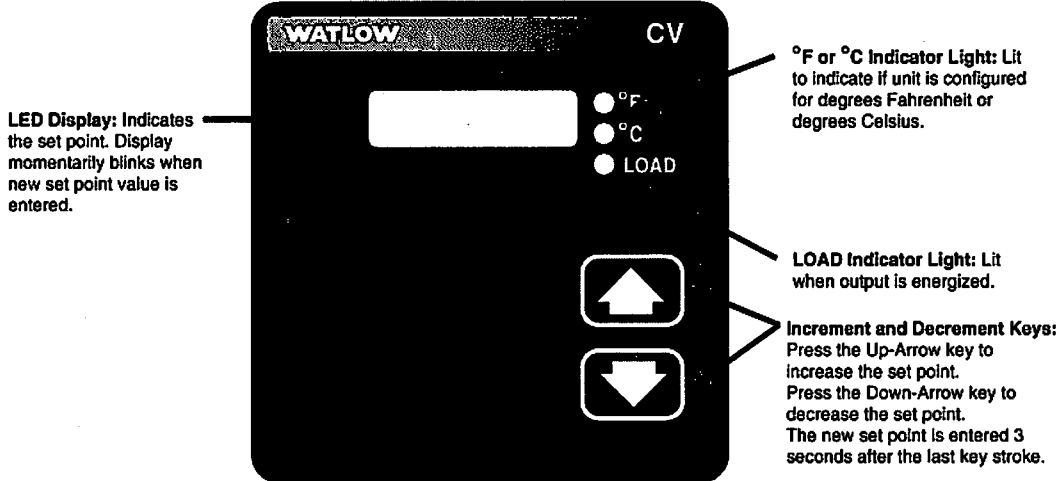


Figure 10b — Variable Set Point with Tactile Keys

To adjust the Calibration Offset on models with tactile keys, first hold down both the Increment and Decrement keys for five seconds. The display will first show **CAL** for five seconds, then it will display the Calibration Offset value. Adjust the value with the Increment and Decrement keys (range: -30 to 30°). The new value will take effect three seconds after the last key stroke. The display will blink, then return to the primary display after five seconds.

To change the temperature units on models with tactile keys, first hold down both the Increment and Decrement keys for ten seconds. The display will show **F °C** for two seconds. Adjust the units with the Increment and Decrement keys. The new value will take effect three seconds after the last key stroke. The display will blink, then return to the primary display after five seconds. The set point value, process value and offset will automatically adjust to the new temperature scale.

Variable Set Point, Push for Process CV _ (1, 2, 5 or 6) ----- B

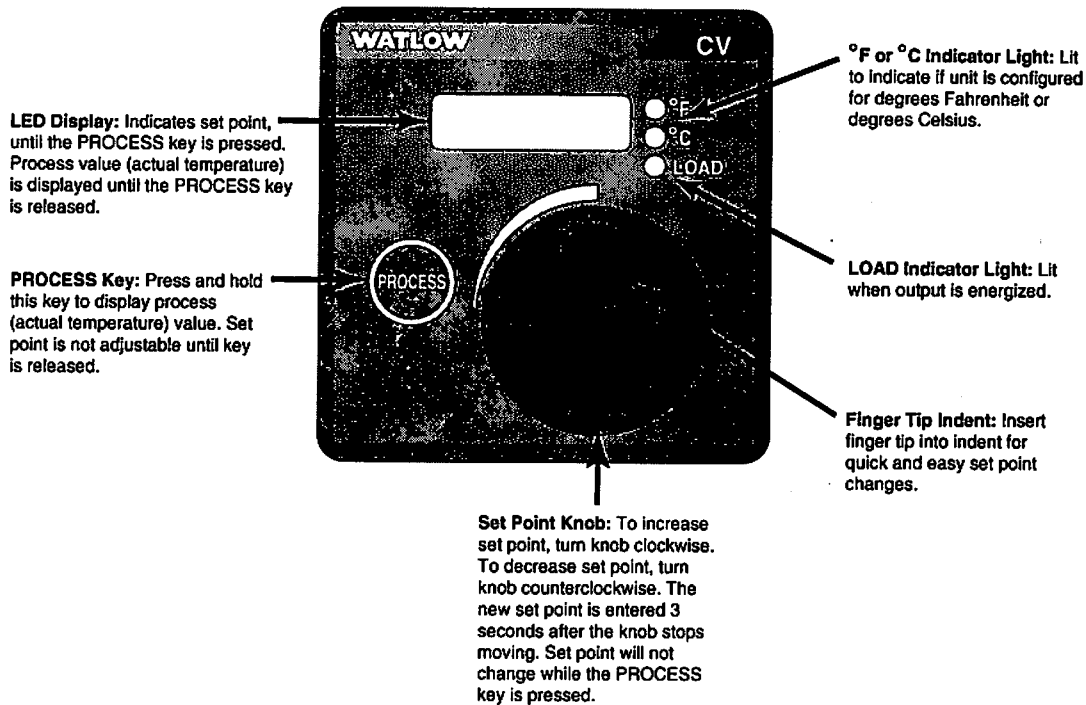


Figure 11a — Variable Set Point, Push for Process Interface

Variable Set Point, Push for Process CV _ (A, B, C or D) ----- B

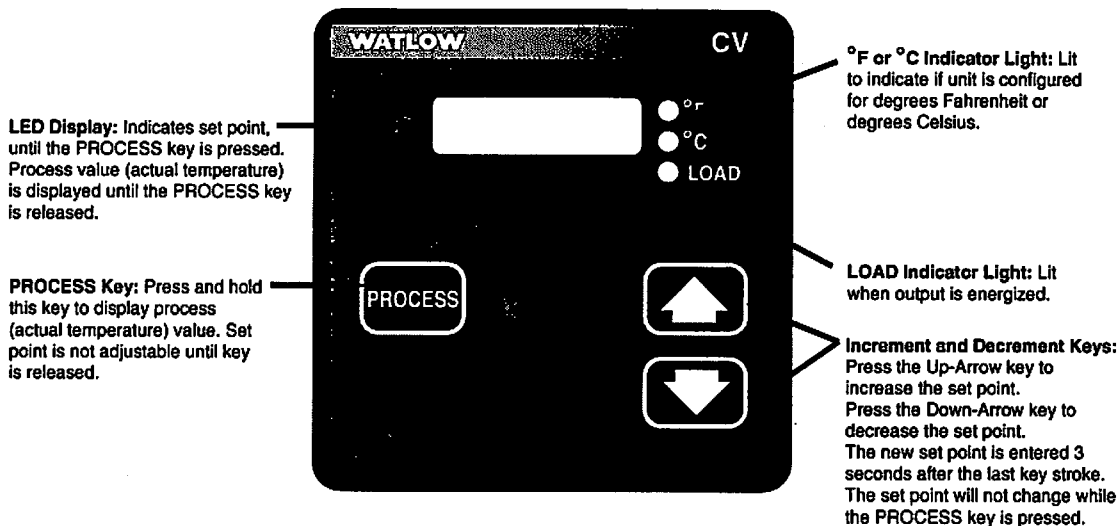


Figure 11b — Variable Set Point, Push for Process Interface with Tactile Keys

To adjust the Calibration Offset on models with tactile keys, first hold down both the Increment and Decrement keys for five seconds. The display will first show **CAL** for five seconds, then it will display the Calibration Offset value. Adjust the value with the Increment and Decrement keys (range: -30 to 30°). The new value will take effect three seconds after the last key stroke. The display will blink, then return to the primary display after five seconds.

To change the temperature units on models with tactile keys, first hold down both the Increment and Decrement keys for ten seconds. The display will show **F C** for two seconds. Adjust the units with the Increment and Decrement keys. The new value will take effect three seconds after the last key stroke. The display will blink, then return to the primary display after five seconds. The set point value, process value and offset will automatically adjust to the new temperature scale.

Variable Set Point, Push to Set CV _ (1, 2, 5 or 6) ----- C

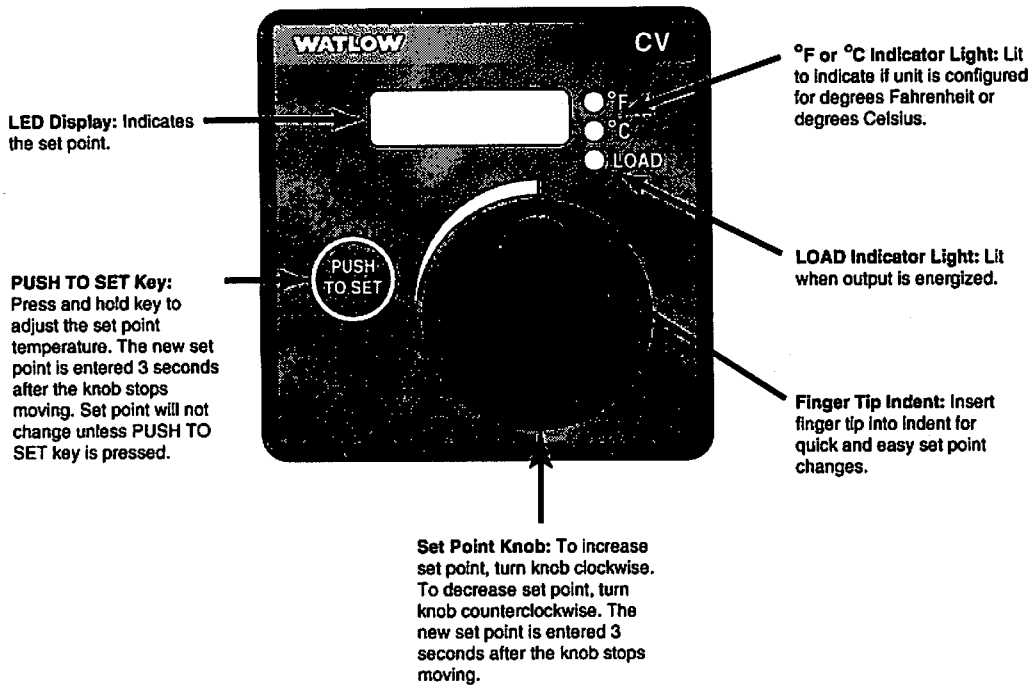


Figure 12a — Variable Set Point, Push to Set Interface

Variable Set Point, Push to Set CV _ (A, B, C or D) ----- C

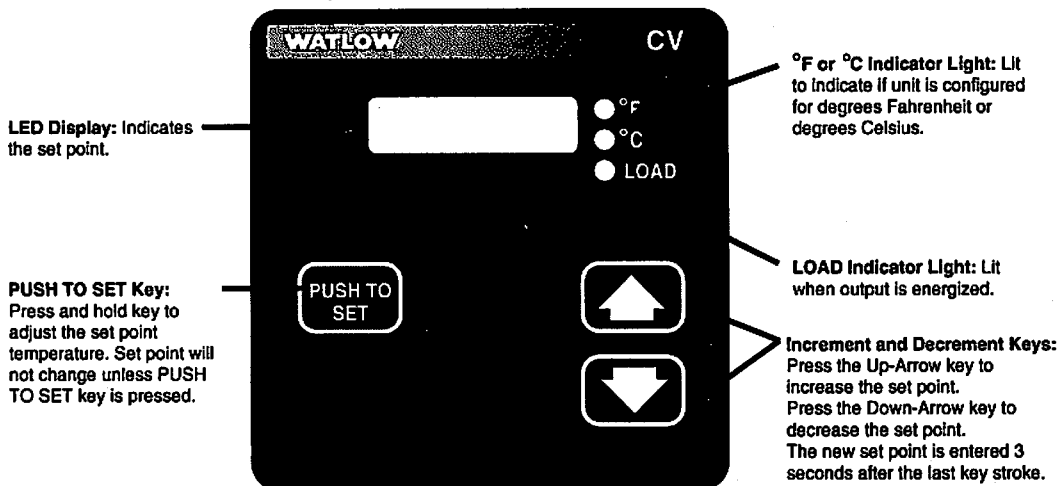


Figure 12b — Variable Set Point, Push to Set Interface with Tactile Keys

To adjust the Calibration Offset on models with tactile keys, first hold down both the Increment and Decrement keys for five seconds. The display will first show **Cal** for five seconds, then it will display the Calibration Offset value. Adjust the value with the Increment and Decrement keys (range: -30 to 30°). The new value will take effect three seconds after the last key stroke. The display will blink, then return to the primary display after five seconds.

To change the temperature units on models with tactile keys, first hold down both the Increment and Decrement keys for ten seconds. The display will show **F** for two seconds. Adjust the units with the Increment and Decrement keys. The new value will take effect three seconds after the last key stroke. The display will blink, then return to the primary display after five seconds. The set point value, process value and offset will automatically adjust to the new temperature scale.

Variable Set Point, Push to Set CV _ (1, 2, 5 or 6) ----- D

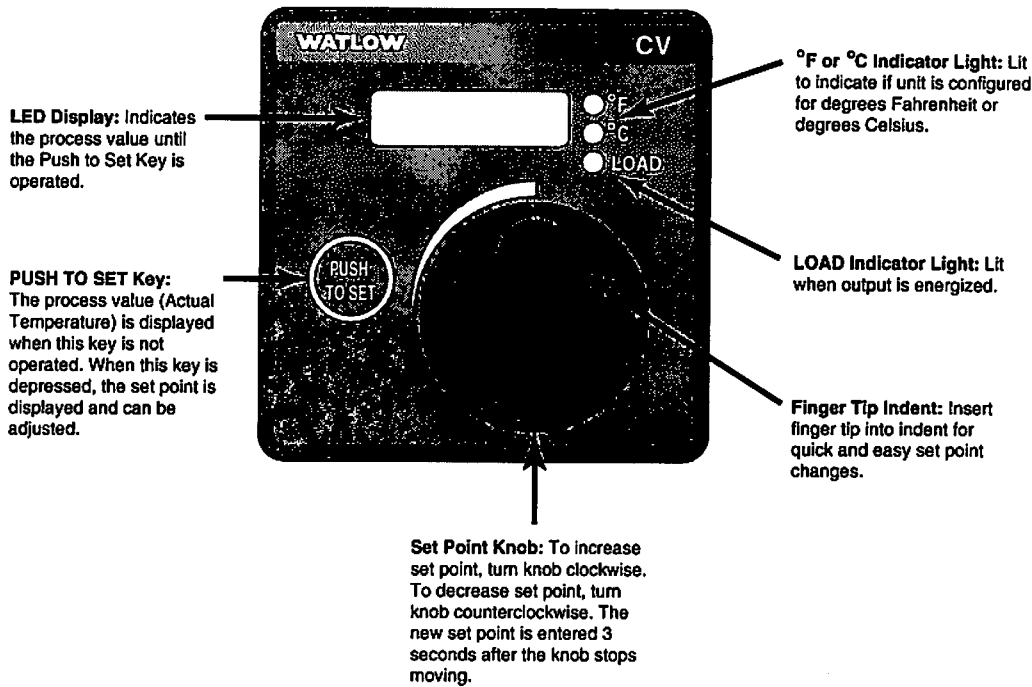


Figure 13a — Variable Set Point, Push to Set Interface

Variable Set Point, Push to Set CV _ (A, B, C or D) ----- D

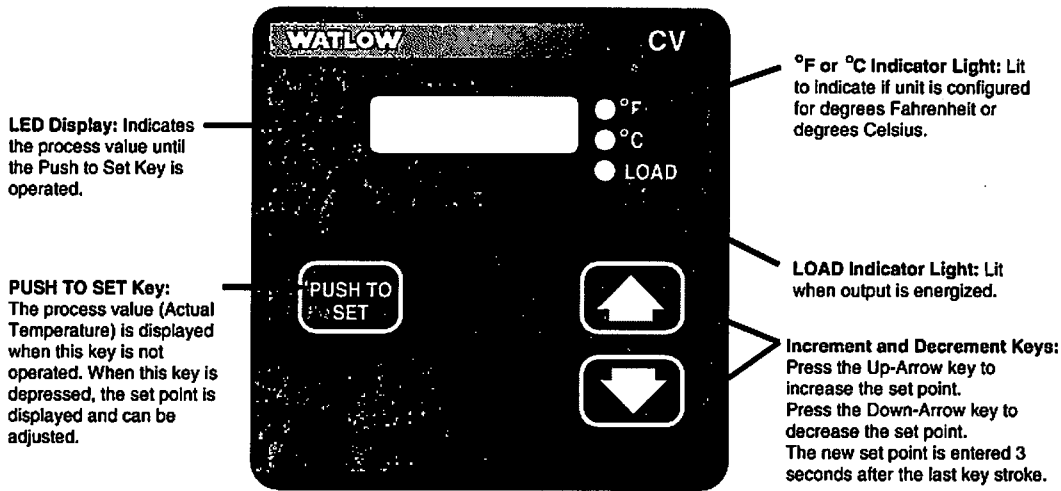


Figure 13b — Variable Set Point, Push to Set Interface with Tactile Keys

To adjust the Calibration Offset on models with tactile keys, first hold down both the Increment and Decrement keys for five seconds. The display will first show **CAL** for five seconds, then it will display the Calibration Offset value. Adjust the value with the Increment and Decrement keys (range: -30 to 30°). The new value will take effect three seconds after the last key stroke. The display will blink, then return to the primary display after five seconds.

To change the temperature units on models with tactile keys, first hold down both the Increment and Decrement keys for ten seconds. The display will show **F** for two seconds. Adjust the units with the Increment and Decrement keys. The new value will take effect three seconds after the last key stroke. The display will blink, then return to the primary display after five seconds. The set point value, process value and offset will automatically adjust to the new temperature scale.

Temperature Indicator TM

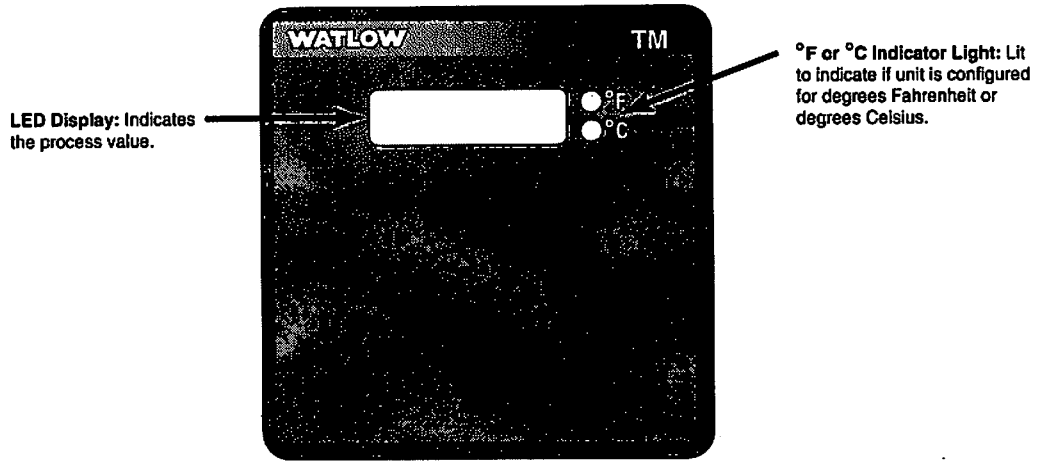


Figure 14 — Temperature Indicator Interface

Troubleshooting

Indication	Probable Cause(s)	Corrective Action
On indicating controls, the display is not illuminated.	• Power supply switch off.	• Turn switch on.
	• Fuse blown.	• Replace fuse (check cause of failure).
	• Breaker tripped.	• Reset breaker (check cause of failure).
	• Safety interlock door switch activated.	• Close door.
	• Separate system limit control latched.	• Reset limit controller.
	• Wiring incorrect or open.	• Check wiring.
	• Power supply voltage incorrect.	• Verify input power.
	• Defective controller.	• Repair or replace controller.
Troubleshooting thermocouple inputs		
Temperature reading is incorrect, showing a sensor error, [E, Lo], or LOAD LED is switching at the wrong temperature.	• Calibration offset is incorrect (tactile models only).	Check calibration offset.
	• Settings for degree C or F is incorrect.	Check model part number for degree C or F. If model has Increment/Decrement keys then C/F setting is adjustable.
	• Sensor or controller may be bad. Sensor connections may be bad.	<ul style="list-style-type: none"> • Place a jumper wire across the thermocouple input terminals. The display should indicate ambient temperature. If it does, the controller is OK. For controllers without the ability to view process temperature: <ul style="list-style-type: none"> - Decrease set point below ambient temperature, LOAD LED should be off for heating controllers and on for cooling controllers. - Increase set point above ambient temperature. LOAD LED should be on for heating controllers and off for cooling controllers.
	• Ambient temperature in the control cabinet is over 70°C.	• Measure temperature in cabinet to ensure it is below 70C. Vent cabinet or add fans if necessary.
	• Ground loop problem. Can occur when using a switched DC output and a grounded thermocouple.	• Remove power from the system. Use an ohm meter to measure resistance between output DC- and the thermocouple sheath. If there is continuity, replace sensor with an ungrounded thermocouple.
Temperature reading is decreasing, but actual process is increasing.	• Thermocouple polarity is reversed. In the US, red wire insulation denotes the negative wire.	• Check thermocouple connections. All connections, including extension wire must maintain the correct polarity. Correct polarity problems.
Temperature reading is reading low and not increasing while actual process temperature is increasing.	• Sensor is bad. Thermocouple is shorted.	• Check thermocouple connections. Check thermocouple wire insulation to make sure it is not damaged, causing the wires to short (making a new junction).
Temperature reading is offset from actual process temperature, or the output switches on or off at the wrong temperature. The offset changes with changes in process temperature.	• Copper wire was used instead of thermocouple extension wire. Connectors of metals different than thermocouple metal were used to splice or make connections.	• Check thermocouple connections. Check to make sure that only thermocouple extension wire of the correct type was used to extend thermocouple leads. Replace if necessary.

Indication	Probable Cause(s)	Corrective Action
Troubleshooting RTD inputs		
Temperature reading is incorrect, showing a sensor error, $[E_r, I_n]$, or LOAD LED is switching at the wrong temperature.	<ul style="list-style-type: none"> • Calibration offset incorrect (tactile models only). 	Check calibration offset
	<ul style="list-style-type: none"> • Settings for degree C or F is incorrect. 	Check model part number for degree C or F. If model has Increment/Decrement keys then C/F setting is adjustable.
	<ul style="list-style-type: none"> • Sensor or controller may be bad. Sensor connections may be bad. 	<ul style="list-style-type: none"> • Place a 110 ohm resistor across the sensor input terminals. The display should indicate 25°C (77°F). If it does, the controller is OK. Sensor or connections may be bad. <p>For controllers without the ability to view process temperature:</p> <ul style="list-style-type: none"> - Decrease set point below ambient temperature, LOAD LED should be off for heating controllers and on for cooling controllers. - Increase set point above ambient temperature. LOAD LED should be on for heating controllers and off for cooling controllers.
	<ul style="list-style-type: none"> • Ambient temperature in the control cabinet is over 70°C (158°F). 	<ul style="list-style-type: none"> • Measure temperature in cabinet to ensure it is below 70°C (158°F). Vent cabinet or add fans if necessary.
	<ul style="list-style-type: none"> • Sensor connections may be bad. Excessive lead wire resistance. 	<ul style="list-style-type: none"> • Check sensor connections. Measure lead wire resistance. There will be a 2.6°C (4.7°F) error for every ohm of lead wire resistance.
Troubleshooting controller outputs		
Controller output signal is not on when it should be. Load LED is not on.	<ul style="list-style-type: none"> • Temperature reading is incorrect on display of indicating controls or limit. See input troubleshooting. 	<ul style="list-style-type: none"> • See input troubleshooting.
	<ul style="list-style-type: none"> • Set point is not set correctly. 	<ul style="list-style-type: none"> • Verify set point setting.
Controller output signal is not on when it should be. Load LED is on.	<ul style="list-style-type: none"> • Output wiring is incorrect. 	<ul style="list-style-type: none"> • Verify wiring. Relay outputs act as a switch, they do not source power. For DC output controls, voltage should be about 20VDC with no load. Greater than 5 volts with load of 500 Ω or greater.
Control output signal is on when it should not be on. Load LED is on.	<ul style="list-style-type: none"> • Temperature reading is incorrect on display of indicating controls or limit. see input troubleshooting. 	<ul style="list-style-type: none"> • See input troubleshooting.
	<ul style="list-style-type: none"> • Set point is not set correctly. 	<ul style="list-style-type: none"> • Verify set point setting.
	<ul style="list-style-type: none"> • Control output is defective. 	<ul style="list-style-type: none"> • Repair or replace controller.
Load is on when it should not be on. Load LED is off	<ul style="list-style-type: none"> • Power switching device (SSR, HG relay, mechanical relay) is shorted. Controller outputs shorted. 	<ul style="list-style-type: none"> • Remove wires from output of control to input of power switching device. If load is still on, replace power switching device. If load turns off, replace controller or sensor. See input troubleshooting.
	<ul style="list-style-type: none"> • Output wiring is incorrect. 	<ul style="list-style-type: none"> • Verify wiring.

Specifications

Controller

- Microprocessor based, on-off control mode.
- Nominal switching hysteresis, typically 1.7°C (3°F).
- Input filter time: 1 second

Operator Interface (model dependent)

- Four digit , 7 segment LED displays, .28" high.
- °F or °C indicator LED.
- LOAD indicator LED.
- Continuous turn, velocity sensitive rotary encoder for set point adjustment, on rotary-knob models.
- Front panel key on Push for Set Point or Push for Process options.
- No operator interface on fixed set point models.
- Increment/Decrement keys for set point adjustment on tactile key models.

Standard Conditions For Specifications

- Rated line voltage, 50 to 60Hz, 0 to 90% RH non-condensing, 15-minute warm-up.

Calibration ambient range: 25°C (77°F) ±3°C

Sensor Input

Thermocouple

- Grounded or ungrounded.
- Type E, J, K, T thermocouple types.
- >10 MΩ input impedance
- 250 nV input referenced error per 1Ω source resistance.

RTD

- 2-wire or 3-wire platinum, 100 Ω
- DIN curve (.00385 curve)
- 125 μA nominal RTD excitation current

Input Accuracy Span Range

Type E: -200 to 800°C or -328 to 1,470°F

Type J: 0 to 750°C or 32 to 1,382°F

Type K: -200 to 1,250°C or -328 to 2,282°F

Type T: -200 to 350°C or -328 to 662°F

RTD (DIN):-200 to 800°C or -328 to 1,472°F

Thermocouple Input

- Calibration accuracy: ±1% of input accuracy span, ±1° at standard conditions and actual calibration ambient.
Exception: Type T, ±2.4% of input accuracy span for -200 to 0° (-328 to 32°F)
- Temperature stability: ±0.3 degree per degree change in ambient.

RTD Input

- Calibration accuracy ±1% of input accuracy span ±1° at standard conditions and actual calibration ambient.
- Temperature stability: ±0.2 degree per degree change in ambient

Allowable Operating Ranges

Type E: -200 to 800°C or -328 to 1,470°F

Type J: -210 to 1,038°C or -346 to 1,900°F

Type K: -270 to 1,370°C or -454 to 2,500°F

Type T: -270 to 400°C or -454 to 750°F

RTD (DIN):-200 to 800°C or -328 to 1,472°F

Output Types

Switched DC (non-isolated)

- Supply voltage maximum: 24V_{DC} (dc) into an infinite load.
- Supply voltage minimum: 5V_{DC} (dc) at 10 mA
- Minimum load impedance: 500 Ω

Electromechanical Relay, Form C

- Minimum load current: 100 mA
- 8 A @ 240V~ (ac) or 30V_{DC} (dc) maximum, resistive
- 250 VA pilot duty, 120/240V~ (ac) maximum, inductive
- Use RC suppression for inductive loads
- Electrical life 100,000 cycles at rated current

Agency Approvals

- UL@873 Recognized Temperature Controller and Indicator. File E43684.
- NEMA 4X/IP65 on panel mount package options with tactile keys for set point.
- UL@197 Reviewed for use in cooking appliances.
- W.E.E.E; CE - See Declaration of Conformity.
- ANSI Z21.23 Gas Appliance Thermostat approval.
- Temperature Control and Indicator CSA 22.2 No. 24.
- RoHS Directive (2002-95-EC)

Terminals

- 6.4 mm (0.25 in) quick connect, push-on terminals. See order options. Refer to Wiring section for crimp-on terminal recommendations.
- Removable screw clamp style terminal blocks. See order options.
- Wire gauge 0.1 to 4 mm² (30 to 12 AWG). Strip length, 8 mm (0.30 in).
- Torque: 0.8 Nm (7 in-lb) maximum.

Power

- 24V~ (ac) +10%; -15%; 50/60 Hz, ±5%
- 120V~ (ac) +10%; -15%; 50/60 Hz, ±5%
- 230 to 240V~ (ac) +10%; -15%; 50/60 Hz, ±5%
- 10VA maximum power consumption
- Data retention upon power failure via nonvolatile memory

Operating Environment

- 0 to 70°C (32 to 158°F)
- 0 to 90% RH, non-condensing
- Storage temperature: -40 to 85°C (-40 to 185°F)

Dimensions

- DIN Rail model can be DIN rail or chassis mount
DIN rail spec DIN 50022, 35 mm x 7.5 mm (1.38 in x 0.30 in)

Style	Width	Height	Depth
Open board	61.7 mm (2.43 in)	61.7 mm (2.43 in)	45.1 mm (1.78 in)
Potted	70.1 mm (2.76 in)	102.9 mm (4.05 in)	46.6 mm (1.84 in)
DIN Rail	78.1 mm (3.08 in)	112.3 mm (4.42 in)	90.7 mm* (3.57 in)
Square 1/8 DIN Panel	72.4 mm (2.85 in)	72.4 mm (2.85 in)	Behind panel 51.7 mm (2.04 in)

*Depth including DIN rail, 94.7 mm (3.73 in)

Note: These specifications are subject to change without prior notice.

Ordering Information and Model Numbers

On-off controller, No user interface

C F

A A A A

Set Point Type

F Fixed Set Point

Line Voltage and Output

- B 120V~ (ac), Switched DC Output
- C 120V~ (ac), 8 Amp Relay Output
- D 230 to 240V~ (ac), Switched DC Output
- E 230 to 240V~ (ac), 8 Amp Relay Output
- F 24V~ (ac), Switched DC Output
- G 24V~ (ac), 8 Amp Relay Output

Controller Package

- 1 Panel Mount, 1/8 DIN Square -Spade Terminals
- 2 DIN Rail Mount -Spade Terminals
- 3 Open Board, not potted -Spade Terminals
- 4 Potted Case -Spade Terminals
- 5 Panel Mount, 1/8 DIN Square -Screw Terminals
- 6 DIN Rail Mount -Screw Terminals
- 7 Open Board, not potted -Screw Terminals

Sensor and Sensor Operating Range

- H Type J -346 to 1900 Degrees F
- J Type J -210 to 1038 Degrees C
- K Type K -454 to 2500 Degrees F
- L Type K -270 to 1370 Degrees C
- M Type T -454 to 750 Degrees F
- N Type T -270 to 400 Degrees C
- P 100 Ω RTD -328 to 1472 Degrees F
- R 100 Ω RTD -200 to 800 Degrees C
- S Type E -328 to 1470 Degrees F
- T Type E -200 to 800 Degrees C

Control Mode

- H Heat
- C Cool

Fixed Set Point Value*

XXXX Control Set Point Value**

Overlay/Custom Options

- A Standard

*Note: Set point must fall within the sensor operating range.

**Note: A (-) is used in the left digit of the operating range to indicate negative temperature values.

Ordering Information and Model Numbers

On-off controller, LED Display

C V

Set Point Type

V Variable Set Point

Line Voltage and Output

B 120V~ (ac), Switched DC Output
 C 120V~ (ac), 8 Amp Relay Output
 D 230 to 240V~ (ac), Switched DC Output
 E 230 to 240V~ (ac), 8 Amp Relay Output
 F 24V~ (ac), Switched DC Output
 G 24V~ (ac), 8 Amp Relay Output

Controller Package

1 Panel Mount, 1/8 DIN Square, Rotary Knob -Spade Terminals
 2 DIN Rail Mount, Rotary Knob -Spade Terminals
 5 Panel Mount, 1/8 DIN Square, Rotary Knob -Screw Terminals
 6 DIN Rail Mount, Rotary Knob -Screw Terminals
 A NEMA 4X Panel Mount, Tactile Keys, Spade Terminals
 B DIN Rail Mount, Tactile Keys, Spade Terminals
 C NEMA 4X Panel Mount, Tactile Keys, Screw Terminals
 D DIN Rail Mount, Tactile Keys, Screw Terminals

Sensor and Sensor Operating Range

H Type J -346 to 1900 Degrees F
 J Type J -210 to 1038 Degrees C
 K Type K -454 to 2500 Degrees F
 L Type K -270 to 1370 Degrees C
 M Type T -454 to 750 Degrees F
 N Type T -270 to 400 Degrees C
 P 100 Ω RTD -328 to 1472 Degrees F
 R 100 Ω RTD -200 to 800 Degrees C
 S Type E -328 to 1470 Degrees F
 T Type E -200 to 800 Degrees C

Control Mode

H Heat
 C Cool

Low Set Point Range Limit *

XXXX Low Set Point Operating Range Value**

High Set Point Range Limit *

XXXX High Set Point Operating Range Value**

Overlay/Custom Options (A through D contain the Watlow Logo on the overlay; 1 through 4 do not have the Watlow Logo on the overlay)

A Standard, displays set point only. Set point is adjustable from default display.
 B Displays set point, and set point is adjustable. Press Process Key to display process.
 C Displays set point. Press Push to Set Key, to allow set point to be adjusted.
 D Displays process. Press Push to Set Key, to allow set point to be adjusted.
 1 Standard, displays set point only. Set point is adjustable from default display.
 2 Displays set point, and set point is adjustable. Press Process Key to display process.
 3 Displays set point. Press Push to Set Key, to allow set point to be adjusted.
 4 Displays process. Press Push to Set Key, to allow set point to be adjusted.

*Note: Set point ranges must fall within the sensor operating range.

**Note: A (-) is used in the left digit of the operating range to indicate negative temperature values.

Ordering Information and Model Numbers

Temperature Indicator

T M

A

A A A A

A A A A

Line Voltage and Output

- B 120V~ (ac)
- D 230 to 240V~ (ac)
- F 24V~ (ac)

Controller Package

- 1 Panel Mount, 1/8 DIN Square -Spade Terminals
- 2 DIN Rail Mount -Spade Terminals
- 5 Panel Mount, 1/8 DIN Square -Screw Terminals
- 6 DIN Rail Mount -Screw Terminals
- A NEMA 4X Panel Mount, Spade Terminals
- C NEMA 4X Panel Mount, Screw Terminals

Sensor and Sensor Operating Range

- H Type J -346 to 1900 Degrees F
- J Type J -210 to 1038 Degrees C
- K Type K -454 to 2500 Degrees F
- L Type K -270 to 1370 Degrees C
- M Type T -454 to 750 Degrees F
- N Type T -270 to 400 Degrees C
- P 100 Ω RTD -328 to 1472 Degrees F
- R 100 Ω RTD -200 to 800 Degrees C
- S Type E -328 to 1470 Degrees F
- T Type E -200 to 800 Degrees C

Overlay/Custom Options

- A Standard with Watlow Logo
- 1 Standard without Watlow Logo

Declaration of Conformity

Series C and Series TM



Watlow Winona, Inc.
1241 Bundy Blvd.
Winona, MN 55987 USA

Declares that the following product:

Designation: Series C and Series TM
Model Numbers: CF – (B, C, D, E, F or G)(1, 2, 3, 4, 5, 6 or 7)(any letter)(H or C) – (any four numbers or – and three numbers) – (AAAA) – may be followed by additional numbers or letters
CV – (B, C, D, E, F or G)(1, 2, 5, 6, A, B, C or D)(any letter)(H or C) – (any four numbers or – and three numbers) – (any four numbers) – may be followed by additional numbers or letters
TM – (B, D or F)(1, 2, 5 or 6)(any letter)(A) – (AAAA) – (AAAA) – may be followed by additional numbers or letters
Classification: CF and CV = Temperature control, TM = Indicator
Installation Category II, Pollution degree 2
Rated Voltage: 24 V, 120 V, 230/240 V~ (ac)
Rated Frequency: 50/60 Hz
Rated Power Consumption: 10 VA maximum

Meets the essential requirements of the following European Union Directives by using the relevant standards show below to indicate compliance.

2004/108/EC Electromagnetic Compatibility Directive

EN 61326:1997 + A1:1998, A2:2002	Electrical equipment for measurement, control and laboratory use – EMC requirements (Industrial Immunity, Class B Emissions).
EN 61000-4-2:1996 + A1, 1998	Electrostatic Discharge Immunity
EN 61000-4-3:1997	Radiated Field Immunity
EN 61000-4-4:1995	Electrical Fast-Transient / Burst Immunity
EN 61000-4-5:1995 + A1, 1996	Surge Immunity
EN 61000-4-6:1996	Conducted Immunity
EN 61000-4-11:1994	Voltage Dips, Short Interrupts and Variations - Immunity
EN 61000-3-2: ED.2. 2000	Harmonic Current Emissions – Class A equipment.
EN 61000-3-3:1995 + A1:1998	Voltage Fluctuations and Flicker

2006-95-EC Low-Voltage Directive

EN 60730-1:2000 +A11:2002 and EN 60730-2-9:2002 CXX4 units	Automatic electric controls for household and similar use: Particular requirements for temperature sensing controls.
EN 61010-1:2001 All other units	Safety Requirements of electrical equipment for measurement, control and laboratory use. Part 1: General requirements

Meets the European Union Limits for hazardous material content as defined by:

2002/95/EC RoHS Reduction of Hazardous Substances Directive

2002/96/EC W.E.E Waste Electrical and Electronic Equipment Directive.

Equipment contains metals and Polycarbonate enclosure and every effort shall be made to recycle and recover these materials.

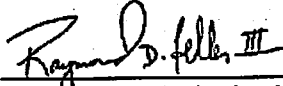
Declaration of Conformity

Raymond D. Feller III
Name of Authorized Representative

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Title of Authorized Representative

February 2008
Date of Issue



Signature of Authorized Representative

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Your Authorized Watlow Distributor

TOTAL
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3 Year Warranty

Installation Operation & Maintenance Instructions

**SERIES 75
ELECTRIC VALVE
ACTUATOR**

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 **Worcester Controls**

 **BTR Flow Control**

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FAX (508) 481-4454

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(416) 298-1671
FAX (416) 298-8330

12156-AB

Description:

Worcester Controls Series 75 actuators are reversible electric quarter-turn valve actuators. Standard units can provide up to 3000 in.-lbs. of torque and have capacitor-start, capacitor-run motors and permanently lubricated gear trains. These actuators are equipped with integral thermal overload protection (AC motors only) with automatic reset and internal adjustable limit switches. In the event of electrical power failure, W, X and Z models feature manual override capabilities.

WARNING: SERIES 75 ACTUATORS ARE ELECTRO-MECHANICAL DEVICES SUBJECT TO NORMAL WEAR AND TEAR. ACTUATOR LIFE IS DEPENDENT UPON APPLICATION AND ENVIRONMENTAL CONDITIONS. IF APPLIED IN HAZARDOUS SERVICES, SUCH AS BUT NOT LIMITED TO, MEDIA TEMPERATURE EXTREMES, TOXINS, FLAMMABLES, OR OTHER SERVICES WHERE IMPROPER OR INCOMPLETE OPERATION COULD PRODUCE A SAFETY HAZARD, IT IS INCUMBENT UPON THE SYSTEM DESIGNER AND THE USER TO PROVIDE PROPER WARNING DEVICES SUCH AS TEMPERATURE SENSORS, OXYGEN SENSORS AND FLOW SENSORS. AT ELEVATED TEMPERATURES THE DUTY CYCLE HAS TO BE DERATED, CONSULT FACTORY. WORCESTER ALSO RECOMMENDS THAT THE OPTIONAL AUXILIARY LIMIT SWITCHES BE USED FOR MONITORING AND/OR ELECTRICAL INTERLOCK. HEATER WITH THERMOSTAT AS WELL AS DRAIN/BREATHING FITTING (V53 OPTION) ARE RECOMMENDED FOR HUMID ENVIRONMENTS WHEN MOISTURE MAY CONDENSE INSIDE THE HOUSING. PLEASE NOTE THAT WEATHERPROOF ENCLOSURES WILL "BREATHE" OVER TIME AND CONDENSATION WITHIN THE HOUSING WILL RESULT.

CAUTION: For actuators with dual DC motor module, failure of one motor may mechanically damage the gear train.

CAUTION: Worcester recommends that all product which must be stored prior to installation be stored indoors, in an environment suitable for human occupancy. Do not store product in areas where exposure to relative humidity above 85%, acid or alkali fumes, radiation above normal background, ultraviolet light, or temperatures above 120°F or below 40°F may occur. Do not store within 50 feet of any source of ozone.

CAUTION: FOR WIRING OF ACTUATOR, INCLUDING OPTIONS, PLEASE REFER TO WIRING DIAGRAM(S) LOCATED INSIDE OF ACTUATOR COVER. Wiring diagrams are also included in this manual for reference.

Installation:

- A. Attach mounting bracket to actuator using four (4) cap screws and lockwashers, provided in mounting kit, and tighten securely. For small size top mount style valves, attach bracket such that bracket nameplate will be to side of valve.

For mounting to 818/828 Series valves, insert ISO locating ring into groove on bottom of actuator before attaching to bracket. Note: Ring can be permanently held in groove by applying Loctite to ring before inserting in groove.

- B. Attach bracket/actuator assembly to valve as follows:

NOTE: If cross-line mounting of actuator is desired, note the following:

Mount the actuator with conduit hole perpendicular to the flow axis (centerline) of the valve and reverse the open/close decals.

For diverter and 3-way valves with V1 porting, and CPT valves, also see Electrical Installation & Adjustment Section, Paragraph D, for cam and limit switch adjustments to facilitate cross-line mounting operation.

CAUTION: Ball valves can trap pressurized media in the cavity. If it is necessary to remove any valve body bolts or remove valve from the line, and if the valve is or has been in operation, make sure there is NO pressure to or in the valve and operate the valve one full cycle.

1. Valve Models Top Mount 44 (1/4"-2"), 45 (2 1/2"-6"), 51/52 (1/2"-10"), 151/301 (3"-6"), Top Mount 59 (1/4"-4"), WK70 & H71 (1/2"-2"), 818/828 (2"-8"), 82/83 (1/2"-10"), and 94 (1/2"-6"):

NOTE: For above listed valves, it is not necessary to remove any valve body bolts or remove valve from line in order to mount actuator.

- a. Close valve [for valves 1/4"-2", the valve is closed when flats on valve stem are perpendicular to the line of flow; for valves 3" and larger, where the valve stem is square, the indicator line on top of stem will be perpendicular to the line of flow or check ball position for closure].
- b. If any valve information is marked on stop plate or handle, it will be necessary to transfer this information to the bracket nameplate.

For 1/4"-2" 44 & 1/2"-2" WK70, 1/4"-1 1/2" 59 & 1/2"-1 1/2" H71 Series top mount style valves and 1/2"-2" 51/52, 1/2"-1 1/2" 82/83 Series valves with high cycle stem packing as standard, remove handle nut, lockwasher, handle, separate stop plate (if any), retaining nut and stop pin(s). Add the 2 additional Belleville washers with their larger diameter sides touching each other. Add the self-locking nut to the stem and tighten while holding the stem flats with wrench. Tighten until Belleville washers are flat, the nut will "bottom", and then back nut off 1/3 of a turn. The 2 additional Belleville washers & the self-locking nut are included in the mounting kit.

CAUTION: The self-locking stem nut is difficult to tighten, and must fully flatten belleville washers before backing off.

For 2" 59, H71, 82/83, and 2 1/2" 45, 82/83 Series valves and valves 3" and larger, remove handle assembly (if any), retaining nut, stop and stop screws. Replace with valve stem spacer or, if valve has graphite stem packing, with 2 belleville washers [except 8", 10" 82/83 & 10" 51/52] and replace retaining nut. **NOTE:** Belleville washers are installed with larger diameters touching each other. Using a wrench to prevent stem from turning, tighten retaining nut until stem packing is fully compressed or bellevilles, if used, are fully flattened, then back off nut 1/6 turn. Excessive tightening causes higher torque and shorter seal life.

NOTE: Large valves with V51 high cycle stem packing option installed, identified by 2 belleville washers installed and handle assembly, stop & stop screws removed, and 818/828 Series valves do not require stem area disassembly.

For 1/2"-2" 94 valves, remove handle (if any). For 3"-6" 94 valves, remove handle assembly, stop, and spacer (if any).

For 2"-8" 818/828 valves, remove handle assembly, locking plates & hardware, and stop screw (if any). Do not remove stop plate (2"-6" sizes) or spacer (8" size).

- c. Center coupling on valve stem.
 - d. Lower mounting bracket/actuator assembly over coupling and onto valve, making sure that male actuator shaft engages slot in coupling.
 - e. Secure bracket to valve using cap screws and lockwashers, or bolts and nuts provided in mounting kit. Tighten securely. For small size top mount style valves, bracket nameplate will be to side of valve.
 - f. Install set screws (if any) in the coupling and tighten securely.
- C. Series 75 actuator in modulating control service and interface with PC and/or computer.
1. Series 75 actuators can be used for modulating control service operated directly by programmable controller or computer under specific conditions as follows:
 - a. To achieve stable control, an actuator with a longer cycle time is recommended.
 - b. To eliminate overheating from frequent startups, 75% or 100% duty cycle actuators are required.
 - c. To eliminate problems with interfacing, and to protect the output circuitry of the controller, use Worcester Controls I-75 interface board.
 2. Alternately a controller coupled with a Series 75 actuator must have:
 - a. Two outputs (one to open, one to close) per actuator being controlled.
 - b. 2 amp minimum output rating.
 - c. Buffered Output - Resistor and capacitor wired in series across each triac.

If a controller output does not meet these requirements, two relays (one to open, one to close) may be installed between controller and each actuator. Failure to observe these precautions will result in controller output damage.

Electrical Installation & Adjustment:

CAUTION: It is recommended that the actuator motor not be driven directly from the PLC output. The inrush current/back EMF can destroy the PLC output card triacs if they are not of sufficient rating. As a minimum these should be rated 800 volt, 12 amp triacs. In addition to these ratings, snubber circuits should be utilized to help protect the triacs. This applies to 120 VAC motors only. 240 VAC motors should never be driven directly from a PLC output card.

- A. To gain access to terminal strip, it is necessary to remove the actuator cover.
- 10-2275 [General Purpose] - Loosen cover screws and lift cover from unit.
- 10-2375 W, X and Z - Remove declutch knob screw and lift knob from shaft. Remove the 2 cover screws from cover (the other 6 screws are in an envelope and inside the cover) and lift cover from unit.
- 25-3075 Z - Remove indicator knob capscrew with Allen wrench and lift knob from shaft. Remove the cover screws and lift cover from unit.
- B. Make conduit connection to NPT fitting on actuator base [1/2" NPT for 10-3075]. Connect power supply to actuator terminal strip as shown on electrical schematic diagram(s) located inside actuator cover and also in this manual.
- The actuator should be electrically grounded in accordance with standard procedures.

For 10-2375 W, X & Z actuators, connect a CSA certified No. 18 AWG green-colored grounding wire to the grounding terminal on actuator base identified with green-colored screw.

For 10-2275 GP actuators, connect grounding wire to any base plate mounting screw in actuator.

For 25 & 3075 Z actuators, connect a CSA certified No. 18 AWG green-colored grounding wire with a ring-type crimp wire connector and a washer to the green-colored grounding screw (near terminal strip) marked with a letter "G" on motor support plate.

See table below for minimum fuse rating when overcurrent protection is used in motor power circuit.

INSTALLATION CAUTION: In cases where the conduit connected to the actuator may be partially or completely run underground, or through which moisture may contact energized live parts, or where the actuator and/or conduit is exposed to temperature differences, the conduit should be sealed within 18" of the actuator in accordance with the National Electrical Code.

Minimum Fuse Rating for Overcurrent Protection	Actuator Size	Voltage	Fuse Rating
NOTE: The table shows the minimum rating to prevent inrush current from blowing the fuse.	10-23	120 VAC	5A
	25/30	120 VAC	10A
	10-23	240 VAC	3A
	25/30	240 VAC	5A
	10-23	12 VDC	10A
	10-23	24 VDC	5A

- C. When electrical installation is complete, it is advisable to check the indexing of the actuator before replacing the cover.

10-3075 [All]: Move actuator to "Open" position (apply power to Terminals 1 and 3). If it does not fully open, or turns past open position, unfasten cam of switch SW2 by loosening set screw (SW2 is to the left of the shaft looking from terminal strip). Move actuator to correct position. Adjust cam so that it just throws micro switch in this position. Tighten set screw and recheck indexing. Repeat this procedure for "Closed" position (apply power to Terminals 1 and 4). **WARNING:** Do not bend switch arms when adjusting cams for actuator travel limits. Doing so will damage the cams.

NOTE: If one or more of the options listed in Options & Adjustments Section have been installed, follow specific instructions for those options as necessary before replacing cover.

- D. If actuator has been cross-line mounted and valve is a diverter or 3-way with V-1 porting or CPT valve, proceed as follows:

Reset both cams to operate in next quadrant, (when looking down at cover, the "next" quadrant is 90° clockwise from standard quadrant, 1 quadrant closer to conduit connection). Switch #1 is the "to close" switch, and is connected to Terminal #4. Switch #2 is "to open", goes to Terminal #3. CPT valves must operate "clockwise to close" viewed from top. Relocate decals to new quadrant. "Open" is 90° from conduit side, "close" is adjacent to conduit side. If mounted on a V-1 diverter, "open" shall expose ball port at one pipe end, "closed" shall expose ball port at the opposite pipe end.

- E. Replace actuator cover. **NOTE:** For W and Z models, make sure flange gasket/seal is properly installed. Tighten all cap screws securely.

For X & Z Models Only.

After placing the cover on the actuator, tighten the cover bolts in a crisscross fashion to a torque of 70-80 in.-lbs.

A feeler gage, being 1/8" to 1/2" wide and .0015 thousandths thick, shall be used to check the clearance between the base and cover flange.

This feeler gage shall not penetrate the base/cover flange gap any more than 1/8".

10-2375 W, X and Z: Replace declutching knob, taking care that knob set screw engages milled flat on clutch shaft and indicates proper position on labeled cover.

25-3075 Z: Replace indicator knob in its proper position to give correct indication. Tighten indicator's cap screw securely.

Options & Adjustments (Factory Installed):

NOTE: FOR WIRING OF THE FOLLOWING OPTIONS, PLEASE REFER TO THE APPROPRIATE OPTION WIRING DIAGRAM(S) LOCATED INSIDE ACTUATOR COVER OR INCLUDED WITH OPTION KIT. Wiring diagrams for most options are also included in this manual for reference.

All wiring to terminal strip should be inserted only to mid-point of terminal strip.

For some options with AC actuators, multiple wires are going to terminal 1. A short white wire is provided and connected to terminal 1, then spliced to the other white wires (common) using a closed end splice.

A. Center-Off Kit (180° Rotation)

1. Readjustment of "Center-Off" Cams [if necessary]:

- a. With the cover removed and the actuator placed with the terminal strip facing the operator, switches 1 and 3 are to the right and switches 2 and 4 are to the left of the main shaft.
- b. There are four cams and two spacers on the shaft. Per the drawing on the following page, these cams are numbered 1 through 4, from bottom to top. [See proper drawing for approximate location and correct orientation of the center-off cams].
- c. Using the manual override (see page 11) as necessary, set the actuator shaft to a "center-off" location.
Set cam #3 such that hook of switch 3 lever arm has just dropped off the cam. Tighten cam screw without moving cam. CAUTION: Do not bend the limit switch lever arm.
Set cam #4 such that hook of switch 4 lever arm will match the arch of cam #4. Tighten cam screw without moving cam. CAUTION: Do not bend the limit switch lever arm.
Release manual override.
- d. Power the actuator to the full clockwise [CW] limit, to the 0° reference position. Check position of ball and valve stem to verify that valve is in the true 0° position, as required by the application.
- e. Repeat the above step for the 180° or full CCW position. Verify that the driven device is in the required position.
- f. Apply power to terminals 1 and 7 for AC (+ to 7 and - to 8 for DC) to verify proper operation of center-off switches. With the actuator shaft positioned at the 180° position, power applied to terminals 1 and 7 for AC(+ to 7 and - to 8 for DC) moves the actuator shaft clockwise [CW] to the center-off position.

With the actuator shaft at the full clockwise position, 0 degrees, apply power to terminals 1 and 7 for AC(+ to 7 and - to 8 for DC). The actuator shaft should move counter-clockwise CCW to the center-off position.

SPECIAL NOTE: If during any of these checks, the actuator shaft stops other than at the required positions, a readjustment of the center-off cams is needed. At no time shall both center-off switches be activated by their cams at the same time. The N.O. contacts on both center-off switches are typically closed. The center-off switch levers must be tripped by their center-off cams at different times.

Therefore, the center-off cams should be set as close to the 90 degree position as possible, yet the cam/switch actuation for each switch is never at the identical position.

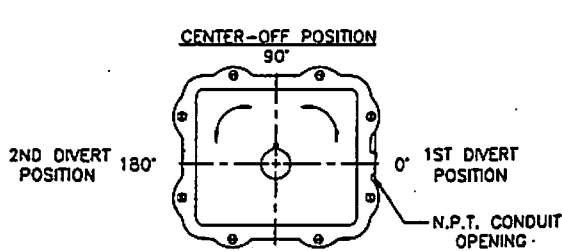
If the center-off switches are set to actuate at a close angular differential, the actuator shaft may oscillate, or not operate. Loosen one cam and move this cam to increase the actuation differential between each of the center-off switches.

If the center-off switches are set to actuate at a wide angular differential, the actuator will not stop at a true center-off position. Adjust one or both cams to decrease the angular differential between each of these switches.

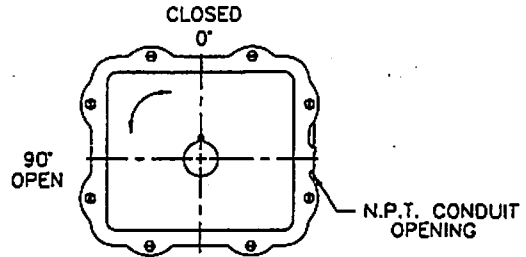
- g. As a final check, alternately apply power to terminals 1 and 4, 1 and 3, and 1 and 7 for AC, (+ to the 1 and - to the 4; - to 1 and + to 3; - to 8 and + to 7 for DC).

No oscillation or hunting of the actuator output shaft should occur.

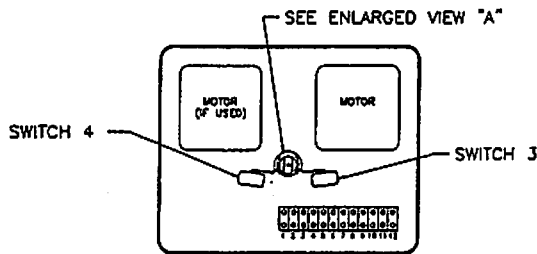
If the above problems are noted, simply readjust the center-off cams as noted in Step f.



**180° CENTER-OFF ACTUATOR
SERIES 75W, X, & Z SHOWN**

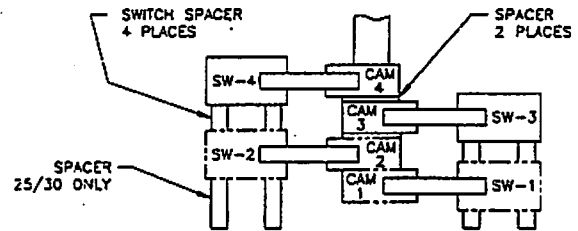


**STANDARD 90° ACTUATOR
SERIES 75W, X, & Z SHOWN**



**TYP. VIEW SHOWING LOCATION OF
CENTER-OFF CAMS & LIMITS SWITCHES
SET UP AT THE CENTER-OFF POSITION**

1. SWITCH CONFIGURATION IS AS FOLLOWS (WHEN VIEWED FROM THE TERMINAL STRIP SIDE OF THE ACTUATOR):



2. ACTUATOR SHOWN AT 0° POSITION (ALL THE WAY CW)

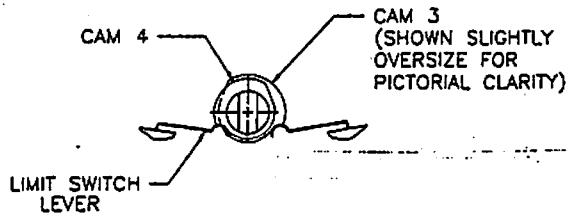
3. CAM SETTINGS ARE AS FOLLOWS:

SWITCH 1 - OPENS AT 0°. CONTROLS 1ST DIVERT POSITION

SWITCH 2 - OPENS AT 180°. CONTROLS 2ND DIVERT POSITION

SWITCH 3 - OPENS AT 89°. CONTROLS CENTER-OFF POSITION FROM 1ST DIVERT POSITION

SWITCH 4 - OPENS AT 91°. CONTROLS CENTER-OFF POSITION FROM 2ND DIVERT POSITION



VIEW "A"

- NOTE: 1. SWITCHES 1 & 2 AND CAMS 1 & 2 ARE STANDARD. SWITCHES 3 & 4 AND CAMS 3 & 4 ARE CENTER-OFF TYPE.

2. USE CAM SPACER AS NEEDED TO LINE UP CAM AND SWITCH.

B. Feedback Potentiometers (Single, Dual)

The potentiometer, as part of the Series 75 Actuator, is used to obtain feedback representing the actuator's position. It requires a power supply, which may be furnished by the end user and/or by optional devices such as a 4-75 (4-20 mA) Position Indicator or AF17 Positioner.

A Dual Potentiometer is used with the DFP17, AF17 Positioners or 4-75 Position Indicator when remote resistance indication is required.

The Dual Potentiometer is required when both AF17 or DFC 17 and 4-20 mA position output options are to be used together, one pot for each device.

Each pot can serve only one function. Remote resistance monitoring and an AF17, for example, cannot share a pot.

1. Adjusting Potentiometer:

NOTES: Potentiometers are adjusted at factory. If readjusting is necessary, follow instructions below.

Voltage limit of single pot or "B" pot of dual potentiometer is 30 volts maximum.

a. 10-3075 Actuator:

If not already installed, place the large face gear [12] over the actuator shaft with the gear teeth down and secure with snap ring(s) [16] provided (use two snap rings on 25 & 30 sizes only).

NOTE: The face gear utilizes a friction fit to the shaft. For best results, wipe off any lubricant that may be on the shaft before sliding on the face gear.

CAUTION: Do not overstretch the snap ring(s), use the minimum opening to allow snap ring(s) to slip over the gear.

b. Adjust the potentiometer spur gear [8] until there is approximately 1/16" engagement with the large face gear. Tighten the spur gear set screw [9]. If necessary, you can slightly bend potentiometer bracket to get proper engagement.

c. Rotate the face gear back and forth to ensure smooth and easy operation of the potentiometer.

d. Important:

FOR 90° VALVES: With the actuator in the OPEN [full CCW] or CLOSED [full CW] position and power off, rotate the face gear, thus turning the potentiometer shaft until the resistance between the white/black lead [terminal 11] and the green lead [terminal 10] or the white/black lead [terminal 11] and the purple lead [terminal 12] respectively, as measured by Ohmmeter, is between 80 Ohms and 90 Ohms. (Refer to instruction sheets of options that may have different pot lead locations and adjustments, e.g., AF17 Positioner.)

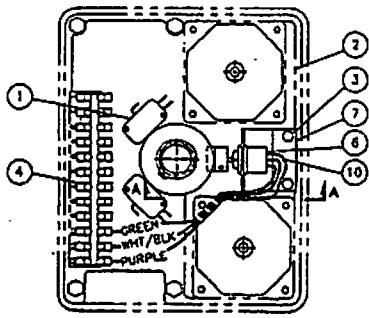
NOTE: It is not necessary to loosen or remove face gear snap ring(s) to rotate gear.

e. Power the actuator to the opposite position from where resistance was measured.

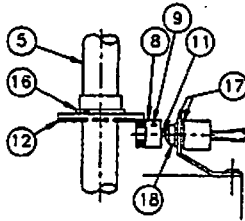
f. At this position, with power off, measure the resistance at the same terminals as stated above. The resistance reading should be greater than 700 Ohms. If not, then power actuator back to original position and adjust pot again, if necessary, as stated in para. d. above. If unsuccessful in getting proper resistance readings, pot is defective and should be replaced.

The feedback potentiometer is now adjusted for use in the 75 actuator.

IMPORTANT: The feedback potentiometer is calibrated for only one 90° quadrant of valve operation. If the output shaft is repositioned to another 90° quadrant or if the output shaft is rotated on a multiple of 360° from its original position, the feedback potentiometer will no longer be in calibration and must be recalibrated.



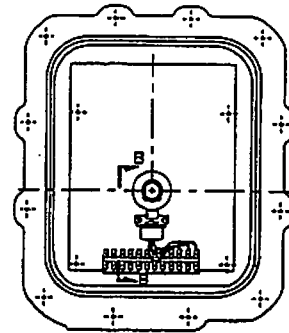
10-2375
PLAN VIEW



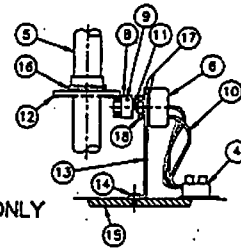
VIEW A-A

ITEM	DESCRIPTION
1	LIMIT SWITCHES
2	MOTOR MODULE
3	MOTOR MODULE MTG. SCREWS (2)
4	TERMINAL STRIP
5	ACTUATOR SHAFT
6	POTENTIOMETER
7	POTENTIOMETER BRACKET
8	SPUR GEAR
9	SPUR GEAR SET SCREW
10	POTENTIOMETER LEADS
11	POTENTIOMETER SHAFT
12	FACE GEAR
13	POTENTIOMETER BRACKET
14	MOUNTING SCREWS (2)
15	MOTOR SUPPORT PLATE
16	SNAP RING(S)
17	LOCKWASHERS (2)
18	NUT

ILLUSTRATIONS SHOW SINGLE POTENTIOMETER ONLY



25/3075
PLAN VIEW



VIEW B-B

C. I-75 Interface

1. Description:

The I-75 Interface is designed to be used and mounted in the Series 75 Actuator as one of many standard options. Function of the I-75 Interface is to allow the Series 75 Actuator to be powered by a 120 or 240 VAC power supply, operated directly by any programmable controller, microprocessor, and/or computer regardless of output rating of these devices. Depending on the control input used there are several options of the I-75 Interface:

5V for 5 VDC input, XV for 12 VDC input, XX for 24 VDC input, 15 for 120 VAC input.

These options are identified by the nameplate on the circuit board.

2. Indication and Repair:

L.E.D. Indicators - Light emitting diodes marked LD1, LD2 are in input circuits and indicating what particular input is on. Left, LD2, L.E.D. indicates that CCW, open, signal is on. Right, LD1, L.E.D. indicates that CW, close, signal is on.

If a malfunction occurs, look for the following:

If particular input is energized and corresponding LED light is not on, check for component damage or other continuity disruption in corresponding CCW and/or CW input circuit. If everything appears to be OK, replace matching opto-couple U2 or U1.

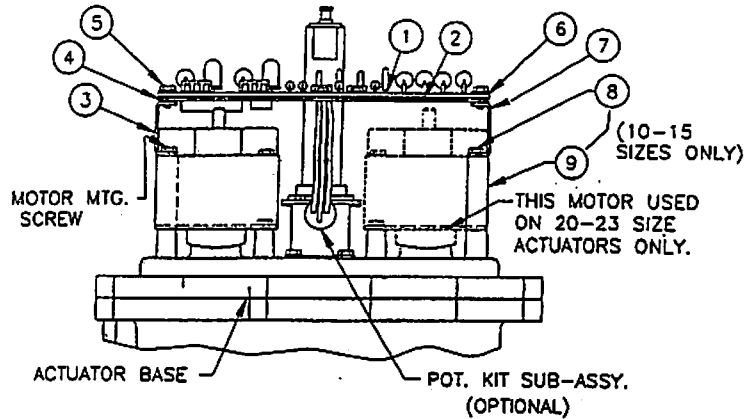
Input circuit is OK. LED is lighted and actuator is not running. If components and continuity in corresponding power circuit are alright, then failed component is triac Q2 or Q1 depending which way the actuator doesn't run, CCW or CW.

If the actuator doesn't run in either direction, it is likely that the actuator is defective. To check this, remove the red and black leads from terminals 3 and 4 of the actuator (coming from interface board) and the AC line connections from terminals 1 and 2. Tape these leads. Using a test cable, apply power to actuator terminals 1 and 3. The 120 VAC actuator only (see Note) should rotate CCW until stopped by the CCW limit switch. Then apply power to terminals 1 and 4 to check CW 120 VAC actuator and the CW limit switch. If the actuator does not operate, check 120 VAC associated wiring, terminal strip, the limit switches, motor, and capacitor. Check switch continuity. Check for an open motor winding, and check for a shorted capacitor. If the problem in the actuator still cannot be determined, return the unit for service. If the actuator functions properly, the problem is in interface board.

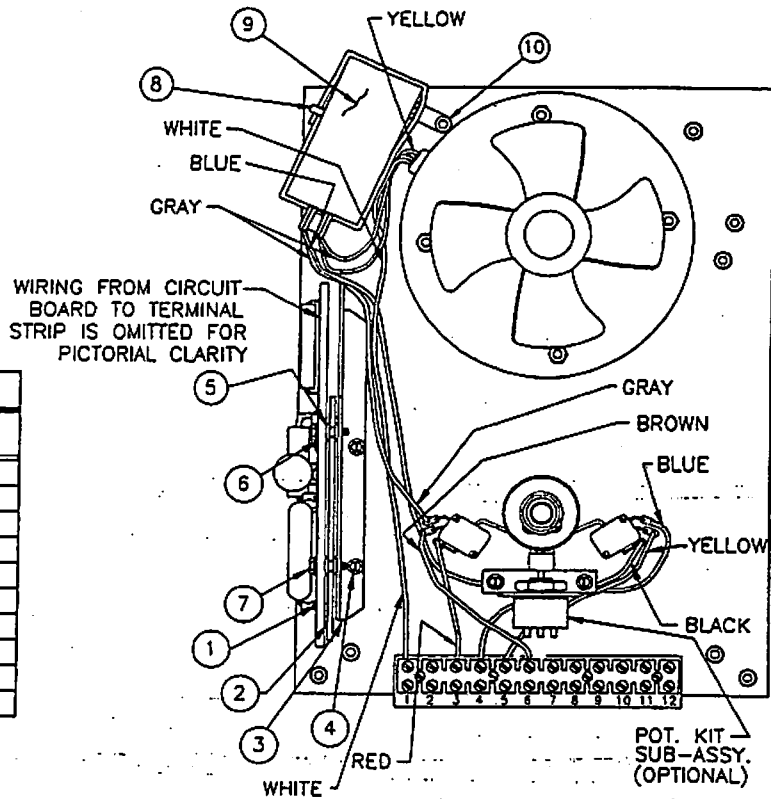
Request RPA (Return Product Authorization) number from the factory, replace defective board, and return it to the factory with proper description of problem and application.

NOTE: The limit switches for the 240 VAC I-75 actuator do not control the motor circuit, they control input circuit only. When applying power to terminals 1 & 3, and 1 & 4 to check CCW, CW rotations, do this momentarily so that you do not override 0-90° quadrant.

10-23 SIZE 75 ACTUATORS	
ITEM	DESCRIPTION
1	CIRCUIT BOARD SUB-ASSY.
2	INSULATING BOARD
3	BRACKET-RIGHT (LONG)
4	GROMMET-RUBBER
5	MTG. SCREWS (CIR. BOARD)
6	WASHER-NYLON
7	BRACKET-LEFT (SHORT)
8	MTG. SCREWS (BRACKET)
9	SPACER (BRACKET)



25-30 SIZE 75 ACTUATORS	
ITEM	DESCRIPTION
1	CIRCUIT BOARD SUB-ASSY.
2	INSULATING BOARD
3	CIRCUIT BOARD BRACKET
4	MTG. SCREW (BRACKET)
5	GROMMET-RUBBER
6	WASHER-NYLON
7	MTG. SCREW (CIR. BOARD)
8	CAPACITOR TIE
9	CAPACITOR
10	CAPACITOR BKT. & SCREW



120VAC SHOWN

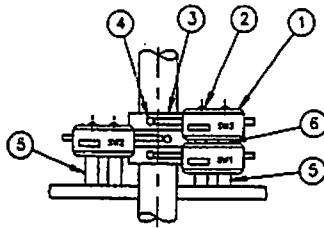
D. M1 or M2 (Extra Limit Switches)

1. Setting:

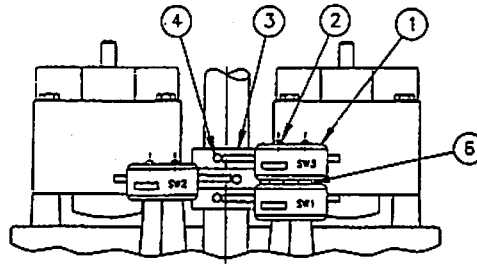
NOTE: Switches and cams are set at factory. If resetting is necessary, use the following procedure:

- Bring actuator into position desired to actuate extra switch. Turn extra cam in direction of normal travel until switch just throws.
- Advance cam in same direction by 1-3° and secure cam by tightening the set screw (4).

For M2, a fourth switch (not shown) is added over SW2. The fourth cam (not shown) is positioned so that cam set screw faces terminal strip when cam is in contact with limit switch to give desired function. Cam lobe must approach switch lever from lever pivot end and not from free end - see top view below. Follow setting instructions above.



25 & 3075



10-2375

ITEM	DESCRIPTION
1	Extra Switch
2	#4-40 Screws (2)
3	Extra Cam
4	Set Screw (1)
5	Spacers (25/30 75 Only)
6	Spacers (2 per Switch)



TYP. TOP VIEW

E. Mechanical Brake (10-2375 Actuators)

NOTE: Mechanical brake should require no adjusting.

1. Testing & Troubleshooting:

- Energize actuator for rotation in both open and closed directions. At the rated actuator voltage, the brake coil is energized and moves the plunger to release brake arm. Clearance of .020" to .030" must exist between the brake arm and the brake disc when power is applied to the actuator.
- If the brake arm is too close to the brake disc, realign the coil housing so that coil plunger can move further toward the center of the actuator, permitting more movement of the brake arm.
- Plunger chattering indicates a low supply voltage. If actuator voltage is at the rated conditions, realign coil housing so that coil moves away from the center of the actuator to reduce plunger movement.
- All coil adjustment is done in small increments of .015 inches or less.
- Additional adjustment may be done by moving mounting plate toward/away from actuator shaft.
- Once proper operation of the brake is verified replace actuator cover.

F. CLC Module (Cycle Length Control)

CAUTION: CLC MODULE MUST BE USED WITH PROPER LINE VOLTAGE.

Control of the actuator's cycle time is achieved by breaking up the power applied to the actuator into a series of pulses.

The length of time a power pulse is applied is controlled by the "ON" adjustable control (control at CCW, for max. pulse length).

The interval between pulses is controlled by the "OFF" adjustable control (control at CCW for longest interval between pulses).

To adjust, start with both controls at midpoint. To reduce cycle time, turn "ON" control in CCW direction and "OFF" control in CW direction. To increase cycle time turn "ON" control in CW direction and "OFF" in CCW direction.

IMPORTANT: The minimum "ON" pulse must allow the actuator to move a closed valve out of its seat. Verify proper CLC operation by opening a fully closed valve.

G. Heater & Thermostat

NOTE: Heater & thermostat option requires no adjusting. If defects are found, notify factory.

The thermostat will close its contacts at 80°F (power on) and open its contacts at 95°F (power off).

H. Drain/Breather (V53) Option (10-2375 Actuators)

If actuator is equipped with drain/breather at bottom of base, actuator must be operated in an upright position for drain to operate properly.

I. Position Indicator

1. Description:

The 4-75 position indicator is designed to be used and mounted with the standard Series 75 (Sizes 10-30), 120 VAC actuator, with many of its standard options. Its output is suited for 4-20 mA DC meter with 0-100% scale (such as General Electric Type GE 185) which is not part of the package. If properly calibrated, it indicates actuator shaft position from close (0°, 0%) to open (90°, 100%).

It is combined with standard potentiometer which supplies information on shaft position. If feedback potentiometer is required for other functions such as remote resistance indication or a DFC17 Controller, a dual potentiometer has to be used. Each potentiometer can serve only one function. See potentiometer kit instructions (Part No. 09750), available from your distributor/supplier, for installation procedures, if necessary.

2. Adjustment and Calibration:

NOTE: If used with a DFC17 Controller, see DFC17 Installation, Operation & Maintenance manual (part no. 14946) for adjustment and calibration.

The feedback potentiometer has to be adjusted to obtain proper resistance range. With the actuator either in the OPEN (full CCW) or CLOSE (full CW) position, and power off, rotate the face gear, thus turning the potentiometer shaft, until the resistance between the white/black lead and the green lead (actuator full CCW) or the white/black lead and the purple lead (actuator full CW) respectively, as measured by Ohmmeter, is between 80 Ohms and 90 Ohms. NOTE: It is not necessary to loosen or remove face gear snap ring(s) to rotate gear, it is a friction fit.

Power the actuator to the opposite position from where resistance was measured.

At this position, with power off, measure the resistance at the same terminals as stated above. The resistance reading should be greater than 700 Ohms. If not, then power actuator back to original position and adjust pot again, if necessary, as stated in para. above. If unsuccessful in getting proper resistance readings, pot is defective and should be replaced.

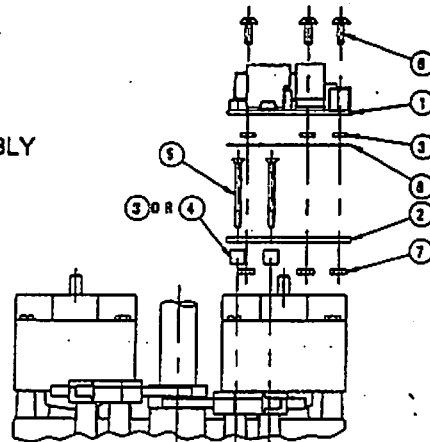
To obtain proper 4-20 mA output, the indicator has to be calibrated. Using an ammeter, connected to actuator Terminals 5 (positive) and 6 (negative), adjust the two potentiometers R4 & R5 on the board. With the actuator in the closed position (0%), adjust R5 potentiometer (adjacent to the #4 etched on the circuit board and closest to terminal block) to obtain 4 mA on the ammeter. Move the actuator to the open position (100%) and adjust R4 potentiometer (adjacent to the #20 etched on the circuit board) to obtain 20 mA. Because adjustment of one potentiometer affects the other, repeat the procedure several times to obtain proper values.

IMPORTANT: The feedback potentiometer is calibrated for only one 90° quadrant of valve operation. If the output shaft is repositioned to another 90° quadrant or if the output shaft is rotated a multiple of 360° from its original position or the position indicator is removed from the actuator, the feedback potentiometer will no longer be in calibration and must be recalibrated.

3. Repair: In case of factory repair, contact factory, request RPA (Return Product Authorization) number from the factory. After receiving new circuit board replace defective board and return it back to factory with description of problem and application.

ITEM	QTY	DESCRIPTION
1	1	Circuit Board
2	1	Mounting Plate
3	5	Spacers (.06")
4	2	Spacers (.25")
5	2	Flat Head Screws
6	3	Round Head Screws
7	3	Nuts
8	1	Insulator
9	3	Cable Ties (Not Shown)
10	1	Potentiometer Kit (Not Shown)

10-23 75 ASSEMBLY SHOWN



Manual Operation:

IMPORTANT: Disconnect actuator from power supply. If power is not off, motor will start when cam moves from limit switch.

- A. 10-2375 W, X and Z: Pull the declutching knob all the way up and hold. Apply wrench to exposed flats on actuator shaft and rotate to desired position. To re-engage, return shaft to original position of disengagement and release declutch knob.
- B. 25-3075 Z: Simply turn manual override handwheel in the desired direction [clockwise rotation of handwheel causes actuator drive shaft to rotate clockwise, when viewed from above]. The manual override can be used at any time without damaging the actuator.

NOTE: Actuator should be manually operated only over the range for which it is set up to operate electrically. Operation beyond this range will totally disrupt indexing.

Maintenance & Trouble-Shooting:

The Series 75 electric valve actuator requires no regular maintenance. Should the unit fail to operate, however, the following are hints for trouble-shooting. If the unit still fails to operate, consult the factory.

Electrical Supply - Be sure the Series 75 is supplied with the correct voltage.

Electrical Connections - Does the wiring conform to the wiring diagram?

Limit Switches - If both switches are depressed simultaneously, the unit will not operate. Make sure the switches trip one at a time.

Capacitor - The AC motors are operated with a capacitor. If the capacitor is defective, it will prevent the motor from starting and/or running. Replace if necessary. If capacitor has metal retaining ring, insulating fiber washer must be used.

Motor - If one of the motor windings is open or short-circuited, the unit will not operate. If motor is hot, allow it to cool down so that the stator is at room temperature. Apply voltage to motor. If motor still fails to operate, replace entire motor module.

DC Motors - DC motors use no thermostat and are therefore not protected against high temperatures and currents. Use of these motors above rated torques [loads] and/or duty cycle can cause permanent damage. If DC motor(s) fail(s) to operate under minimal torque loading, or if one of the two motors fail, replace entire motor module. **NOTE:** Failure of one motor on dual DC motor module may mechanically damage the gear train.

Gear Train:

10-2375 (All) - Remove motor module from the actuator. Rotate the motor by hand. Spinning the motor shaft should rotate the module output pinion. If module output pinion fails to rotate, replace entire motor module. Also, check bull gear for missing or broken teeth. Replace if necessary.

25-3075 (All) - Remove actuator from valve. Rotating the motor shaft manually should cause the actuator output shaft to rotate. If output shaft does not rotate, gearing has been damaged. Return actuator to factory for repair.

Valve - The problem may lie with the valve instead of with the actuator. Check the operation of the valve by removing the actuator and operating the valve by hand.

Options - For troubleshooting or adjustment of options, see Options & Adjustment section for individual options.

Spare Parts:

The following are recommended spare parts which should be kept on hand for Series 75 electric actuators:

- 1 Limit Switch Kit
- 1 Capacitor [AC Units Only]

When ordering spare parts, please specify actuator size, voltage and cycle time.

ELECTRICAL REQUIREMENTS:

The following table represents approximate current draw (at rated stall torques) in amperes at various voltages for each motor.

Actual values depend on several variables. For exact values, test the unit at a particular load.

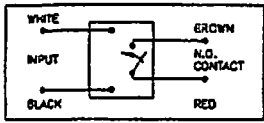
SUFFIX CODE	DUTY CYCLE	VOLTAGE	ACTUATOR SIZE							
			10	12	15	20	22	23	25	30
Blank	20%	120 AC	—	—	0.7	—	—	—	—	—
Blank	25%	120 AC	0.7	0.7	—	1.5	1.5	—	2.7	3.5
2	10%	120 AC	1.5	1.5	—	2.9	2.9	—	—	—
4	75%	120 AC	0.3	0.3	—	0.7	0.7	0.7	2.2	2.2
5	100%	120 AC	0.25	0.25	—	0.5	—	—	—	—
Blank	25%	240 AC	0.4	0.4	—	0.9	0.9	—	1.3	1.4
2	10%	240 AC	0.6	0.6	—	1.3	1.3	—	—	—
4	75%	240 AC	0.15	0.15	—	0.3	0.3	0.3	1.2	1.2
5	100%	240 AC	—	—	—	—	—	—	—	—
Blank	25%	12 DC	1.4	1.2	—	5	4.2	—	—	—
4	75%	12 DC	0.5	0.5	—	1.6	1.5	2	—	—
Blank	25%	24 DC	0.7	0.6	—	2.5	2.1	—	—	—
4	75%	24 DC	0.25	0.25	—	0.8	0.75	1	—	—

ELECTRICAL SCHEMATICS & WIRING DIAGRAMS FOR OPTIONS (SERIES 75):

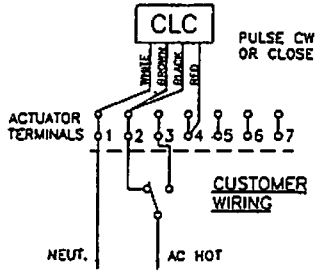
(For installation of options, refer to installation instructions and wiring diagram(s) contained in respective kit.)

NOTE: D.C. center-off wiring diagram as shown on page 15 is for size 12 & 22 actuators. For 10, 20 & 23 sizes, the red/black motor leads are reversed.

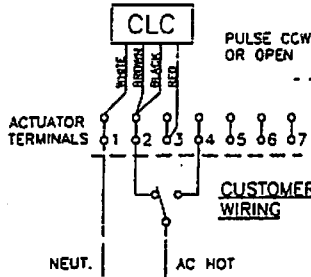
Cycle Length Control



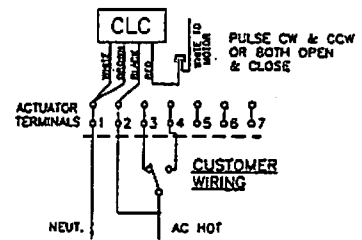
GENERAL SCHEMATIC



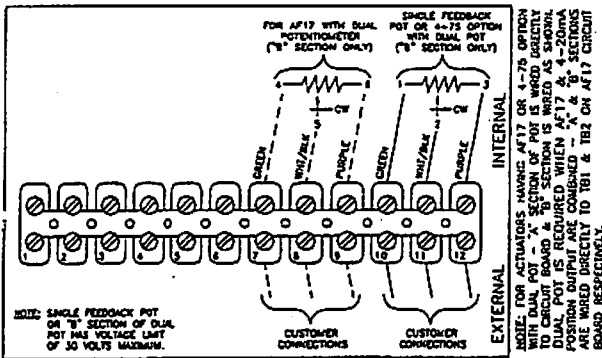
10-30 C 75 120A/240A C



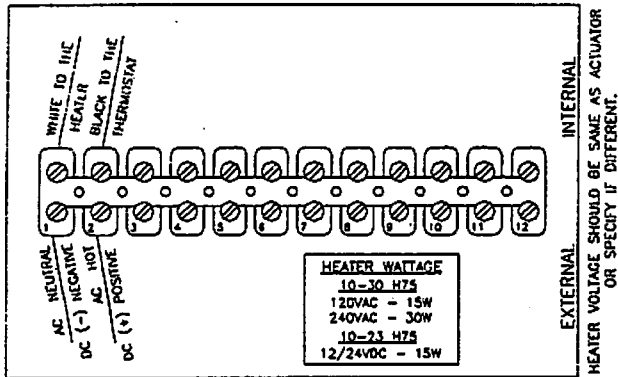
10-30 C 75 120A/240A Q



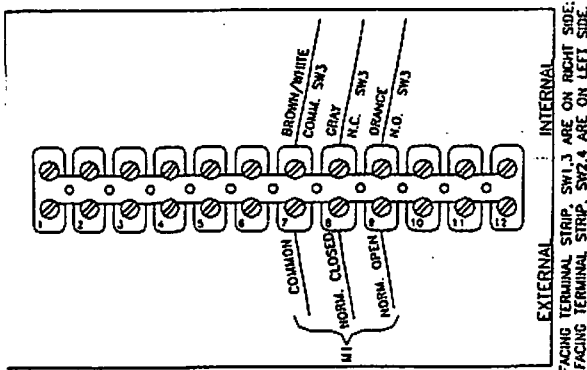
10-30 C 75 120A/240A



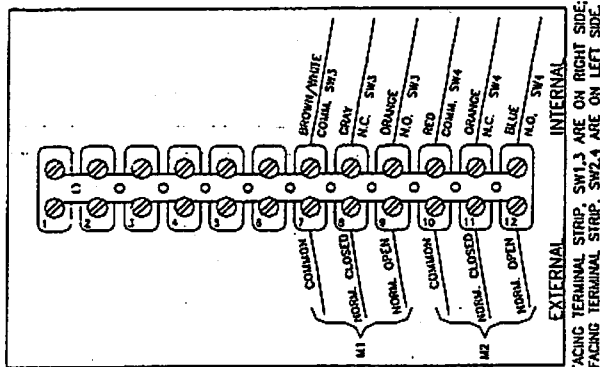
WIRING FOR 10-30 P/D 75 FEEDBACK POT OPTION



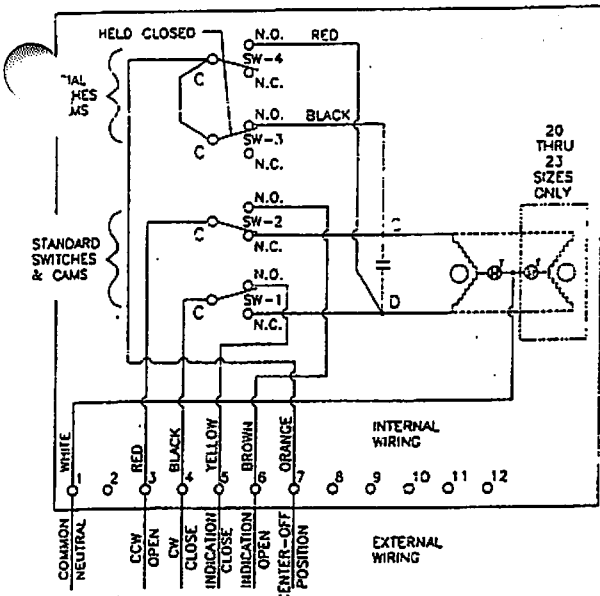
WIRING FOR 10-30 H75 HEATER/ THERMOSTAT OPTION



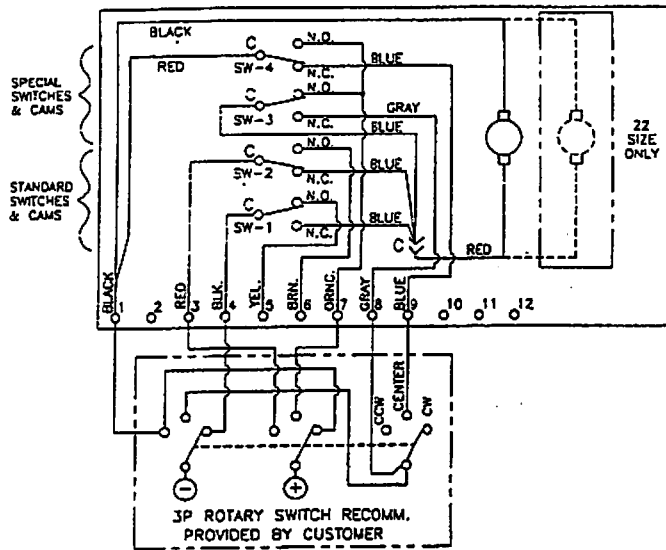
WIRING FOR 10-30 75 M1 OPTION (ONE EXTRA LIMIT SWITCH)



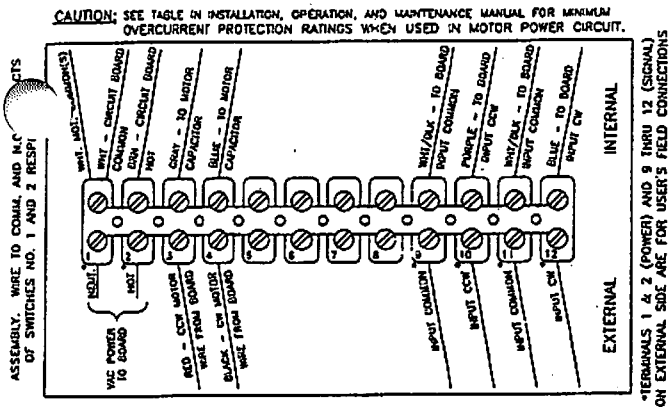
WIRING FOR 10-30 75 M2 OPTION (TWO EXTRA LIMIT SWITCHES)



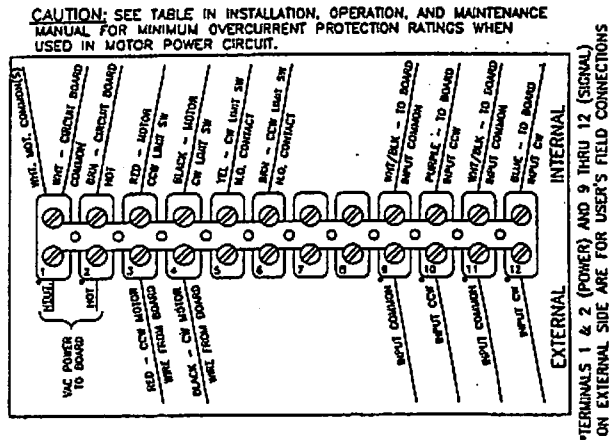
SERIES 75 AC ELECTRIC ACTUATOR WITH CENTER-OFF (D3) OPTION



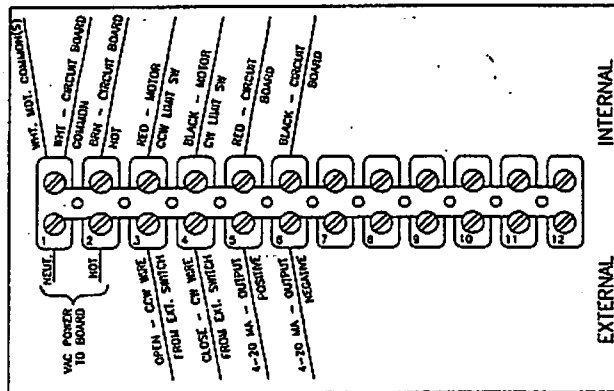
SERIES 75 DC ELECTRIC ACTUATOR WITH CENTER-OFF (D3) OPTION



WIRING OF I-75 240 VAC INTERFACE

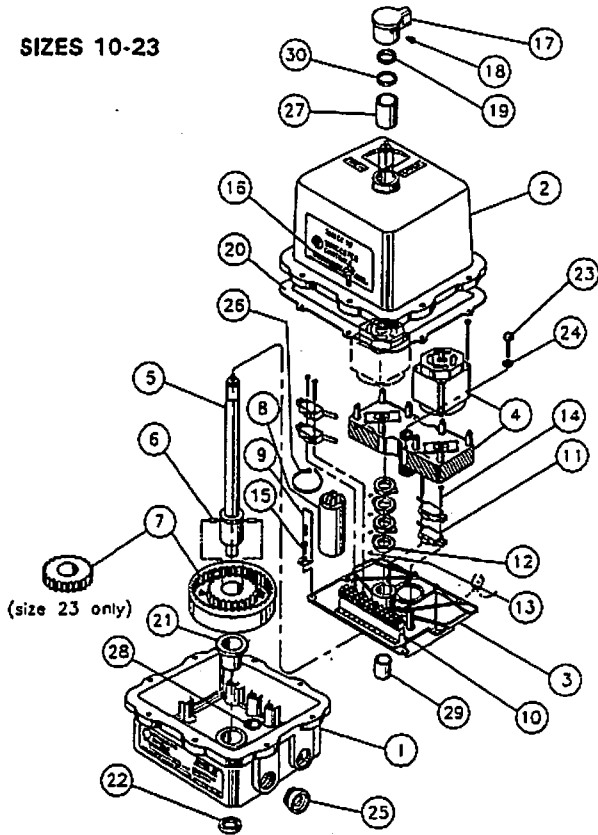


WIRING OF I-75 120 VAC INTERFACE



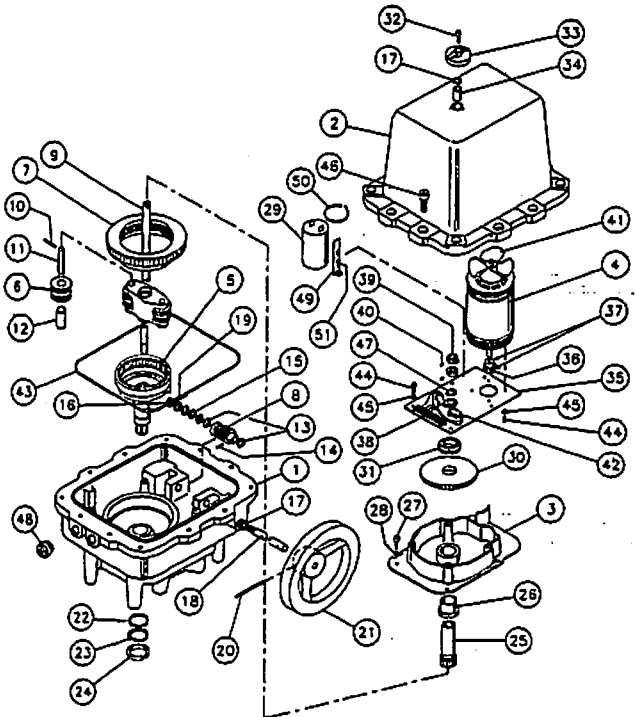
WIRING OF 4-75 120 VAC POSITION INDICATOR

SIZES 10-23



NOTE: SERIES 75 W IS SHOWN. SERIES 75 GENERAL PURPOSE, X AND Z UNITS HAVE DIFFERENT BASES AND COVERS.

SIZES 25, 30



Item	Qty.	Description	Material
1	1	Base	Aluminum Casting
2	1	Cover	Aluminum Casting
3	1	Base Plate	Zinc Casting
4	1	Motor Module	Zinc Casting
5	1	Output Shaft	Steel
6	2	Gear Drive Pin	Steel
7	1	Bull Gear	Steel
8	1	Capacitor (w/ Fiber Washer If Required)	Phenolic Encapsulated
9	1	Capacitor Bracket	Steel
10	1	Terminal Strip	Polyethylene Based Material
11	2	Limit Switch	Phenolic Encapsulated
12	2	Limit Switch Cam	Zinc Casting
13	1/Cam	Cam Set Screw	Steel
14	4	Limit Switch Screw	Steel
15	6	Base Plate Screw	Steel
16	8	Hex Screw (W,X,Z)	Stainless Steel
16	4	Hex Screw (GP)	Steel
17	1	Position Indicator (W,X,Z)	Lexan
18	1	Indicator Set Screw (W,X,Z)	Steel
19	1	Seal (W,X,Z)	Reinforced Rubber
20	1	Gasket (W only)	Neoprene
20	1	Flange Seal (Z only)	Buna N
21	1	Bearing	Bronze
22	1	Seal	Reinforced Nitrile
23	4	Screw	Steel
24	4	Lock Washer	Steel
25	1	Conduit Plug	Polyethylene
26	1	Capacitor Tie	Plastic
27	1	Bearing (W, X, Z)	Bronze
28	1	Roller Bearing (size 23 only)	Steel
29	1	Bearing, Base Plate	Nylon
30	1	*O* Ring (W, X, Z)	Buna

Item	Qty.	Description	Material
1	1	Base	Aluminum
2	1	Cover	Aluminum
3	1	Gear Train Support	Aluminum
4	1	Motor	
5	1	Output Gear	Steel Casting
6	2	Planet Gear	Hardened Steel
7	1	Planetary Gear	Ductile Iron
8	1	Worm Gear	Steel
9	1	Sensing Shaft	Steel
10	2	Pin, Spring	Steel
11	2	Shaft	Hardened Steel
12	2	Bushing	Bronze
13	2	Thrust Washer	Steel
14	1	Pin, Spring	Steel
15	4	Bellville Washer	Steel
16	1	Nut	Steel
17	2	Seal	Rubber, Steel
18	1	Manual Override Shaft	Steel
19	1	Pin, Cotter	Steel
20	1	Pin, Spring	Steel
21	1	Handwheel, Manual Override	Aluminum
22	1	Thrust Washer	Steel
23	1	Tru-arc Ring	Steel
24	1	Seal	Rubber, Steel
25	1	Sun Gear	Steel
26	1	Bushing	Bronze
27	4	Cap Screw	Steel
28	4	L Washer	Steel
29	1	Capacitor (w/ Fiber Washer If Required)	Phenolic Encapsulated
30	1	Input Gear	Steel
31	1	Nut	Steel
32	1	Cap Screw	Steel
33	1	Position Indicator	Aluminum
34	1	Bushing	Bronze
35	1	Motor Support Plate	Aluminum
36	1	Gear, Pinion	Steel
37	2	Set Screw	Steel
38	1	Terminal Strip	Polyethylene Based Material
39	2	Limit Switch Cam	Zinc Casting
40	1/Cam	Cam Set Screw	Steel
41	1	Fan	Plastic
42	2	Limit Switches	Phenolic Encapsulated
43	1	*O* Ring	Buna
44	9	Cap Screw	Steel
45	9	Lock Washer	Steel
46	12	Cap Screw	Steel
47	1	Sensing Shaft Ret. Ring	Steel
48	1	Conduit Plug	Polyethylene
49	1	Capacitor Bracket	Steel
50	1	Capacitor Tie	Plastic
51	1	Capacitor Bracket Screw	Steel



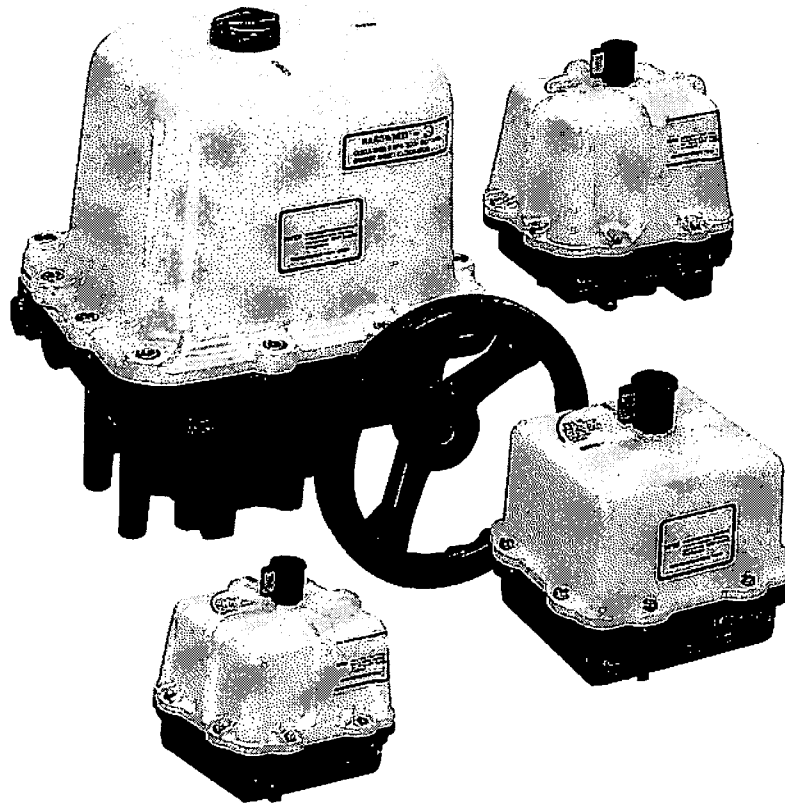
USER INSTRUCTIONS

Worcester Actuation Systems

Series 75 Electric
Valve Actuator

FCD WCAIM2013-01 – 08/04 (Replaces IOM-12156)

Installation
Operation
Maintenance



Experience In Motion

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Description

Worcester Actuation Systems/McCANNNA Series 75 actuators are reversible electric quarter-turn valve actuators. Standard units can provide up to 3000 in-lb of torque and have capacitor-start, capacitor-run motors and permanently lubricated gear trains. These actuators are equipped with integral thermal overload protection (AC motors only) with automatic reset and internal adjustable limit switches. In the event of electrical power failure, W, X and Z models feature manual override capabilities.

⚠ WARNING: Series 75 actuators are electromechanical devices subject to normal wear and tear. Actuator life is dependent upon application and environmental conditions. If applied in hazardous services, such as but not limited to, media temperature extremes, toxins, flammables, or other services where improper or incomplete operation could produce a safety hazard, it is incumbent upon the system designer and the user to provide proper warning devices such as temperature sensors, oxygen sensors and flow sensors. At elevated temperatures the duty cycle has to be derated, consult factory. Flowserve also recommends that the optional auxiliary limit switches be used for monitoring and/or electrical interlock. Heater with thermostat as well as drain/breather fitting (V53 option) are recommended for humid environments when moisture may condense inside the housing. Please note that weatherproof enclosures will "breathe" over time and condensation within the housing will result.

▲ CAUTION: For actuators with dual DC motor module, failure of one motor may mechanically damage the gear train.

▲ CAUTION: Flowserve recommends that all products, which must be stored prior to installation, be stored indoors, in an environment suitable for human occupancy. Do not store product in areas where exposure to relative humidity above 85%, acid or alkali fumes, radiation above normal background, ultraviolet light, or temperatures above 120°F or below 40°F may occur. Do not store within 50 feet of any source of ozone.

▲ CAUTION: For wiring of actuator, including options, please refer to wiring diagram(s) located inside of actuator cover. Wiring diagrams are also included in this manual for reference.

Installation

- A. Attach mounting bracket to actuator using four (4) cap screws and lockwashers, provided in mounting kit, and tighten securely. For small size top mount style valves, attach bracket such that bracket nameplate will be to side of valve.

For mounting to 818/828 Series valves, insert ISO locating ring into groove on bottom of actuator before attaching to bracket. Note: Ring can be permanently held in groove by applying Loctite to ring before inserting in groove.

- B. Attach bracket/actuator assembly to valve as follows:

NOTE: If cross-line mounting of actuator is desired, note the following:

Mount the actuator with conduit hole perpendicular to the flow axis (centerline) of the valve and reverse the open/close decals.

For diverter and three-way valves with V1 porting, and CPT valves, also see Electrical Installation and Adjustment Section, Paragraph D, for cam and limit switch adjustments to facilitate cross-line mounting operation.

▲ CAUTION: Ball valves can trap pressurized media in the cavity. If it is necessary to remove any valve body bolts, stem nuts, or remove valve from the line, and if the valve is or has been in operation, make sure there is NO pressure to or in the valve and operate the valve one full cycle.

1. Valve Models Top Mount 44 (¼"-2"), 45 (2½"-6"), 51/52 (½"-10"), 151/301 (3"-6"), Top Mount 59 (¼"-4"), WK70/WK74 and H71 (½"-2"), 818/828 (2"-8"), 82/83 (½"-10"), and 94 (½"-6"):

NOTE: For above listed valves, it is not necessary to remove any valve body bolts or remove valve from line in order to mount actuator.

- a. Close valve (for valves ¼"-2", the valve is closed when flats on valve stem are perpendicular to the line of flow; for valves 3" and larger, where the valve stem is square, the indicator line on top of stem will be perpendicular to the line of flow or check ball position for closure).

- b. If any valve information is marked on stop plate or handle, it will be necessary to transfer this information to the bracket nameplate.

For ¼"-2" 44 and ½"-2" WK70/WK74, ¼"-1½" 59 and ½"-1½" H71 Series top mount style valves and ½"-2" 51/52, ½"-1½" 82/83 Series valves with high cycle stem packing as standard, remove handle nut, lockwasher, handle, separate stop plate (if any), retaining nut and stop

pin(s). Add the two additional Belleville washers with their larger diameter sides touching each other. Add the self-locking nut to the stem and tighten while holding the stem flats with wrench. Tighten until Belleville washers are flat, the nut will "bottom", and then back nut off 1/4 turn. The two additional Belleville washers and the self-locking nut are included in the mounting kit.

▲ CAUTION: The self-locking stem nut is difficult to tighten, and must fully flatten Belleville washers before backing off.

For 2" 59, H71, 82/83, and 2 1/2" 45, 82/83 Series valves and valves 3" and larger with square stem, remove handle assembly (if any), retaining nut, stop and stop screws. Replace with valve stem spacer or, if valve has graphite stem packing, with two Belleville washers (except 8", 10" 82/83 and 10" 51/52) and replace retaining nut. **NOTE:** Belleville washers are installed with larger diameters touching each other. Using a wrench to prevent stem from turning, tighten retaining nut until stem packing is fully compressed or Bellevilles, if used, are fully flattened, then back off nut 1/4 turn. Excessive tightening causes higher torque and shorter seal life.

NOTE: Large valves with V51 high cycle stem packing option installed, identified by two belleville washers installed and handle assembly, stop and stop screws removed, and 818/828 Series valves do not require stem area disassembly.

For 1/2"-2" 94 valves, remove handle (if any). For 3"-6" 94 and 2"-8" E818/E828 valves, remove handle assembly, stop, and spacer (if any). Do NOT remove gland plate or gland bolts.

For 2"-8" 818/828 valves, remove handle assembly, locking plates and hardware, and stop screw (if any). Do not remove stop plate (2"-6" sizes) or spacer (8" size).

- c. Center coupling on valve stem.
- d. Lower mounting bracket/actuator assembly over coupling and onto valve, making sure that male actuator shaft engages slot in coupling.
- e. Secure bracket to valve using cap screws and lockwashers, or bolts and nuts provided in mounting kit. Tighten securely. For small size top mount style valves, bracket nameplate will be to side of valve.
- f. Install set screws (if any) in the coupling and tighten securely.

C. Series 75 actuator in modulating control service and interface with PC and/or computer.

1. Series 75 actuators can be used for modulating control service operated directly by programmable controller or computer under specific conditions as follows:
 - a. To achieve stable control, an actuator with a longer cycle time is recommended.
 - b. To eliminate overheating from frequent startups, 75% or 100% duty cycle actuators are required.
 - c. To eliminate problems with interfacing, and to protect the output circuitry of the controller, use Worcester I-75 interface board.
2. Alternately a controller coupled with a Series 75 actuator must have:
 - a. Two outputs (one to open, one to close) per actuator being controlled.
 - b. Nine amp minimum output rating.
 - c. Buffered Output – Resistor and capacitor wired in series across each triac.

If a controller output does not meet these requirements, two relays (one to open, one to close) may be installed between controller and each actuator. Failure to observe these precautions will result in controller output damage.

Electrical Installation and Adjustment

▲ CAUTION: It is recommended that the actuator motor not be driven directly from the PLC output. The inrush current/back EMF can destroy the PLC output card triacs if they are not of sufficient rating. As a minimum these should be rated 800 volt, 12 amp triacs. In addition to these ratings, snubber circuits should be utilized to help protect the triacs. This applies to 120 VAC motors only. 240 VAC motors should never be driven directly from a PLC output card.

A. To gain access to terminal strip, it is necessary to remove the actuator cover.

10-2275 (General Purpose) Loosen cover screws and lift cover from unit.

10-2375 W, X and Z Remove declutch knob screw and lift knob from shaft. Remove the two cover screws from cover (the other

six screws are in an envelope and inside the cover) and lift cover from unit.

25-3075 Z Remove indicator knob capscrew with Allen wrench and lift knob from shaft. Remove the cover screws and lift cover from unit.

- B. Make conduit connection to NPT fitting on actuator base. Connect power supply to actuator terminal strip as shown on electrical schematic diagram(s) located inside actuator cover and also in this manual.

The actuator should be electrically grounded in accordance with standard procedures.

For 10-2375 W, X and Z actuators, connect a CSA certified No. 18 AWG green-colored grounding wire to the green-colored grounding screw on actuator base.

For 10-2275 GP actuators, connect a CSA certified No. 18 AWG green-colored grounding wire to terminal marked "G" on actuator terminal strip.

For 25 and 3075 Z actuators, connect a CSA certified No. 18 AWG green-colored grounding wire with a ring-type crimp wire connector and a washer to the green-colored grounding screw (near terminal strip) marked with a letter "G" on motor support plate.

See table below for minimum fuse rating when overcurrent protection is used in motor power circuit.

▲ CAUTION: In cases where the conduit connected to the actuator may be partially or completely run underground, or through which moisture may contact energized live parts, or where the actuator and/or conduit is exposed to temperature differences, the conduit should be sealed within 18" of the actuator in accordance with the National Electrical Code.

Minimum Fuse Rating for Overcurrent Protection

Actuator Size	Voltage	Fuse Rating (A)
10-23	120 VAC	5A
25/30	120 VAC	10A
10-23	240 VAC	3A
25/30	240 VAC	5A
10-23	12 VDC	10A
10-23	24 VDC	5A

NOTE: The table shows the minimum rating to prevent inrush current from blowing the fuse.

- C. When electrical installation is complete, it is advisable to check the indexing of the actuator before replacing the cover.

10-3075 (All): Move actuator to "Open" position (apply power to Terminals 1 and 3). If it does not fully open, or turns past open position, unfasten cam of switch SW2 by loosening set screw (SW2 is to the left of the shaft looking from terminal strip). Move actuator to correct position. Adjust cam so that it just throws micro switch in this position. Tighten set screw and recheck indexing. Repeat this procedure for "Closed" position (apply power to Terminals 1 and 4). **WARNING:** Do not bend switch arms when adjusting cams for actuator travel limits. Doing so will damage the cams.

NOTE: If one or more of the options listed in Options and Adjustments Section have been installed, follow specific instructions for those options as necessary before replacing cover.

- D. If actuator has been cross-line mounted and valve is a diverter or three-way with V-1 porting or CPT valve, proceed as follows:

Reset both cams to operate in next quadrant, (when looking down at cover, the "next" quadrant is 90° clockwise from standard quadrant, one quadrant closer to conduit connection). Switch #1 is the "to close" switch, and is connected to Terminal #4. Switch #2 is "to open", goes to Terminal #3. CPT valves must operate "clockwise to close" viewed from top. Relocate decals to new quadrant. "Open" is 90° from conduit side, "close" is adjacent to conduit side. If mounted on a V-1 diverter, "open" shall expose ball port at one pipe end, "closed" shall expose ball port at the opposite pipe end.

- E. Replace actuator cover.

NOTE: For W and Z models, make sure flange gasket/seal is properly installed. Tighten all cap screws securely.

For X and Z Models Only:

After placing the cover on the actuator, tighten the cover bolts in a crisscross fashion to a torque of 70-80 in-lbs.

A feeler gage, being 1/8" to 1/2" wide and 0.0015" thick, shall be used to check the clearance between the base and cover flange.

This feeler gage shall not penetrate the base/cover flange gap any more than 1/8".

10-2375 W, X and Z: Replace declutching knob, taking care that knob set screw engages milled flat on clutch shaft and indicates proper position on labeled cover.

25-3075 Z: Replace indicator knob in its proper position to give correct indication. Tighten indicator's cap screw securely.

Options and Adjustments (Factory Installed)

NOTE: For wiring of the following options, please refer to the appropriate option wiring diagram(s) located inside actuator cover or included with option kit. Wiring diagrams for most options are also included in this manual for reference.

All wiring to terminal strip should be inserted only to mid-point of terminal strip.

For some options with AC actuators, multiple wires are going to terminal 1. A short white wire is provided and connected to terminal 1, then spliced to the other white wires (common) using a closed end splice.

A. Center-Off (180° Rotation)

1. Readjustment of "Center-Off" Cams (if necessary):

- a. With the cover removed and the actuator placed with the terminal strip facing the operator, switches 1 and 3 are to the right and switches 2 and 4 are to the left of the main shaft.
- b. There are four cams and two spacers on the shaft. Per the drawing on the following page, these cams are numbered 1 through 4, from bottom to top. (See proper drawing for approximate location and correct orientation of the center-off cams.)
- c. Using the manual override (see page 12) as necessary, set the actuator shaft to a "center-off" location.

Set cam #3 such that hook of switch 3 lever arm has just dropped off the cam. Tighten cam screw without moving cam.

▲ CAUTION: Do not bend the limit switch lever arm.

Set cam #4 such that hook of switch 4 lever arm will match the arch of cam #4. Tighten cam screw without moving cam.

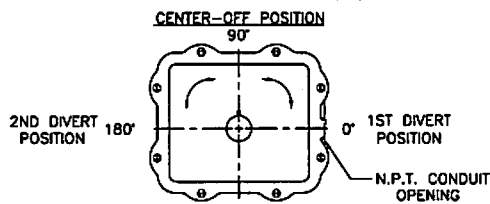
▲ CAUTION: Do not bend the limit switch lever arm.

Release manual override.

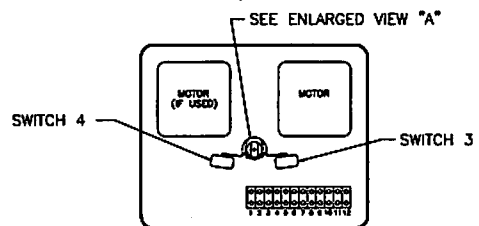
- d. Power the actuator to the full clockwise (CW) limit, to the 0° reference position. Check position of ball and valve stem to verify that valve is in the true 0° position, as required by the application.
- e. Repeat the above step for the 180° or full CCW position. Verify that the driven device is in the required position.
- f. Apply power to terminals 1 and 7 for AC (+ to 7 and - to 8 for DC) to verify proper operation of center-off switches. With the actuator shaft positioned at the 180° position, power applied to terminals 1 and 7 for AC (+ to 7 and - to 8 for DC) moves the actuator shaft clockwise (CW) to the center-off position.

With the actuator shaft at the full clockwise position, 0 degrees, apply power to terminals 1 and 7 for AC (+ to 7 and - to 8 for DC). The actuator shaft should move counter-clockwise CCW to the center-off position.

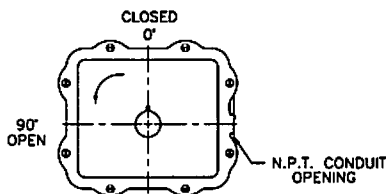
180° Center-Off Actuator Series 75W, X, And Z Shown



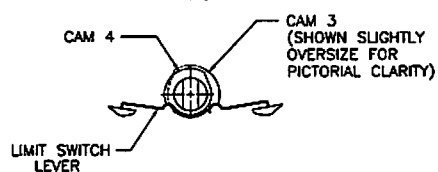
Typical View Showing Location of Center-Off Cams and Limits Switches Set Up at the Center-Off Position



Standard 90° Actuator Series 75W, X, and Z Shown



View "A"



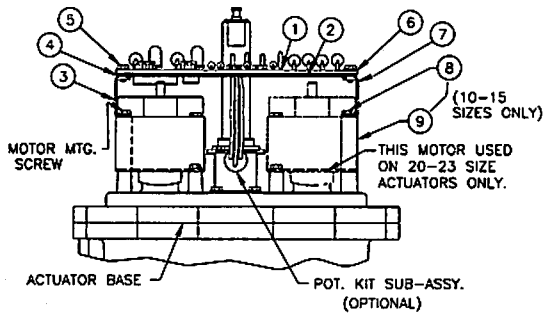
SPECIAL NOTE: If during any of these checks, the actuator shaft stops other than at the required positions, a readjustment of the center-off cams is needed. At no time shall both center-off switches be activated by their cams at the same time. The N.O. contacts on both center-off switches are typically closed. The center-off switch levers must be tripped by their center-off cams at different times.

Therefore, the center-off cams should be set as close to the 90 degree position as possible, yet the cam/switch actuation for each switch is never at the identical position.

If the center-off switches are set to actuate at a close angular differential, the actuator shaft may oscillate, or not operate. Loosen one cam and move this cam to increase the actuation differential between each of the center-off switches.

If the center-off switches are set to actuate at a wide angular differential, the actuator will not stop at a true center-off position. Adjust one or both cams to decrease the angular differential between each of these switches.

- g. As a final check, alternately apply power to terminals 1 and 4, 1 and 3, and 1 and 7 for AC, (+ to the 1 and - to the 4; - to 1 and + to 3; - to 8 and + to 7 for DC).

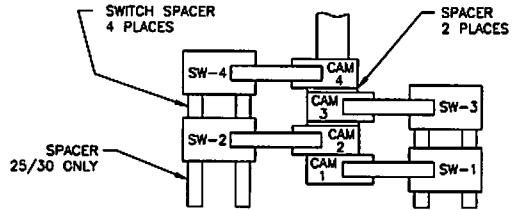


10-23 Size 75 Actuators

Item	Description
1	Circuit Board Sub-Assembly
2	Insulating Board
3	Bracket-Right (Long)
4	Grommet-Rubber
5	Mounting Screws (Cir. Board)
6	Washer-Nylon
7	Bracket-Left (Short)
8	Mounting Screws (Bracket)
9	Spacer (Bracket)

No oscillation or hunting of the actuator output shaft should occur.

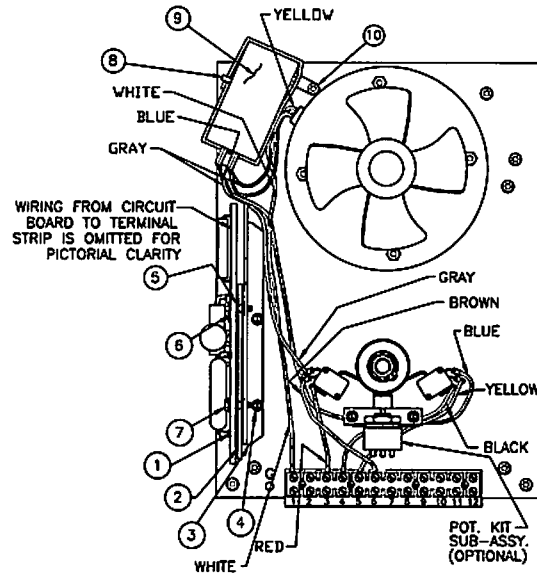
If the above problems are noted, simply readjust the center-off cams as noted in Step f.



Switch configuration is as above (when viewed from the terminal strip side of the actuator).

Actuator shown at 0° position (fully CW).

120 VAC Shown



25-30 Size 75 Actuators

Item	Description
1	Circuit Board Sub-Assembly
2	Insulating Board
3	Circuit Board Bracket
4	Mounting Screw (Bracket)
5	Grommet-rubber
6	Washer-Nylon
7	Mounting Screw (Cir. Board)
8	Capacitor (Round Or Rectangular)
9	Capacitor Tie (See Note)
10	Capacitor Bracket And Screw (See Note)

Note: Not Used For Round Type Capacitor With Threaded Lug.

Cam settings are as follows:

Switch 1 opens at 0°. Controls first divert position.

Switch 2 opens at 180°. Controls second divert position.

Switch 3 opens at 89°. Controls center-off position from first divert position.

Switch 4 opens at 91°. Controls center-off position from second divert position.

NOTE: Switches 1 and 2 and Cams 1 and 2 are standard. Switches 3 and 4 and Cams 3 and 4 are center-off type.

Use cam spacer as needed to line up cam and switch.

B. Feedback Potentiometers (Single, Dual)

The potentiometer, as part of the Series 75 Actuator, is used to obtain feedback representing the actuator's position. It requires a power supply, which may be furnished by the end user and/or by optional devices such as a 4-75 (4-20 mA) Position Indicator or AF17 Positioner.

A Dual Potentiometer is used with the DFP17, AF17 Positioners or 4-75 Position Indicator when remote resistance indication is required.

The Dual Potentiometer is required when both AF17 or DFC 17 and 4-20 mA position output options are to be used together, one pot for each device.

Each pot can serve only one function. Remote resistance monitoring and an AF17, for example, cannot share a pot.

1. Adjusting Potentiometer:

NOTES: Potentiometers are adjusted at factory. If readjusting is necessary, follow instructions below.

Voltage limit of single pot or "B" pot of dual potentiometer is 30 volts maximum.

a. 10-3075 Actuator:

If not already installed, place the large face gear (12) over the actuator shaft with the gear teeth down and secure with snap ring (16) provided.

NOTE: The face gear utilizes a friction fit to the shaft. For best results, wipe off any lubricant that may be on the shaft before sliding on the face gear.

▲ CAUTION: Do not overstretch the snap ring, use the minimum opening to allow snap ring to slip over the gear.

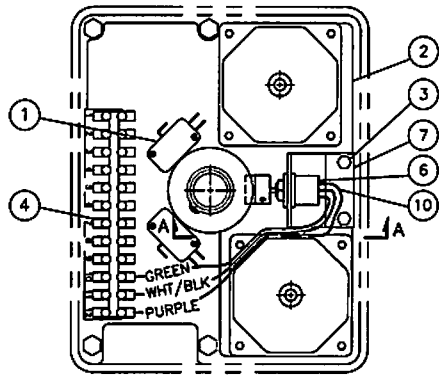
- b. Adjust the potentiometer spur gear (8) until there is approximately 1/16" engagement with the large face gear. Tighten the spur gear set screw (9). If necessary, you can slightly bend potentiometer bracket to get proper engagement.
- c. Rotate the face gear back and forth to ensure smooth and easy operation of the potentiometer.
- d. Important: FOR 90° VALVES: With the actuator in the OPEN (full CCW) or CLOSED (full CW) position and power off, rotate the face gear, thus turning the potentiometer shaft until the resistance between the white/black lead (terminal 11) and the green lead (terminal 10) or the white/black lead (terminal 11) and the purple lead (terminal 12) respectively, as measured by an ohmmeter, is between 80 ohms and 90 ohms. (Refer to instruction sheets of options that may have different pot lead locations and adjustments, e.g., AF17 Positioner.)
- e. Power the actuator to the opposite position from where resistance was measured.
- f. At this position, with power off, measure the resistance at the same terminals as stated above. The resistance reading should be greater than 700 ohms. If not, then power actuator back to original position and adjust pot again, if necessary, as stated in paragraph d. above. If unsuccessful in getting proper resistance readings, pot is defective and should be replaced.

The feedback potentiometer is now adjusted for use in the 75 actuator.

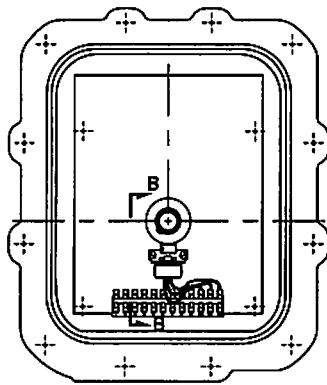
IMPORTANT: The feedback potentiometer is calibrated for only one 90° quadrant of valve operation. If the output shaft is repositioned to another 90° quadrant or if the output shaft is rotated on a multiple of 360° from its original position, the feedback potentiometer will no longer be in calibration and must be recalibrated.

Feedback Potentiometers

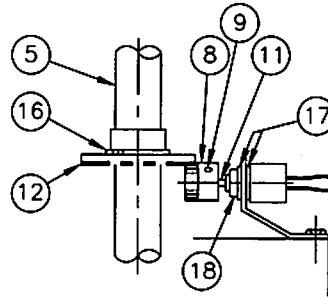
10-2375 Plan View



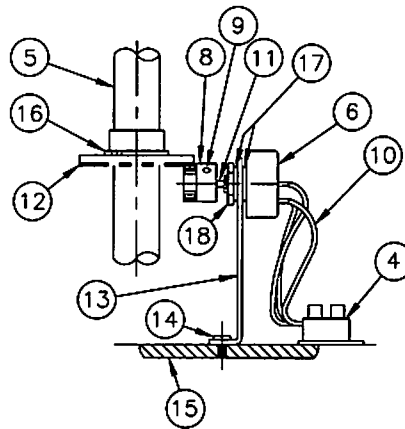
25/3075 Plan View



View A-A



View B-B

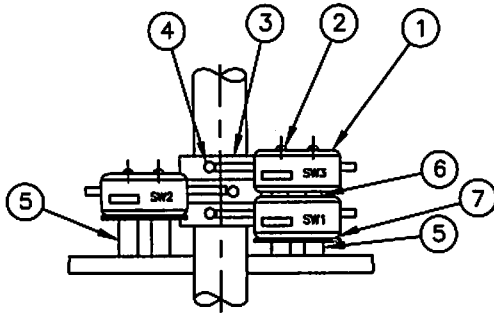


Item	Description
1	Limit Switches
2	Motor Module
3	Motor Module Mounting Screws (2)
4	Terminal Strip
5	Actuator Shaft
6	Potentiometer
7	Potentiometer Bracket
8	Spur Gear
9	Spur Gear Set Screw

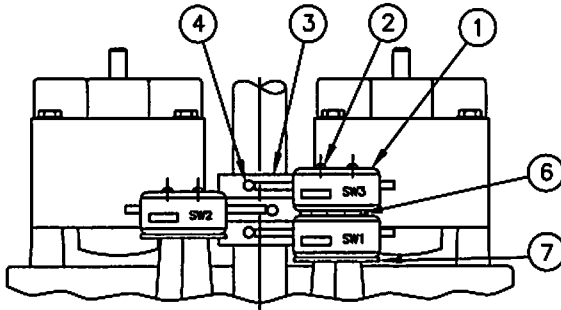
Item	Description
10	Potentiometer Leads
11	Potentiometer Shaft
12	Face Gear
13	Potentiometer Bracket
14	Mounting Screws (2)
15	Motor Support Plate
16	Snap Ring
17	Lockwashers (2)
18	Nut

Illustrations show single potentiometer only.

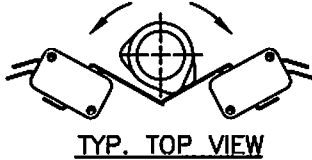
25 and 3075



10-2375



Typical Top View



Item	Description
1	Extra Switch
2	#4-40 Screws (2)
3	Extra Cam
4	Set Screw (1)
5	Spacers (25/3075 Only)
6	Spacers (two per Switch)
7	Insulator

C. I-75 Interface

1. Description:

The I-75 Interface is designed to be used and mounted in the Series 75 Actuator as one of many standard options. Function of the I-75 Interface is to allow the Series 75 Actuator to be powered by a 120 or 240 VAC power supply, operated directly by any programmable controller, microprocessor, and/or computer regardless of output rating of these devices.

Depending on the control input used there are several options of the I-75 Interface:

5V for 5 VDC input, XV for 12 VDC input, XX for 24 VDC input, 15 for 120 VAC input.

These options are identified by the nameplate on the circuit board.

2. Indication and Repair:

LED Indicators – Light emitting diodes marked LD1, LD2 are in input circuits and indicating what particular input is on. Left, LD2, LED indicates that CCW, open, signal is on. Right, LD1, LED indicates that CW, close, signal is on.

If a malfunction occurs, look for the following:

If particular input is energized and corresponding LED light is not on, check for component damage or other continuity disruption in corresponding CCW and/or CW input circuit. If everything appears to be OK, replace matching opto-coupler U2 or U1.

Input circuit is OK. LED is lighted and actuator is not running. If components and continuity in corresponding power circuit are all right, then failed component is triac Q2 or Q1 depending which way the actuator doesn't run, CCW or CW.

If the actuator doesn't run in either direction, it is likely that the actuator is defective. To check this, remove the red and black leads from terminals 3 and 4 of the actuator (coming from Interface board) and the AC line connections from terminals 1 and 2. Tape these leads. Using a test cable, apply power to actuator terminals 1 and 3. The 120 VAC actuator only (see Note) should rotate CCW until stopped by the CCW limit switch. Then apply power to terminals 1 and 4 to check CW 120 VAC actuator and the CW limit switch. If the actuator does not operate, check 120 VAC associated wiring, terminal strip, the limit switches, motor, and capacitor. Check switch continuity. Check for an open motor winding, and check for a shorted capacitor. If the problem in the actuator still cannot be determined, return the unit for service. If the actuator functions properly, the problem is in interface board.

Request an RMA (Return Material Authorization) number from the service department, replace the defective board, and return it to the factory with proper description of problem and application.

NOTE: The limit switches for the 240 VAC I-75 actuator do not control the motor circuit, they control input circuit only. When applying power to terminals 1 and 3, and 1 and 4 to check CCW, CW rotations, do this momentarily so that you do not override 0-90° quadrant.

D. Extra Limit Switches (M1 or M2)

1. Setting:

NOTE: Switches and cams are set at factory. If resetting is necessary, use the following procedure:

- a. Bring actuator into position desired to actuate extra switch. Turn extra cam in direction of normal travel until switch just throws.
- b. Advance cam in same direction by 1–3° and secure cam by tightening the set screw (4).

For M2, a fourth switch (not shown) is added over SW2. The fourth cam (not shown) is positioned so that cam set screw faces terminal strip when cam is in contact with limit switch to give desired function. Cam lobe must approach switch lever from lever pivot end and not from free end—see Typical Top View on page 9. Follow setting instructions on last page.

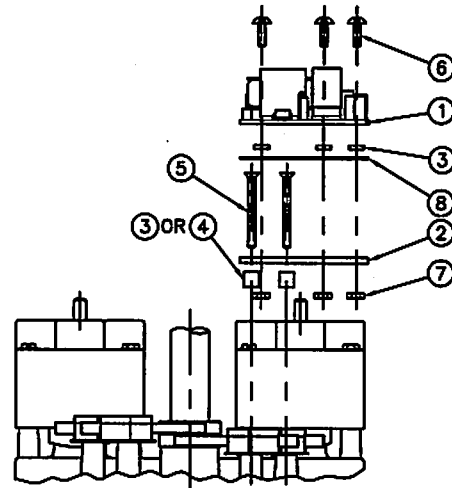
E. Mechanical Brake (10-2375 Actuators)

NOTE: Mechanical brake should require no adjusting.

1. Testing and Troubleshooting:

- a. Energize actuator for rotation in both open and closed directions. At the rated actuator voltage, the brake coil is energized and moves the plunger to release brake arm. Clearance of .020" to .030" must exist between the brake arm and the brake disc when power is applied to the actuator.
- b. If the brake arm is too close to the brake disc, realign the coil housing so that coil plunger can move further toward the center of the actuator, permitting more movement of the brake arm.
- c. Plunger chattering indicates a low supply voltage. If actuator voltage is at the rated conditions, realign coil housing so that coil moves away from the center of the actuator to reduce plunger movement.
- d. All coil adjustment is done in small increments of .015 inches or less.
- e. Additional adjustment may be done by moving mounting plate toward/away from actuator shaft.
- f. Once proper operation of the brake is verified replace actuator cover.

10-23 75 Assembly Shown



Item	Qty	Description
1	1	Circuit Board
2	1	Mounting Plate
3	5	Spacers (.06")
4	2	Spacers (.25")
5	2	Flat Head Screws
6	3	Head Screws
7	3	Nuts
8	1	Insulator
9	3	Cable Ties (Not Shown)
10	1	Potentiometer Kit (Not Shown)

F. Cycle Length Control (CLC Module)

CAUTION: CLC module must be used with proper line voltage.

Control of the actuator's cycle time is achieved by breaking up the power applied to the actuator into a series of pulses. The length of time a power pulse is applied is controlled by the "ON" adjustable control. The interval between pulses is controlled by the "OFF" adjustable control.

To adjust, start with both controls at midpoint. To reduce cycle time on 120 VAC units, turn "ON" control in CW direction and "OFF" control in CCW direction. To increase cycle time turn "ON" control in CCW direction and "OFF" in CW direction. To reduce cycle time on 240 VAC units, turn "ON" control in CCW direction and "OFF" control in CW direction. To increase cycle time turn "ON" control in CW direction and "OFF" in CCW direction.

IMPORTANT: If "ON" time adjustable control is at minimum and/or "OFF" time adjustable control is at maximum, the actuator will not rotate. The minimum "ON" pulse must allow the actuator to move a closed valve out of its seat. Verify proper CLC operation by opening a fully closed valve.

G. Heater and Thermostat

NOTE: Heater and thermostat option requires no adjusting. If defects are found, notify factory.

The thermostat will close/energize heater at ambient temperatures below 70°F.

H. Drain/Breather (V53) Option (10-2375 Actuators)

If actuator is equipped with drain/breather at bottom of base, actuator must be operated in an upright position for drain to operate properly.

I. 4-75 Position Indicator**1. Description:**

The 4-75 position indicator is designed to be used and mounted with the standard Series 75 (Sizes 10-30), 120 VAC actuator, with many of its standard options. Its output is suited for 4-20 mA DC meter with 0-100% scale, which is not part of the package. If properly calibrated, it indicates actuator shaft position from close (0°, 0%) to open (90°, 100%).

It is combined with standard potentiometer, which supplies information on shaft position. If feedback potentiometer is required for other functions such as remote resistance indication or a DFC17 Controller, a dual potentiometer has to be used. Each potentiometer can serve only one function. See potentiometer kit instructions (Part No. 66-09750), available from your distributor/ supplier, for installation procedures, if necessary.

2. Adjustment and Calibration:

NOTE: If used with a DFC17 Controller, see DFC17 Installation, Operation and Maintenance manual (part no. 66-14946) for adjustment and calibration.

The feedback potentiometer has to be adjusted to obtain proper resistance range. With the actuator either in the OPEN (full CCW) or CLOSE (full CW) position, and power off, rotate the face gear, thus turning the potentiometer shaft, until the resistance between the white/black lead and the green lead (actuator full CCW) or the white/black lead and the purple lead (actuator full CW) respectively, as measured by ohmmeter, is between 80 ohms and 90 ohms.

NOTE: It is not necessary to loosen or remove face gear snap ring to rotate gear, it is a friction fit.

Power the actuator to the opposite position from where resistance was measured.

At this position, with power off, measure the resistance at the same terminals as stated above. The resistance reading should be greater than 700 ohms. If not, then power actuator back to original position and adjust pot again, if necessary, as stated in paragraph above. If unsuccessful in getting proper resistance readings, pot is defective and should be replaced.

To obtain proper 4-20 mA output, the indicator has to be calibrated. Using an ammeter, connected to actuator Terminals 5 (positive) and 6 (negative), adjust the two potentiometers R4 and R5 on the board. With the actuator in the closed position (0%), adjust R5 potentiometer (adjacent to the #4 etched on the circuit board and closest to terminal block) to obtain 4 mA on the ammeter. Move the actuator to the open position (100%) and adjust R4 potentiometer (adjacent to the #20 etched on the circuit board) to obtain 20 mA. Because adjustment of one potentiometer affects the other, repeat the procedure several times to obtain proper values.

IMPORTANT: The feedback potentiometer is calibrated for only one 90° quadrant of valve operation. If the output shaft is repositioned to another 90° quadrant or if the output shaft is rotated a multiple of 360° from its original position or the position indicator is removed from the actuator, the feedback potentiometer will no longer be in calibration and must be recalibrated.

3. Repair: In case factory repair is required, contact service department, and request an RMA (Return Material Authorization) number. After receiving new circuit board replace defective board and return it back to factory with description of problem and application.

Manual Operation

IMPORTANT: Disconnect actuator from power supply. If power is not off, motor will start when cam moves from limit switch.

- A. 10-2375 W, X and Z: Pull the declutching knob all the way up and hold. Apply wrench to exposed flats on actuator shaft and rotate to desired position. To reengage, return shaft to original position of disengagement and release declutch knob.
- B. 25-3075 Z: Simply turn manual override handwheel in the desired direction (clockwise rotation of handwheel causes actuator drive shaft to rotate clockwise, when viewed from above). The manual override can be used at any time without damaging the actuator.

NOTE: Actuator should be manually operated only over the range for which it is set up to operate electrically. Operation beyond this range will totally disrupt indexing.

Maintenance and Troubleshooting

The Series 75 electric valve actuator requires no regular maintenance. Should the unit fail to operate, however, the following are hints for troubleshooting. If the unit still fails to operate, consult the factory.

Electrical Supply Be sure the Series 75 is supplied with the correct voltage.

Electrical Connections Does the wiring conform to the wiring diagram?

Limit Switches If both switches are depressed simultaneously, the unit will not operate. Make sure the switches trip one at a time.

Capacitor The AC motors are operated with a capacitor. If the capacitor is defective, it will prevent the motor from starting and/or running. Replace if necessary. If capacitor has metal retaining ring, insulating fiber washer must be used.

Motor If one of the motor windings is open or short-circuited, the unit will not operate. If motor is hot, allow it to cool down so that the stator is at room temperature. Apply voltage to motor. If motor still fails to operate, replace entire motor module.

DC Motors DC motors use no thermostat and are therefore not protected against high temperatures and currents. Use of these motors above rated torques (loads) and/or duty cycle can cause permanent damage. If DC motor(s) fail(s) to operate under minimal torque loading, or if one of the two motors fail, replace entire motor module.

NOTE: Failure of one motor on dual DC motor module may mechanically damage the gear train.

Gear Train

10-2375 (All) Remove motor module from the actuator. Rotate the motor by hand. Spinning the motor shaft should rotate the module output pinion. If module output pinion fails to rotate, replace entire motor module. Also, check bull gear for missing or broken teeth. Replace if necessary.

25-3075 (All) Remove actuator from valve. Rotating the motor shaft manually should cause the actuator output shaft to rotate. If output shaft does not rotate, gearing has been damaged. Return actuator to factory for repair.

Valve The problem may lie with the valve instead of with the actuator. Check the operation of the valve by removing the actuator and operating the valve by hand.

Options For troubleshooting or adjustment of options, see Options and Adjustment section for individual options.

Spare Parts

The following are recommended spare parts which should be kept on hand for Series 75 electric actuators:

1 Limit Switch Kit

1 Capacitor (AC Units Only)

When ordering spare parts, please specify actuator size, voltage and cycle time.

Electrical Requirements

The following table represents approximate current draw (at rated stall torques) in amp at various voltages for each motor.

Actual values depend on several variables. For exact values, test the unit at a particular load.

Suffix Code	Duty Cycle	Voltage	Actuator Size							
			10	12	15	20	22	23	25	30
Blank	20%	120 AC	—	—	0.7	—	—	—	—	—
Blank	25%	120 AC	0.7	0.7	—	1.5	1.5	—	2.7	3.5
2	10%	120 AC	1.5	1.5	—	2.9	2.9	—	—	—
4	75%	120 AC	0.3	0.3	—	0.7	0.7	0.7	2.2	2.2
5	100%	120 AC	0.25	0.25	—	0.5	—	—	—	—
Blank	25%	240 AC	0.4	0.4	—	0.9	0.9	—	1.3	1.4
2	10%	240 AC	0.6	0.6	—	1.3	1.3	—	—	—
4	75%	240 AC	0.15	0.15	—	0.3	0.3	0.3	1.2	1.2
5	100%	240 AC	—	—	—	—	—	—	—	—
Blank	25%	12 DC	1.4	1.2	—	5	4.2	—	—	—
4	75%	12 DC	0.5	0.5	—	1.6	1.5	2	—	—
Blank	25%	24 DC	0.7	0.6	—	2.5	2.1	—	—	—
4	75%	24 DC	0.25	0.25	—	0.8	0.75	1	—	—

Cycle Time (sec.)

Suffix Code	10	12	15	20	22	23	25	30
Blank	5	8	5	5	8	—	10	15
2	2.5	4	—	2.5	4	—	—	—
4	17, 15	27, 25	—	17, 15	27, 25	25	15	23
5	17	27	—	27	—	—	—	—

If a heater is used on 12 or 24 VDC actuators, increase the locked rotor currents shown above by the following values (This applies to DC voltages only):

Locked Rotor Currents

	12 VDC	24 VDC
Heater	1.3 amp	0.7 amp

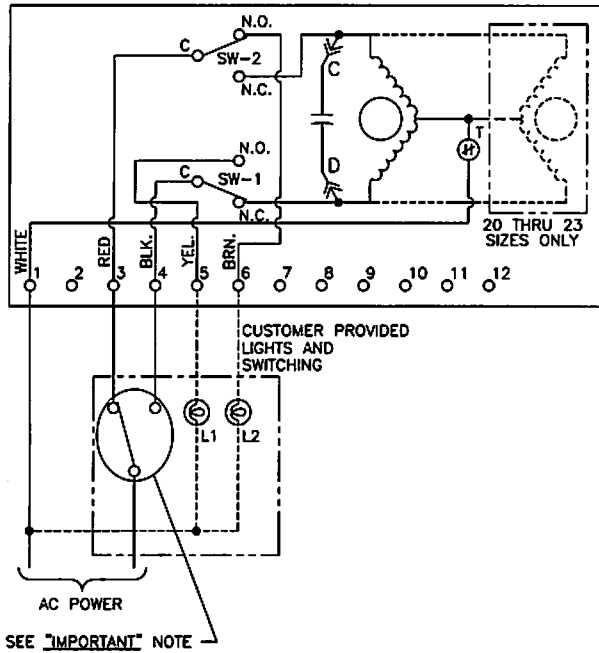
Electrical Schematics (Series 75)

(Actuator shown in counter-clockwise extreme of travel, or "open" position.)

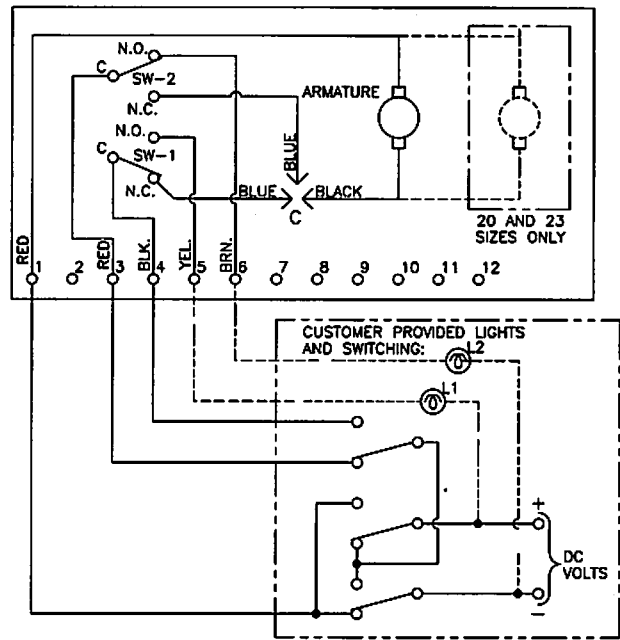
NOTE: DC wiring diagram shown is for size 10, 20 and 23 actuators. For 12 and 22 sizes, the red/black motor leads are reversed.

For G.P. Actuators only, terminal 6 is used for ground connection and L2 should be wired directly to N.O. Terminal of SW-2.

AC



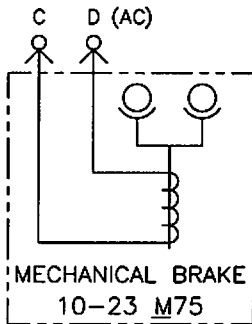
DC



IMPORTANT: each actuator should be electrically powered through its own individual switch to isolate the unused winding.

Each motor has a "thermal protector" as shown by wiring of MB 75 option in diagram.

See table on page 5 for minimum fuse rating when overcurrent protection is used in motor power circuit.



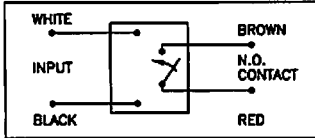
Electrical Schematics and Wiring Diagrams for Options (Series 75)

(For installation of options, refer to installation instructions and wiring diagram(s) contained in respective kit.)

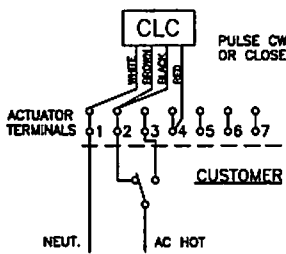
NOTE: DC center-off wiring diagram as shown on page 17 is for size 12 and 22 actuators.

For 10, 20 and 23 sizes, the red/black motor leads are reversed.

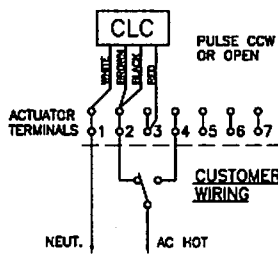
General Schematic



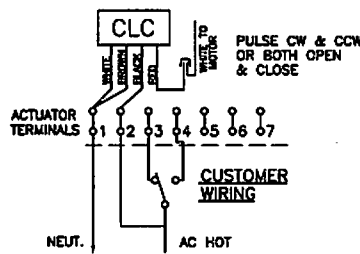
10-30 C 75 120A/240A C



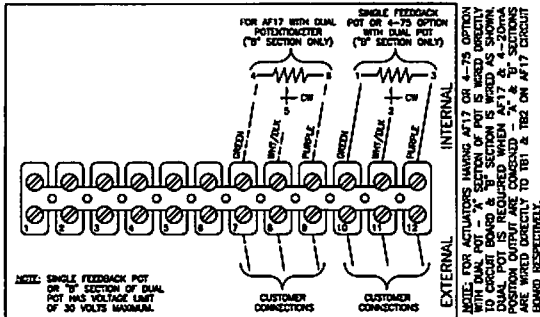
10-30 C 75 120A/240A O



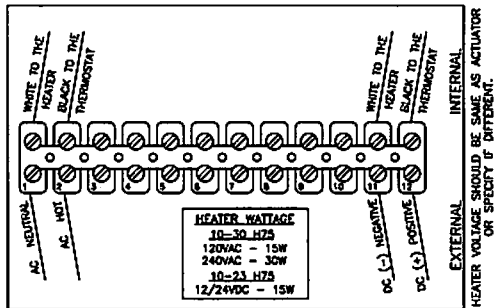
10-30 C 75 120A/240A



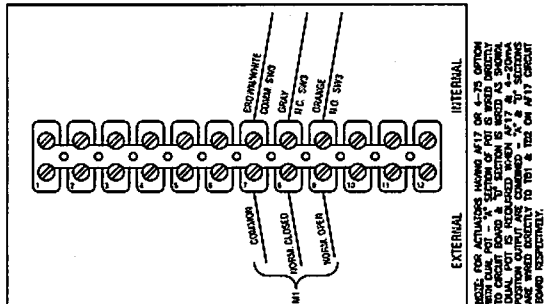
Wiring for 10-30 P/D 75 Feedback Pot Option



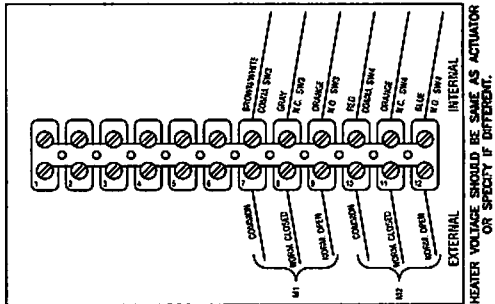
Wiring for 10-30 H75 Heater/ Thermostat Option



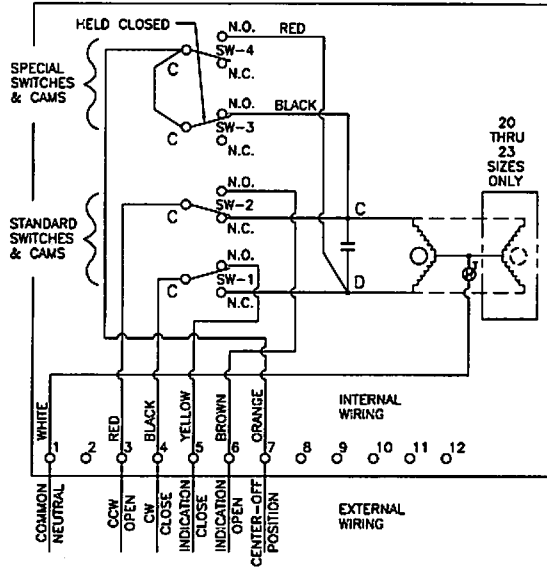
Wiring for 10-30 75 M1 Option (One Extra Limit Switch)



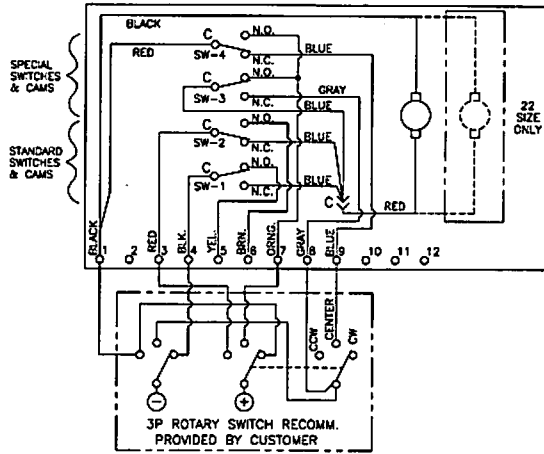
Wiring for 10-30 75 M2 Option (Two Extra Limit Switches)



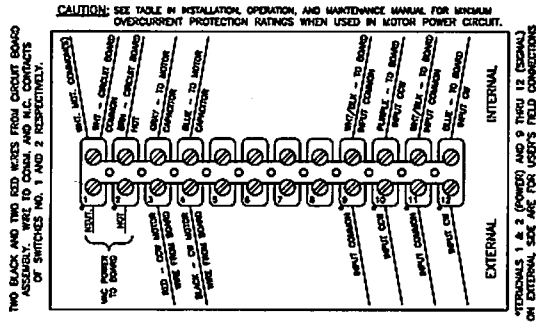
Series 75 AC Electric Actuator with Center-Off (D3) Option



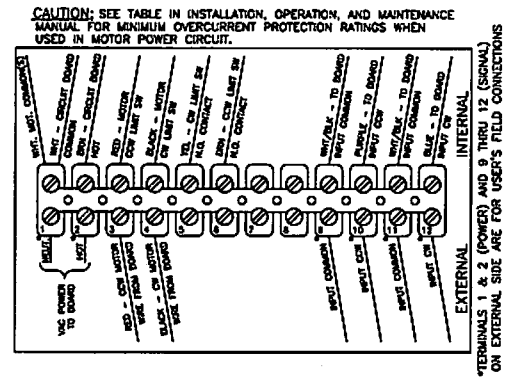
Series 75 DC Electric Actuator with Center-Off (D3) Option



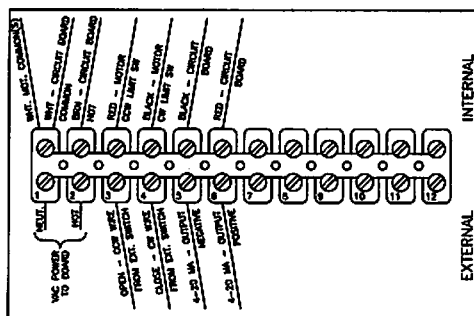
Wiring of I-75 240 VAC Interface



Wiring of I-75 120 VAC Interface

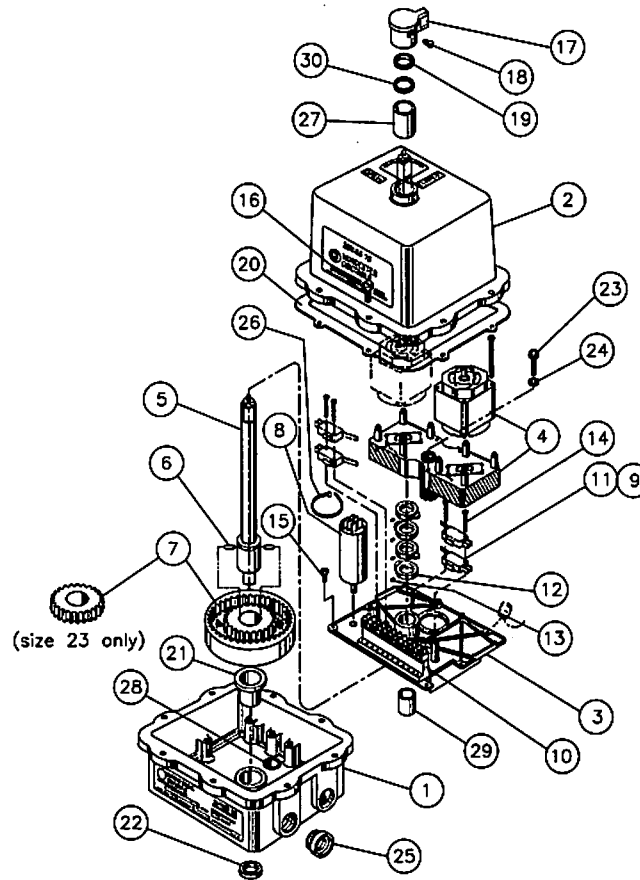


Wiring of 4-75 120 VAC Position Indicator



Parts List

Sizes 10-23

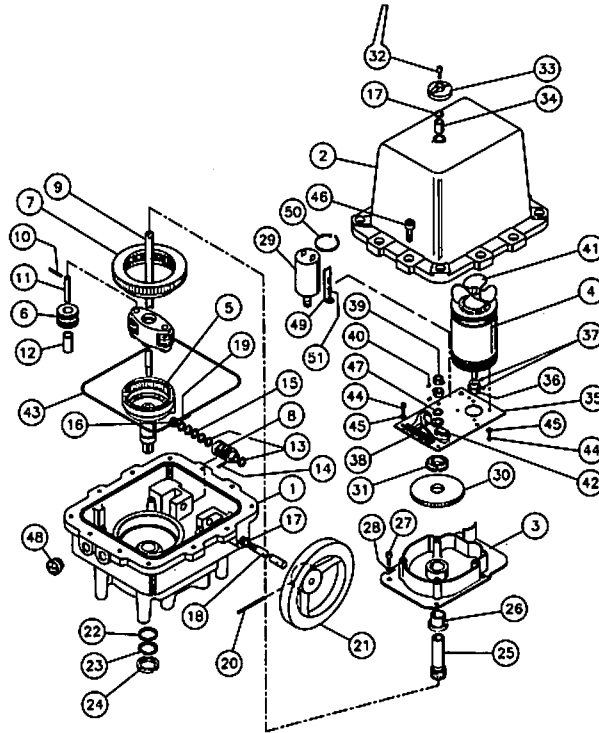


Note: Series 75 W is shown. Series 75 general purpose, X and Z units have different bases and covers.

Item	Qty	Description	Material
1	1	Base	Aluminum Casting
2	1	Cover	Aluminum Casting
3	1	Base Plate	Zinc Casting
4	1	Motor Module	Zinc Casting
5	1	Output Shaft	Steel
6	2	Gear Drive Pin	Steel
7	1	Bull Gear	Steel
8	1	Capacitor (Round or Rectangular Type)	Phenolic Encapsulated
9	2	Switch Insulator (not shown)	Nylon
10	1	Terminal Strip	Polyethylene Based Material
11	2	Limit Switch	Phenolic Encapsulated
12	2	Limit Switch Cam	Zinc Casting
13	1/Cam	Cam Set Screw	Steel
14	4	Limit Switch Screw	Steel
15	6	Base Plate Screw	Steel
16	8	Hex Screw (W, X, Z)	Stainless Steel

Item	Qty	Description	Material
16	4	Hex Screw (GP)	Steel
17	1	Position Indicator (W, X, Z)	Lexan
18	1	Indicator Set Screw (W, X, Z)	Steel
19	1	Seal (W, X, Z)	Reinforced Rubber
20	1	Gasket (W only)	Neoprene
20	1	Flange Seal (Z only)	Buna N
21	1	Bearing	Bronze
22	1	Seal	Reinforced Nitrile
23	4	Screw	Steel
24	4	Lock Washer	Steel
25	1	Conduit Plug	Polyethylene
26	1	Cap. Tie (for Rect. Cap. only)	Plastic
27	1	Bearing (W,X,Z)	Bronze
28	1	Roller Bearing (size 23 only)	Steel
29	1	Bearing, Base Plate	Nylon
30	1	"O" Ring (W,X,Z)	Buna

Sizes 25, 30



Item	Qty	Description	Material
1	1	Base	Aluminum
2	1	Cover	Aluminum
3	1	Gear Train Support	Aluminum
4	1	Motor	
5	1	Output Gear	Steel Casting
6	2	Planet Gear	Hardened Steel
7	1	Planetary Gear	Ductile Iron
8	1	Worm Gear	Steel
9	1	Sensing Shaft	Steel
10	2	Pin, Spring	Steel
11	2	Shaft	Hardened Steel
12	2	Bushing	Bronze
13	2	Thrust Washer	Steel
14	1	Pin, Spring	Steel
15	4	Belleville Washer	Steel
16	1	Nut	Steel
17	2	Seal	Rubber, Steel
18	1	Manual Override Shaft	Steel
19	1	Pin, Cotter	Steel
20	1	Pin, Spring	Steel
21	1	Handwheel, Manual Override	Aluminum
22	1	Thrust Washer	Steel
23	1	Tru-arc Ring	Steel
24	1	Seal	Rubber, Steel
25	1	Sun Gear	Steel
26	1	Bushing	Bronze

Item	Qty	Description	Material
27	4	Cap Screw	Steel
28	4	L Washer	Steel
29	1	Capacitor (Round or Rectangular type)	Phenolic Encapsulated
30	1	Input Gear	Steel
31	1	Nut	Steel
32	1	Cap Screw	Steel
33	1	Position Indicator	Aluminum
34	1	Bushing	Bronze
35	1	Motor Support Plate	Aluminum
36	1	Gear, Pinion	Steel
37	2	Set Screw	Steel
38	1	Terminal Strip	Polyethylene Based Material
39	2	Limit Switch Cam	Zinc Casting
40	1/Cam	Cam Set Screw	Steel
41	1	Fan	Plastic
42	2	Limit Switches	Phenolic Encapsulated
43	1	"O" Ring	Buna
44	9	Cap Screw	Steel
45	9	Lock Washer	Steel
46	12	Cap Screw	Steel
47	1	Sensing Shaft Ret. Ring	Steel
48	1	Conduit Plug	Polyethylene
49	1	Cap. Bracket (for Rect Cap. only)	Steel
51	1	Cap. Bracket Screw (for Rect. Cap.)	Steel



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FCD WCAIM2013-01 Printed in USA. (Replaces IOM-12156)

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Installation Operation & Maintenance Instructions

AF-17
ELECTRONIC
POSITIONER

MODELS:

20 - For AF-17 Boards Mounted Inside 10-23 75 Actuator.

30 - For AF-17 Boards Mounted Inside 25-30 75 Actuator.

AF-17-1K, 120A or 240A, 1000 OHM Resistance Input

AF-17-13, 120A or 240A, 135 OHM Resistance Input

AF-17- 1, 120A or 240A, 1 to 5 Milliampere Input

AF-17- 4, 120A or 240A, 4 to 20 Milliampere Input

AF-17-10, 120A or 240A, 10 to 50 Milliampere Input

AF-17-5V, 120A or 240A, 0 to 5 VDC Input

AF-17-XV, 120A or 240A, 0 to 10 VDC Input

R - Reverse Action Option

120A - 120VAC Power Circuits

240A - 240VAC Power Circuits

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1.0 GENERAL

1.1 Basic Design:

The Worcester AF-17 Electronic Positioner was designed for use with the Worcester Series 75 actuators. However, it may also be used with other actuators or electrically operated rotary devices, provided the specified load parameters as given in Part 6.3 are not exceeded.

CAUTION: THIS POSITIONER IS SENSITIVE TO ELECTRICAL NOISE; PLEASE SEE PART 1.2.

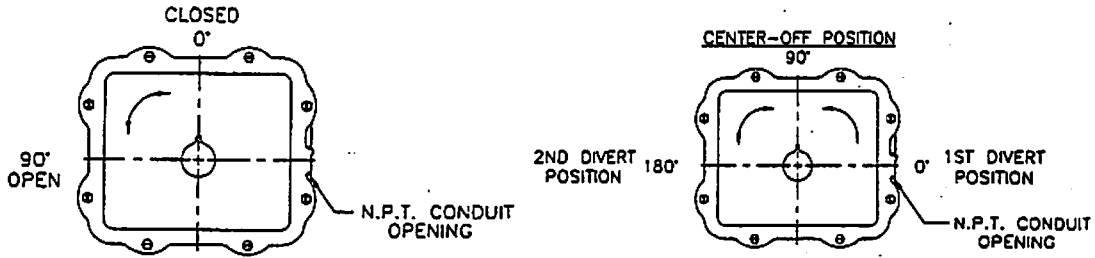
PLEASE READ THIS SECTION

- A. The AC AF-17 board 4-20 mA signal input circuit is protected with a 62 mA fuse (F1). The fuse is used to protect the input circuit from an excessively high voltage. The fuse used in the input circuit is a Littelfuse PICO II very fast acting fuse rated at 62 mA. There is a spare fuse located on the circuit board in the area of the large power resistors.
- B. The AF-17 board is designed to receive a floating current input signal. This allows several pieces of equipment to be operated from the same current loop while at the same time remaining electrically independent of each other.
- C. The AF-17 board can be set up in several ways for normal operation. The board is designed to control in 90° quadrants only. The number of quadrants over which the board will control is determined by the number of teeth on the feedback pot pinion gear. The adjustment trimpots on the board were not set up to reduce actuator travel for a 4-20 mA input span. For example, trying to adjust the board such that 4 mA is closed and 20 mA is only 60% open is just not possible with the standard set up.

The standard setups are:

- 1. 4 mA for Full Clockwise Rotation - i.e., 0°, and 20 mA for Full Counter-clockwise Rotation - i.e., 90° or 180°.
- 2. Split range where 4 mA would be full clockwise and 12 mA would be full counter-clockwise or 12 mA would be full clockwise and 20 mA would be full counter-clockwise.
- 3. Each of the above standard setups can also be made reverse acting.

Quadrants of Operation



STANDARD 90° ACTUATOR
SERIES 75W, X, & Z SHOWN

180° CENTER-OFF ACTUATOR
SERIES 75W, X, & Z SHOWNTYP.

- D. Quite often when we receive an actuator for repair at Worcester Controls we find that the only thing wrong with the unit is that the feedback potentiometer is out of calibration. It is very important that the feedback pot be properly calibrated for correct operation of the positioner board. It is also very important that the actuator shaft not be rotated out of the quadrant for which the feedback pot has been calibrated. Whenever you have a problem with the positioner calibration, always check the feedback pot calibration first. This must be done with no power applied to the circuit board. If the actuator is in the full clockwise position, check the resistance between the purple and white/black potentiometer leads. The reading should be 80-90 ohms. If it is not, rotate the face gear until the proper reading is achieved. If the actuator happens to be in the full counter-clockwise position then check the resistance between the green and white/black potentiometer leads. If necessary adjust the face gear for an 80-90 ohm reading. NOTE: It is not necessary to loosen or remove face gear snap ring(s) to rotate gear, it is a friction fit.

1.2 Environmental Considerations:

CAUTION: The AF-17 Electronic Positioner is sensitive to electrical noise on signal or supply lines and in the environment. For maximum sensitivity, the electrical noise level should not exceed 10mV. Follow installation, calibration and adjustment guidelines carefully and use shielded wire as stated in paragraph 1.2.4.

Worcester recommends that all products which must be stored prior to installation be stored indoors, in an environment suitable for human occupancy. Do not store product in areas where exposure to relative humidity above 85%, acid or alkali fumes, radiation above normal background, ultraviolet light, or temperatures above 120°F or below 40°F may occur. Do not store within 50 feet of any source of ozone.

Temperature and humidity are the two most important factors that determine the usefulness and life of electronic equipment.

1.2.1 Temperature:

Operating solid state electronic equipment near or beyond its high temperature ratings is the primary cause for most failures. It is, therefore, very important that the user be aware of and take into consideration, factors that affect the temperature at which the electronic circuits will operate.

Operating an electronic device at or below its low temperature rating generally results in a unit operating poorly or not at all, but it will usually resume normal operation as soon as rated operating temperatures are reached. Low temperature problems can be easily cured by addition of a thermostatically controlled heater to the unit's housing.

At high temperatures some components will destruct completely when their maximum temperature is exceeded, others will cease operation at temperatures above ratings and will return to operation at normal ratings, but may have been permanently changed in one or another parameter causing a device to operate poorly, and may also cause greatly reduced component life.

1.2.2 Positioner Temperature Considerations:

The Worcester AF-17 Electronic Positioner is rated for operation between -40°F and 160°F. When using the positioner inside the Worcester 75 Series actuators, a maximum ambient temperature of 115°F is required to insure the circuit board maximum temperature of 160°F is not exceeded.

1.2.3 Humidity:

Most electronic equipment has a reasonable degree of inherent humidity protection and additional protection is supplied by the manufacturer, in the form of moisture proofing and fungicidal coatings.

Such protection, and the 3 to 4 watts of heat generated by the circuit board assembly will generally suffice for environments where the average relative humidity is in the area of 80% or less and ambient temperatures are in the order of 70°F average with only occasional short term exposure to temperatures up to 90°F. Where relative humidity is consistently 80 to 90% and the ambient temperature is high or subject to large variations, consideration should be given to installing a heater and thermostat option in the enclosure. The heater should not increase the enclosure temperature to the point where the circuit board assembly's temperature rating of 160°F is exceeded.

In those instances where the internal heater would bring the circuit board's operating temperature near or above its maximum rating, the user might consider purging the enclosure with a cool, dry gas. The initial costs can usually be paid off quickly in the form of greatly extended equipment life, low maintenance needs, and much less process downtime.

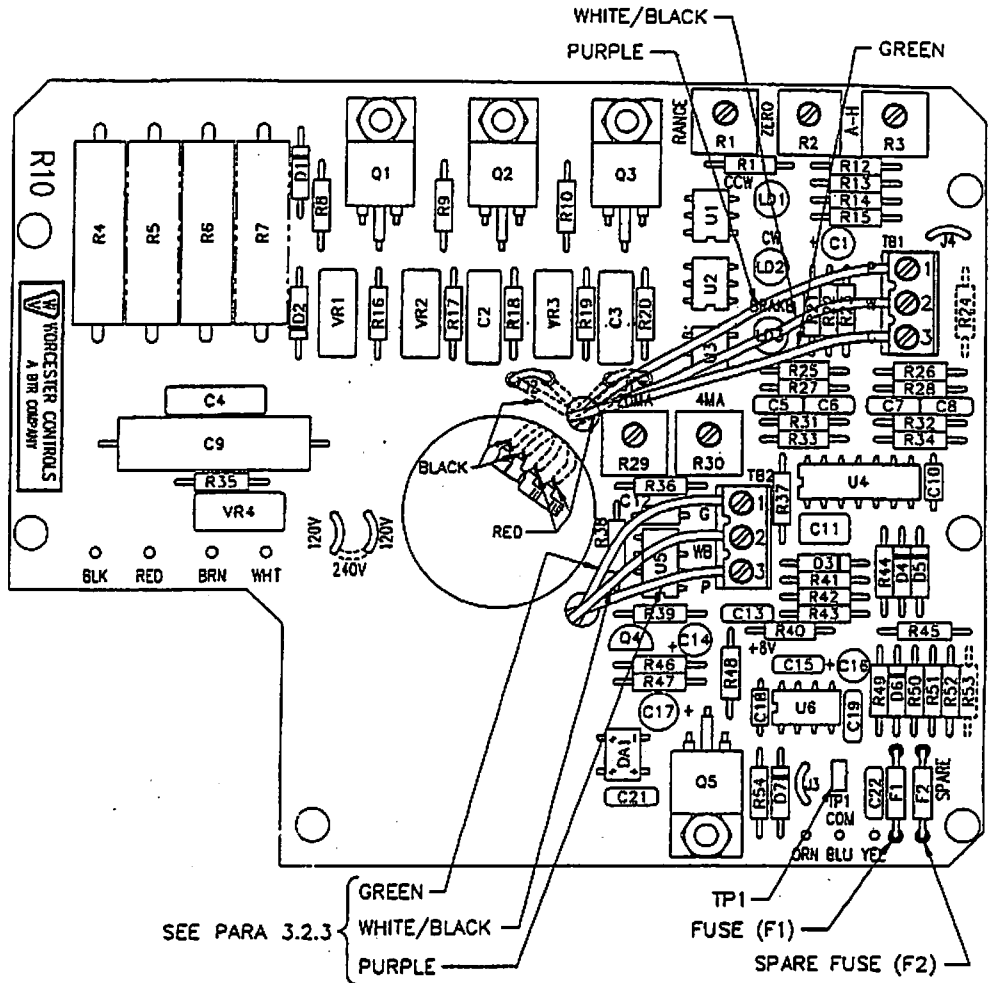
1.2.4 Input Circuit Noise Protection:

Shielded wiring should be used for all signal input circuit wiring regardless of length.

With separately housed positioners, the wiring from the feedback potentiometer to remote positioner, would be considered as signal input wiring and should also be shielded wire.

The shields should never be used in place of one of the input wires, and the shields normally should be grounded to equipment housings at one end of the wiring run only. Grounding both ends of shielding can eliminate the shielding benefits because of current ground loops. If two or more shielded cables come to the positioner from different locations, ground the shields at the positioner.

Figure 1 - 120 VAC AND 240 VAC POSITIONER CIRCUIT BOARD



NOTES:

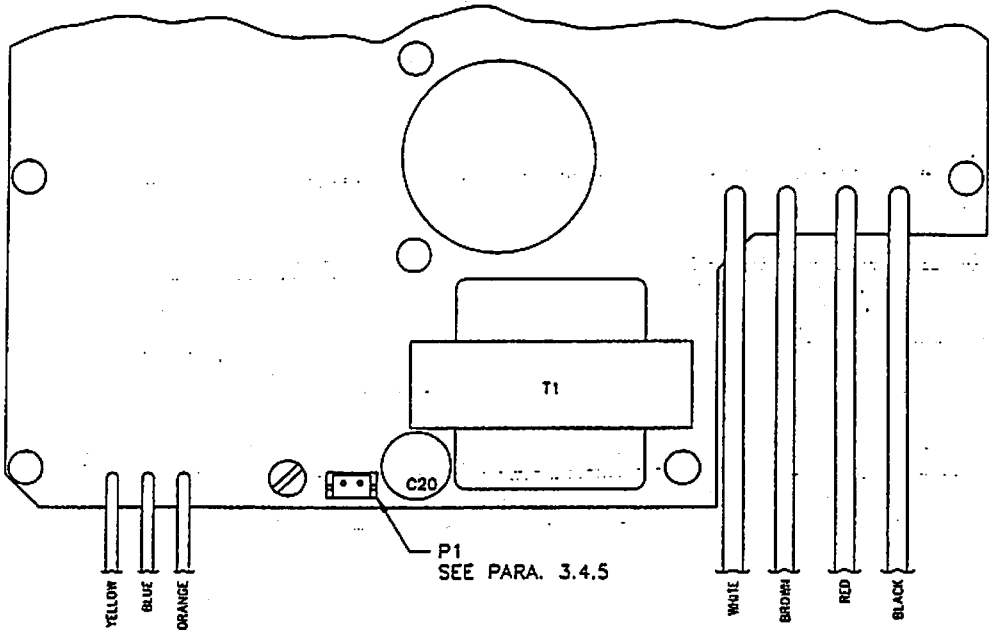
J1 & J2 WITH RED & BLACK WIRES ARE ON 240 VAC BOARD ONLY.

USE OR VALUES OF COMPONENTS R13, R24, R52, R53, R54, C22, J3, J4 & ORANGE WIRE WILL VARY DEPENDING ON INPUT SIGNAL.

R5 & R7 USED ONLY FOR 25 & 30 SIZE ACTUATORS.

SEE PARA 3.2.3

GREEN
WHITE/BLACK
PURPLE



2.0 ELECTRONIC CIRCUIT BOARD (120/240 VAC)

2.1 General:

Figure 1 defines the location of major components and wires from the positioner to terminal strip connections. (The #18 gauge white wire is the AC power unit "neutral" (or common) in the case of DC input wire. The #20 gauge white/black wire is one of the connections between the feedback pot and the terminal block (TB-1) on the circuit board.)

2.2 Circuit Board Configurations:

The positioner board is factory supplied for one of the 7 input signal options.

NOTE: Field changes to the positioner board are not advised. Consult Worcester before attempting any modification.

2.3 L.E.D. Indicators:

Light emitting diodes (L.E.D.) marked LD1, LD2 and LD3 are in the output circuits of amplifier U4. LD1 is tied to pin #13, LD2 to pin #14, and LD3 to pin #1, and they are each associated with their respective opto-coupler U1, U2 and U3 and indicate when the input side of the opto-coupler is energized.

2.4 Controls:

Three adjustment potentiometers are provided, located on the top side of the board and marked "Range", "Zero", and "AH" - See Figure 1.

2.4.1 The "Range" Control adjusts the positioners feedback circuit to cover the same span of voltage as generated by the input signal.

2.4.2 The "Zero" adjustment is basically an offset adjustment in that essentially all input signals start at other than a zero signal condition (i.e., 1, 4 or 12 milliamperes).

2.4.3 The "AH" Control is used primarily to balance the positioner to the dynamic characteristics of the device and media being controlled. Functionally, it varies the amount of input signal that must be applied to the positioner to cause the actuator to reverse its direction of rotation. In effect it varies the deadband of the positioner on a reversing signal condition only. The deadband - the percent change in input signal change that must be applied to initiate a movement of the actuator - on a signal that is constantly increasing or decreasing, is relatively unaffected by the "AH" control.

The "AH" control can vary the balance point deadband from approximately .3% to 4.0% of signal span. It can therefore be used to help decrease the effects of signal noise, with a tradeoff in accuracy/sensitivity.

2.5 AC Power Control:

The AC output circuits are controlled by solid state switches (triacs Q1, Q2, Q3), which will provide trouble free operation for the life of the equipment they are used with, AS LONG AS THEY ARE OPERATED WITHIN THEIR RATINGS.

The ratings for the solid state switches used in the Worcester AF-17 Positioner are listed in Part 6.3.

3.0 INSTALLATION OF AF-17 INTO SERIES 75 ELECTRIC ACTUATOR

3.1 General:

If the actuator was purchased with the AF-17 positioner board factory installed, proceed to section 4.0.

If a 4-20 mA Position Output option is also used with the AF-17 positioner, refer to paragraph 3.3.3 for installation (if not already installed), & paragraph 3.4.5 for wiring.

3.1.1 Check Kit For Parts:

A. Common Parts For Sizes 10-30 Actuators:

Qty.	Name
1	Circuit Board Sub-Assy.
1	Insulating Board
5 or 6	Washers (Nylon)
5 or 6	Grommets (Rubber)
5 or 6	Mounting Screws (Cir. Board)
1	Nameplate - Cir. Board
1	Nameplate - Base
1	Wiring Label - Cover
1	Instruction Manual
5	Cable Ties
2	Closed End Splice
1	Wire - White

Additional Parts For 10-23 Actuators:

<u>Qty.</u>	<u>Name</u>
1	Pot Kit Sub-Assy.
1	Bracket - Right (Long)
1	Bracket - Left (Short)
2	Spacer (Bracket)
2	Mounting Screw (Bracket/Spacer)
1	Support Bracket - Transformer
1	Spacer - Transformer Support Bracket (for 23 Size Only)

Additional Parts For 25 & 30 Actuators:

<u>Qty.</u>	<u>Name</u>
1	Pot Kit Sub-Assy.
1	Mounting Bracket
2	Mounting Screw (Bracket)

3.1.2. Tools Needed:

- 1/4" Nut Driver, 1/8" screwdriver, needle nose pliers, 1/16" Allen wrench (cams and spur gear).
- Volt/Ohm Meter (checking feedback potentiometer resistance, voltages - incoming process signal).
- Milliampere source (to check calibration of positioner on actuator).
- VAC line cord (to power basic actuator).

3.1.3. Operation Check of Basic Actuator:

Set cams for about 1° to 3° of over travel in each direction (full open and full closed). That is, for 0° to 90° operation set at minus 3° and plus 93°. Power terminals 1 & 3 for CCW rotation, terminals 1 & 4 for CW rotation (reference paragraph 4.7.6.).

3.2 Mounting Potentiometer:

3.2.1 Mounting Single Potentiometer Into Series 75 Actuator (See Figure 2):

- A. With the potentiometer mounted to the potentiometer bracket and the spur gear loosely fitted to the potentiometer shaft, mount the potentiometer bracket (if not already mounted) as follows:

10-23 75 Actuator:

Remove the motor module mounting screws on the side of the module furthest away from the actuator shaft. Position potentiometer assembly bracket holes over screw holes and line up potentiometer shaft with center of actuator shaft, replace and tighten screws.

25/3075 Actuator:

Attach potentiometer bracket to motor support plate between the terminal strip and actuator shaft with mounting screws as shown.

3.2.2 Mounting Dual Potentiometer Into Series 75 Electric Actuator:

A dual potentiometer is also available and is required with the AF-17 when external resistance indication is also desired, or when the 4-20 Position Output option is also used.

Each pot can serve only one function. Remote resistance monitoring and an AF-17, for instance, cannot share a pot.

Note: Voltage limit of "B" pot is 30 volts maximum.

Mount potentiometer per paragraph A. of 3.2.1.

3.2.3 Potentiometer Wiring:

- A. The feedback potentiometer leads are connected to the terminal block (TB-1) on the AF-17 board. Run the three leads up through the hole next to pot R29. See Figure 1.
- B. Connect the potentiometer leads to the terminal block as follows:

<u>TB-1</u>		(DO NOT CUT POT WIRES!)
<u>Terminal</u>	<u>Wire Color</u>	
1	Purple	
2	White/Black	
3	Green	

NOTE 1: In the case of a dual potentiometer, "A" [front, close to the bracket] potentiometer wires are wired to the AF-17 board terminal block (TB-1) as stated above, "B" [rear, far from the bracket] potentiometer wires may be wired to terminals 7 (green), 8 (white/black), and 9 (purple) if available and the potentiometer will be used for resistive feedback, or they may be wired to TB-2 if 4-20 mA position output option is used. The wires are run up through the hole next to Q4 then connected to TB-2 as follows:

<u>TB-2</u>		
<u>Terminal</u>	<u>Wire Color</u>	
1	Purple	(DO NOT CUT POT WIRES!)
2	White/Black	
3	Green	

3.2.4 Adjusting Potentiometer:

- A. Reference paragraph 4.7.6 for moving the actuator shaft electrically.
- B. **10-30 75 Actuator:**

Place the large face gear (12) over the actuator shaft with the gear teeth down and secure with snap ring(s) (16) provided (use two snap rings on 25 & 30 sizes only).

NOTE: The face gear utilizes a friction fit to the shaft. For best results, wipe off any lubricant that may be on the shaft before sliding on the face gear.

CAUTION: Do not overstretch the snap ring(s), use the minimum opening to allow them to slip over the gear.

- C. Adjust the potentiometer spur gear until there is approximately 1/16" engagement with the large face gear. Ensure there is minimum backlash between the gears. Tighten the spur gear set screw.
- D. Rotate the face gear back and forth to ensure smooth and easy operation of the potentiometer.
- E. **IMPORTANT:** For 90° Valves:

Depending on whether the AF-17 board is installed and wired, either measure the resistance directly at the potentiometer wires if not installed or at the AF-17 terminal block (TB-1) if installed and wired. With the actuator either in the OPEN (full CCW) or CLOSED (full CW) position, and power off, rotate the face gear, thus turning the potentiometer shaft, until the resistance between the white/black lead (AF-17 terminal 2) and the green lead (AF-17 terminal 3) or the white/black lead (AF-17 terminal 2) and the purple lead (AF-17 terminal 1) respectively, as measured by Ohmmeter, is between 80 Ohms and 90 ohms.

NOTE: It is not necessary to loosen or remove face gear snap ring(s) to rotate gear.

- F. Power the actuator to the opposite position from where resistance was measured. (Reference paragraph 4.7.6 for moving actuator shaft electrically.)
- G. At this position, with power off, measure the resistance at the same terminals as stated above. The resistance reading should be greater than 700 Ohms. If not, then power actuator back to original position and adjust pot again, if necessary, as stated in paragraph E above. If unsuccessful in getting proper resistance readings, pot is defective and should be replaced.
- H. The feedback potentiometer is now adjusted for use in the 75 actuator. Add the potentiometer caution label to the outside of the actuator cover.

CAUTION: If the actuator shaft is manually rotated a multiple of 360° from its original position, the feedback potentiometer will no longer be in calibration. It must be recalibrated per paragraphs E-G above, in order for the AF-17 board to operate properly.

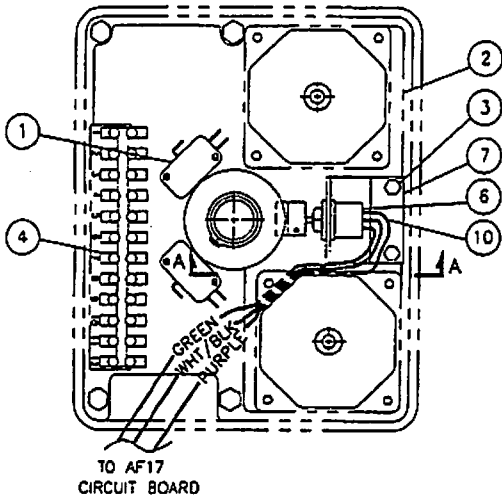
3.2.5 IMPORTANT:

The feedback potentiometer is calibrated for only one 90 degree quadrant of valve operation.

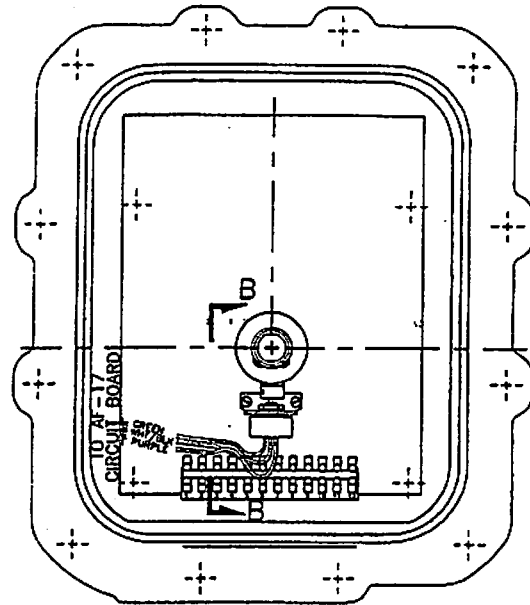
If the valve and actuator output shaft is repositioned to another 90 degree quadrant the feedback potentiometer must be recalibrated as per Section 3.2.4.

The Series 75 actuators offer a manual override feature. Whenever repositioning the valve using this manual override capability on these actuators, move the valve only within the 90 degrees for which the feedback potentiometer has been calibrated.

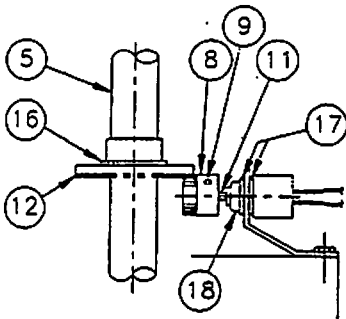
Figure 2 - NOTE: Illustrations Show Single Potentiometer Only.



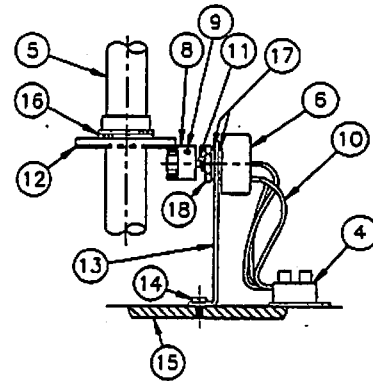
10-2375
PLAN VIEW



25/3075
PLAN VIEW



VIEW A-A



VIEW B-B

ITEM	DESCRIPTION
1	LIMIT SWITCHES
2	MOTOR MODULE
3	MOTOR MODULE MTG. SCREWS (2)
4	TERMINAL STRIP
5	ACTUATOR SHAFT
6	POTENTIOMETER
7	POTENTIOMETER BRACKET
8	SPUR GEAR
9	SPUR GEAR SET SCREW
10	POTENTIOMETER LEADS
11	POTENTIOMETER SHAFT
12	FACE GEAR
13	POTENTIOMETER BRACKET
14	MOUNTING SCREWS (2)
15	MOTOR SUPPORT PLATE
16	SNAP RING(S)
17	LOCKWASHERS (2)
18	NUT

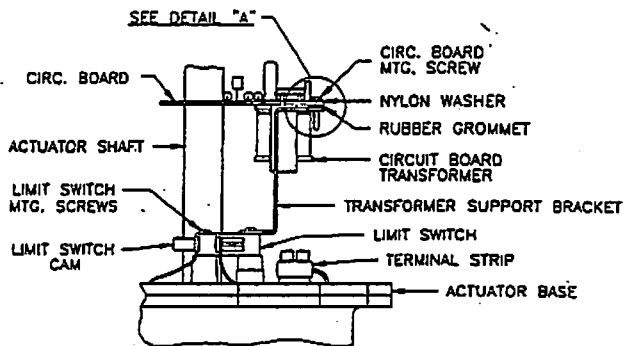
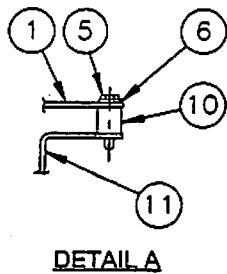
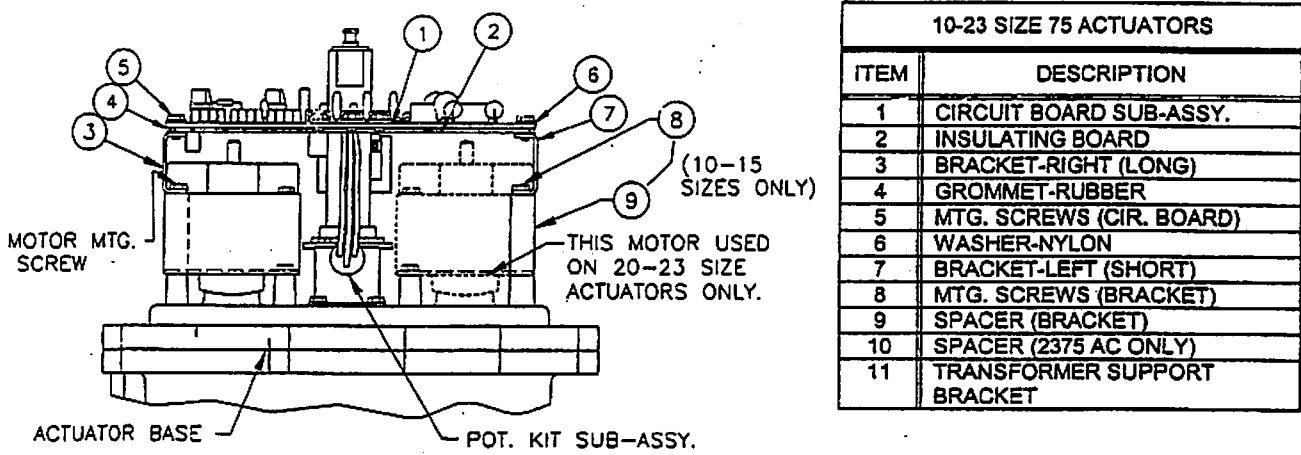
ILLUSTRATIONS SHOW SINGLE POTENTIOMETER ONLY

3.3 Mounting Circuit Board

3.3.1 For 120/240VAC 10-23 Size Electric Actuators: (See Figure 3)

- A. Mount these brackets to the actuator motors or spacers as provided. The longer bracket is mounted to the right side of the actuator when facing the terminal strip using the motor mounting screws. Mount transformer support bracket to limit switch using existing switch screw.
- B. Remove and replace motor screws carefully to avoid stripping the threads of these self-tapping screws.
- C. Once these motor screws and brackets are firmly secured, firmly tap the motor stator to force realignment of the top motor bearing.
- D. Loosen all actuator terminal strip screws necessary to connect the circuit board's wiring to the terminal strip. See manual Part 3.4 for proper wiring of circuit board to the actuator's terminal strip. Wire routing is important. Ensure that wiring is not pinched and is not near cams or mechanical brake.
- E. Assemble circuit board into actuator. Slide rubber grommets onto insulating board. Put nylon washers under heads of self-tapping screws. (Six screws will be used to install the circuit board onto the brackets).
- F. Place circuit board over brackets. Feed the 3 feedback pot wires up through the hole in the circuit board near pot R29. See Figure 3 below and Figure 1 on page 6. Loosely fasten board to brackets using mounting screws. Use a nylon washer and a rubber grommet on the self-tapping screw securing the left front corner of board to transformer support bracket when facing terminal strip. **NOTE:** For 23 size only, use spacer (10) in place of grommet. Wire potentiometer to the AF-17 board per paragraph 3.2.3.
- G. The circuit board is wired to the terminal strip as shown in Part 3.4.
- H. Snug down the circuit board and secure mounting screws such that grommets are about half compressed.

Figure 3

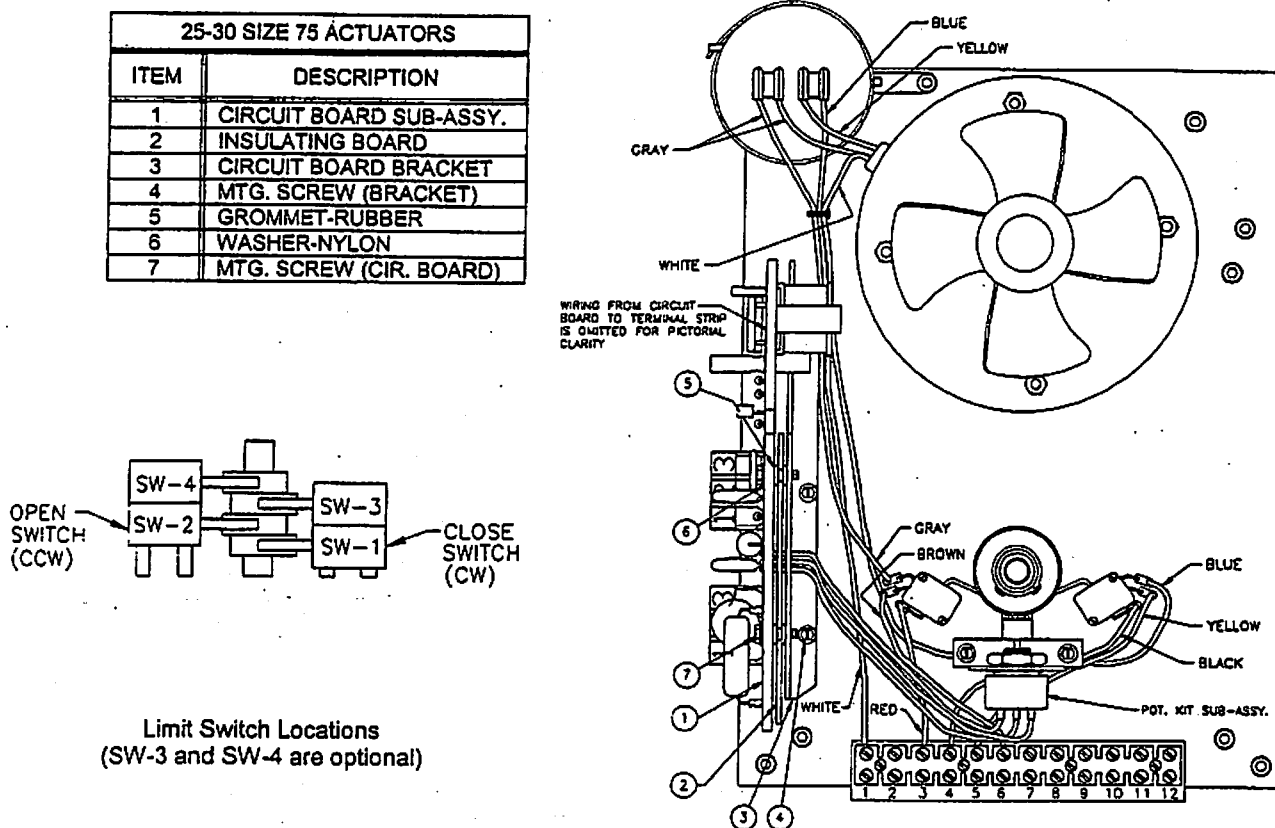


**VIEW SHOWN FROM THE CAPACITOR END OF THE 75 ACTUATOR
(CAPACITOR NOT SHOWN FOR PICTORIAL CLARITY)**

3.3.2 For 120/240 VAC 25 & 30 Size Electric Actuators: (See Figure 4)

- A. Assemble circuit board to bracket as shown.
- B. Place four of the five rubber grommets onto the insulating board. Put nylon washers on the self-tapping screws and place screws through the circuit board and insulating board. Start screws into the bracket. Use a nylon washer and a rubber grommet on the self-tapping screw, securing the lower left corner of circuit board.
- C. If no insulating board is used, place a rubber grommet between the board and the bracket. Tighten all screws such that the grommets are about half compressed.
- D. Use two screws to fasten circuit board bracket to the motor mounting plate, component side of the board is facing out.
- E. The circuit board is wired to the terminal strip as shown in Part 3.4.

Figure 4



NOTE: Standard wiring for switches and capacitor as shown in Figure 4 is the same for 10-23 75 actuators and is for 120 VAC Positioner only. For 240 VAC Positioner, see paragraph 3.4.4.

3.3.3 Installation of Optional 4-20 Position Output (if used and not factory installed):

- A. The output of the position output option is suited for a 4-20 mA DC meter with 0-100% scale (such as General Electric type GE185) which is not part of the package. If properly calibrated, it indicates actuator shaft position from closed (0°, 0%) to open (90°, 100%).
A dual potentiometer has to be used with the AF-17 to achieve the 4-20 mA output. Each potentiometer can serve only one function. See Part 3.2 for potentiometer installation & wiring procedures.

B. Parts Available for Assembly:

Item	Qty	Description
1	3	Cable Ties
2	1	Potentiometer Kit (Not Shown)
3	1	Connector Assembly (Not Shown)

3.4 Wiring of AF-17 Board to Actuator:

NOTE: When there are multiple wires going to terminal 1, use short white wire provided. Connect it to terminal 1 and then splice it to the other white wires (common) using the closed end splice provided.

3.4.1 The AF-17 positioner board is wired to the terminal strip per Figure 5 for 120 VAC or Figure 6 for 240 VAC. **CAUTION:** Wiring should be inserted only to mid-point of terminal strip.

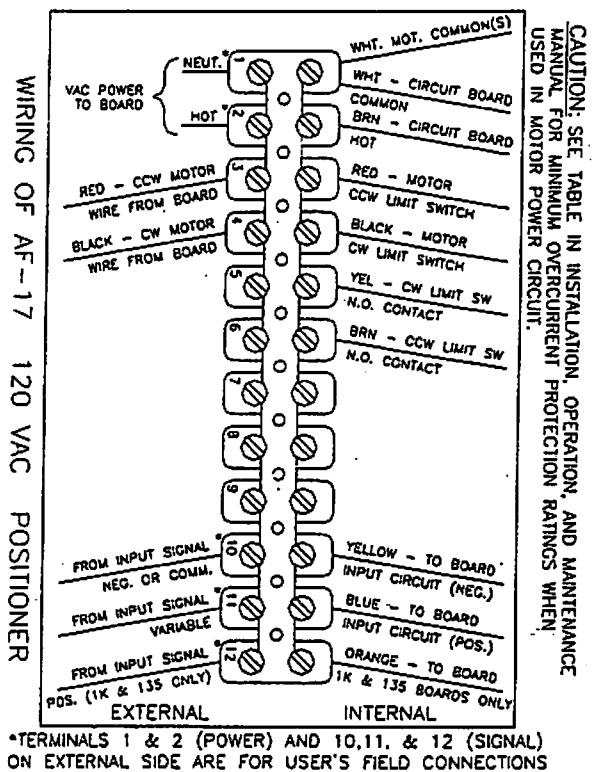


Figure 5

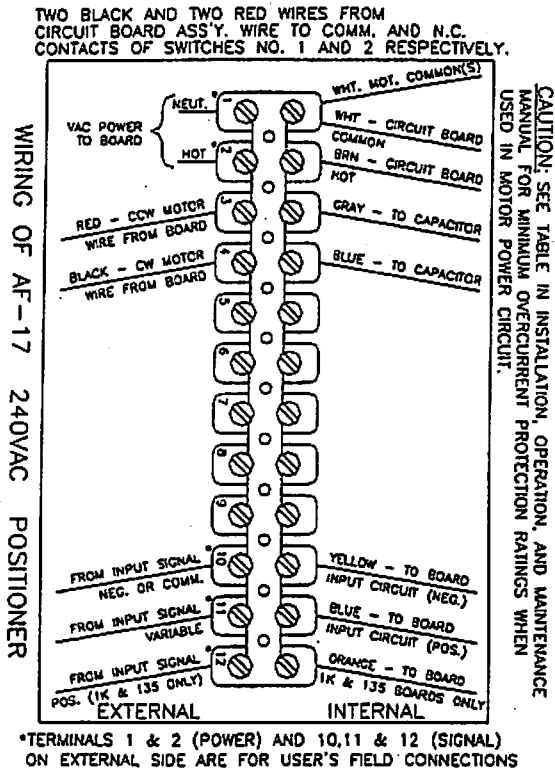


Figure 6

NOTE: For all input signal circuit wiring, regardless of length, shielded wiring should be used. See Paragraph 1.2.

3.4.2 Feedback Connections:

Actuators shipped with the positioner circuit board installed will have the feedback potentiometer also installed and connected to the AF-17 terminal block (TB-1) numbers 1, 2 and 3, green wire to 3, white/black wire to 2, and purple wire to 1. (Reference Figure 2.) If not already done, connect the three feedback potentiometer leads as listed above. See Figure 1.

3.4.3 Output Connections:

The AC power switching circuits on the circuit board connect to actuator terminals 3 and 4. The circuit board's CCW power control circuit connects to terminal 3 via the positioner's red wire and the CW power control circuit connects to terminal 4 via the positioner's black wire. (Reference Figures 5 and 6). The actuator's motor "Common" must connect to the positioner board's white wire and AC "neutral" for correct actuator operation.

3.4.4 For 10-30 AF-17 240 VAC Positioner Wiring:

For this voltage only, the two limit switches are used to switch off the opto-coupler (U1, U2, U3) outputs at the end of CW and CCW strokes instead of directly switching off the motor. This protects the triacs (Q1, Q2, Q3) by ensuring that they are switched off via their gate circuit and do not shut off on full power.

Replace the original gray & blue actuator wires (make a note of which color wire is on which capacitor terminal and then discard them) with those provided. Connect them to the capacitor as originally wired and to terminals 3 and 4 (gray to no. 3, blue to no. 4) (reference Figure 6).

The two black wires (#20 gauge) from the positioner board connect to the common and normally closed contacts of switch no. 1 (lower right hand switch), and the two red wires (#20 gauge) from the positioner board connect to the common and normally closed contacts of switch no. 2 (lower left hand switch). Route the wires so they will not interfere with switch or feedback pot operation.

The cams which operate these switches are adjusted as referenced in paragraphs 3.1.3, 4.1, 4.2, 4.3 and 4.7.1.

NOTE: Securely tighten all terminal screws. Keep wiring away from all rotating parts and ensure it will not be pinched when the actuator cover is installed.

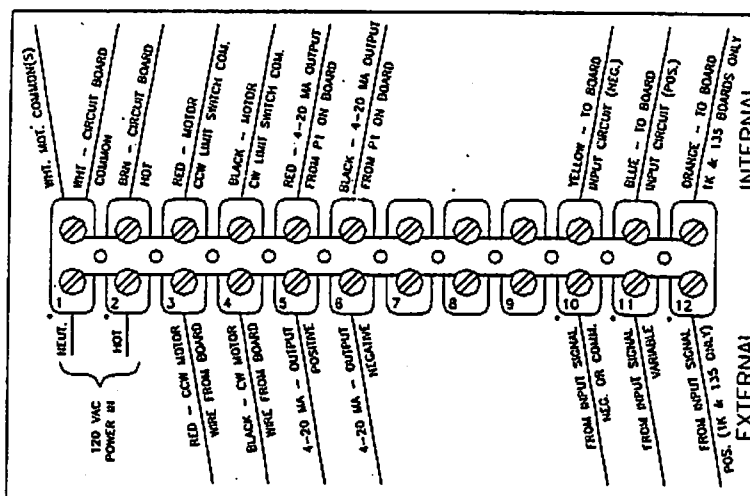
3.4.5 Wiring for AF-17 with 4-20 mA Output (See Figure 7):

A. The white wire (common) from the AF-17 PC board is wired to terminal no. 1 on internal side; the brown wire (hot) from the AF-17 PC board is wired to terminal no. 2 on internal side. Feedback potentiometer wires from the "B" section of the dual potentiometer are wired directly to the AF-17 circuit board terminal block TB-2 (green to terminal 1, white/black to terminal 2, and purple to terminal 3).

WIRING OF AF-17 & 4-20 MA POSITION OUTPUT 120 VAC POSITIONER SHOWN

*TERMINALS 1 & 2 (POWER) AND 10, 11 & 12 (SIGNAL) ON EXTERNAL SIDE ARE FOR USER'S FIELD CONNECTIONS

CAUTION: SEE TABLE IN PARA. 3.5.3 FOR MINIMUM OVERCURRENT PROTECTION RATINGS WHEN USED IN MOTOR POWER CIRCUIT



WIRING OF AF-17 & 4-20 MA POSITION OUTPUT 120 VAC POSITIONER

Figure 7

B. For 120 VAC board only, remove yellow wire from terminal no. 5 and brown wire from terminal no. 6, disconnect them from N.O. contacts of switches 1 and 2 and discard them. For all AC boards, connect wires of output signal connector assembly from AF-17 board connector (P1) such that red wire (+) is wired to terminal no. 5 and black wire (-) is wired to terminal no. 6 on internal side of terminal strip.

NOTE: Check for wiring diagram label inside of cover, if it doesn't have the 4-20 mA output wiring shown, mark label for terminals 5 & 6 according to Figure 7.

C. External wiring is between actuator terminal strip and outside power supply and various controls. Common wire of the power supply is wired to terminal no. 1 and hot wire of the power supply to terminal no. 2. An outside position indicator meter is wired with positive connection to terminal no. 5 and negative connection to terminal no. 6.

D. Securely tighten all terminal screws. Secure all wires neatly with the cable ties. Keep wiring away from all rotating parts and ensure wiring is not pinched when actuator cover is installed.

E. The feedback potentiometer has to be adjusted to obtain the proper resistance range. See paragraph 3.2.4. To obtain proper 4-20 mA output, the AF-17 board 4-20 mA output has to be calibrated. Using an ammeter connected to actuator terminals 5 (positive) and 6 (negative) adjust the two potentiometers R29 and R30 on the board. Locate the actuator in the closed position (0%) and adjust R30 potentiometer (closest to TB-2) to obtain 4 mA on the ammeter. Move the actuator to the open position (100%) and adjust R29 potentiometer (closest to the shaft hole) to obtain 20 mA. Because adjustment of one potentiometer affects the other, repeat the procedure several times to obtain proper values.

IMPORTANT: The feedback potentiometer is calibrated for only one 90° quadrant of valve operation. If the output shaft is repositioned to another 90° quadrant or if the output shaft is rotated a multiple of 360° from its original position, or if the 4-20 mA position output option is disconnected from the AF-17 board, the feedback potentiometer will no longer be in calibration and must be recalibrated. See paragraph C of part 1.1 and paragraph 3.2.4.

3.5 Actuator Power:

3.5.1 AC power to the positioner and from the positioner to the actuator should be with wire no smaller than #18 gauge and with insulation rated for the particular application. The #18 gauge wire size is sufficient for all Worcester Series 75 actuators. When using the positioner with other makes of actuators, check the manufacturer's current rating to determine the correct wire size.

3.5.2 AC power connections are made to terminals 1 and 2 of the terminal strip. The AC neutral, or common, wire should be connected to terminal #1 and the AC "Hot" wire to terminal #2. Note that the positioner requires a minimum of 110 VAC, and a maximum of 130 VAC for the 120 VAC version and a 220 VAC minimum, 250 VAC maximum for the 240 VAC version.

Grounding wires should be connected to green colored grounding screw (if present) on actuator base or to any base plate mounting screw in the actuator.

3.5.3 Minimum Fuse Ratings:

See table below for minimum fuse rating when overcurrent protection is used in motor power circuit.
Minimum Fuse Rating for Overcurrent Protection

Actuator Size	Voltage	Fuse Rating
10-23	120 VAC	5A
23/30	120 VAC	10A
10-23	240 VAC	3A
25/30	240 VAC	5A
10-23	12 VDC	10A
10-23	24 VDC	5A

NOTE: This table shows the minimum rating to prevent inrush current from blowing the fuse.

3.6 Input Signal Connections:

NOTE: The 120/240 VAC AF-17 positioner board signal input circuit is protected by a 1/16 amp fuse, F1 (See Figure 1 and Paragraph A of Part 1.1).

3.6.1 AF-17-1, AF-17-4, AF-17-10 [Milliampere Input Signal for AF-17]

For a milliampere signal input, the more positive or "High" signal lead should connect to terminal 11. The less positive or "Common" lead should connect to terminal 10. [Terminal 10 is (-), Terminal 11 is (+).]

This positioner is available for use with the standard milliampere signals: 1 to 5, 4 to 20, and 10 to 50 milliamperes. The positioner board is factory calibrated for one of the 3 milliampere signal ranges, and field changes are not advised. A label on the circuit board indicates the positioner's signal range.

Paragraph 6.4.1 gives the nominal resistance load, which the positioner presents to the control circuit for the three signal ranges.

Comparison of resistance measurements made at terminals 10 and 11 (on the yellow and blue wires from the circuit board) against the resistances shown in paragraph 6.4.1 provides a quick way to determine the milliampere range for which a particular board is calibrated.

NOTE: If the circuit board has an orange wire (See Figure 1) attached to it, the board is for a Resistive Input. See paragraph 3.6.2 and Figure 8.

3.6.2 AF-17-13, AF-17-1K [Resistive Input for AF-17]

NOTE: The Resistive Input Potentiometer is not the Feedback Potentiometer, but is an additional Potentiometer provided and externally located by user.

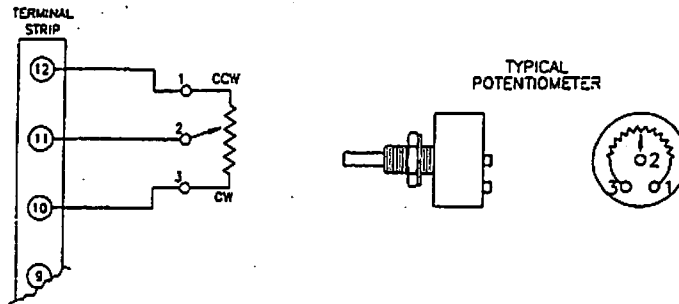


Figure 8

For a resistance input signal, the usual connections will be similar to that shown in Figure 8 with a "Close" command being generated where the potentiometer of Figure 8 is rotated to its full CCW position and an "Open" command when it is in the full CW position.

If the command signal is derived from other than a rotary pot, it is only necessary to keep in mind that a "Closed" (full CW) valve is called for when the command potentiometer presents the least resistance between terminals 10 and 11 and the most resistance between terminals 11 and 12. A full "Open" (full CCW) valve would be the reverse condition; the least resistance between terminals 11 and 12 and the most resistance between terminals 10 and 11.

If the "Command" potentiometer is reasonably linear, the actuator/valve will be approximately 50% open when the resistances between terminals 10 to 11 and 11 to 12 are equal.

Resistive input circuit boards are made in two versions, one for high resistance command circuits - 1000 Ohms nominal, and one for low resistance command circuits - 135 Ohms nominal.

3.6.3 AF-17-5V, AF-17-XV [Direct Voltage Input Signal for AF-17]

For a voltage input signal, the more positive or "high" signal lead should connect to terminal 11. The less positive or "Common" lead should connect to terminal 10. [Terminal 10 is (-), Terminal 11 is (+).]

This positioner is available for use with the standard direct voltage signals: 0 to 5 VDC and 0 to 10 VDC. The positioner board is factory calibrated for one of these two signal ranges and field changes are not advised.

Paragraph 6.4.1 gives the nominal resistance load which the positioner presents to the control circuit for the two signal ranges.

4.0 CALIBRATION & ADJUSTMENT

4.1 Initial Set-Up & Adjustment (Applies To All Models):

When properly adjusted, the actuator will stop at the full open and full closed points as a result of having reached one of the limits of the input signal span, and the actuator's limit switches will be used in a back-up mode to stop the actuator, should an out-of-range input signal occur.

In case of Series 75, 240 VAC Actuator with AF-17 240 VAC positioner, the two limit switches do not limit actuator travel. Exercise caution not to override limit switches. (Reference paragraph 3.4.4).

Actuators with factory mounted positioners will be shipped with their limit switches properly adjusted. When the positioner, whether internally or externally mounted, is installed to an actuator in the field, the actuator limit switches should be initially adjusted to trip at 1 to 3 degrees AFTER the positioner would normally have shut the actuator off upon reaching the upper or lower input signal limit (Reference parts 4.2, 4.3 and paragraph 4.7.1. CAUTION: If either the valve or the actuator have mechanical end of travel stops, the limit switches should be set to trip JUST before a mechanical stop is reached even if this point is coincident with one of the limits of the input signal.

NOTE: Prior to starting potentiometer adjustment procedure set the AF-17 adjustment Pots as follows: "Range" and "Zero" pots full clockwise, "AH" full clockwise then 1/4 turn counter-clockwise.

4.2 "Zero" Adjustment ["Zero" Pot Initially Full Clockwise (CW)]:

Apply a "full closed" signal to the positioners input (i.e., 4 mA). The actuator should rotate in the CW direction and come to a stop at or near the CW limit of rotation. Adjust the "Zero" adjustment until the actuator stops in the fully closed position AND the indicator LD2 is "OFF". If LD2 is "ON", this indicates that the "Closed" (SW-1) limit switch has tripped. The "Closed" limit switch should be adjusted such that it will trip 1 to 3° beyond the full closed position of the actuator. Readjust the "Closed" limit switch if necessary.

4.3 "Range" Adjustment ["Range" Pot Initially Full Clockwise (CW)]:

Apply a "full open" signal to the positioner's input (i.e., 20 mA). The actuator should rotate in the CCW direction and come to a stop at or near the CCW limit of rotation. Adjust the "Range" adjustment until the actuator stops in the fully open position AND the indicator LD1 is "OFF". If LD1 is "ON", this indicates that the "Open" (SW-2) limit switch has tripped. The "Open" limit switch should be adjusted such that it will trip 1° to 3° beyond the full "Open" position of the actuator. Readjust the "Open" limit switch if necessary. When 4.2 & 4.3 are complete, ensure that limit switches are set 1° to 3° beyond the electronic travel limits. (Reference CAUTION in 4.1).

4.4 "AH" Adjustment (Anti-Hunt) ("AH" Pot - turn fully clockwise (CW), then 1/4 turn CCW):

This adjustment can be made only after installation is complete and actuator is operational. Apply sufficient input signal to turn the actuator shaft an amount that would open the valve approximately 10%. If the actuator hunts, adjust the "AH" control in a CCW direction until the hunting stops. If no hunting occurs, adjust the control towards the CW direction. Increase the input signal in steps of approximately 10% and reset the "AH" adjustment until no hunting occurs over the entire input signal range.

4.5 Adjustment Recheck:

There is some interaction between adjustments of the "Zero" and "Range" controls, therefore if an adjustment is made at one end of travel, the opposite end should be rechecked.

Although the "Range" and "Zero" settings are relatively unaffected by fairly large temperature changes, it is suggested that positioners be checked during a user's routine maintenance schedule.

4.6 Once the AF-17's circuit board zero and span potentiometers are set for the min. and max. process signal values, typically a 4-20 mA signal, do the following checks:

4.6.1 Reduce process input signal below the minimum value so that actuator stops on its closed limit switch and closed LD2 is on. Increasing the input signal in small increments should allow the actuator to move in angular increments proportional to these small incremental increases in the incoming signal.

4.6.2 Continually adjust the signal until the maximum signal value is reached and actuator is in fully open position. With a signal over 20 mA, when the positioner is calibrated for 4 to 20 mA, the actuator will operate until the proper cam has actuated the open limit switch. Note that the open LD1 will be "on" when actuator stops at limit switch.

In similar fashion, decrease the process signal in small values. The actuator should move closed in small steps until the fully closed position is reached at the minimum signal value, typically 4 mA for a 4-20 mA calibration.

4.6.3 Attach label to board.

4.7 If problems occur while trying to obtain the desired positioner action, check the following:

4.7.1 Cam Adjustment:

The actuator cams should actuate the limit switches 1° to 3° after the actuator stops at either the fully open or fully closed position.

If the actuator is closed at 0 degrees, the limit switch must actuate by the time the actuator is at the minus 1 to 3 degree position. Similarly, at the open or 90 degree position, the limit switch must actuate by the time the actuator is at the 91 to 93 degree position.

NOTE: See CAUTION in part 4.1.

4.7.2 Feedback Pot Calibration:

Check the feedback potentiometer calibration per paragraph 3.2.4 of the manual. At either the full open or the full closed position, stopping at either limit switch, the potentiometer must still be within its electrical travel. To verify this, check the resistance at either the full open or full closed position. The resistance measured between terminals 2 and 3 or 2 and 1 on the AF-17 terminal block, with the power off, must be between 80 ohms and 90 ohms.

Readjust the feedback potentiometer as necessary and check as in the previous steps for proper incremental movement of the valve actuator from limit switch to limit switch; full closed to full open; -1° to -3°, +91° to +93°.

4.7.3 For a reverse acting actuator, read part 5.4 in the manual. Simply follow the instructions of part 5.4 and readjust the circuit board "zero" and "range" pots as needed.

4.7.4 Once the actuator and positioner are installed in the system, further adjustments may be necessary to trim the AF-17 circuit board/actuator action to the process controller's action in the process loop. The AH potentiometer on the circuit board may require adjustment counterclockwise to stop the AF-17 circuitry from reacting to spurious electrical noise signals.

4.7.5 Check Fuse F1:

For AC boards, check fuse F1 to see if it is blown. If it is, replace with spare fuse F2 attached to P.C. Board and order another fuse for spare (Newark part number 94F2146). **IMPORTANT:** To check fuse - remove it from circuit and test with ohmmeter. Resistance should be about 6 ohms.

NOTE: If fuse F1 is blown, excessive voltage (possibly 120 VAC) was applied to the signal input circuit. If so, correct this condition before changing fuse. See paragraph A of Part 1.1.

For DC boards, check fuse F1 to see if it is blown. If it is, replace it with a 1 1/4", 250 volt, 3 amp fuse, available through any electrical supplier. See Part 2.2 In DCAF17 IOM supplement.

4.7.6 Check basic actuator for proper operation using the proper AC voltage:

A. Remove red and black leads coming from circuit board at terminals 3 & 4 (if already installed). Tape stripped ends of these wires.

B. Alternately energize, with the appropriate AC voltage, terminals 1 & 3 and 1 & 4. The actuator should move clockwise when energizing terminals 1 & 4, stopping only at the clockwise limit switch. The actuator should move counterclockwise when energizing terminals 1 & 3, stopping only at the counterclockwise limit switch.

NOTE: For AF-17 240 VAC Positioner only, limit switches do not directly control motor. Therefore, the actuator will not stop when the limit switches trip. Use care not to drive the actuator past its normal limits. Run the actuator to its limits in each direction, to assure proper operation of the actuator.

4.7.7 If the circuit board's light emitting diodes (L.E.D.'s) blink or seem to continuously glow, electrical noise is interfering with the positioner's input process signal. (Always use shielded cable for the process signal coming to the AF-17 board. Ground the shield at only one end.) Adjust AF-17 positioner as necessary. See Section 4.0.

4.7.8 If problems still occur after taking these remedial steps, replace circuit board in the actuator.

5.0 OPERATIONAL VARIABLES

5.1 Sensitivity:

The Worcester AF-17 Electronic Positioner has been designed to a standard sensitivity equivalent to approximately 240 positions for a 15 second 90 degree shaft movement.

5.2 Reduced Travel Operation:

A small amount of travel reduction can be achieved (4-6 degrees). This can be accomplished by applying maximum and minimum input signals and adjusting the "Range" and "Zero" controls to determine the new rotation end limits. (Limit switch cams should also be reset. See parts 4.1 and 4.4)

5.3 Split Range:

With AF-17 Positioner circuit board revisions (Revision R10 and later) split range adjustment capability is available with standard board and may be obtained using the standard calibration procedures.

5.4 Reverse Action:

The usual mode of operation of an actuator is to use an increasing signal for the open direction of travel and a decreasing signal for the close direction of travel. For use in certain types of applications, it may be desirable to operate using a decreasing signal for the open direction and an increasing signal for the close direction. For some valves this can be done by cross-line mounting the actuator (mounting the actuator to the valve such that it is rotated 90° from the normal mounting position. This has the effect of rotating the valve ball 90° with the actuator at its 4 mA position. As the signal is increased toward 20 mA the valve ball will travel toward its closed position but in a counter-clockwise direction. Therefore, this method will work only with valves with round seats, not with characterized seats). No positioner wiring changes would be required using this method. If cross-line mounting is not feasible, the reversal can be accomplished at the positioner as follows:

5.4.1 Input Reversing - (AF-17-1, AF-17-4, AF-17-10) (mA Input); 120 VAC:

Reverse the black and red wires from the positioner board, the red goes to terminal 4 and the black to terminal 3. Change the feedback pot wires on the board at TB-1 terminals 1 and 3, the purple wire goes to terminal 3 and the green wire to terminal 1. The positioner will now operate in reverse of the usual manner and the controls "Range" and "Zero" will also be reversed. The "Range" control should now be used to adjust the closed end of travel and the "Zero" control used to adjust the open end of travel. Always adjust the "Zero" control first!

NOTE: If the 4-20 mA signal output (if installed) is to be reversed also, then the wires at TB-2 terminals 1 and 3 must also be reversed. The AF-17 board must be recalibrated after switching the wires at TB-2 and/or TB-1.

5.4.2 Input Reversing - (AF-17-1K, AF-17-13) (Resistance Input); 120 VAC:

Make the same changes as in 5.4.1. If the input is from a manual control station and it is desired that the direction for "Closed" and "Open" also be reversed at the "Command" potentiometer, change additionally the wires from the circuit board to terminals #10 and #12. Connect the orange wire to terminal #10 and the yellow wire to terminal #12. The operation of adjustments "Range" and "Zero" will be reversed, as in paragraph 5.4.1. Recalibrate the AF-17 board.

5.4.3 Input Reversing - (AF-17-5V, AF-17-XV) (Direct Voltage Input); 120 VAC:

Follow same procedure as paragraph 5.4.1.

5.4.4 Input Reversing, 240 VAC Only:

In addition to performing the steps in paragraphs 5.4.1, 5.4.2, or 5.4.3, it is also necessary to swap the two black wires from limit switch no. 1 to limit switch no. 2 and the two red wires from limit switch no. 2 to limit switch no. 1.

6.0 TECHNICAL DATA

6.1 AC Input Voltage:

All voltages ± 10%

Power Consumption (Circuit Board Only) 2.5 Watts

6.2 Input Circuit Specifications:

Maximum Noise Level at Maximum Positions

Approx. 7mV

Resistance Input

AF-17-1K
AF-17-13

Nom. 1000 Ohms
Nom. 135 Ohms

Current Input

AF-17-1
AF-17-4
AF-17-10

1 to 5 Milliampers
4 to 20 Milliampers
10 to 50 Milliampers

Voltage Input

AF-17-5V
AF-17-XV

0 to 5 VDC
0 to 10 VDC

6.3 Output Circuits Specifications:

All Models

Maximum Surge Current
Maximum Normal Starting or In-Rush Current
Maximum Stall Current
Maximum Running Current - Resistive Load
90% Duty Cycle
Maximum Running Current - Inductive Load
90% Duty Cycle
Maximum Peak Voltage on Load Circuit
All 120 VAC and 240 VAC

100 Amps for 1 Cycle
10 Amps for 1 Second
8 Amps for 1 Minute
5 Amps
3 Amps
800 VAC

4-20 mA output will drive 20 mA into a 600 ohm maximum load.

6.4 Input Circuit Characteristics:

6.4.1 Input Circuit Load Resistances:

1 to 5 Milliampere Models
4 to 20 Milliampere Models
10 to 50 Milliampere Models
0 to 5 VDC Models
0 to 10 VDC Models

Approx. 1000 Ohms
Approx. 220 Ohms
Approx. 100 Ohms
Approx. 800 Ohms
Approx. 1100 Ohms

6.4.2 Nominal Useable Input Signal Deadband:

1000 Ohm Input	5.5 Ohms
135 Ohm Input	.75 Ohms
1 to 5 Milliampere Input	20 Microamperes
4 to 20 Milliampere Input	80 Microamperes
10 to 50 Milliampere Input	200 Microamperes
0 to 5 VDC Input	25 Millivolts
0 to 10 VDC Input	50 Millivolts

NOTE: Above "Useable" deadband figures are "NORMS" determined by multiple tests of various actuator/valve combinations. All actuators used a permanent split phase motor, with an output shaft speed of 1 RPM (15-second cycle time). Electronic braking was employed on all tests. Results may differ in applications where different shaft speeds are used.

6.5 Controls - All Models:

- Zero - Adjustment for Low End of Control Signal +60% Span
- Range - Adjustment for High End of Control Signal -60% Span
- AH - Adjustment for Hysteresis (Anti-Hunt) 0.3% to 4.0% of full scale
- 4 mA - Adjust 4 mA Output
- 20 mA - Adjust 20 mA Output

7.0 APPLICATION NOTES

7.1 DC Motor Actuator:

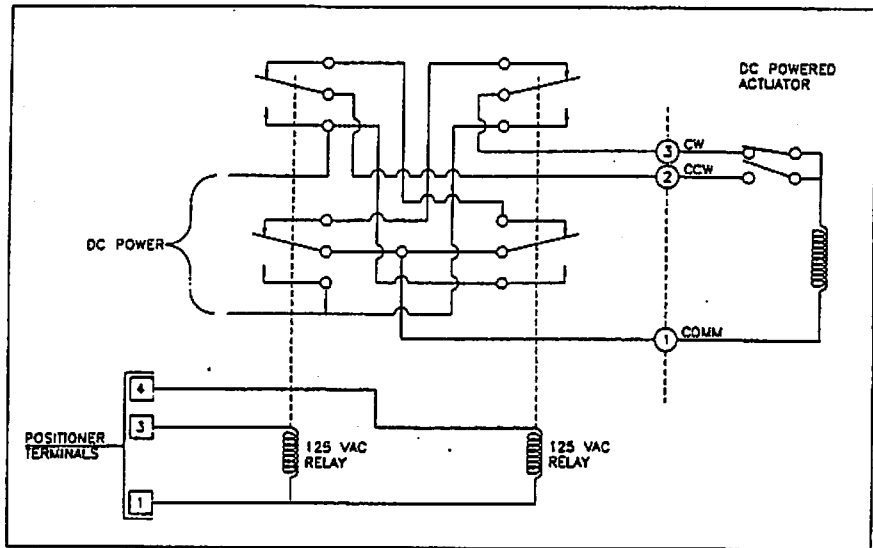


Figure 9 - Typical wiring to operate DC motor actuators from Worcester AF-17 120 VAC electronic positioner. Terminal numbers in schematic are for Worcester 75 actuators, but wiring arrangement is applicable to other makes. Relay contact ratings should be based on switching a highly inductive load at the actuator's maximum current rating (stalled current).

Motor is automatically braked when either relay goes from the "on" to the "off" position.

NOTE: The electronic brake on the positioner board should be made inoperative for this application (clip out U3 from circuit board - See Figure 1 for location).

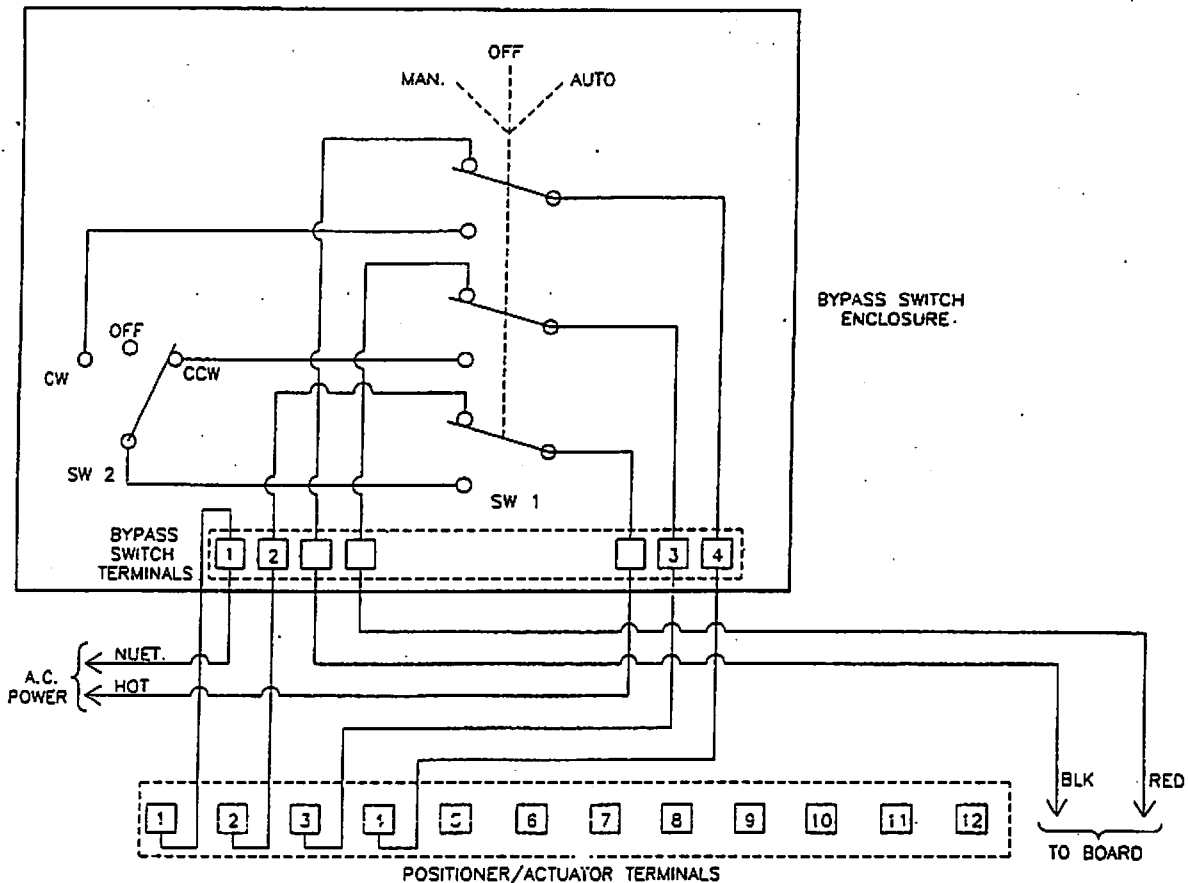
7.2 Bypass Switch for Manual Control (For 120 VAC Only):

This application is offered as a non-standard option through Worcester Controls' Custom Products Department or may be altered by end user. Figure 10 on the next page shows a schematic diagram of two switches for controlling the following functions:

One triple pole, double throw (TPDT) switch with center-off, switching from automatic to manual operation.

One single pole, double throw (SPDT) switch with center-off position for manually controlling clockwise (CW), counter-clockwise (CCW) directions of actuator.

Figure 10



8.0 TROUBLE-SHOOTING

8.1 General:

The following charts are a trouble-shooting guide for servicing the positioner, should a malfunction occur. If the problem cannot be solved, the unit should be returned to the factory for service.

The first thing to be checked, before proceeding to the trouble-shooting guide, is to determine if the malfunction is in the positioner, or in the actuator. To do this, remove the red and black positioner leads from terminals 3 and 4 of the actuator, and the AC line connections from terminals 1 and 2. Tape these leads. Using a test cable, apply power to actuator terminals 1 and 3. The actuator should rotate CCW until stopped by the CCW limit switch. Then apply power to terminals 1 and 4 to check CW actuation and the CW limit switch.

For AF-17-240 VAC positioner only, switches do not directly limit travel. Exercise caution not to override limit switches. Operate the unit to its limits in each direction, to assure that the basic actuator is functional.

If the actuator does not operate, check wiring from the terminal strip, through the limit switches to the motor and capacitor. For 240 VAC actuator with AF-17 positioner, check wiring from the terminal strip to the capacitor and to the motor. Check switch continuity. Check for an open motor winding, and check for a shorted capacitor. If the problem in the actuator still cannot be determined, return the unit for service. If the actuator functions properly, then proceed to the trouble-shooting guide.

To facilitate trouble-shooting a positioner, it would be advantageous on resistive input units to connect a potentiometer directly to the signal input terminals in place of the standard process input. Use a 150 Ohm or 1000 Ohm potentiometer depending on which model is used. Figure 11 on next page shows a schematic of a simple test unit that can be connected to the input terminals to stimulate the process signal for a milliampere rating.

8.2 Symptom Table:

	SYMPTOM	GUIDELINES TO FOLLOW
8.2.1	Actuator will not operate in either direction [no sound from motor(s)].	8.3.1, 8.3.2, 8.3.3, 8.3.4, 8.3.5, 8.3.6, 8.3.7, 8.3.10
8.2.2	Actuator will not operate in either direction [humming or buzzing sound from motor(s)].	8.3.2, 8.3.3, 8.3.4, 8.3.5, 8.3.6, 8.3.9, 8.3.10, 8.3.11, 8.3.12
8.2.3	Actuator slowly moves in one direction on its own.	8.3.4
8.2.4	Actuator runs normally for 7° to 8° while coming off limit switch, then slows down or stops [motor(s) hum or buzz].	8.3.4, 8.3.15
8.2.5	Actuator oscillates intermittently or upon reaching a new position.	8.3.2, 8.3.8, 8.3.13
8.2.6	Actuator runs slowly in one or both directions, but otherwise operates normally.	8.3.2, 8.3.4, 8.3.9, 8.3.10, 8.3.11, 8.3.12
8.2.7	Actuator works intermittently.	8.3.2, 8.3.10, 8.3.12
8.2.8	Actuator runs normally in one direction but will not operate in the other direction [no hum or buzz from motor(s)].	8.3.2, 8.3.4, 8.3.7
8.2.9	Actuator will not move valve after a stop when signaled to travel in same direction as previous command.	8.3.14

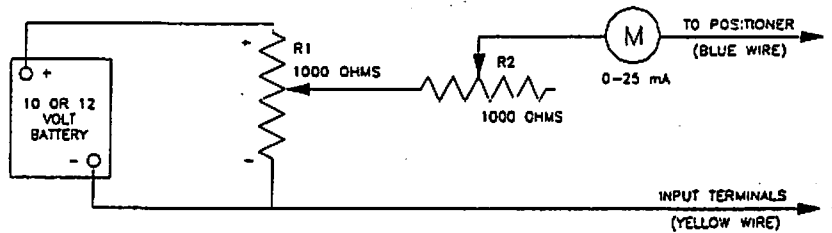


Figure 11

Test Unit for Milliampere Input Positioner - Set R1 all the way toward the plus end. Adjust R2 for a 20 mA reading. Varying R1 will now provide input signals between 4 and 20 milliamperes.

8.3 Use the following trouble-shooting guidelines to isolate problems/bad components:

Prior to beginning any procedure, read all of Check, Action, and Notes and Cautions sections.

	CHECK	ACTION	NOTES AND CAUTIONS
8.3.1	Check for proper AC/DC power to actuator and circuit board. See Figures 5 or 6 for AC or Figure 3 in DCAF17 IOM supplement for DC.	Correct as necessary.	
8.3.2	With power off, check for broken wires and/or loose connections.	Repair broken wires and tighten loose connections.	
8.3.3	With power off, check to see if fuse F1 is blown.	Remove F1 from socket pins or fuse clips. For AC boards only, check for continuity through fuse with an ohm meter. If F1 is bad, replace it. AC boards have a spare fuse (F2) located on board.	Before restoring power, try to determine what caused F1 to blow and correct problem. See part 3.6 and para. 4.7.5 Notes and Paragraph A of Part 1.1 for AC boards. See part 2.2 in DCAF17 IOM supplement for DC boards.
8.3.4	Check operation of basic actuator per Part 8.1.	See Part 8.1.	This check will isolate the problem to either the actuator or the circuit board.
8.3.5	Check for proper range of input signal.	Use ammeter, voltmeter or ohm meter to verify input signal range.	See models listed at beginning of IOM for ranges. 4-20 mA is standard.
8.3.6	With power off, check calibration of feedback potentiometer per Paragraph 3.2.4.	A quick check to see if this is the problem is to declutch the actuator shaft and reposition the shaft to about 45° (if valve torque permits). If the actuator now runs normally in each direction (after clutch re-engages), recalibrate the feedback potentiometer.	When trying to move the valve manually with the clutch disengaged, be certain that the wrench fits properly on the flats of the actuator shaft. Improper fit can cause shaft damage with consequent damage to cover bearing surface. Stay within the preset quadrant of operation. See Paragraph C of Part 1.1.
8.3.7	Check to see that varying input signal from 4-20 mA causes the light emitting diodes (LEDs) to turn on and off individually.	If LEDs do not turn on and off, replace board.	The turning on and off of the LEDs is indicative that the input side of the circuit board is OK.
8.3.8	Check the operation of the positioner with a portable, battery operated signal source.	If intermittent or jittery operation stops, it is indicative of a noisy, on-line signal input. To avoid damaging the actuator, it is necessary to "clean up" the signal. Also, follow the shielding guidelines of Paragraphs 1.2 and 1.2.4.	Turning the A-H control CCW may help to alleviate the problem.
8.3.9	Check the motor run capacitor for a short, excessively high leakage and low capacitance. Use a capacitance meter to check. (AC boards only)	Replace as necessary.	Disconnect all leads from capacitor terminals (power off) prior to testing. Do not exceed rated voltage of capacitor. Make certain that capacitor is discharged before reconnecting.

	CHECK	ACTION	NOTES AND CAUTIONS
8.3.10	Check temperature of motor(s). Each AC motor has a thermal cutout switch built in that opens at about 210°F (winding temperature). If the thermal cutout in one motor has opened, the other motor by itself may not be strong enough to move the valve (20-2375 sizes).	Allow the motor(s) to cool so that the thermal switches can reset. Normally the thermal switches will not open unless the motor's rated duty cycle is exceeded and/or the ambient temperature is very high. Correct the problem.	Duty cycle is specified at an ambient temperature of 70°F, 60 HZ.
8.3.11	Check the operating torque of the valve. If necessary, remove the actuator from the valve. Measure valve torque with an accurate torque wrench. Check torque under actual operating conditions if possible.	If operating torque of valve exceeds the specified torque for the seats used and the DP across the valve, determine cause and correct. If torque falls within normal range, it is possible that the actuator is undersized.	If the actuator is removed from a 3-piece valve that requires the body bolts to also be removed, the valve body bolts must be retorqued to spec. before checking valve torque. See Valve IOM.
8.3.12	Check ambient temperature.	Actuator duty cycles are specified at an ambient temperature of 70°F.	Higher ambient derates duty cycle.
8.3.13	Check to see that mechanical brake is operating correctly.	Replace defective mechanical brake. If one was never installed, order a kit and install it in actuator.	All 2" CPT valves with positioner boards in actuator must have mechanical brake installed to prevent oscillation.
8.3.14	Check to see if actuator can move a high torque valve from a stop under load when moving in the same direction as last command (mechanical brake does not allow motor(s) to unwind).	If motor(s) cannot start, go to next larger size actuator.	
8.3.15	Check to see which direction of travel causes problem. If actuator is coming off open limit switch (traveling CW) when it slows down or stops, then either Q1 or U1 is bad. If actuator is coming off closed limit switch (traveling CCW), then either Q2 or U2 is bad. (AC boards only)	Replace circuit board.	

9.0 SUGGESTED SPARE PARTS

It is suggested that where 10 or more units are in service, one or more complete circuit boards be stocked as spares for ease of maintenance and minimum downtime. All circuit boards are wired directly to screw type terminal strips (no solder connections) and can be easily changed on location.

Fuse F2 is a spare fuse attached to AC circuit boards but not wired in the circuit (see Figure 1). If fuse F2 is used to replace fuse F1, it is recommended that another be purchased and attached to circuit board as a spare.



Worcester Controls



BTR Flow Control

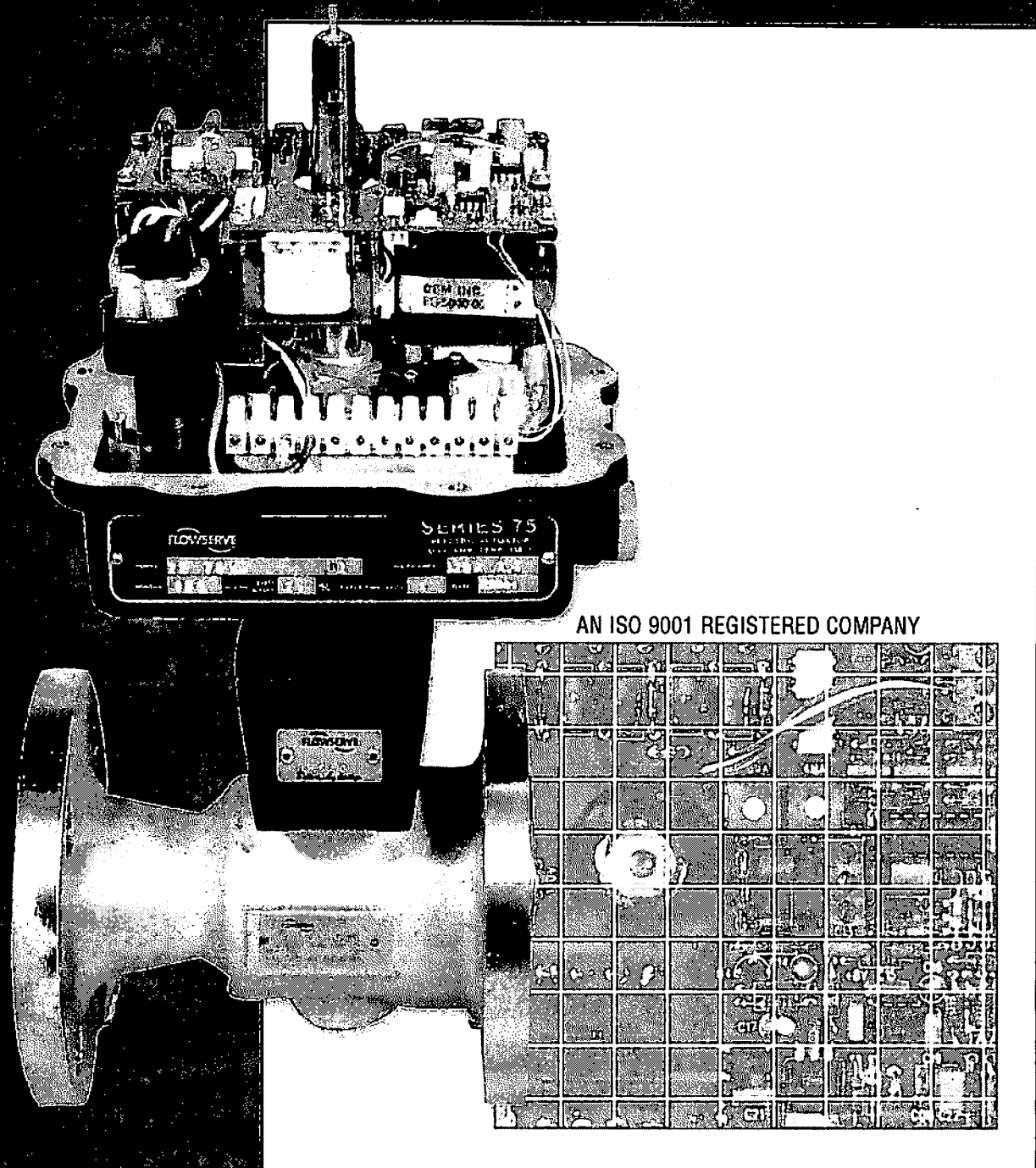
33 LOCKE DRIVE
 P.O. BOX 538
 MARLBOROUGH, MA 01752
 (508) 481-4800
 FAX (508) 481-4454

20 MID-DOMINION ACRES
 SCARBOROUGH, ONTARIO
 M1S 4A5 CANADA
 (416) 298-1671
 FAX (416) 298-8330

FLowsERVE

Worcester Actuation Systems

FCD WCABR1000-00
(Part AF-101)



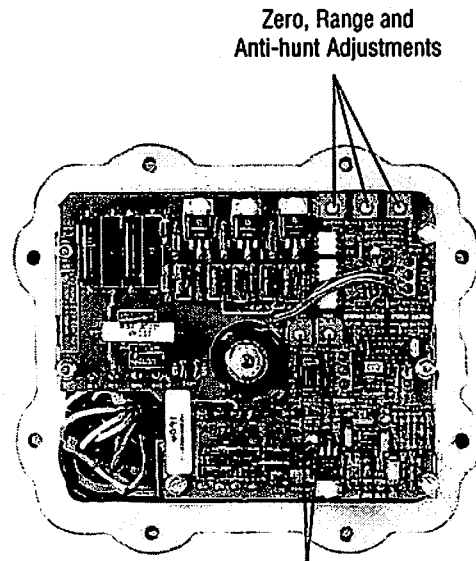
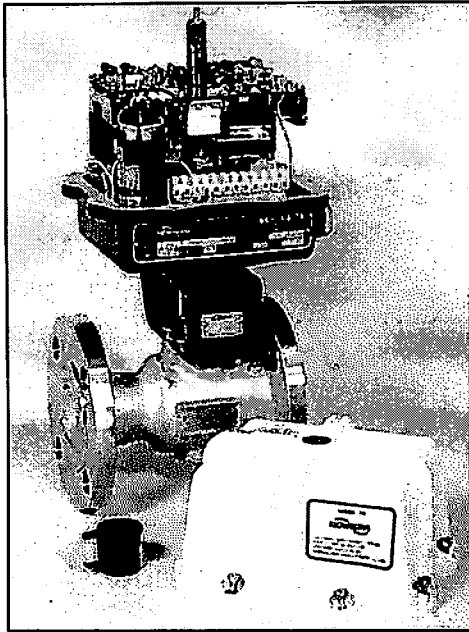
AN ISO 9001 REGISTERED COMPANY

Series AF17 Electronic Positioner

*100% solid-state electronic positioner,
precisely designed and manufactured to provide the most
reliable positioning of rotary electric actuators*

The Series AF17 Positioner

Powers and Precisely Positions Valves, Dampers and Similar Equipment



Zero, Range and Anti-hunt Adjustments

Zero and Range Adjustments for 4-20 mA Position Output

Features and Benefits

- **90° rotation standard** – AF17 Actuators are designed specifically for quarter-turn operation and are engineered to meet the needs of your application.
- **Other rotations available.**
- **Standard inputs** – 1-5, 4-20, 10-50 milliamps, 135 or 1000 ohm potentiometer, 0-5 & 0-10 volts DC. Other inputs available upon request.
- **Direct or reverse-acting** – nothing additional to buy.
- **Zero and span adjustment** – speeds calibration time, lowers maintenance labor costs.
- **All solid-state electronic circuitry** – reduces heat, saves energy, gives longer life and higher reliability.
- **Anti-hunting control built-in** – facilitates balancing of positioner to dynamic characteristics of the total system. Helps eliminate final control element oscillation.
- **Solid-state relays are standard** – provide longer life and higher reliability.
- **Dynamic electronic braking** – stops actuator movement with momentary electric pulse (reverse current brake). Allows quicker and more accurate operation.
- **Electromechanical brake optional** – provides continuous holding when needed, such as on dampers or butterfly valves.
- **LED calibration check** – indicator lights verify proper calibration “at-a-glance.” Makes calibrating simple and easy.
- **Standard split-range capability.**
- **Bypass for manual operation** – interrupts control signal, provides local manual position control. Consult factory.
- **Position feedback module (optional)** – 4–20 mA output.

Performance

Positioner Mounted in Typical Actuator Series 75, 15/23 Second Cycle Time

Independent Linearity (The maximum deviation of the actual characteristic from a straight line)	0.5% of span
Resolution (Smallest possible change in valve position)	0.5% of span (~80 microamps when moving in the same direction)
Deadband (The maximum range through which the input signal can be varied without initiating a change in output shaft position) Adjustable via anti-hunt control.	0.4% min. of span
Hysteresis (The maximum difference in output shaft position for a given input signal during full range traverse in each direction)	0.5% of span
Temperature Limits (Operating Temperature)	*-40°F to 150°F †
Duty Cycle	Specify 75% or 100%
Current Drain	5 watts plus actuator current drain
Characteristic (Input/Output Relationship)	Linear

* 32°F and less requires the use of a heater and thermostat.

† For conditions beyond these ratings, consult factory.

Specifications

AF17 Positioner with Series 75 Actuator

Voltages

120 V 50/60 Hz
240 V 50/60 Hz
12 VDC
24 VDC

Cycle Time

15 Sec/90° Rotation, 23 Sec/90° Rotation
(Other speed and rotation options available. Consult factory.)

Standard Inputs

1-5 mA DC	0-135 ohm potentiometer	0-5 VDC
4-20 mA DC	0-1000 ohm potentiometer	0-10 VDC
10-50 mA DC		

Load Resistance (for AF17)

100 ohms for 10-50 mA signal	800 ohms for 0-5 VDC
220 ohms for 4-20 mA signal	1100 ohms for 0-10 VDC
1000 ohms for 1-5 mA signal	

Output Ratings

Peak Voltage on load circuit, at 120 VAC - 800 VAC, and 240 VAC - 800 VAC.
Maximum Standard Current - 8 A/1 minute. Maximum run current with:
Resistive load - 5A, Inductive load - 3A.

Enclosure Options

TYPE 4 - Watertight*
TYPE 7 and TYPE 9 - Hazardous Locations*
TYPE 4, 4x, 7, AND 9 Inclusive*

*Includes Manual Override/Indicator Knob

Adjustments

Zero - 25% of span
Range - 25% of span
Anti-hunt Control .25 to 10% of signal

Potentiometer - 1000 ohms

A standard, installed potentiometer is for feedback to the positioner circuit board only. If remote valve position monitoring is required, order the optional Dual Potentiometer ("D" in the ordering code). With the dual potentiometer installed, one pot operates with the positioner circuitry, the other is used for external position monitoring. They are independently adjustable.

Options Available with AF17

Extra Limit Switches (2)
Heater/Thermostat
Mechanical Brake - for butterfly valve and damper applications
Direct or Reverse-Acting
Dual Potentiometer (for remote position monitoring)
Position Feedback 4-20 mA Output (requires dual potentiometer)

Theory of Operation

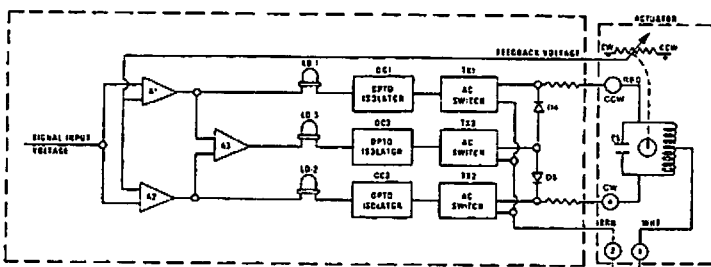
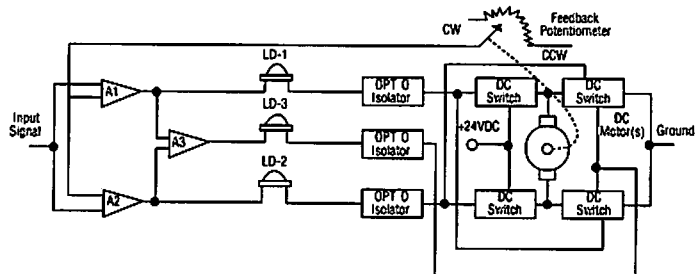
The AF17 Positioner is a unique circuit board specifically designed to provide accurate and reliable position control.

The operation of the AF17 is based on the comparison of two voltages—one derived from the input signal and the other from the feedback potentiometer driven by the actuator shaft.

- The signal input voltage is derived from an input signal conversion circuit (not shown) that changes the milliampere or resistance input signals to voltage.
- The signal is then compared with the voltage from the feedback potentiometer located beneath the circuit board.

- Both voltages—from the input signal and the feedback potentiometer—are fed to the two comparison amplifiers A1 and A2 (as shown in diagram below) which have been calibrated to provide the correct action. If the voltages are equal, both amplifiers will be in the "off" state, and the actuator motor will not be energized.
- If there is a difference between the two voltages, either amplifier will be "on." The actuator motor will then be energized, turning the actuator shaft and the feedback potentiometer until the potentiometer's output voltage is the same as the signal input voltage. This turns the amplifier "off" and de-energizes the actuator motor.

AF17 DC Positioner and Actuator Block Diagram



AF17 DC Positioner and Actuator Block Diagram

How to Order

Series AF17 Electric Positioners

Positioner Size	Product Series	Variations	Product Number	Range	Mode of Operation	Voltage
20 - 10-2375 Actuator 30 - 25-3075 Actuator	AF	Blank - Single Potentiometer ‡ D - Dual Potentiometer 4 - 4-20 mA Position Output	17	1 - 1-5 mA input 4 - 4-20 mA input 10 - 10-50 mA input 13 - 135 ohm input 1K - 1000 ohm input 5V - 0-5 VDC input XV - 0-10 VDC input	Blank - Direct-Acting R - Reverse-Acting	120A - 120 VAC 50/60 Hz 240A - 240 VAC 50/60 Hz† 12D - 12 VDC†† 24D - 24 VDC†† †† If using 240 VAC for AF17, actuator order code must have an "A" after the actuator size. (Example: 20A)

NOTE: Code above depicts Size 20 AF17, 4-20 mA input, direct acting 120V 60 Hz operation.
‡Dual Potentiometer must be ordered if independent feedback potentiometer is required.

Series 75 Electric Actuators

Actuator Size	Variations	Product Series	Duty Cycle*	Standard Options	Voltage
10 12 15 20 22 23 25 30	†A - AF17 240 VAC only H - Heater/Thermostat M - Mechanical Brake §R - AF17 12/24 VDC only † If 240 VAC board is ordered an "A" must appear after the actuator size.	75	5- 100% Duty Cycle. Available on sizes 10,12, 20 AC units only §4- 75% Duty Cycle. Available on all AC sizes; sizes 10, 12, 20, 22, 23 DC	Must use: W - TYPE 4 X - TYPE 7, 9 or Z - TYPE 4, 4x, 7, 9 **Additional Options: M1 - One extra auxiliary limit switch (SPDT) with cam M2 - Two extra auxiliary limit switches (SPDT) with cams	120A - 120 VAC 50/60 Hz 240A - 240 VAC 50/60 Hz 12D - 12 VDC†† 24D - 24 VDC††

NOTE: Code above depicts Size 20 Series 75 Actuator with Heater/Thermostat, for Hazardous Environment with One Auxiliary Limit Switch and 120 V 60 Hz.
*When using electric actuators for modulating applications, extended or continuous duty cycle motors must be selected.
§ "R" and "4" must be used in the Actuator Code when DC AF17 positioner is ordered.
†† 12-24 VDC not available in sizes 2575 and 3075 as standard.
**Order auxiliary limit switches for DC actuators with DC positioners through custom products. 15 size actuators are available as 120 VAC only.

Due to continuous development of our product range, we reserve the right to alter the dimensions and information contained in this leaflet as required.

Caution: Ball valves can retain pressurized media in the body cavity when closed. Use care when disassembling. Always open valve to relieve pressure prior to disassembly.

Flowserve Corporation has established industry leadership in the design and manufacture of its products. When properly selected, this Flowserve product is designed to perform its intended function safely during its useful life. However, the purchaser or user of Flowserve products should be aware that Flowserve products might be used in numerous applications under a wide variety of industrial service conditions. Although Flowserve can (and often does) provide general guidelines, it cannot provide specific data and warnings for all possible applications. The purchaser/user must therefore assume the ultimate responsibility for the proper sizing and selection, installation, operation, and maintenance of Flowserve products. The purchaser/user should read and understand the Installation Operation Maintenance (IOM) instructions included with the product, and train its employees and contractors in the safe use of Flowserve products in connection with the specific application.

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Worcester Actuation Systems
5114 Woodall Road, P.O. Box 11318
Lynchburg, VA 24506-1318 USA
Phone: 434 528 4400
Facsimile: 434 845 9736

(Part AF-101)

Tufline[®] High Performance Butterfly Valve Installation Instructions

Read carefully.

The following procedures and illustrations have been prepared to assist you in the installation and adjustment of your Tufline Valves. Please read these instructions carefully.

1989 125 psi rating and AWWA C-207-55 Class D (150 psi) flange specifications. Class 300/740 Δ P valves meet MSS SP-44-1996 Class 300 flange specifications. For flange requirements other than those mentioned above, consult the factory.

3. Mount actuator on the valve prior to installation in the pipeline to facilitate proper alignment of the disc in the valve seat.

4. Rotate valve disc to the closed position.

⚠ WARNING

READ AND UNDERSTAND INSTRUCTIONS BEFORE SERVICING VALVE. Failure to follow instructions could result in death or serious injury. If there is any question, contact the factory at 513-745-6000.

For valve sizes 5" through 24", the seat retainer ring is designed to accommodate the use of standard spiral wound metallic flange gaskets as specified by API-601-1988.

For valve sizes 2" through 4" and sizes 28" and larger, spiral wound metallic flange gaskets with special gasket inside and outside diameters are required.

⚠ WARNING

Make sure the open and closed positions of the actuator correspond to the counter-clockwise to open rotation of the valve. Death, serious injury, and severe property damage could result.

⚠ WARNING

PERSONAL PROTECTION. Be sure to follow personal protective procedures and safety practices for protection against hazardous media. Failure to do so could result in death or serious injury.

Alternatively, gaskets may be suitable sheet gasket material of 1/16" thickness or less, meeting the dimensional requirements of specification ANSI B16.21-1992.

5. Cycle the valve to the fully open position, then back to the fully closed position, checking the actuator travel stop settings for proper disc alignment. In the closed position, the disc is properly aligned when the flat face is parallel to the body face within .015 of an inch. If the valve is supplied with an internal over-travel stop, there will be clearance between the back of the disc and the stop.

⚠ WARNING

This valve should not be used in service conditions where materials of its construction are not suitable. Failure to heed this warning could result in death, serious injury, or property damage.

⚠ CAUTION

Do not use thick elastomeric gaskets, in-line leakage may occur.

For recommended flange gasket dimensions, see the "Tufline High Performance Butterfly Valve Flange Gasket Selection Guide."

⚠ CAUTION

Do not use the internal over-travel stop to position the disc or limit travel of the actuator. This may cause property damage to the processing system.

The Tufline High Performance Butterfly Valve in sizes 2" through 24" is designed to fit between standard ANSI pipe flanges, Classes 150, 300, and 600, meeting ANSI B16.5-1996 flange specifications.

Pre-Installation Steps

1. Remove the protective face covers from the valve.

2. Inspect the valve to be certain the waterway is free from dirt and foreign matter. Be certain the adjoining pipeline is free from any foreign material such as rust and pipe scale or welding slag that could damage the seat and disc sealing surfaces.

6. Check the valve identification tag for valve class, materials, and operating pressure to be sure they are correct for the application.

The Tufline High Performance Butterfly Valve in sizes 28" through 72" is designed to fit between standard MSS, ANSI, and AWWA pipe flanges. Class 150/150 Δ P and Class 150/285 Δ P valves meet MSS SP-44-1996 Class 150, ANSI B16.1-

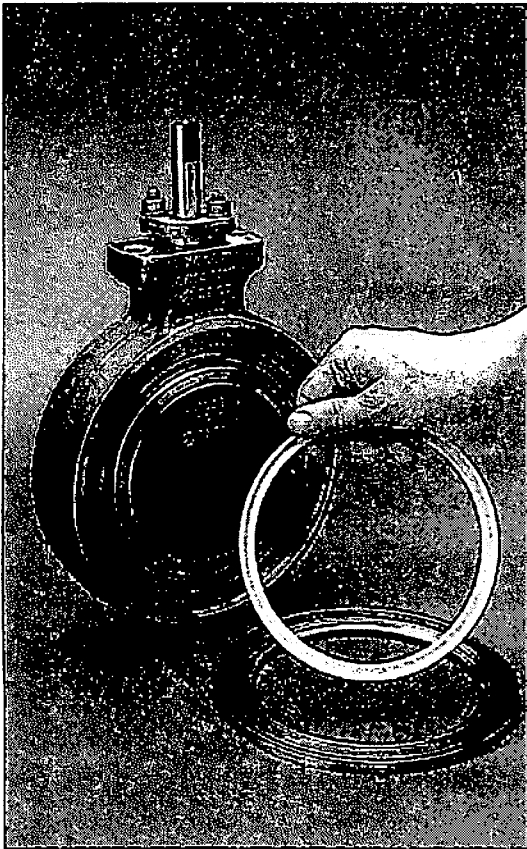
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▲WARNING

EXPLOSION! DO NOT INSTALL VALVE WHERE SERVICE CONDITIONS EXCEED THE VALVE RATINGS. Death or serious injury could result or the warranty could become invalid. If there are any questions, contact the factory.

7. Check the flange bolts or studs for proper size, threading, and length. For suggested flange bolt and stud sizes, see the "Tulline High Performance Butterfly Valve Flange Bolt Selection Guide."

8. The valve is now ready to be installed.



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Valve Installation

The Tulline High Performance Butterfly Valve can be installed in the pipeline with the shaft in the vertical, horizontal, or other intermediate diagonal position.

Based on applications experience, media with concentrations of solid or abrasive particles or media subject to solidification build-up, valve performance and service life will be enhanced by mounting the valve with the shaft in the horizontal position.

Except for valves marked for uni-directional service, Tulline Butterfly Valves are bi-directional and can be mounted in the pipeline in either flow direction.

▲CAUTION

The preferred flow direction for all seat styles and materials is with the seat retainer ring located upstream (shaft downstream) to provide maximum seat protection. See Figure 1.

Installing wafer style (flangeless) valves:

1. Loosely install the lower flange bolts to form a cradle between the flanges. See Figure 2.
2. Fully close the valve.

▲CAUTION

Make sure the valve is in the fully closed position when installing. Damage to the seat may occur and cause internal leakage.

3. Noting the flow direction arrow cast or stamped on the body, place the valve and flange gaskets between the flanges, making sure the seat faces the direction of flow. See Figure 1. Be sure the gasket covers the outside diameter of the seal retainer ring.

4. Install the remaining flange bolts, shifting the valve as necessary to permit the bolts to pass by the valve body.

5. Using the sequence shown in Figure 3, tighten the flange bolts evenly to assure uniform gasket compression.

▲CAUTION

VALVE DAMAGE. Center the valve between the flanges and gaskets. Failure to center the valve may result in the disc striking the flange, gasket, or pipe, and may damage the disc edge and shaft.

6. If an actuator is to be used, air hoses or electrical lines should be connected to the unit as specified by the actuator manufacturer.

7. The valve is now ready for operation.

Installing lug style (single flange) valves:

1. Fully close the valve.

CAUTION
 Make sure the valve is in the fully closed position when installing. Damage to the seat may occur and cause internal leakage.

2. Noting the flow direction arrow cast or stamped on the body, place the valve between the flanges, making sure the seat faces the direction of flow. See Figure 1.

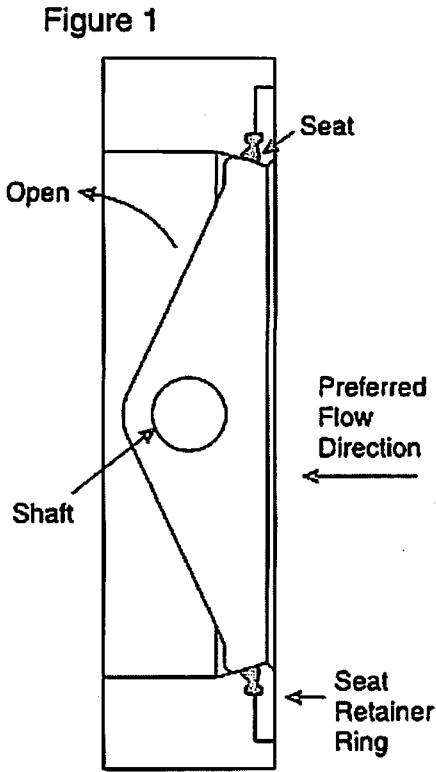


Figure 2

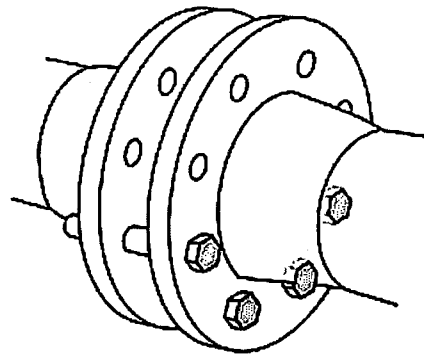
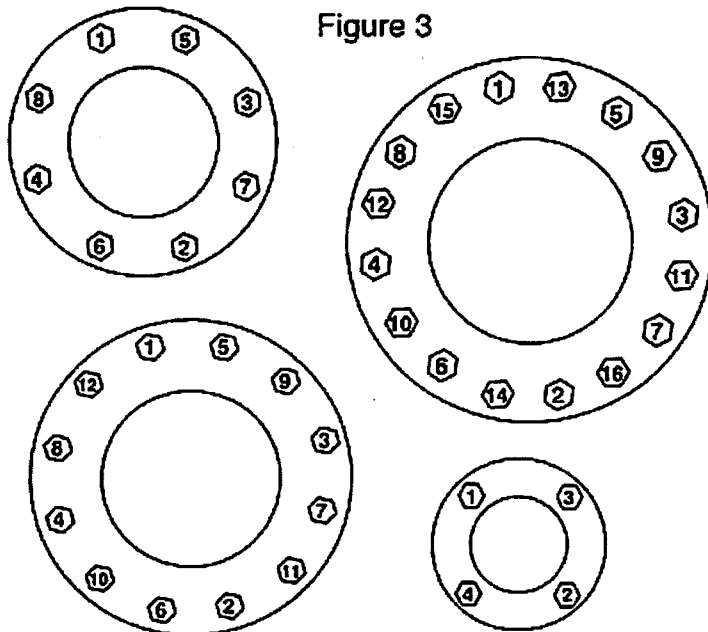


Figure 3



3. Install the lower flange bolts loosely, leaving space for flange gaskets.

4. After inserting the flange gaskets, install the remaining flange bolts.

5. Using the sequence shown in Figure 3, tighten the flange bolts evenly to assure uniform gasket compression.

CAUTION
VALVE DAMAGE. Center the valve between the flanges and gaskets. Failure to center the valve may result in the disc striking the flange, gasket, or pipe, and may damage the disc edge and shaft.

WARNING
MASSIVE LEAKAGE. All lug style valves designated 810, 811, 813, or 816 that are tagged for UNIDIRECTIONAL SERVICE **MUST** have the seat retainer ring mounted against the upstream flange for dead end service and in applications where the downstream piping may be removed. Improper mounting could result in death or serious injury.

WARNING
ACCIDENTAL VALVE OPERATION. All valves placed in dead end service where the downstream side is exposed to atmosphere must be utilized with locking devices on manual lever and gear actuators. Failure to provide locking devices could result in death or serious injury due to accidental valve operation.

6. If an actuator is to be used, air hoses or electrical lines should be connected to the unit as specified by the actuator manufacturer.

7. The valve is now ready for operation.

Product responsibility.

Xomox's concern for product performance extends to the product's period of service.

We feel it is important for users to also be aware of their responsibilities. Our products are manufactured and used in numerous applications with a wide variety of service conditions.

While general guidelines are often furnished, it obviously is not possible to provide complete and specific performance data for every conceivable service condition.

Therefore, the end user must assume final responsibility for proper evaluation, application and performance of all products. The contents of this document are presented for information purposes only. Every effort has been made to ensure accuracy.

This information is not intended to be construed as warranties or guarantees, expressed or implied, nor imply use applicability, for products or services described herein.

We reserve the right to modify or improve the designs and specifications of such products at any time without notice.

As the manufacturer, Xomox sells its products and services pursuant to its standard terms and conditions of sale, including its limited warranty, copies of which are available upon request.

Xomox limits its liability specifically to the replacement or repair of defective items, or to a refund for same. Xomox does not accept liability for any incidental or consequential damages.

Service Centers

U.S.A.

Southeast (Atlanta)

Phone ... 770-939-7760
Fax 770-939-7820

Central (Chicago)

Phone ... 708-598-5098
Fax 708-598-9270

Southwest (Baton Rouge)

Phone ... 225-644-2300
Fax 225-647-5893
24-hour service phone
..... 225-644-2300

Southwest (Houston)

Phone ... 713-668-6300
Fax 713-668-1809

West (Portland)

19437 S.W. 90th Court
Tualatin, Oregon 97062
Phone ... 503-692-3455
Fax 503-692-3805

CANADA

Markham, Ontario

Phone ... 905-201-4693
Fax 905-201-4632

Edmonton, Alberta

Phone ... 780-462-3100
Fax 780-463-7846

For sales and service locations throughout the world, visit our web site:
www.xomox.com

Xomox Corporation
World Headquarters
4444 Cooper Road
Cincinnati, Ohio 45242

Worldwide Resources

On our web site ...

www.xomox.com

... you will find the most current and comprehensive listing of Xomox Service Centers, Regional Offices, and Authorized Distributors.

- Using a color-coded application chart, select appropriate valves that meet your specific requirements.
- To help you quickly pinpoint the Xomox product you need, you can easily word-search the entire site.
- Review a corporate profile that highlights Xomox's worldwide capabilities.
- Application and corrosion data tables list more than 500 types of flow-media to help assure that valve materials are appropriate for your application.
- Evaluate in-depth descriptive, dimensional, and technical data for all Xomox products.

Phone Support

Phone support for Xomox valving products as well as locations of Service Centers, Regional Offices, and Authorized Distributors:

- Phone: 513-745-6000
- Fax: 513-745-6093
- 24-hour toll-free access line:
1-800-749-1735

XOMOX
Tufline Valves & Matryx Actuators

Installation, Operation and Maintenance Instructions for Models 2340, 2475, 2545, 7100, 15T & 3000 Two-Stage Reciprocating Air Compressors

IMPORTANT INFORMATION! READ AND FOLLOW THESE INSTRUCTIONS. RETAIN FOR REFERENCE.

SAFETY

DEFINITIONS

- △ **DANGER** WILL cause DEATH, SEVERE INJURY or substantial property damage.
- △ **WARNING** CAN cause DEATH, SEVERE INJURY or substantial property damage.
- △ **CAUTION** WILL or CAN cause MINOR INJURY or property damage.

GENERAL SAFETY PRECAUTIONS

- △ **DANGER** **INTAKE AIR.** Can contain carbon monoxide or other contaminants. Will cause serious injury or death. Ingersoll-Rand air compressors are not designed, intended or approved for breathing air. Compressed air should not be used for breathing air applications unless treated in accordance with all applicable codes and regulations.
- △ **WARNING** **HAZARDOUS VOLTAGE.** Can cause serious injury or death. Disconnect power and bleed pressure from the tank before servicing. Lockout/Tagout machine. Compressor must be connected to properly grounded circuit. See grounding instructions in manual. Do not operate compressor in wet conditions. Store indoors.
MOVING PARTS. Can cause serious injury. Do not operate with guards removed. Machine may start automatically. Disconnect power before servicing. Lockout/Tagout machine.
HOT SURFACES. Can cause serious injury. Do not touch. Allow to cool before servicing. Do not touch hot compressor or tubing.
HIGH PRESSURE AIR. Bypassing, modifying or removing safety/relief valves can cause serious injury or death. Do not bypass, modify or remove safety/relief valves. Do not direct air stream at body. Rusted tanks can cause explosion and severe injury or death. Drain tank daily or after each use. Drain valve located at bottom of tank.
- △ **CAUTION** **RISK OF BURSTING.** Use only suitable air handling parts acceptable for pressure of not less than the maximum allowable working pressure of the machine.

GENERAL INFORMATION

INTRODUCTION

This manual provides safe and reliable instructions for the installation, operation and maintenance of your Ingersoll-Rand air compressor. Carefully read this manual before attempting to operate or perform any maintenance. If you are uncertain about any of the instructions or procedures provided in this manual, contact Ingersoll-Rand. We recommend you retain this manual, and all publications provided with your air compressor, in a location which is accessible to all personnel who operate and service your compressed air equipment.

APPLICATION

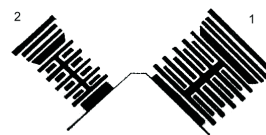
Ingersoll-Rand's standard two-stage lubricated air compressors are single-acting, air-cooled machines. Typical compressors are furnished as compact, self-contained, air receiver tank mounted units that are automatically regulated and driven by an electric motor or gasoline engine. An air-cooled aftercooler, low oil level shutdown switch and automatic drain valve are among the optional accessories that can be furnished. Bare compressor pumps and baseplate-mounted units are also available.

These compressors may be used for a variety of compressed air application up to 250 PSIG (17.5 kg/cm²). Application of these compressors as either a primary or supplementary source of air is virtually unlimited in industrial plants, service stations and auto repair shops. Supplementary service includes such uses as furnishing air at pressure not carried in regular shop lines, air at isolated locations, and standby service for air when larger compressors are shut down.

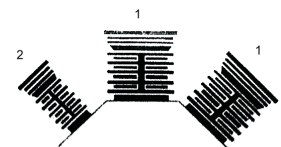
TWO-STAGE OPERATION

Two-stage compressors consist of one or two first-stage cylinders with the same bore size and one second-stage cylinder with a smaller bore size.

Typical Two-Stage, Two Cylinder Unit



Typical Two-Stage, Three Cylinder Unit



The basic principle of operation is as follows: On the suction stroke of the first-stage piston(s), air at atmospheric pressure enters the cylinders through the inlet filter(s) and then the inlet valves located in the head. On the compression stroke of the first-stage piston(s), the air is compressed to an intermediate pressure and discharged through the discharge valves(s) into common manifold(s). From the manifold(s) the air passes through the intercooler tubes, where the heat of first-stage compression is removed. On the suction stroke of the second-stage piston this cooled air enters the second-stage cylinder through the inlet valve. The compression stroke of the second-stage piston compresses the air to the final discharge pressure and forces it out through the discharge valve into the receiver tank or system. If cooling of the discharge air is required, an air-cooled aftercooler should be installed between the compressor discharge and the receiver tank or system.

For maintaining the receiver tank or system air pressure within predetermined limits, the compressor may be operated with automatic start & stop control or constant speed control regulation. The type of regulation used depends upon the application.

ADDITIONAL REFERENCES

Unless otherwise stated, dimensions, weights and measurements are provided in standard U.S. measure followed in parentheses by the metric conversion. Any torque values given are stated in inch or foot pounds followed by the Newton-meter equivalent in parentheses. Electrical characteristics are given in voltage-phase-hertz.

RECEIPT & INSPECTION

Ensure adequate lifting equipment is available for unloading and moving the unit to the installation site.

NOTE Lifting equipment must be properly rated for the weight of the unit.

△ CAUTION Lift the unit by the shipping skid only. Do not use the motor lifting eye to lift the entire unit. The motor lifting eye is for removing the motor from the unit only.

△ CAUTION! Do not work on or walk under the unit while it is suspended.

Before signing the delivery receipt, inspect for damage and missing parts. If damage or missing parts are apparent, make the appropriate notation on the delivery receipt, then sign the receipt. Immediately contact the carrier for an inspection.

All material must be held in the receiving location for the carrier's inspection.

Delivery receipts that have been signed without a notation of damage or missing parts are considered to be delivered "clear." Subsequent claims are then considered to be concealed damage claims. Settle damage claims directly with the transportation company.

If you discover damage after receiving the unit (concealed damage), the carrier must be notified within 15 days of receipt and an inspection must be requested by telephone with confirmation in writing. On concealed damage claims, the burden of establishing that the unit was damaged in transit reverts back to the claimant.

Read the unit nameplate to verify it is the model ordered, and read the motor nameplate to verify it is compatible with your electrical conditions. Make sure electrical enclosures and components are appropriate for the installation environment.

INSTALLATION

SELECTING A LOCATION

ELECTRIC MOTOR UNITS. For most electric motor units, select a relatively clean and dry well-lighted indoor area with plenty of space for proper ventilation, cooling air flow and accessibility. Provide 1,000 cubic feet of fresh air per 5 horsepower. Locate the unit at least 15 inches (38 cm) from walls, and make sure the main power supply is clearly identified and accessible.

Unless the electrical components of the unit are specially protected for outdoor use, do not install an electric motor unit outdoors or in an area that will expose the electrical components to rain, snow or sources of appreciable moisture.

WARNING FOR UNITS EQUIPPED WITH ELECTRIC DRAIN VALVE

△ WARNING The electric drain valve incorporates arcing or sparking parts, such as snap switches, receptacles and the like that tend to produce arcs or sparks and, therefore, when located in a garage, the compressor should be in a room or enclosure provided for the purpose, or the electric drain valve should be 18 inches (457 mm) or more above the floor.

GASOLINE ENGINE UNITS. For gasoline engine units, keep the engine at least 3 feet (1 m) away from building walls and other equipment. Install the unit in a location with plenty of space for proper ventilation, cooling air flow and accessibility. Do not install or operate a gasoline engine unit in a confined area.

AMBIENT TEMPERATURE CONSIDERATIONS. Ideal operating temperatures are between 32°F and 100°F (0°C and 37.8°C). If temperatures consistently drop below 32°F (0°C), install the compressor in a heated area. If this is not possible, you must protect safety/relief valves and drain valves from freezing. If temperatures are consistently below 40°F (4.4°C), consider installing an external crankcase heater kit, especially if the compressor has difficulty starting.

△ CAUTION Never operate the compressor in temperatures below -15°F (-26.1°C) or above 125°F (51.0°C).

HUMID AREAS. In frequently humid areas, moisture may form in the pump and produce sludge in the lubricant, causing running parts to wear out prematurely. Excessive moisture is especially likely to occur if the unit is located in an unheated area that is subject to large temperature changes.

Two signs of excessive humidity are external condensation on the pump when it cools down and a "milky" appearance in petroleum lubricant.

You may be able to prevent moisture from forming in the pump by increasing ventilation, operating for longer intervals or installing an external crankcase heater kit.

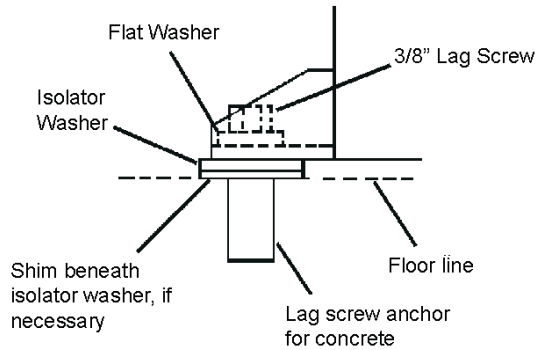
NOISE CONSIDERATIONS. Consult local officials for information regarding acceptable noise levels in your area. To reduce excessive noise, use vibration isolator pads or intake silencers, relocate the unit or construct total enclosures or baffle walls.

MOUNTING

△ **WARNING** Remove the unit from the skid before mounting.

ELECTRIC MOTOR UNITS. Bolt the unit to a firm, level foundation (such as a concrete floor). Do not bolt uneven feet tightly to the foundation, as this will cause excessive stress on the receiver tank. Use metal shims under the "short" feet if necessary.

Typical Permanent Mounting (Customer Supplied Hardware)



GASOLINE ENGINE UNITS. Bolt the unit to a firm, level foundation. Do not bolt uneven feet tightly to the foundation, as this will cause excessive stress on the receiver tank. Use metal shims under the "short" feet if necessary. Gasoline engine units mounted on truck beds must be fastened securely without applying excessive stress on the receiver tank. We recommend installing a vibration isolator kit with gasoline engine models.

INSTALLING REMOTE AIR INLET PIPING

△ **CAUTION** Do not operate the unit without air inlet filtration.

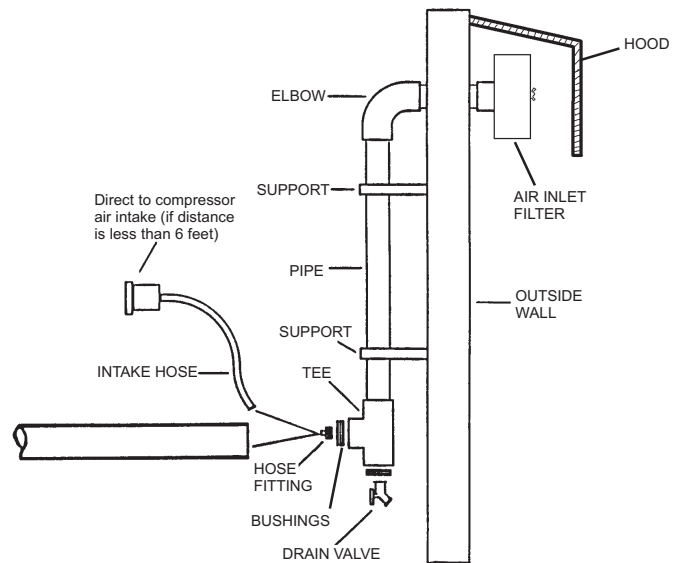
If the air around the unit is relatively free of dirt, install the air inlet filter at the inlet connection at the pump. If the air is dirty, pipe the filter to a source of clean air. Use PVC plastic tubes for remote inlet piping. Do not use black pipe or galvanized pipe, as these promote sweating and rust. Consider installing an in-line type filter for ease of cleaning and replacement. Make the line as short and direct as possible and as large, or larger, than the diameter of the inlet connection on the pump. Do not install piping with a diameter lower than that of the pump intake.

Increase the pipe diameter one size for every 10 feet (3 m) of length or every 90° bend. Make sure the piping is adequately braced.

If you pipe the filter outdoors, cover it with a hood to prevent the entrance of rain or snow.

Heavy duty filter elements and filtration equipment are available for fine airborne dust, such as cement and rock dust.

Typical Remote Air Inlet Piping.



INSTALLING DISCHARGE PIPING

△ **WARNING** Do not use plastic pipe, soldered copper fittings, rubber hose, or lead-tin soldered joints anywhere in the compressed air system.

△ **CAUTION!** If you will be using synthetic compressor lubricant, all downstream piping material and system components must be compatible. Refer to the following material compatibility list. If there are incompatible materials present in your system, or if there are materials not included in the list, contact Ingersoll-Rand for recommendations.

SYNTHETIC COMPRESSOR LUBRICANT MATERIAL COMPATIBILITY LIST

SUITABLE

Viton®, Teflon®, Epoxy (Glass Filled), Oil Resistant Alkyd, Fluorosilicone, Fluorocarbon, Polysulfide, 2-Component Urethane, Nylon, Delrin®, Celcon®, High Nitrile Rubber (Buna N. NBR more than 36% Acrylonitrile), Polyurethane, Polyethylene, Epichlorohydrin, Polyacrylate, Melamine, Polypropylene, Baked Phenolics, Epoxy, Modified Alkyls
(® indicates trademark of DuPont Corporation)

NOT RECOMMENDED

Neoprene, Natural Rubber, SBR Rubber, Acrylic Paint, Lacquer, Varnish, Polystyrene, PVC, ABS, Polycarbonate, Cellulose Acetate, Low Nitrile Rubber (Buna N. NBR less than 36% Acrylonitrile), EPDM, Ethylene Vinyl Acetate, Latex, EPR, Acrylics, Phenoxy, Polysulfones, Styrene Acrylonitrile (San), Butyl

NOTE All compressed air systems generate condensate which accumulates in any drain point (e.g. tanks, filters, drip legs, aftercoolers, dryers). This condensate contains lubricating oil and/or substances which may be regulated and must be disposed of in accordance with local, state, and federal laws and regulations.

GENERAL REQUIREMENTS. The piping, fittings, air receiver tank, etc. must be certified safe for at least the maximum working pressure of the unit. Use hard-welded or threaded steel or copper pipes and cast iron fittings that are certified safe for the unit's discharge pressure and temperature. **DO NOT USE PVC PLASTIC IN THE COMPRESSED AIR DISCHARGE LINE.** Use pipe thread sealant on all threads, and make up joints tightly to prevent air leaks.

CONDENSATE DISCHARGE PIPING. If installing a condensate discharge line, the piping must be at least one size larger than the connection, as short and direct as possible, secured tightly and routed to a suitable drain point or waste container. Condensate must be disposed of in accordance with local, state, and federal laws and regulations.

△ WARNING If an aftercooler, check valve, block valve, or any other restriction is added to the compressor discharge, install a properly-sized ASME approved safety/relief valve between the compressor discharge and the restriction.

INSTALLING ELECTRICAL WIRING (ELECTRIC MOTOR UNITS)

△ WARNING Electrical installation and service should be performed by a qualified electrician who is familiar with all applicable local, state and federal laws and regulations.

GENERAL. The motor rating, as shown on the motor nameplate, and the power supply must have compatible voltage, phase and hertz characteristics.

WIRE SIZE. The electrical wiring between the power supply and electric motor varies according to motor horsepower and other factors. Install adequately sized power leads to protect against excessive voltage drop during start-up. Refer to the National Electric Code (NEC) for information on selecting the proper wire size and securing electrical connections. If you connect additional electrical equipment to the same circuit, consider the total electrical load when selecting the proper wire size. **DO NOT USE UNDERSIZE WIRE.**

If wire size information is not available, the wire sizes shown in the following wire selection chart can be used as a safe guide, if the distance does not exceed 50 feet (15.3 m). For longer distances, consult an electrical contractor or the local electric company for recommendations.

MOTOR HP	SINGLE PHASE		THREE PHASE			
	115V	230V	200V	230V	460V	575V
1	12	14	14	14	14	14
1.5	10	14	14	14	14	14
2	8	14	14	14	14	14
3	8	12	14	14	14	14
5	4	8	10	12	14	14
7.5		6	8	10	14	14
10			8	8	12	14
15			4	6	10	10
20			3	4	8	10
25			1	2	6	8
30			0	1	6	8

MAGNETIC STARTER. If the motor installed on your unit has a motor reset button, it does not require a magnetic starter. If the motor does not have this button and the unit does not have a factory-installed starter, install a magnetic starter with thermal overload protection. Follow the manufacturer's instructions for installation. Ingersoll-Rand cannot accept responsibility for damages arising from failure to provide adequate motor protection.

FUSES. Refer to the NEC to determine the proper fuse or circuit breaker rating required. When selecting fuses, remember the momentary starting current of an electric motor is greater than its full load current. Time-delay or "slow-blow" fuses are recommended.

PRESSURE SWITCH. On units without a factory-installed pressure switch, wire a pressure switch in accordance with the appropriate wiring schematic in the DIAGRAMS section of this manual. Mount the pressure switch in accordance with the manufacturer's recommendations. The connecting line to the receiver tank must be as short and direct as possible, and certified safe for at least the maximum working pressure of the unit.

CONNECTING A BATTERY (GASOLINE ENGINE UNITS)

NOTE If you will be making connections to a remote battery, the engine on the compressor unit must be equipped with an alternator.

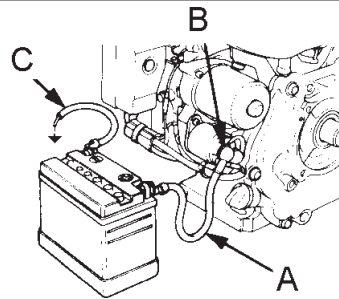
BATTERY. A 12 volt battery with a minimum current rating of 250 CCA (cold cranking amps) and minimum ampere-hour rating of 24 Ah should be sufficient for cranking most electric start engines.

BATTERY CABLES. Refer to the following table for size and length recommendations.

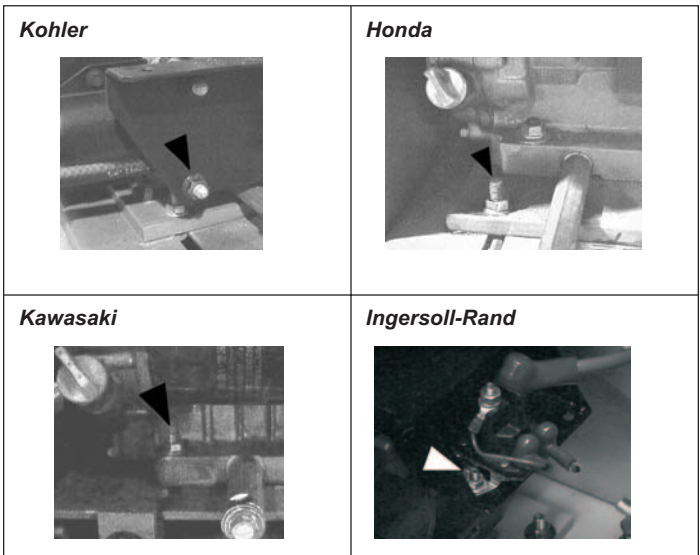
Cable Size (GA)	Maximum Length
6	5' (1.5 m.)
4	7'-2.5" (2.1 m.)
2	12' (3.6 m.)

CONNECTION PROCEDURES:

1. Connect the battery positive (+) cable (A) to the starter solenoid terminal (B).



2. Connect the battery negative (-) cable (C) to the bolt shown in the following illustration. Secure the wire in place by screwing a suitably-sized nut onto the bolt and down onto the terminal.



3. Connect the battery positive (+) cable (A) to the battery positive (+) terminal.
4. Connect the battery negative (-) cable to the battery negative (-) terminal.
5. Coat the terminals and cable ends with corrosion-preventive grease.

⚠ WARNING Remove the cable from the negative (-) side of the battery before servicing.

Refer to the engine manufacturer's instructions for more information.

FUEL PUMP INSTALLATION (GASOLINE ENGINE UNITS) _

Some engines use an optional fuel pump to supply gasoline to the engine directly from a vehicle's onboard fuel system. Install the fuel pump within 12 inches (30 cm) of the bottom surface of the vehicle's fuel tank. Protect the pump from contamination by installing a fuel isolation valve and an inline filter between the pump fuel system.

COMPRESSOR LUBRICATION _____

⚠ CAUTION Do not operate without lubricant or with inadequate lubricant. Ingersoll-Rand is not responsible for compressor failure caused by inadequate lubrication.

SYNTHETIC COMPRESSOR LUBRICANT. Ingersoll-Rand recommends All Season Select synthetic lubricant from start-up. See the WARRANTY section for extended warranty information.

ALTERNATE LUBRICANTS. You may use XL-300 or a comparable petroleum-based lubricant that is premium quality, does not contain detergents, contains only anti-rust, anti-oxidation, and anti-foam agents as additives, has a flashpoint of 440°F (227°C) or higher, and has an auto-ignition point of 650°F (343°C) or higher.

See the petroleum lubricant viscosity table below. The table is intended as a general guide only. Heavy duty operating conditions require heavier viscosities. Refer specific operating conditions to Ingersoll-Rand for recommendations.

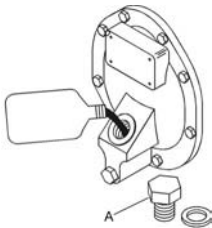
Temperature Around Compressor		Viscosity @ 100°F (37.8°C)		Viscosity Grade	
°F	°C	SUS	Centistokes	ISO	SAE
< 40	< 4.4	150	32	32	10
40-80	4.4-26.7	500	110	100	30
80-125	26.7-51.0	750	165	150	40

If you use a petroleum-based compressor lubricant at start-up and decide to convert to All Season Select later on, the pump must be decarbonized and flushed before conversion. Contact Ingersoll-Rand for more information.

FILLING PROCEDURES:

1. Unscrew and remove the oil fill plug.
2. Fill the crankcase with lubricant.
3. Replace the oil fill plug **HAND TIGHT ONLY**.

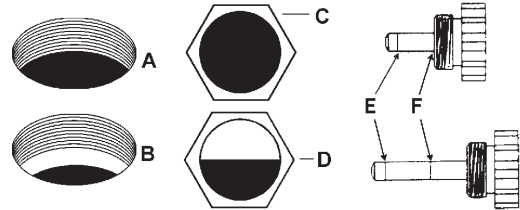
⚠ CAUTION Do not remove the oil fill plug while the compressor is running.



Refer to the following table for crankcase capacity.

Model	Crankcase Capacity
2340	28 oz. (827 ml.)
2475	41 oz. (1212 ml.)
2545	73 oz. (2158 ml.)
7100	80 oz. (2365 ml.)
15T, 3000	144 oz. (4258 ml.)

Use one of the following methods illustrated to determine when the crankcase is full.



A = FULL level at bottom thread of oil fill opening on units without sight glass or dipstick.

B = ADD level below bottom thread of oil fill opening on units without sight glass or dipstick.

C = FULL level on units with sight glass.

D = ADD level on units with sight glass.

E = ADD level on units with dipstick.

F = FULL level on units with dipstick.

LOW OIL LEVEL SWITCH _____

A float activated low oil level switch may be installed to protect your unit against damage due to insufficient compressor oil level. Low oil level in the compressor crankcase causes the switch contacts to open, thus shutting the unit down until the proper oil level has been restored.

Proper protection against low oil level depends on proper adjustment of the low oil level switch. During the initial run, stop the unit and drain one quart of oil from the compressor crankcase into a suitable clean container. Listen for the switch to click or check the switch with a continuity tester.

The float sometimes gets cocked or stuck during shipping. If the float is cocked or stuck, open the disconnect switch, drain the remaining oil, remove the crankcase cover and then free the float. Reassemble and then reuse the same oil.

NOTE If the float is cocked in the low position, the unit cannot start.

OPERATION

INTERMITTENT DUTY FORMULA

Units operating above 200 PSIG are to be operated according to the "Intermittent Duty Formula."

INTERMITTENT DUTY FORMULA

Pump-up time should not ordinarily exceed thirty (30) minutes or be less than ten (10) minutes. Shutdown periods between cycles of operation should be at least equal to the pump-up time. Note: When the compressor is regulated by constant speed control, the shutdown period is the time the compressor is operating unloaded.

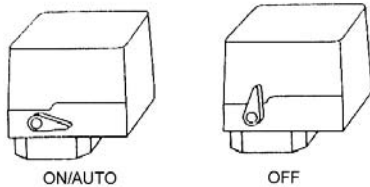
A pump-up time limit with the following cool-down period is recommended to protect the valves and heads against stabilized high operating temperatures, which could rapidly build up carbon in these areas.

All inquiries for high-pressure compressor application where the "use" cycle differs from the "Intermittent Duty Formula" should be referred to Ingersoll-Rand.

START-UP (ELECTRIC MOTOR DRIVEN MODELS)

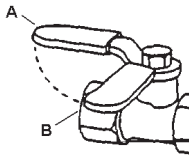
1. Close the service valve.
2. Release any remaining tank pressure by slowly opening the manual drain valve.
3. Close the manual drain valve and apply power to the compressor. If the pressure switch is equipped with an "ON/AUTO-OFF" lever, flip the switch to the "ON/AUTO" position. If the unit is equipped with a control panel "ON/OFF" switch, move the switch to the "ON" position.

Typical Pressure Switch Lever (If Equipped)



4. Slowly open the service valve.

Typical Service Valve (A = Open, B = Closed)



CAUTION Unusual noise or vibration indicates a problem. Do not continue to operate until you identify and correct the source of the problem.

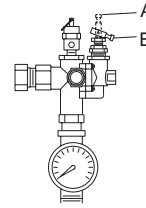
NOTE Ensure the direction of rotation is correct per the arrow on the motor. If the rotation is incorrect on three-phase units, interchange any two of the three leads.

START-UP (GASOLINE ENGINE UNITS)

WARNING Do not operate gasoline engine units in an enclosed area.

1. Release any remaining tank pressure by slowly opening the manual drain valve.
2. Turn on the engine gasoline supply.
3. Put the choke in the "on" position.
4. Close the service valve and put the unloader lever in the "unload" (A) position for Kawasaki and Honda engine driven models, or the "load" (B) position for Kohler engine driven models.
5. Start the engine, release the choke, and allow the engine to warm up for two to three minutes.
6. Return the unloader lever to the "load" (B) position on Kawasaki and Honda engine driven models.

Typical Unloader (A = Unload, B = Load)



NOTE Turn the gasoline supply off when the compressor is not being used.

NOTE Some gasoline engine driven compressors require 5-8 break-in hours of operation before reaching full capacity and speed.

COMPRESSOR CONTROLS

AUTOMATIC START & STOP CONTROL. This type of control applies to electric motor driven models under 10 horsepower.

NOTE Automatic Start & Stop Control is intended for use when the motor will start no more than 6 times per hour.

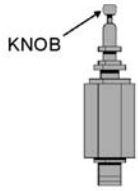
When the receiver tank pressure reaches the factory pre-set maximum pressure (usually 175 PSIG), the pressure switch stops the unit. When the receiver tank pressure drops below the factory pre-set minimum (usually 135 PSIG), the pressure switch resets and restarts the unit.



CONSTANT SPEED CONTROL. This type of control applies to gasoline engine units.

When the receiver tank pressure reaches the factory pre-set maximum pressure (usually 175 PSIG), the unloader slows down the engine and the unit stops pumping. When the receiver tank pressure drops to the factory pre-set minimum (usually 145 PSIG), the unloader resets, the engine returns to full speed, and the unit resumes pumping.

DUAL CONTROL. This type of control applies to electric motor units over 10 horsepower. Select either automatic start and stop control or constant speed control by adjusting the knob on the auxiliary valve. For automatic start and stop control, turn the knob on the auxiliary valve fully clockwise to disable the auxiliary valve. The pressure switch will then start and stop the unit.

NOTE For dual control models, automatic start and stop is preferred.

Auxiliary Valve.

-  CLOCKWISE
 COUNTERCLOCKWISE

Select constant speed control if the unit restarts in less than 10 minute intervals or runs more than 40 minutes per hour. Turn the knob fully counterclockwise to run the unit continually. When the receiver tank pressure reaches 170 PSIG, the unit runs but does not pump.

NOTE The auxiliary valve is factory pre-set at 5 PSIG lower than the factory pressure switch setting.

CAUTION Running unloaded for more than 20 minutes per hour or more than 15 minutes continually with the use of constant speed control will cause oil pumping and should be avoided.

PRESSURE SWITCH ADJUSTMENT

WARNING High voltage is present at the pressure switch contacts when the power supply is connected. Disconnect, lock and tag main power supply before making adjustments.

CAUTION Do not adjust the pressure switch to exceed the maximum discharge pressure of the unit.

NOTE Adjust the pressure switch only if adjustments are absolutely necessary.

CUT-IN & CUT-OUT. The cut-out (compressor shut-down) is the pressure at which the switch contacts open, and the cut-in (compressor restart) is the pressure at which the switch contacts close. See COMPRESSOR CONTROLS.

ADJUSTMENT CONTROLS. All pressure switches have a range adjustment control (A). Some pressure switches also have a differential adjustment (B) control. On switches without a differential adjustment control, the span between cut-in and cut-out pressure levels switches is factory set for 40 ± 4 PSIG and cannot be adjusted.

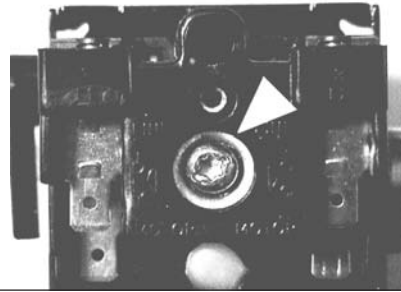
NOTE Some pressure switches are equipped with an on-off lever used to open and close the electrical contacts inside the switch. **THIS LEVER IS NOT A DIFFERENTIAL ADJUSTMENT CONTROL.** The pressure switches with the on-off lever do not have a differential adjustment control.

ADJUSTMENT PROCEDURES (SWITCHES WITHOUT DIFFERENTIAL ADJUSTMENT CONTROL):

1. Remove the pressure switch cover.
2. Adjust the range by turning the range adjustment screw clockwise (in) to increase the cut-out point or counter-clockwise (out) to decrease the cut-out point.

NOTE: One full turn changes the setting approximately 2 PSIG.

3. Replace cover, reconnect power supply and start the compressor.
4. Note the pressure gauge reading at which the compressor cuts out.
5. Repeat adjustment procedure if necessary.

Pressure Switch Range Adjustment.**ADJUSTMENT PROCEDURES (SWITCHES WITH DIFFERENTIAL ADJUSTMENT CONTROL):**

1. Remove the pressure switch cover.
2. Set the cut-in pressure with the range adjustment nut. Turn the nut clockwise (in) to increase the pressure or counter-clockwise (out) to decrease the pressure.

NOTE: One full turn changes the setting approximately 2 PSIG.

3. Set the cut-out pressure with the differential adjustment. Turn the differential adjustment nut clockwise (in) to increase the pressure or counter-clockwise (out) to decrease the pressure.

NOTE: One full turn changes the setting approximately 2 PSIG.

4. Replace the cover, reconnect the power supply and start the unit.
5. Note the pressure gauge reading at which the unit cuts out.
6. Repeat the adjustment procedure if necessary.

The minimum possible differential is approximately 20% of cutout pressure. It is advisable to have as wide a differential as possible to avoid frequent starting and stopping of the unit. Note the pressure gauge reading at which the unit cuts-out and re-establish this point if necessary.

Note the interaction between the range and differential adjustments, i.e., if the cut-out is increased, the differential will also increase, or if the differential is narrowed, the cut-out will be reduced, etc. These factors must be considered when adjusting the switch and compensated for accordingly.

STARTING UNLOADING SYSTEM

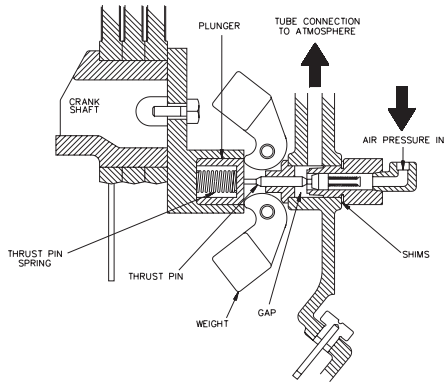
The starting unloading feature exists on certain models. The purpose of the system is to relieve cylinder pressure when the unit stops, permitting it to start against a light load. A light load increases the life of the driver and belts and also reduces the possibility of tripping the overload relay. The system operates in the following manner:

The centrifugal unloader is attached to the end of the crankshaft as shown in the following illustrations.

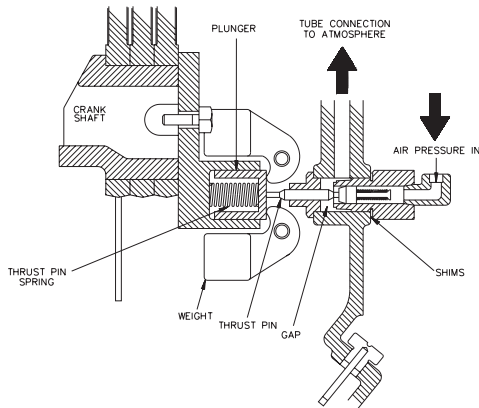
When the unit starts, centrifugal force acts upon the unloader weights and they swing outward. This permits the plunger and thrust pin to move inward and the pilot valve to close. The escape path to atmosphere for the cylinder pressure is now closed and the compressor pumps air in a normal manner.

When the unit stops, the weights retract, permitting the thrust pin spring to move the plunger and thrust pin outward. The thrust pin opens the pilot valve and the trapped air pressure escapes from the cylinder and intercooler through a passage in the frame end cover, through the unloader tube and to atmosphere through the inlet filter/silencer.

Position of weight and thrust pin when unit is operating.



Position of weight and thrust pin when unit is stopped.



PILOT VALVE ADJUSTMENT

If the pilot valve tube line is excessively hot, it is a good indication that the pilot valve is leaking and adjustment is required.

To adjust the pilot valve, proceed as follows:

1. Stop the unit and disconnect and tag the electrical supply main switch to prevent accidental start-up.
2. Remove the pilot valve tube and the tube fittings.
3. Remove the pilot valve body and all existing shims.
4. Screw the pilot valve body back into the frame end cover (without any shims) until contact with the thrust pin is felt. Advance the pilot valve body 1/4 to 1/2 turn more.

If contact with the thrust pin cannot be felt, the following steps may be necessary to locate the contact point:

1. Insert a small instrument (punch, rod, nail, etc.) into the end of the pilot valve until it contacts the valve stem.
2. While still inserted in the pilot valve, make a mark on the instrument even with the outside edge of the pilot valve body.
3. Keeping the instrument pressed lightly against the valve stem, screw the pilot valve body into the frame end cover. When the mark on the instrument starts moving out away from the edge of the pilot valve body, contact has been made with the thrust pin.
4. Advance the pilot valve body 1/4 to 1/2 turn more and proceed with step five.
5. Measure the gap between the pilot valve body and the frame end cover.
6. Remove the pilot valve body and add enough shims to fill the gap measured in step five.
7. Screw the pilot valve body back into the frame end cover until the body is tight on the shims.
8. Reconnect the pilot valve tube and tube fittings.

BREATHER/UNLOADER BY-PASS

The breather/unloader by-pass tube lines eliminates air pressure build-up in the compressor frame by providing a passage for the air to escape through the inlet unloader (if opened) or (if closed) through the check valve, therefore, by-passing the inlet unloader and escaping to atmosphere through the inlet filter/silencer.

OIL CONSUMPTION CHECK

A rule of thumb in determining a "passing grade" for oil consumption is to consider consumption at or above 50 horsepower-hours per ounce to be acceptable.

The formula is as follows:

$$\frac{\text{Horsepower} \times \text{Hours of Operation}}{\text{Ounces of Oil Used}} = \text{Horsepower Hours per Ounce}$$

To apply this formula, consider the size of the machine. In the following example, a 5 horsepower compressor uses 2 ounces of oil every 20 hours of operation.

$$\frac{5 \text{ Horsepower} \times 20 \text{ Hours of Operation}}{2 \text{ Ounces of Oil Used}} = 50 \text{ Horsepower Hours per Ounce}$$

The compressor in the example passes the oil consumption test.

NOTE New or rebuilt compressor pumps will discharge higher than normal amounts of oil until the piston rings are seated (approximately 100 operating hours).

MAINTENANCE

⚠ WARNING Before performing maintenance, release air pressure from the system and disconnect, lock and tag the main power supply or disconnect the wire from the engine spark plug.

NOTE All compressed air systems contain maintenance parts (e.g. lubricating oil, filters, separators) which are periodically replaced. These used parts may be, or may contain, substances that are regulated and must be disposed of in accordance with local, state, and federal laws and regulations.

NOTE Take note of the positions and locations of parts during disassembly to make reassembly easier. The assembly sequences and parts illustrated may differ for your particular unit.

NOTE Any service operations not explained in this manual should be performed by an authorized service representative.

NOTE Reference the engine owner's manual for engine care information.

NOTE The following maintenance schedule has been developed for typical applications. Maintenance intervals should be shortened in harsher environments.

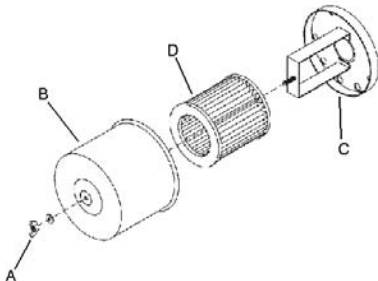
MAINTENANCE SCHEDULE

Daily or Before Each Operation	<ul style="list-style-type: none"> ● Check for oil leaks. ● Check lubricant level. Fill as needed. ● Drain receiver tank condensate (if automatic draining device is not provided). Open manual drain valve and collect and dispose of condensate accordingly. ● Check for unusual noise and vibration. ● Ensure beltguards and covers are securely in place. ● Ensure engine (if supplied) is filled with fuel and lubricant according to the manufacturer's recommendations. ● Ensure area around compressor is free from rags, tools, debris, and flammable or explosive materials.
Weekly	<ul style="list-style-type: none"> ● Observe operation of safety/relief valves while the compressor is running. Replace safety/relief valves that do not operate freely. ● Inspect air filter element(s). Clean if necessary.
Monthly	<ul style="list-style-type: none"> ● Inspect for air leaks. Squirt soapy water around joints during compressor operation and watch for bubbles. ● Check tightness of screws and bolts. Tighten as needed. ● Inspect drive belts. Adjust if necessary. ● Clean exterior.
3/500 *	<ul style="list-style-type: none"> ● Change petroleum lubricant while crankcase is warm.
12/2000 *	<ul style="list-style-type: none"> ● Drain compressor oil and clean oil sight glass ● Install maintenance pak — or — ● Change synthetic lubricant while crankcase is warm. ● Replace filter element.

* indicates months/operating hours, whichever occurs first.

FILTER INSPECTION & CLEANING

1. Unscrew and remove the wing nut (A) securing the filter housing (B) to its base (C).
2. Remove the filter housing and withdraw the old filter element (D). Clean the element with a jet of air or vacuum.
3. Replace the filter element and housing, securing it in place with the wing nut previously removed.



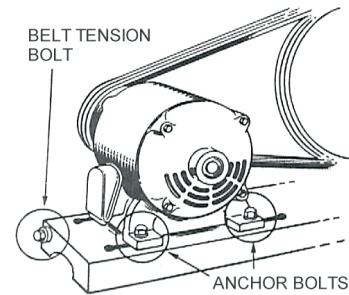
OIL CHANGE

1. Remove the oil drain plug (A) and allow the lubricant to drain into a suitable container.
2. Replace the oil drain plug.
3. Follow the filling procedures in OPERATION section.

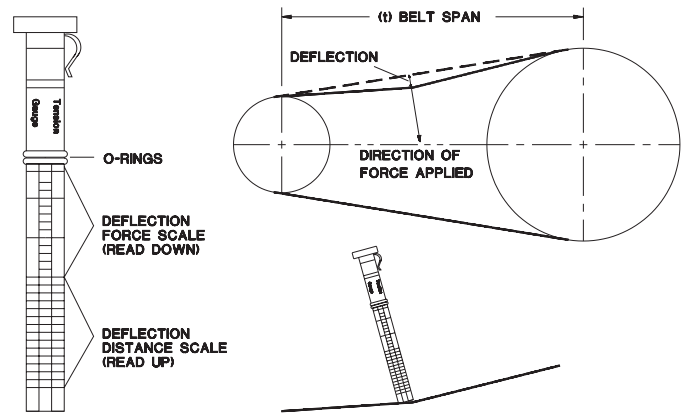
BELT ADJUSTMENT

CHECKING BELT TENSION. Check belt tension should be occasionally, especially if looseness is suspected. New belts must also be properly tensioned upon installation.

TENSIONING BELTS. Belt tensioning can be achieved by loosening the motor or engine anchor screws, pushing the motor or engine away from the pump, and retightening the motor or engine anchor screws. Some units are equipped with a belt tensioning bolt that, when turned, pulls the motor or engine away from the pump. Otherwise, the motor can be easily moved by placing a prying tool beneath it. A commercially available spreader or other belt tensioning device can also be helpful.



Follow the procedures outlined below to correctly set and measure belt tension on electric motor and gas engine models including 2340, 2475, and 2545 (with "A" belt type only). Refer to the following illustration for a visual representation.



1. Lay a straight edge across the top outer surface of the belt drive from pulley to sheave.
2. At the center of the span, perpendicular to the belt, apply pressure to the outer surface of the belt with a tension gauge. Force the belt to the deflection indicated in the BELT TENSION TABLE in the DIAGRAMS & TABLES section. Compare the reading on the tension gauge to the table.

Follow the procedures outlined below to correctly set and measure tension on 7.5 through 30 horsepower models 2545, 7100, 15T and 3000 with "B" and "C" belt types.

1. Measure the span length (t) of the drive.
2. Determine the amount of deflection (in inches) required to measure deflection force (in pounds) by multiplying the span length (t) by 1/64. For example, a 32" span length multiplied by 1/64 equals 1/2" of deflection required to measure deflection force.
3. Lay a straight edge across the top outer surface of the belt drive from pulley to sheave.
4. At the center of the span, perpendicular to the belt, apply pressure to the outer surface of the belt with a tension gauge. Force the belt to the predetermined deflection calculated in step 2. Compare the reading on the tension gauge to the BELT TENSION TABLE in the DIAGRAMS & TABLES section.

Ensure the pulley and sheave are properly aligned and the motor anchor screws are adequately retightened prior to restarting the compressor.

△ CAUTION Improper pulley/sheave alignment and belt tension can result in motor overload, excessive vibration, and premature belt and/or bearing failure.

To prevent these problems from occurring, ensure the pulley and sheave are aligned and belt tension is satisfactory after installing new belts or tensioning existing belts.

ELECTRIC DRAIN MAINTENANCE

NOTE The following maintenance schedule has been developed for typical applications. Maintenance intervals should be shortened in harsher environments.

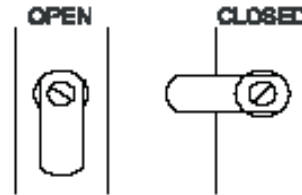
DRAIN VALVE MAINTENANCE SCHEDULE	
DAILY	Test the valve for proper operation. Clean the filter screen if needed.
MONTHLY (EVERY 30 DAYS)	Clean the filter screen.

To clean the filter screen, perform the following steps:

1. Close the strainer ball valve completely to isolate it from the air receiver tank.
 2. Press the TEST button on the timer to vent the pressure remaining in the valve. Repeat until all pressure is removed.
- △ CAUTION** High pressure air can cause injury from flying debris. Ensure the strainer ball valve is completely closed and pressure is released from the valve prior to cleaning.
3. Remove the plug from the strainer with a suitable wrench. If you hear air escaping from the cleaning port, STOP IMMEDIATELY and repeat steps 1 and 2.
 4. Remove the stainless steel filter screen and clean it. Remove any debris that may be in the strainer body before replacing the filter screen.

5. Replace plug and tighten with wrench.

Position of weight and thrust pin when unit is operating.



6. When putting the EDV-2000 back into service, press the TEST button to confirm proper function.

TANK INSPECTION

The life of an air receiver tank is dependent upon several factors including, but not limited to, operating conditions, ambient environments, and the level of maintenance. The exact effect of these factors on tank life is difficult to predict; therefore, Ingersoll-Rand recommends that you schedule a certified tank inspection within the first five years of compressor service. To arrange a tank inspection, contact Ingersoll-Rand.

If the tank has not been inspected within the first 10 years of compressor service, the receiver must be taken out of service until it has passed inspection. Tanks that fail to meet requirements must be replaced.

△ WARNING Failure to replace a rusted air receiver tank could result in air receiver tank rupture or explosion, which could cause substantial property damage, severe personal injury, or death. Never modify or repair tank. Obtain replacement from service center.

TROUBLESHOOTING

PROBLEM	CHECK POINT
Abnormal piston, ring or cylinder wear	4, 8, 9, 19, 28, 35
Air delivery drops off	1, 6, 15, 16, 18, 19, 29
Automatic drain valve leaks or does not drain automatically	16
Auxiliary valve chatters or leaks around stem	23, 24
Broken intercooler or aftercooler tubes	36
Compressor does not come up to speed	2, 6, 12, 15, 21
Compressor is slow to come up to speed	26, 27, 33, 34
Compressor runs excessively hot	3, 14, 15, 22
Compressor will not unload cycle	23, 24, 26
Compressor will not unload when stopped	26, 33
Excessive noise during operation	2, 6, 15, 16, 21, 27, 32
Excessive starting and stopping	5, 11, 16, 32, 40
Knocks or rattles	2, 15, 17, 19, 20, 21
Lights flicker or dim when running	12, 13
Moisture in crankcase or "milky" appearance in petroleum lubricant or rusting in cylinders	9, 10
Motor overload trips or draws excessive current	5, 6, 12, 13, 14, 15, 16, 19, 20, 21, 34
Oil in discharge air (oil pumping)	4, 7, 9, 18, 19, 25, 35
Oil leaking from shaft seal	25
Safety/relief valve "pops"	1, 5, 29, 30
High interstage pressure	30
Low interstage pressure	31
Engine cranks slowly or will not start	6, 14, 37, 38
Motor will not start	12
Engine will not start	39
Oil Leaks	41

ELECTRIC DRAIN TROUBLESHOOTING

Trouble	Cause	Action
Valve will not close.	<ol style="list-style-type: none"> 1. Debris in solenoid valve prevents diaphragm from seating. 2. Short in electrical component. 	<ol style="list-style-type: none"> 1. Remove solenoid valve, disassemble, clean and reassemble. 2. Check and replace power cord or timer as needed.
Timer will not activate.	<ol style="list-style-type: none"> 1. No electrical supply. 2. Timer malfunction 3. Clogged port. 4. Solenoid valve malfunction. 5. Clogged strainer. 	<ol style="list-style-type: none"> 1. Apply power. 2. Replace timer. 3. Clean valve. 4. Replace solenoid valve. 5. Clean strainer.

CHECK POINT	POSSIBLE CAUSE	POSSIBLE SOLUTION
1	Clogged or dirty inlet and/or discharge line filter.	Clean or replace.
2	Loose beltwheel or motor pulley, excessive end play in motor shaft or loose drive belts.	Check beltwheel, motor pulley, crankshaft, drive belt tension and alignment. Repair or replace as required.
3	Inadequate ventilation around beltwheel.	Relocate compressor for better air flow.
4	Lubricant viscosity too low.	Drain existing lubricant and refill with proper lubricant.
5	Air leaks in air discharge piping.	Check tubing and connections. Tighten joints or replace as required.
6	Lubricant viscosity too high.	Drain existing lubricant and refill with proper lubricant.
7	Lubricant level too high.	Drain excess lubricant.
8	Lubricant level too low.	Add lubricant to crankcase to proper level.
9	Detergent type lubricant being used.	Drain existing lubricant and refill with proper lubricant.
10	Extremely light duty cycles. Compressor located in damp or humid location.	Run compressor for longer duty cycles. Relocate compressor or install crankcase heater kit.
11	Pressure switch differential too narrow.	Adjust pressure switch to increase differential, if differential adjustment is provided. Install pressure switch with differential adjustment feature if differential adjustment is desired.
12	Improper line voltage. Wiring or electric service panel too small. Poor contact on motor terminals or starter connections. Improper starter overload heaters.	Check line voltage and upgrade lines as required. Contact electrician. Install properly sized wire or service box. Contact electrician. Ensure good contact on motor terminals or starter connections. Install proper starter overload heaters. Contact electrician.
13	Poor power regulation (unbalanced line).	Contact power company.
14	Drive belts too tight or misaligned.	Adjust belts to proper tension and alignment.
15	Compressor valves leaky, broken, carbonized or loose.	Inspect valves. Clean or replace as required. Install Valve/Gasket Step Saver Kit..
16	Automatic drain valve clogged, leaking or defective.	Inspect valve and clean, repair or replace as required.
17	Carbon build-up on top of piston(s).	Clean piston(s). Repair or replace as required.
18	Piston rings damaged or worn (broken, rough or scratched). Excessive end gap or side clearance. Piston rings not seated, are stuck in grooves or end gaps not staggered.	Install Ring/Gasket Step Saver Kit. Adjust piston rings.
19	Cylinder(s) or piston(s) scratched, worn or scored.	Repair or replace as required.
20	Connecting rod, piston pin or crankpin bearings worn or scored. Loose bearing spacer on crankshaft.	Inspect all. Repair or replace as required. Install Bearing/Connecting Rod Step Saver Kit.
21	Defective ball bearings on crankshaft or motor shaft.	Inspect bearings and replace if required. Install Bearing/Connecting Rod Step Saver Kit.
22	Wrong beltwheel direction of rotation.	Check motor wiring for proper connections. Reverse two leads on three-phase motors.
23	Leaking, broken or worn inlet unloader parts.	Inspect parts and replace as required.
24	Auxiliary valve dirty or seats worn.	Inspect parts. Clean, adjust or replace as required.
25	Crankshaft seal worn or crankshaft scored.	Replace seal. Install shaft sleeve if required. Install Bearing/Connecting Rod Step Saver Kit.
26	Leaking or maladjusted centrifugal pilot valve.	Replace pilot valve o-ring. Adjust pilot valve.
27	Leaking check valve or check valve seat blown out.	Replace check valve.
28	Extremely dusty atmosphere.	Install remote air inlet piping and route to source of cleaner air. Install more effective filtration.
29	Defective safety/relief valve.	Replace.
30	High pressure inlet valve leaking.	Inspect, clean or repair as required.
31	Low pressure discharge valve leaking.	Inspect, clean or repair as required.
32	Automatic start and stop mode is not suitable for air demand.	Adjust auxiliary valve for constant speed operation.
33	Pressure switch unloader leaks or does not work.	Realign stem or replace.
34	Ambient temperature too low.	Install crankcase heater kit. Convert to All Season Select lubricant. Relocate compressor to warmer environment.
35	Worn cylinder finish.	Deglaze cylinder with 180 grit flex-hone.
36	Beltwheel out of balance, tubes not braced or secured, wrong pulley speed.	Check vibration level, change pulley or beltwheel if required, tighten tube clamps.
37	Engine not grounded properly.	Ground battery to engine as recommended.
38	Gasoline exceeds storage time or contains water.	Replace gas, add fuel stabilizer.
39	No fuel in tank. Fuel valve closed.	See manufacturer's instructions for refueling. Open fuel valve.
40	Low oil pressure. Excessive condensate in receiver tank.	See manufacturer's instructions. Drain receiver tank with manual drain valve or install automatic drain valve.
41	Loose fittings/elbows/connectors	Re-torque fittings per specified torque requirements

DIAGRAMS & TABLES

FASTENER TORQUE TABLE

	2340	2475	2545	7100	15T	3000
High Pressure Head Bolts	75	75	75	75	75	75
Low Pressure Head Bolts	75	75	75	75	75	75
Cylinder Flange Bolts	30	50	50	50	50	50
Frame Cover Bolts	17	17	17	20	20	20
Shaft Cover Bolts	17	17	17	20	20	20
Crankpin Cap Screws	5.5	11	11	12-15	12-15	12-15
Unloader Cover Screws	—	—	11	11	20	11
High Pressure Inlet Valve Screws	11-15 LB-IN	11-15 LB-IN	11-15 LB-IN	5.5	—	5.5
Low Pressure Inlet Valve Screws	11-15 LB-IN	25-30 LB-IN	25-30 LB-IN	5.5	—	5.5
High Pressure Outlet Valve Screws	11-15 LB-IN	11-15 LB-IN	11-15 LB-IN	26	50	26
Low Pressure Outlet Valve Screws	25-30 LB-IN	25-30 LB-IN	25-30 LB-IN	26	90	26
Beltwheel Bolt	33	60	60	113	213	213
High Pressure Head Center Bolts	—	—	10	—	—	—
Low Pressure Head Center Bolts	—	—	14-16	—	—	—

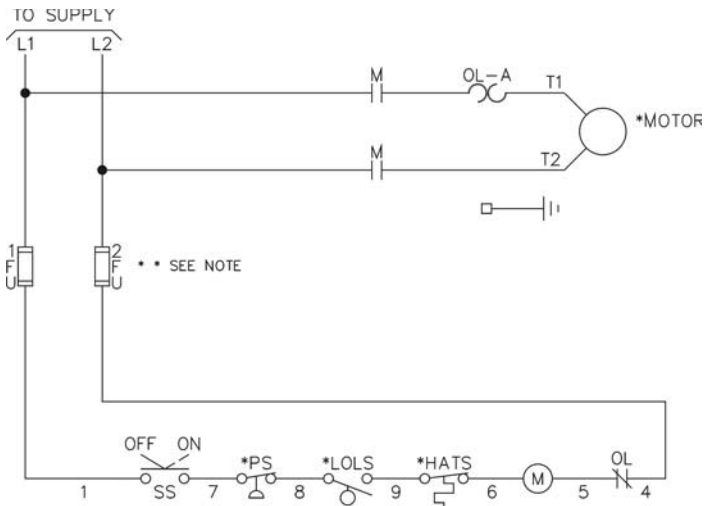
NOTE Tighten all fasteners evenly using a cross pattern in two stages.

BELT TENSION TABLE

MODEL	DEFLECTION (IN.)	TENSION (LB.)	BELT TYPE	HORSEPOWER	TENSION AT 1/64" DEFLECTION PER INCH OF SPAN
2340 (14" Span)	0.25	4.9 - 7.1			
2340 (19" Span)	0.29	4.9 - 7.1	B	7.5	7.0 - 10.0
2475 (14" Span)	0.25	4.9 - 7.1		10-15	8.0 - 12.0
2475 (19" Span)	0.29	4.9 - 7.1	C	20	12.0 - 18.0
2475F/X11GH	0.34	5.5 - 8.0		25-30	14.0 - 21.0
2475F/X9/11GK	0.25	11.25 - 13.0			
2475N5 (14.5" Span, Cogged belt)	0.23	4.5 - 6.5			
2545 (A Groove)	0.29	4.9 - 7.1			

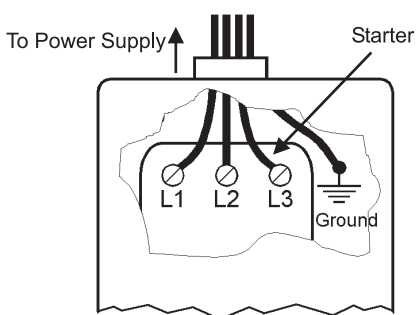
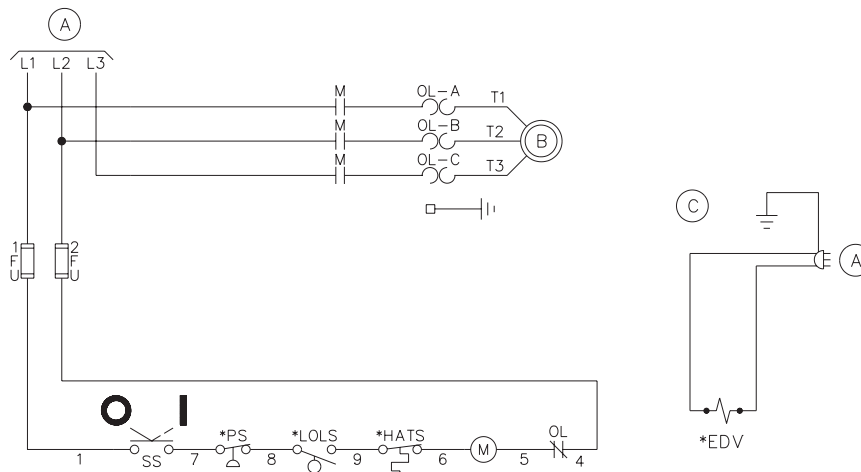
ELECTRICAL WIRING DIAGRAMS

Single Phase Wiring



A	To supply
C	Wiring for optional electric drain valve
EDV	Electric drain valve
T	Supply Line Terminal
L	Load Terminal
FU	Control Circuit Fuse
HATS	High Air Temperature Switch (#)
LOLS	Low Oil Level Switch (#)
M	Motor Starter Coil
OL	Motor Starter Overload
PS	Pressure Switch
SS	Selector Switch (#)
*	Alternate wiring for converting 3 phase starter to 1 phase application
(#)	= if provided

Three Phase Wiring

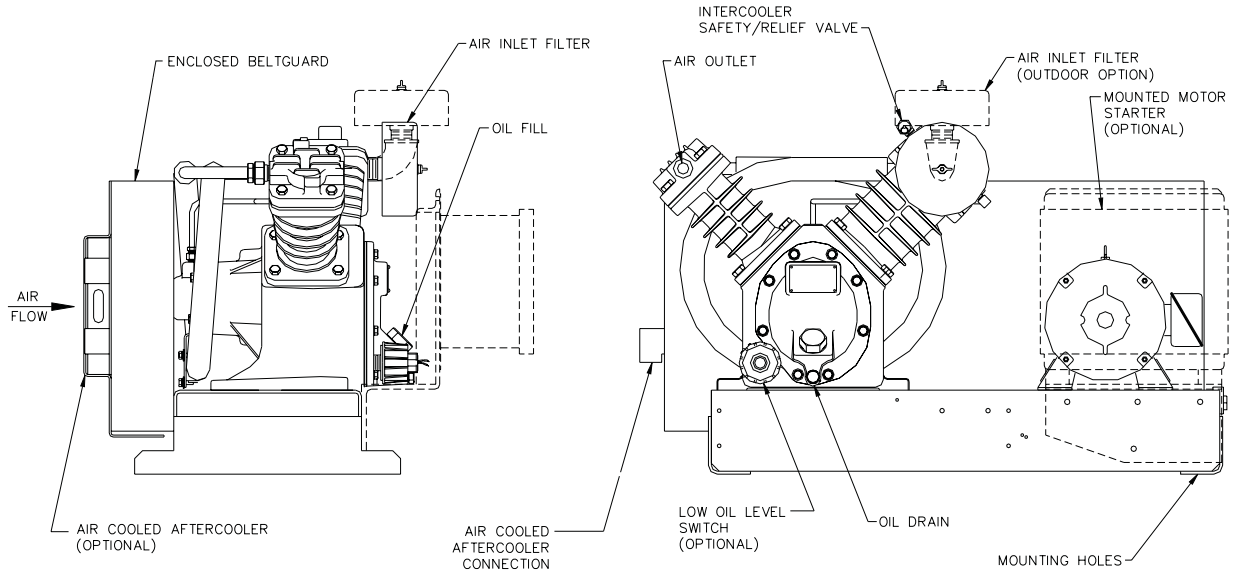


NOTE

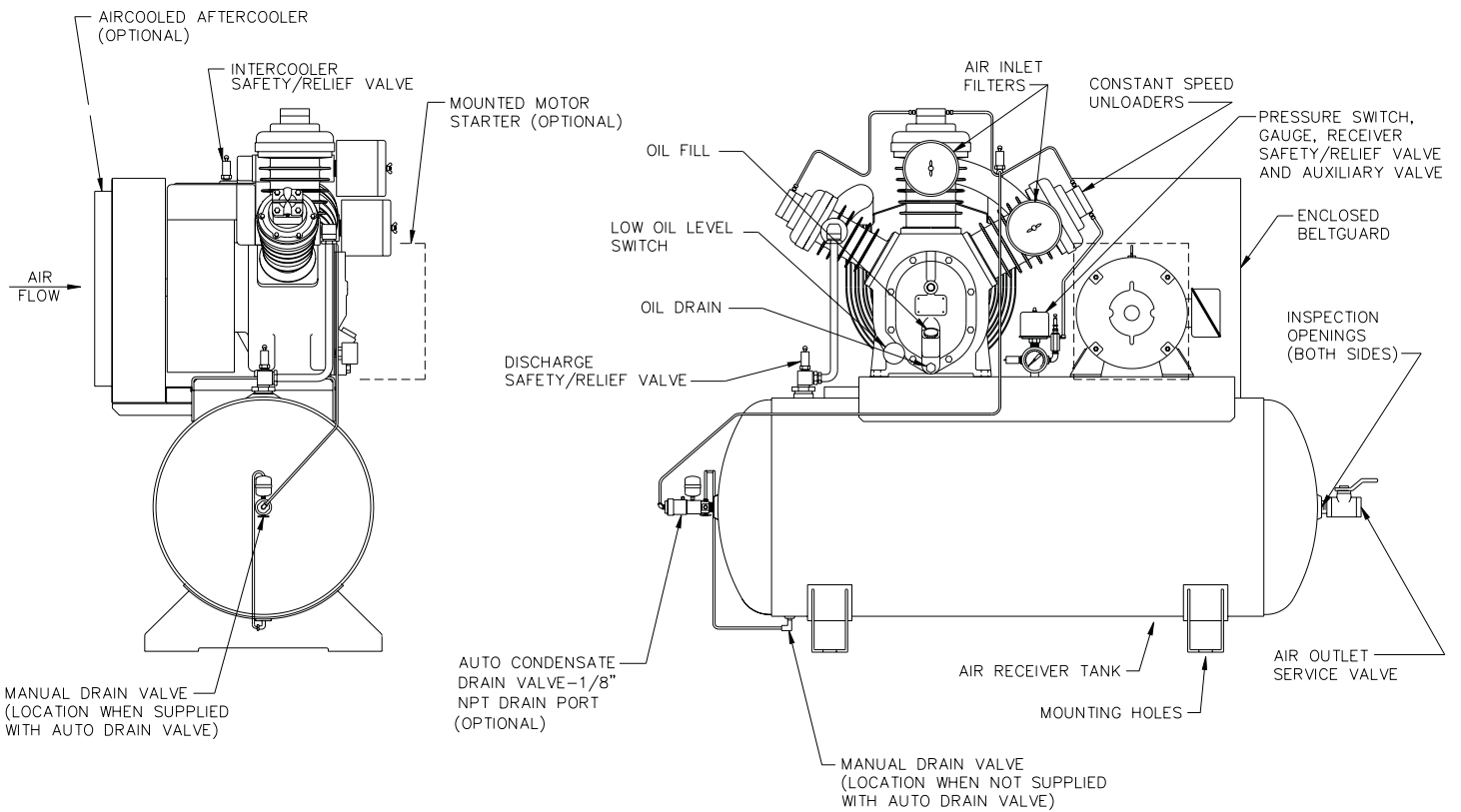
On units requiring a starter, connect line power to the starter. do not connect line power to the pressure switch.

- Connect ground wire to ground lug
- L3 used for 3-phase motors & starters only

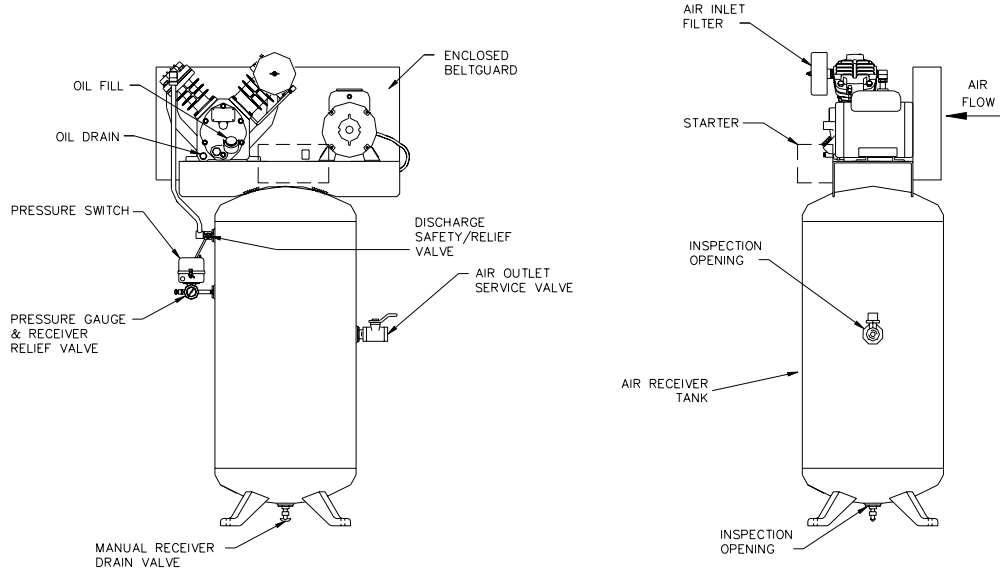
Typical Baseplate Unit



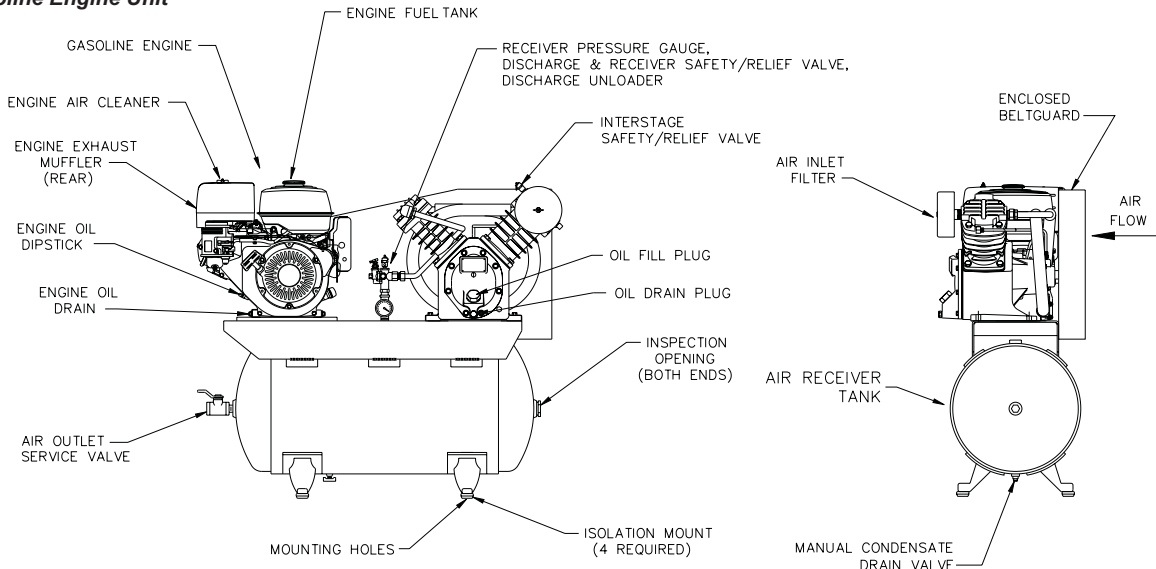
Typical Horizontal Simplex Unit



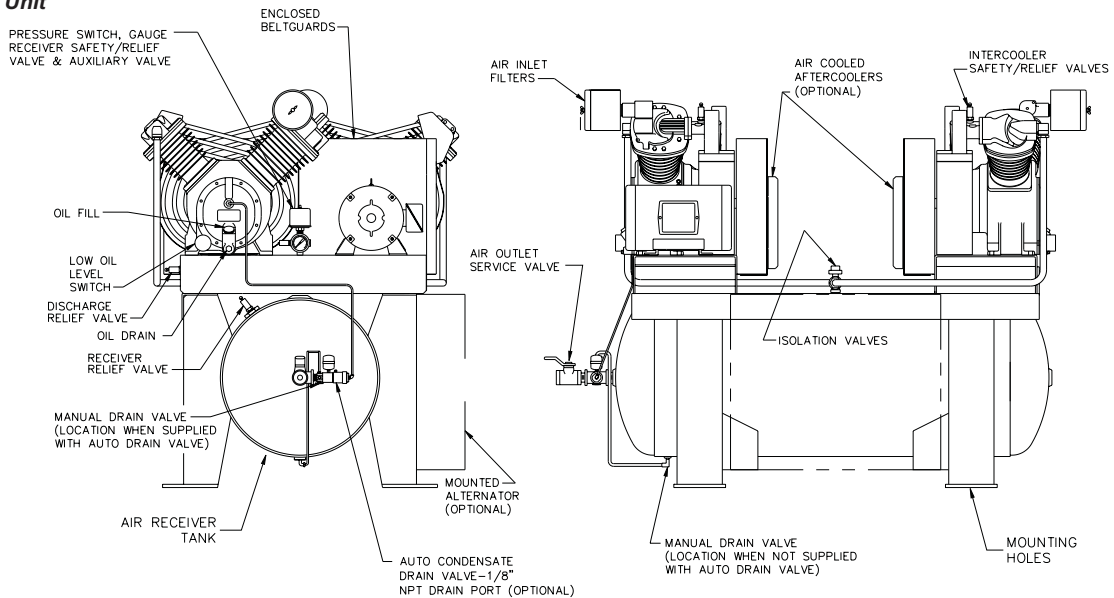
Typical Vertical Simplex Unit



Typical Gasoline Engine Unit



Typical Duplex Unit



WARRANTY

Ingersoll-Rand Company warrants that the Equipment manufactured by it and delivered hereunder shall be free of defects in material and workmanship for a period of twelve (12) months from the date of placing the Equipment in operation or eighteen (18) months from the date of shipment, whichever shall occur first. The foregoing warranty period shall apply to all Equipment, except for the following: (A) Compressors that are operated solely on All Season Select synthetic compressor lubricant will have their bare compressor warranted for the earlier of twenty-four (24) months from the date of initial operation or thirty (30) months from the date of shipment. (B) Replacement parts will be warranted for six (6) months from the date of shipment. Should any failure to conform to this Warranty be reported in writing to the Company within said period, the Company shall, at its option, correct such nonconformity by suitable repair to such Equipment, or furnish a replacement part F.O.B. point of shipment, provided the purchaser has installed, maintained and operated such equipment in accordance with good industry practices and has complied with specific recommendations of the Company. Accessories or equipment furnished by the Company, but manufactured by others, shall carry whatever warranty the manufacturer conveyed to Ingersoll-Rand Company and which can be passed on to the Purchaser. The Company shall not be liable for any repairs, replacements, or adjustments to the Equipment or any costs of labor performed by the Purchaser without the Company's prior written approval.

The Company makes no performance warranty unless specifically stated within its proposal and the effects of corrosion, erosion and normal wear and tear are specifically excluded from the Company's Warranty. In the event performance warranties are expressly included, the Company's obligation shall be to correct in the manner and for the period of time provided above.

THE COMPANY MAKES NO OTHER WARRANTY OF REPRESENTATION OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE HEREBY DISCLAIMED.

Correction by the Company of nonconformities, whether patent or latent, in the manner and for the period of time provided above, shall constitute fulfillment of all liabilities of the Company and its Distributors for such nonconformities with respect to or arising out of such Equipment.

LIMITATION OF LIABILITY

THE REMEDIES OF THE PURCHASER SET FORTH HEREIN ARE EXCLUSIVE, AND THE TOTAL LIABILITY OF THE COMPANY, ITS DISTRIBUTORS AND SUPPLIERS WITH RESPECT TO CONTRACT OR THE EQUIPMENT AND SERVICES FURNISHED, IN CONNECTION WITH THE PERFORMANCE OR BREACH THEREOF, OR FROM THE MANUFACTURE, SALE, DELIVERY, INSTALLATION, REPAIR OR TECHNICAL DIRECTION COVERED BY OR FURNISHED UNDER CONTRACT, WHETHER BASED ON CONTRACT, WARRANTY, NEGLIGENCE, INDEMNITY, STRICT LIABILITY OR OTHERWISE SHALL NOT EXCEED THE PURCHASE PRICE OF THE UNIT OF EQUIPMENT UPON WHICH SUCH LIABILITY IS BASED.

THE COMPANY, ITS DISTRIBUTORS AND ITS SUPPLIERS SHALL IN NO EVENT BE LIABLE TO THE PURCHASER, ANY SUCCESSORS IN INTEREST OR ANY BENEFICIARY OR ASSIGNEE OF THE CONTRACT FOR ANY CONSEQUENTIAL, INCIDENTAL, INDIRECT, SPECIAL OR PUNITIVE DAMAGES ARISING OUT OF THIS CONTRACT OR ANY BREACH THEREOF, OR ANY DEFECT IN, OR FAILURE OF, OR MALFUNCTION OF THE EQUIPMENT, WHETHER OR NOT BASED UPON LOSS OF USE, LOSS PROFITS OR REVENUE, INTEREST, LOST GOODWILL, WORK STOPPAGE, IMPAIRMENT OF OTHER GOODS, LOSS BY REASON OF SHUTDOWN OR NON-OPERATION, INCREASED EXPENSES OF OPERATION, COST OF PURCHASE OF REPLACEMENT POWER, OR CLAIMS OF PURCHASER OR CUSTOMERS OF PURCHASER FOR SERVICE INTERRUPTION WHETHER OR NOT SUCH LOSS OR DAMAGE IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, INDEMNITY, STRICT LIABILITY OR OTHERWISE.



Installation, Operation and Maintenance Instructions for Models 2340, 2475, 2545, 7100, 15T & 3000 Two-Stage Reciprocating Air Compressors

IMPORTANT INFORMATION! READ AND FOLLOW THESE INSTRUCTIONS. RETAIN FOR REFERENCE.

SAFETY

DEFINITIONS

- △ **DANGER** WILL cause DEATH, SEVERE INJURY or substantial property damage.
- △ **WARNING** CAN cause DEATH, SEVERE INJURY or substantial property damage.
- △ **CAUTION** WILL or CAN cause MINOR INJURY or property damage.

GENERAL SAFETY PRECAUTIONS

- △ **DANGER** **INTAKE AIR.** Can contain carbon monoxide or other contaminants. Will cause serious injury or death. Ingersoll-Rand air compressors are not designed, intended or approved for breathing air. Compressed air should not be used for breathing air applications unless treated in accordance with all applicable codes and regulations.
- △ **WARNING** **HAZARDOUS VOLTAGE.** Can cause serious injury or death. Disconnect power and bleed pressure from the tank before servicing. Lockout/Tagout machine. Compressor must be connected to properly grounded circuit. See grounding instructions in manual. Do not operate compressor in wet conditions. Store indoors.

MOVING PARTS. Can cause serious injury. Do not operate with guards removed. Machine may start automatically. Disconnect power before servicing. Lockout/Tagout machine.

HOT SURFACES. Can cause serious injury. Do not touch. Allow to cool before servicing. Do not touch hot compressor or tubing.

HIGH PRESSURE AIR. Bypassing, modifying or removing safety/relief valves can cause serious injury or death. Do not bypass, modify or remove safety/relief valves. Do not direct air stream at body. Rusted tanks can cause explosion and severe injury or death. Drain tank daily or after each use. Drain valve located at bottom of tank.
- △ **CAUTION** **RISK OF BURSTING.** Use only suitable air handling parts acceptable for pressure of not less than the maximum allowable working pressure of the machine.

GENERAL INFORMATION

INTRODUCTION

This manual provides safe and reliable instructions for the installation, operation and maintenance of your Ingersoll-Rand air compressor. Carefully read this manual before attempting to operate or perform any maintenance. If you are uncertain about any of the instructions or procedures provided in this manual, contact Ingersoll-Rand. We recommend you retain this manual, and all publications provided with your air compressor, in a location which is accessible to all personnel who operate and service your compressed air equipment.

APPLICATION

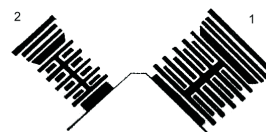
Ingersoll-Rand's standard two-stage lubricated air compressors are single-acting, air-cooled machines. Typical compressors are furnished as compact, self-contained, air receiver tank mounted units that are automatically regulated and driven by an electric motor or gasoline engine. An air-cooled aftercooler, low oil level shutdown switch and automatic drain valve are among the optional accessories that can be furnished. Bare compressor pumps and baseplate-mounted units are also available.

These compressors may be used for a variety of compressed air application up to 250 PSIG (17.5 kg/cm²). Application of these compressors as either a primary or supplementary source of air is virtually unlimited in industrial plants, service stations and auto repair shops. Supplementary service includes such uses as furnishing air at pressure not carried in regular shop lines, air at isolated locations, and standby service for air when larger compressors are shut down.

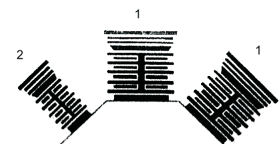
TWO-STAGE OPERATION

Two-stage compressors consist of one or two first-stage cylinders with the same bore size and one second-stage cylinder with a smaller bore size.

Typical Two-Stage, Two Cylinder Unit



Typical Two-Stage, Three Cylinder Unit



The basic principle of operation is as follows: On the suction stroke of the first-stage piston(s), air at atmospheric pressure enters the cylinders through the inlet filter(s) and then the inlet valves located in the head. On the compression stroke of the first-stage piston(s), the air is compressed to an intermediate pressure and discharged through the discharge valves(s) into common manifold(s). From the manifold(s) the air passes through the intercooler tubes, where the heat of first-stage compression is removed. On the suction stroke of the second-stage piston this cooled air enters the second-stage cylinder through the inlet valve. The compression stroke of the second-stage piston compresses the air to the final discharge pressure and forces it out through the discharge valve into the receiver tank or system. If cooling of the discharge air is required, an air-cooled aftercooler should be installed between the compressor discharge and the receiver tank or system.

For maintaining the receiver tank or system air pressure within predetermined limits, the compressor may be operated with automatic start & stop control or constant speed control regulation. The type of regulation used depends upon the application.

ADDITIONAL REFERENCES

Unless otherwise stated, dimensions, weights and measurements are provided in standard U.S. measure followed in parentheses by the metric conversion. Any torque values given are stated in inch or foot pounds followed by the Newton-meter equivalent in parentheses. Electrical characteristics are given in voltage-phase-hertz.

RECEIPT & INSPECTION

Ensure adequate lifting equipment is available for unloading and moving the unit to the installation site.

NOTE Lifting equipment must be properly rated for the weight of the unit.

△ CAUTION Lift the unit by the shipping skid only. Do not use the motor lifting eye to lift the entire unit. The motor lifting eye is for removing the motor from the unit only.

△ CAUTION! Do not work on or walk under the unit while it is suspended.

Before signing the delivery receipt, inspect for damage and missing parts. If damage or missing parts are apparent, make the appropriate notation on the delivery receipt, then sign the receipt. Immediately contact the carrier for an inspection.

All material must be held in the receiving location for the carrier's inspection.

Delivery receipts that have been signed without a notation of damage or missing parts are considered to be delivered "clear." Subsequent claims are then considered to be concealed damage claims. Settle damage claims directly with the transportation company.

If you discover damage after receiving the unit (concealed damage), the carrier must be notified within 15 days of receipt and an inspection must be requested by telephone with confirmation in writing. On concealed damage claims, the burden of establishing that the unit was damaged in transit reverts back to the claimant.

Read the unit nameplate to verify it is the model ordered, and read the motor nameplate to verify it is compatible with your electrical conditions. Make sure electrical enclosures and components are appropriate for the installation environment.

INSTALLATION

SELECTING A LOCATION

ELECTRIC MOTOR UNITS. For most electric motor units, select a relatively clean and dry well-lighted indoor area with plenty of space for proper ventilation, cooling air flow and accessibility. Provide 1,000 cubic feet of fresh air per 5 horsepower. Locate the unit at least 15 inches (38 cm) from walls, and make sure the main power supply is clearly identified and accessible.

Unless the electrical components of the unit are specially protected for outdoor use, do not install an electric motor unit outdoors or in an area that will expose the electrical components to rain, snow or sources of appreciable moisture.

WARNING FOR UNITS EQUIPPED WITH ELECTRIC DRAIN VALVE

△ WARNING The electric drain valve incorporates arcing or sparking parts, such as snap switches, receptacles and the like that tend to produce arcs or sparks and, therefore, when located in a garage, the compressor should be in a room or enclosure provided for the purpose, or the electric drain valve should be 18 inches (457 mm) or more above the floor.

GASOLINE ENGINE UNITS. For gasoline engine units, keep the engine at least 3 feet (1 m) away from building walls and other equipment. Install the unit in a location with plenty of space for proper ventilation, cooling air flow and accessibility. Do not install or operate a gasoline engine unit in a confined area.

AMBIENT TEMPERATURE CONSIDERATIONS. Ideal operating temperatures are between 32°F and 100°F (0°C and 37.8°C). If temperatures consistently drop below 32°F (0°C), install the compressor in a heated area. If this is not possible, you must protect safety/relief valves and drain valves from freezing. If temperatures are consistently below 40°F (4.4°C), consider installing an external crankcase heater kit, especially if the compressor has difficulty starting.

△ CAUTION Never operate the compressor in temperatures below -15°F (-26.1°C) or above 125°F (51.0°C).

HUMID AREAS. In frequently humid areas, moisture may form in the pump and produce sludge in the lubricant, causing running parts to wear out prematurely. Excessive moisture is especially likely to occur if the unit is located in an unheated area that is subject to large temperature changes.

Two signs of excessive humidity are external condensation on the pump when it cools down and a "milky" appearance in petroleum lubricant.

You may be able to prevent moisture from forming in the pump by increasing ventilation, operating for longer intervals or installing an external crankcase heater kit.

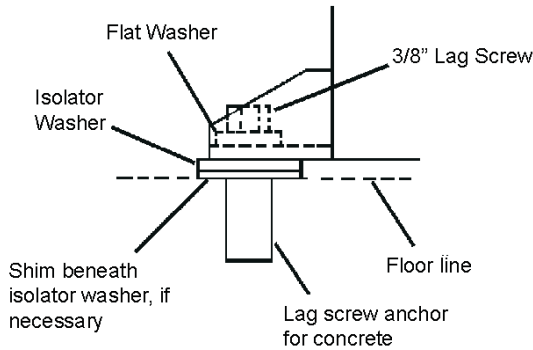
NOISE CONSIDERATIONS. Consult local officials for information regarding acceptable noise levels in your area. To reduce excessive noise, use vibration isolator pads or intake silencers, relocate the unit or construct total enclosures or baffle walls.

MOUNTING

⚠ **WARNING** Remove the unit from the skid before mounting.

ELECTRIC MOTOR UNITS. Bolt the unit to a firm, level foundation (such as a concrete floor). Do not bolt uneven feet tightly to the foundation, as this will cause excessive stress on the receiver tank. Use metal shims under the "short" feet if necessary.

Typical Permanent Mounting (Customer Supplied Hardware)



GASOLINE ENGINE UNITS. Bolt the unit to a firm, level foundation. Do not bolt uneven feet tightly to the foundation, as this will cause excessive stress on the receiver tank. Use metal shims under the "short" feet if necessary. Gasoline engine units mounted on truck beds must be fastened securely without applying excessive stress on the receiver tank. We recommend installing a vibration isolator kit with gasoline engine models.

INSTALLING REMOTE AIR INLET PIPING

⚠ **CAUTION** Do not operate the unit without air inlet filtration.

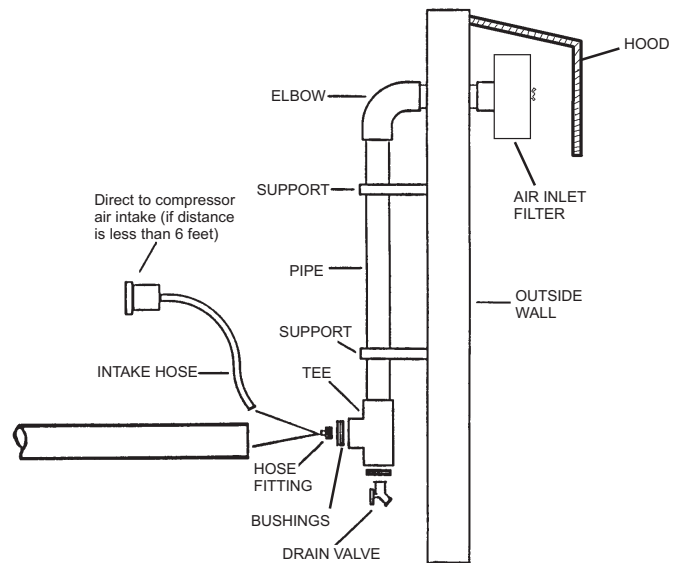
If the air around the unit is relatively free of dirt, install the air inlet filter at the inlet connection at the pump. If the air is dirty, pipe the filter to a source of clean air. Use PVC plastic tubes for remote inlet piping. Do not use black pipe or galvanized pipe, as these promote sweating and rust. Consider installing an in-line type filter for ease of cleaning and replacement. Make the line as short and direct as possible and as large, or larger, than the diameter of the inlet connection on the pump. Do not install piping with a diameter lower than that of the pump intake.

Increase the pipe diameter one size for every 10 feet (3 m) of length or every 90° bend. Make sure the piping is adequately braced.

If you pipe the filter outdoors, cover it with a hood to prevent the entrance of rain or snow.

Heavy duty filter elements and filtration equipment are available for fine airborne dust, such as cement and rock dust.

Typical Remote Air Inlet Piping.



INSTALLING DISCHARGE PIPING

⚠ **WARNING** Do not use plastic pipe, soldered copper fittings, rubber hose, or lead-tin soldered joints anywhere in the compressed air system.

⚠ **CAUTION!** If you will be using synthetic compressor lubricant, all downstream piping material and system components must be compatible. Refer to the following material compatibility list. If there are incompatible materials present in your system, or if there are materials not included in the list, contact Ingersoll-Rand for recommendations.

SYNTHETIC COMPRESSOR LUBRICANT MATERIAL COMPATIBILITY LIST

SUITABLE

Viton®, Teflon®, Epoxy (Glass Filled), Oil Resistant Alkyd, Fluorosilicone, Fluorocarbon, Polysulfide, 2-Component Urethane, Nylon, Delrin®, Celcon®, High Nitrile Rubber (Buna N. NBR more than 36% Acrylonitrile), Polyurethane, Polyethylene, Epichlorohydrin, Polyacrylate, Melamine, Polypropylene, Baked Phenolics, Epoxy, Modified Alkyls
(® indicates trademark of DuPont Corporation)

NOT RECOMMENDED

Neoprene, Natural Rubber, SBR Rubber, Acrylic Paint, Lacquer, Varnish, Polystyrene, PVC, ABS, Polycarbonate, Cellulose Acetate, Low Nitrile Rubber (Buna N. NBR less than 36% Acrylonitrile), EPDM, Ethylene Vinyl Acetate, Latex, EPR, Acrylics, Phenoxy, Polysulfones, Styrene Acrylonitrile (San), Butyl

NOTE All compressed air systems generate condensate which accumulates in any drain point (e.g. tanks, filters, drip legs, aftercoolers, dryers). This condensate contains lubricating oil and/or substances which may be regulated and must be disposed of in accordance with local, state, and federal laws and regulations.

GENERAL REQUIREMENTS. The piping, fittings, air receiver tank, etc. must be certified safe for at least the maximum working pressure of the unit. Use hard-welded or threaded steel or copper pipes and cast iron fittings that are certified safe for the unit's discharge pressure and temperature. **DO NOT USE PVC PLASTIC IN THE COMPRESSED AIR DISCHARGE LINE.** Use pipe thread sealant on all threads, and make up joints tightly to prevent air leaks.

CONDENSATE DISCHARGE PIPING. If installing a condensate discharge line, the piping must be at least one size larger than the connection, as short and direct as possible, secured tightly and routed to a suitable drain point or waste container. Condensate must be disposed of in accordance with local, state, and federal laws and regulations.

△ WARNING If an aftercooler, check valve, block valve, or any other restriction is added to the compressor discharge, install a properly-sized ASME approved safety/relief valve between the compressor discharge and the restriction.

INSTALLING ELECTRICAL WIRING (ELECTRIC MOTOR UNITS)

△ WARNING Electrical installation and service should be performed by a qualified electrician who is familiar with all applicable local, state and federal laws and regulations.

GENERAL. The motor rating, as shown on the motor nameplate, and the power supply must have compatible voltage, phase and hertz characteristics.

WIRE SIZE. The electrical wiring between the power supply and electric motor varies according to motor horsepower and other factors. Install adequately sized power leads to protect against excessive voltage drop during start-up. Refer to the National Electric Code (NEC) for information on selecting the proper wire size and securing electrical connections. If you connect additional electrical equipment to the same circuit, consider the total electrical load when selecting the proper wire size. **DO NOT USE UNDERSIZE WIRE.**

If wire size information is not available, the wire sizes shown in the following wire selection chart can be used as a safe guide, if the distance does not exceed 50 feet (15.3 m). For longer distances, consult an electrical contractor or the local electric company for recommendations.

MOTOR HP	SINGLE PHASE		THREE PHASE			
	115V	230V	200V	230V	460V	575V
1	12	14	14	14	14	14
1.5	10	14	14	14	14	14
2	8	14	14	14	14	14
3	8	12	14	14	14	14
5	4	8	10	12	14	14
7.5		6	8	10	14	14
10			8	8	12	14
15			4	6	10	10
20			3	4	8	10
25			1	2	6	8
30			0	1	6	8

MAGNETIC STARTER. If the motor installed on your unit has a motor reset button, it does not require a magnetic starter. If the motor does not have this button and the unit does not have a factory-installed starter, install a magnetic starter with thermal overload protection. Follow the manufacturer's instructions for installation. Ingersoll-Rand cannot accept responsibility for damages arising from failure to provide adequate motor protection.

FUSES. Refer to the NEC to determine the proper fuse or circuit breaker rating required. When selecting fuses, remember the momentary starting current of an electric motor is greater than its full load current. Time-delay or "slow-blow" fuses are recommended.

PRESSURE SWITCH. On units without a factory-installed pressure switch, wire a pressure switch in accordance with the appropriate wiring schematic in the DIAGRAMS section of this manual. Mount the pressure switch in accordance with the manufacturer's recommendations. The connecting line to the receiver tank must be as short and direct as possible, and certified safe for at least the maximum working pressure of the unit.

CONNECTING A BATTERY (GASOLINE ENGINE UNITS)

NOTE If you will be making connections to a remote battery, the engine on the compressor unit must be equipped with an alternator.

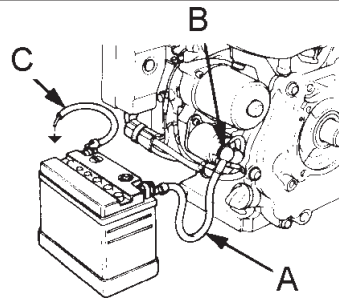
BATTERY. A 12 volt battery with a minimum current rating of 250 CCA (cold cranking amps) and minimum ampere-hour rating of 24 Ah should be sufficient for cranking most electric start engines.

BATTERY CABLES. Refer to the following table for size and length recommendations.

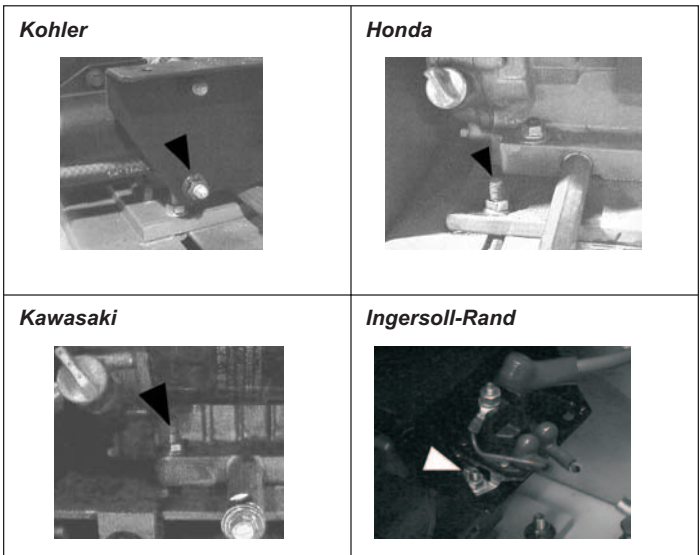
Cable Size (GA)	Maximum Length
6	5' (1.5 m.)
4	7'-2.5" (2.1 m.)
2	12' (3.6 m.)

CONNECTION PROCEDURES:

1. Connect the battery positive (+) cable (A) to the starter solenoid terminal (B).



2. Connect the battery negative (-) cable (C) to the bolt shown in the following illustration. Secure the wire in place by screwing a suitably-sized nut onto the bolt and down onto the terminal.



3. Connect the battery positive (+) cable (A) to the battery positive (+) terminal.
4. Connect the battery negative (-) cable to the battery negative (-) terminal.
5. Coat the terminals and cable ends with corrosion-preventive grease.

⚠ WARNING Remove the cable from the negative (-) side of the battery before servicing.

Refer to the engine manufacturer's instructions for more information.

FUEL PUMP INSTALLATION (GASOLINE ENGINE UNITS) _

Some engines use an optional fuel pump to supply gasoline to the engine directly from a vehicle's onboard fuel system. Install the fuel pump within 12 inches (30 cm) of the bottom surface of the vehicle's fuel tank. Protect the pump from contamination by installing a fuel isolation valve and an inline filter between the pump fuel system.

COMPRESSOR LUBRICATION _____

⚠ CAUTION Do not operate without lubricant or with inadequate lubricant. Ingersoll-Rand is not responsible for compressor failure caused by inadequate lubrication.

SYNTHETIC COMPRESSOR LUBRICANT. Ingersoll-Rand recommends All Season Select synthetic lubricant from start-up. See the WARRANTY section for extended warranty information.

ALTERNATE LUBRICANTS. You may use XL-300 or a comparable petroleum-based lubricant that is premium quality, does not contain detergents, contains only anti-rust, anti-oxidation, and anti-foam agents as additives, has a flashpoint of 440°F (227°C) or higher, and has an auto-ignition point of 650°F (343°C) or higher.

See the petroleum lubricant viscosity table below. The table is intended as a general guide only. Heavy duty operating conditions require heavier viscosities. Refer specific operating conditions to Ingersoll-Rand for recommendations.

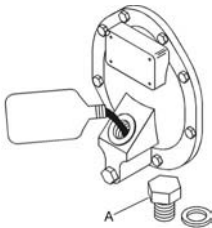
Temperature Around Compressor		Viscosity @ 100°F (37.8°C)		Viscosity Grade	
°F	°C	SUS	Centistokes	ISO	SAE
< 40	< 4.4	150	32	32	10
40-80	4.4-26.7	500	110	100	30
80-125	26.7-51.0	750	165	150	40

If you use a petroleum-based compressor lubricant at start-up and decide to convert to All Season Select later on, the pump must be decarbonized and flushed before conversion. Contact Ingersoll-Rand for more information.

FILLING PROCEDURES:

1. Unscrew and remove the oil fill plug.
2. Fill the crankcase with lubricant.
3. Replace the oil fill plug **HAND TIGHT ONLY**.

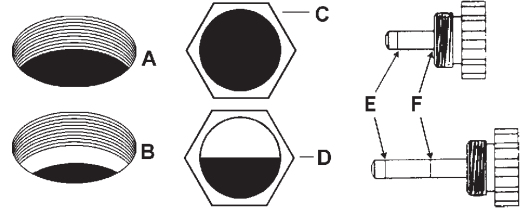
⚠ CAUTION Do not remove the oil fill plug while the compressor is running.



Refer to the following table for crankcase capacity.

Model	Crankcase Capacity
2340	28 oz. (827 ml.)
2475	41 oz. (1212 ml.)
2545	73 oz. (2158 ml.)
7100	80 oz. (2365 ml.)
15T, 3000	144 oz. (4258 ml.)

Use one of the following methods illustrated to determine when the crankcase is full.



A = FULL level at bottom thread of oil fill opening on units without sight glass or dipstick.

B = ADD level below bottom thread of oil fill opening on units without sight glass or dipstick.

C = FULL level on units with sight glass.

D = ADD level on units with sight glass.

E = ADD level on units with dipstick.

F = FULL level on units with dipstick.

LOW OIL LEVEL SWITCH _____

A float activated low oil level switch may be installed to protect your unit against damage due to insufficient compressor oil level. Low oil level in the compressor crankcase causes the switch contacts to open, thus shutting the unit down until the proper oil level has been restored.

Proper protection against low oil level depends on proper adjustment of the low oil level switch. During the initial run, stop the unit and drain one quart of oil from the compressor crankcase into a suitable clean container. Listen for the switch to click or check the switch with a continuity tester.

The float sometimes gets cocked or stuck during shipping. If the float is cocked or stuck, open the disconnect switch, drain the remaining oil, remove the crankcase cover and then free the float. Reassemble and then reuse the same oil.

NOTE If the float is cocked in the low position, the unit cannot start.

OPERATION

INTERMITTENT DUTY FORMULA

Units operating above 200 PSIG are to be operated according to the "Intermittent Duty Formula."

INTERMITTENT DUTY FORMULA

Pump-up time should not ordinarily exceed thirty (30) minutes or be less than ten (10) minutes. Shutdown periods between cycles of operation should be at least equal to the pump-up time. Note: When the compressor is regulated by constant speed control, the shutdown period is the time the compressor is operating unloaded.

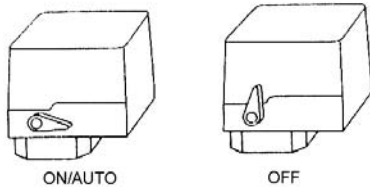
A pump-up time limit with the following cool-down period is recommended to protect the valves and heads against stabilized high operating temperatures, which could rapidly build up carbon in these areas.

All inquiries for high-pressure compressor application where the "use" cycle differs from the "Intermittent Duty Formula" should be referred to Ingersoll-Rand.

START-UP (ELECTRIC MOTOR DRIVEN MODELS)

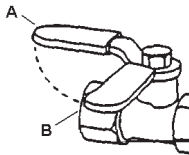
1. Close the service valve.
2. Release any remaining tank pressure by slowly opening the manual drain valve.
3. Close the manual drain valve and apply power to the compressor. If the pressure switch is equipped with an "ON/AUTO-OFF" lever, flip the switch to the "ON/AUTO" position. If the unit is equipped with a control panel "ON/OFF" switch, move the switch to the "ON" position.

Typical Pressure Switch Lever (If Equipped)



4. Slowly open the service valve.

Typical Service Valve (A = Open, B = Closed)



CAUTION Unusual noise or vibration indicates a problem. Do not continue to operate until you identify and correct the source of the problem.

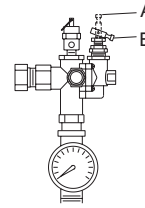
NOTE Ensure the direction of rotation is correct per the arrow on the motor. If the rotation is incorrect on three-phase units, interchange any two of the three leads.

START-UP (GASOLINE ENGINE UNITS)

WARNING Do not operate gasoline engine units in an enclosed area.

1. Release any remaining tank pressure by slowly opening the manual drain valve.
2. Turn on the engine gasoline supply.
3. Put the choke in the "on" position.
4. Close the service valve and put the unloader lever in the "unload" (A) position for Kawasaki and Honda engine driven models, or the "load" (B) position for Kohler engine driven models.
5. Start the engine, release the choke, and allow the engine to warm up for two to three minutes.
6. Return the unloader lever to the "load" (B) position on Kawasaki and Honda engine driven models.

Typical Unloader (A = Unload, B = Load)



NOTE Turn the gasoline supply off when the compressor is not being used.

NOTE Some gasoline engine driven compressors require 5-8 break-in hours of operation before reaching full capacity and speed.

COMPRESSOR CONTROLS

AUTOMATIC START & STOP CONTROL. This type of control applies to electric motor driven models under 10 horsepower.

NOTE Automatic Start & Stop Control is intended for use when the motor will start no more than 6 times per hour.

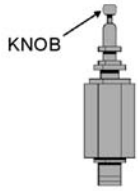
When the receiver tank pressure reaches the factory pre-set maximum pressure (usually 175 PSIG), the pressure switch stops the unit. When the receiver tank pressure drops below the factory pre-set minimum (usually 135 PSIG), the pressure switch resets and restarts the unit.



CONSTANT SPEED CONTROL. This type of control applies to gasoline engine units.

When the receiver tank pressure reaches the factory pre-set maximum pressure (usually 175 PSIG), the unloader slows down the engine and the unit stops pumping. When the receiver tank pressure drops to the factory pre-set minimum (usually 145 PSIG), the unloader resets, the engine returns to full speed, and the unit resumes pumping.

DUAL CONTROL. This type of control applies to electric motor units over 10 horsepower. Select either automatic start and stop control or constant speed control by adjusting the knob on the auxiliary valve. For automatic start and stop control, turn the knob on the auxiliary valve fully clockwise to disable the auxiliary valve. The pressure switch will then start and stop the unit.

NOTE For dual control models, automatic start and stop is preferred.

Auxiliary Valve.

-  CLOCKWISE
 COUNTERCLOCKWISE

Select constant speed control if the unit restarts in less than 10 minute intervals or runs more than 40 minutes per hour. Turn the knob fully counterclockwise to run the unit continually. When the receiver tank pressure reaches 170 PSIG, the unit runs but does not pump.

NOTE The auxiliary valve is factory pre-set at 5 PSIG lower than the factory pressure switch setting.

CAUTION Running unloaded for more than 20 minutes per hour or more than 15 minutes continually with the use of constant speed control will cause oil pumping and should be avoided.

PRESSURE SWITCH ADJUSTMENT

WARNING High voltage is present at the pressure switch contacts when the power supply is connected. Disconnect, lock and tag main power supply before making adjustments.

CAUTION Do not adjust the pressure switch to exceed the maximum discharge pressure of the unit.

NOTE Adjust the pressure switch only if adjustments are absolutely necessary.

CUT-IN & CUT-OUT. The cut-out (compressor shut-down) is the pressure at which the switch contacts open, and the cut-in (compressor restart) is the pressure at which the switch contacts close. See COMPRESSOR CONTROLS.

ADJUSTMENT CONTROLS. All pressure switches have a range adjustment control (A). Some pressure switches also have a differential adjustment (B) control. On switches without a differential adjustment control, the span between cut-in and cut-out pressure levels switches is factory set for 40 ± 4 PSIG and cannot be adjusted.

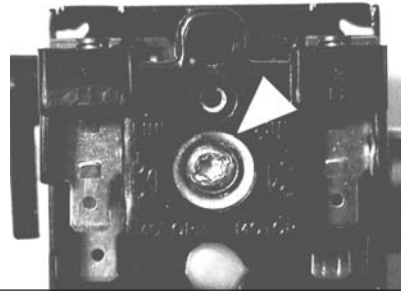
NOTE Some pressure switches are equipped with an on-off lever used to open and close the electrical contacts inside the switch. **THIS LEVER IS NOT A DIFFERENTIAL ADJUSTMENT CONTROL.** The pressure switches with the on-off lever do not have a differential adjustment control.

ADJUSTMENT PROCEDURES (SWITCHES WITHOUT DIFFERENTIAL ADJUSTMENT CONTROL):

1. Remove the pressure switch cover.
2. Adjust the range by turning the range adjustment screw clockwise (in) to increase the cut-out point or counter-clockwise (out) to decrease the cut-out point.

NOTE: One full turn changes the setting approximately 2 PSIG.

3. Replace cover, reconnect power supply and start the compressor.
4. Note the pressure gauge reading at which the compressor cuts out.
5. Repeat adjustment procedure if necessary.

Pressure Switch Range Adjustment.**ADJUSTMENT PROCEDURES (SWITCHES WITH DIFFERENTIAL ADJUSTMENT CONTROL):**

1. Remove the pressure switch cover.
2. Set the cut-in pressure with the range adjustment nut. Turn the nut clockwise (in) to increase the pressure or counter-clockwise (out) to decrease the pressure.

NOTE: One full turn changes the setting approximately 2 PSIG.

3. Set the cut-out pressure with the differential adjustment. Turn the differential adjustment nut clockwise (in) to increase the pressure or counter-clockwise (out) to decrease the pressure.

NOTE: One full turn changes the setting approximately 2 PSIG.

4. Replace the cover, reconnect the power supply and start the unit.
5. Note the pressure gauge reading at which the unit cuts out.
6. Repeat the adjustment procedure if necessary.

The minimum possible differential is approximately 20% of cutout pressure. It is advisable to have as wide a differential as possible to avoid frequent starting and stopping of the unit. Note the pressure gauge reading at which the unit cuts-out and re-establish this point if necessary.

Note the interaction between the range and differential adjustments, i.e., if the cut-out is increased, the differential will also increase, or if the differential is narrowed, the cut-out will be reduced, etc. These factors must be considered when adjusting the switch and compensated for accordingly.

STARTING UNLOADING SYSTEM

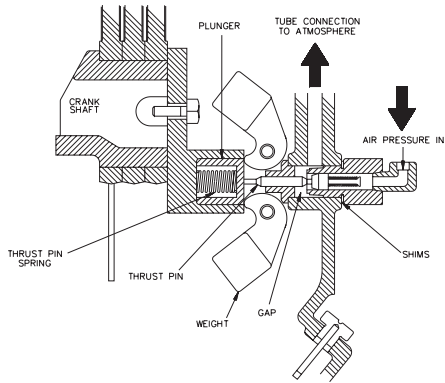
The starting unloading feature exists on certain models. The purpose of the system is to relieve cylinder pressure when the unit stops, permitting it to start against a light load. A light load increases the life of the driver and belts and also reduces the possibility of tripping the overload relay. The system operates in the following manner:

The centrifugal unloader is attached to the end of the crankshaft as shown in the following illustrations.

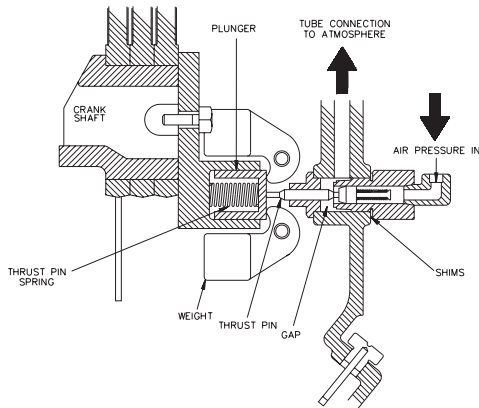
When the unit starts, centrifugal force acts upon the unloader weights and they swing outward. This permits the plunger and thrust pin to move inward and the pilot valve to close. The escape path to atmosphere for the cylinder pressure is now closed and the compressor pumps air in a normal manner.

When the unit stops, the weights retract, permitting the thrust pin spring to move the plunger and thrust pin outward. The thrust pin opens the pilot valve and the trapped air pressure escapes from the cylinder and intercooler through a passage in the frame end cover, through the unloader tube and to atmosphere through the inlet filter/silencer.

Position of weight and thrust pin when unit is operating.



Position of weight and thrust pin when unit is stopped.



PILOT VALVE ADJUSTMENT

If the pilot valve tube line is excessively hot, it is a good indication that the pilot valve is leaking and adjustment is required.

To adjust the pilot valve, proceed as follows:

1. Stop the unit and disconnect and tag the electrical supply main switch to prevent accidental start-up.
2. Remove the pilot valve tube and the tube fittings.
3. Remove the pilot valve body and all existing shims.
4. Screw the pilot valve body back into the frame end cover (without any shims) until contact with the thrust pin is felt. Advance the pilot valve body 1/4 to 1/2 turn more.

If contact with the thrust pin cannot be felt, the following steps may be necessary to locate the contact point:

1. Insert a small instrument (punch, rod, nail, etc.) into the end of the pilot valve until it contacts the valve stem.
2. While still inserted in the pilot valve, make a mark on the instrument even with the outside edge of the pilot valve body.
3. Keeping the instrument pressed lightly against the valve stem, screw the pilot valve body into the frame end cover. When the mark on the instrument starts moving out away from the edge of the pilot valve body, contact has been made with the thrust pin.
4. Advance the pilot valve body 1/4 to 1/2 turn more and proceed with step five.
5. Measure the gap between the pilot valve body and the frame end cover.
6. Remove the pilot valve body and add enough shims to fill the gap measured in step five.
7. Screw the pilot valve body back into the frame end cover until the body is tight on the shims.
8. Reconnect the pilot valve tube and tube fittings.

BREATHER/UNLOADER BY-PASS

The breather/unloader by-pass tube lines eliminates air pressure build-up in the compressor frame by providing a passage for the air to escape through the inlet unloader (if opened) or (if closed) through the check valve, therefore, by-passing the inlet unloader and escaping to atmosphere through the inlet filter/silencer.

OIL CONSUMPTION CHECK

A rule of thumb in determining a "passing grade" for oil consumption is to consider consumption at or above 50 horsepower-hours per ounce to be acceptable.

The formula is as follows:

$$\frac{\text{Horsepower} \times \text{Hours of Operation}}{\text{Ounces of Oil Used}} = \text{Horsepower Hours per Ounce}$$

To apply this formula, consider the size of the machine. In the following example, a 5 horsepower compressor uses 2 ounces of oil every 20 hours of operation.

$$\frac{5 \text{ Horsepower} \times 20 \text{ Hours of Operation}}{2 \text{ Ounces of Oil Used}} = 50 \text{ Horsepower Hours per Ounce}$$

The compressor in the example passes the oil consumption test.

NOTE New or rebuilt compressor pumps will discharge higher than normal amounts of oil until the piston rings are seated (approximately 100 operating hours).

MAINTENANCE

⚠ WARNING Before performing maintenance, release air pressure from the system and disconnect, lock and tag the main power supply or disconnect the wire from the engine spark plug.

NOTE All compressed air systems contain maintenance parts (e.g. lubricating oil, filters, separators) which are periodically replaced. These used parts may be, or may contain, substances that are regulated and must be disposed of in accordance with local, state, and federal laws and regulations.

NOTE Take note of the positions and locations of parts during disassembly to make reassembly easier. The assembly sequences and parts illustrated may differ for your particular unit.

NOTE Any service operations not explained in this manual should be performed by an authorized service representative.

NOTE Reference the engine owner's manual for engine care information.

NOTE The following maintenance schedule has been developed for typical applications. Maintenance intervals should be shortened in harsher environments.

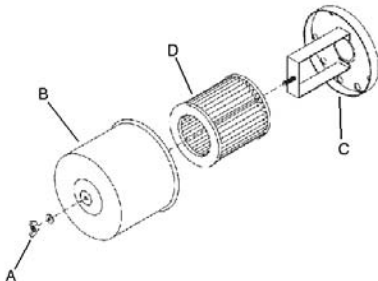
MAINTENANCE SCHEDULE

Daily or Before Each Operation	<ul style="list-style-type: none"> ● Check for oil leaks. ● Check lubricant level. Fill as needed. ● Drain receiver tank condensate (if automatic draining device is not provided). Open manual drain valve and collect and dispose of condensate accordingly. ● Check for unusual noise and vibration. ● Ensure beltguards and covers are securely in place. ● Ensure engine (if supplied) is filled with fuel and lubricant according to the manufacturer's recommendations. ● Ensure area around compressor is free from rags, tools, debris, and flammable or explosive materials.
Weekly	<ul style="list-style-type: none"> ● Observe operation of safety/relief valves while the compressor is running. Replace safety/relief valves that do not operate freely. ● Inspect air filter element(s). Clean if necessary.
Monthly	<ul style="list-style-type: none"> ● Inspect for air leaks. Squirt soapy water around joints during compressor operation and watch for bubbles. ● Check tightness of screws and bolts. Tighten as needed. ● Inspect drive belts. Adjust if necessary. ● Clean exterior.
3/500 *	<ul style="list-style-type: none"> ● Change petroleum lubricant while crankcase is warm.
12/2000 *	<ul style="list-style-type: none"> ● Drain compressor oil and clean oil sight glass ● Install maintenance pak — or — ● Change synthetic lubricant while crankcase is warm. ● Replace filter element.

* indicates months/operating hours, whichever occurs first.

FILTER INSPECTION & CLEANING

1. Unscrew and remove the wing nut (A) securing the filter housing (B) to its base (C).
2. Remove the filter housing and withdraw the old filter element (D). Clean the element with a jet of air or vacuum.
3. Replace the filter element and housing, securing it in place with the wing nut previously removed.



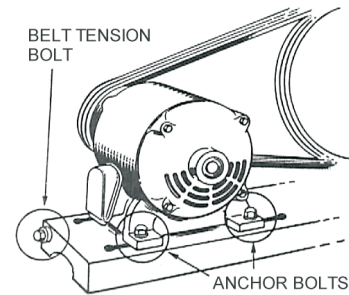
OIL CHANGE

1. Remove the oil drain plug (A) and allow the lubricant to drain into a suitable container.
2. Replace the oil drain plug.
3. Follow the filling procedures in OPERATION section.

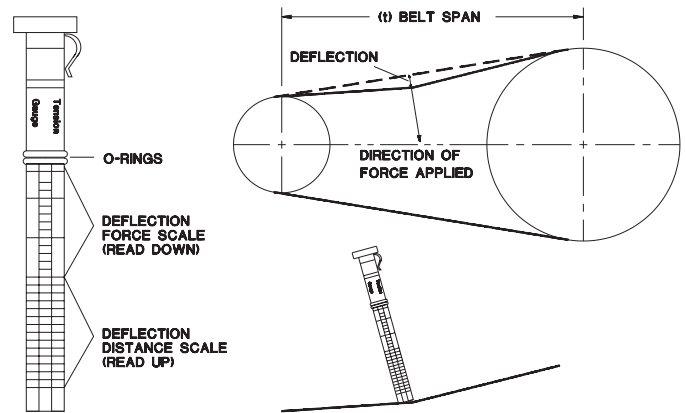
BELT ADJUSTMENT

CHECKING BELT TENSION. Check belt tension should be occasionally, especially if looseness is suspected. New belts must also be properly tensioned upon installation.

TENSIONING BELTS. Belt tensioning can be achieved by loosening the motor or engine anchor screws, pushing the motor or engine away from the pump, and retightening the motor or engine anchor screws. Some units are equipped with a belt tensioning bolt that, when turned, pulls the motor or engine away from the pump. Otherwise, the motor can be easily moved by placing a prying tool beneath it. A commercially available spreader or other belt tensioning device can also be helpful.



Follow the procedures outlined below to correctly set and measure belt tension on electric motor and gas engine models including 2340, 2475, and 2545 (with "A" belt type only). Refer to the following illustration for a visual representation.



1. Lay a straight edge across the top outer surface of the belt drive from pulley to sheave.
2. At the center of the span, perpendicular to the belt, apply pressure to the outer surface of the belt with a tension gauge. Force the belt to the deflection indicated in the BELT TENSION TABLE in the DIAGRAMS & TABLES section. Compare the reading on the tension gauge to the table.

Follow the procedures outlined below to correctly set and measure tension on 7.5 through 30 horsepower models 2545, 7100, 15T and 3000 with "B" and "C" belt types.

1. Measure the span length (t) of the drive.
2. Determine the amount of deflection (in inches) required to measure deflection force (in pounds) by multiplying the span length (t) by 1/64. For example, a 32" span length multiplied by 1/64 equals 1/2" of deflection required to measure deflection force.
3. Lay a straight edge across the top outer surface of the belt drive from pulley to sheave.
4. At the center of the span, perpendicular to the belt, apply pressure to the outer surface of the belt with a tension gauge. Force the belt to the predetermined deflection calculated in step 2. Compare the reading on the tension gauge to the BELT TENSION TABLE in the DIAGRAMS & TABLES section.

Ensure the pulley and sheave are properly aligned and the motor anchor screws are adequately retightened prior to restarting the compressor.

△ CAUTION Improper pulley/sheave alignment and belt tension can result in motor overload, excessive vibration, and premature belt and/or bearing failure.

To prevent these problems from occurring, ensure the pulley and sheave are aligned and belt tension is satisfactory after installing new belts or tensioning existing belts.

ELECTRIC DRAIN MAINTENANCE

NOTE The following maintenance schedule has been developed for typical applications. Maintenance intervals should be shortened in harsher environments.

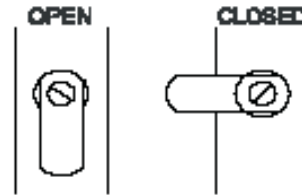
DRAIN VALVE MAINTENANCE SCHEDULE	
DAILY	Test the valve for proper operation. Clean the filter screen if needed.
MONTHLY (EVERY 30 DAYS)	Clean the filter screen.

To clean the filter screen, perform the following steps:

1. Close the strainer ball valve completely to isolate it from the air receiver tank.
 2. Press the TEST button on the timer to vent the pressure remaining in the valve. Repeat until all pressure is removed.
- △ CAUTION** High pressure air can cause injury from flying debris. Ensure the strainer ball valve is completely closed and pressure is released from the valve prior to cleaning.
3. Remove the plug from the strainer with a suitable wrench. If you hear air escaping from the cleaning port, STOP IMMEDIATELY and repeat steps 1 and 2.
 4. Remove the stainless steel filter screen and clean it. Remove any debris that may be in the strainer body before replacing the filter screen.

5. Replace plug and tighten with wrench.

Position of weight and thrust pin when unit is operating.



6. When putting the EDV-2000 back into service, press the TEST button to confirm proper function.

TANK INSPECTION

The life of an air receiver tank is dependent upon several factors including, but not limited to, operating conditions, ambient environments, and the level of maintenance. The exact effect of these factors on tank life is difficult to predict; therefore, Ingersoll-Rand recommends that you schedule a certified tank inspection within the first five years of compressor service. To arrange a tank inspection, contact Ingersoll-Rand.

If the tank has not been inspected within the first 10 years of compressor service, the receiver must be taken out of service until it has passed inspection. Tanks that fail to meet requirements must be replaced.

△ WARNING Failure to replace a rusted air receiver tank could result in air receiver tank rupture or explosion, which could cause substantial property damage, severe personal injury, or death. Never modify or repair tank. Obtain replacement from service center.

TROUBLESHOOTING

PROBLEM	CHECK POINT
Abnormal piston, ring or cylinder wear	4, 8, 9, 19, 28, 35
Air delivery drops off	1, 6, 15, 16, 18, 19, 29
Automatic drain valve leaks or does not drain automatically	16
Auxiliary valve chatters or leaks around stem	23, 24
Broken intercooler or aftercooler tubes	36
Compressor does not come up to speed	2, 6, 12, 15, 21
Compressor is slow to come up to speed	26, 27, 33, 34
Compressor runs excessively hot	3, 14, 15, 22
Compressor will not unload cycle	23, 24, 26
Compressor will not unload when stopped	26, 33
Excessive noise during operation	2, 6, 15, 16, 21, 27, 32
Excessive starting and stopping	5, 11, 16, 32, 40
Knocks or rattles	2, 15, 17, 19, 20, 21
Lights flicker or dim when running	12, 13
Moisture in crankcase or "milky" appearance in petroleum lubricant or rusting in cylinders	9, 10
Motor overload trips or draws excessive current	5, 6, 12, 13, 14, 15, 16, 19, 20, 21, 34
Oil in discharge air (oil pumping)	4, 7, 9, 18, 19, 25, 35
Oil leaking from shaft seal	25
Safety/relief valve "pops"	1, 5, 29, 30
High interstage pressure	30
Low interstage pressure	31
Engine cranks slowly or will not start	6, 14, 37, 38
Motor will not start	12
Engine will not start	39
Oil Leaks	41

ELECTRIC DRAIN TROUBLESHOOTING

Trouble	Cause	Action
Valve will not close.	<ol style="list-style-type: none"> 1. Debris in solenoid valve prevents diaphragm from seating. 2. Short in electrical component. 	<ol style="list-style-type: none"> 1. Remove solenoid valve, disassemble, clean and reassemble. 2. Check and replace power cord or timer as needed.
Timer will not activate.	<ol style="list-style-type: none"> 1. No electrical supply. 2. Timer malfunction 3. Clogged port. 4. Solenoid valve malfunction. 5. Clogged strainer. 	<ol style="list-style-type: none"> 1. Apply power. 2. Replace timer. 3. Clean valve. 4. Replace solenoid valve. 5. Clean strainer.

CHECK POINT	POSSIBLE CAUSE	POSSIBLE SOLUTION
1	Clogged or dirty inlet and/or discharge line filter.	Clean or replace.
2	Loose beltwheel or motor pulley, excessive end play in motor shaft or loose drive belts.	Check beltwheel, motor pulley, crankshaft, drive belt tension and alignment. Repair or replace as required.
3	Inadequate ventilation around beltwheel.	Relocate compressor for better air flow.
4	Lubricant viscosity too low.	Drain existing lubricant and refill with proper lubricant.
5	Air leaks in air discharge piping.	Check tubing and connections. Tighten joints or replace as required.
6	Lubricant viscosity too high.	Drain existing lubricant and refill with proper lubricant.
7	Lubricant level too high.	Drain excess lubricant.
8	Lubricant level too low.	Add lubricant to crankcase to proper level.
9	Detergent type lubricant being used.	Drain existing lubricant and refill with proper lubricant.
10	Extremely light duty cycles. Compressor located in damp or humid location.	Run compressor for longer duty cycles. Relocate compressor or install crankcase heater kit.
11	Pressure switch differential too narrow.	Adjust pressure switch to increase differential, if differential adjustment is provided. Install pressure switch with differential adjustment feature if differential adjustment is desired.
12	Improper line voltage. Wiring or electric service panel too small. Poor contact on motor terminals or starter connections. Improper starter overload heaters.	Check line voltage and upgrade lines as required. Contact electrician. Install properly sized wire or service box. Contact electrician. Ensure good contact on motor terminals or starter connections. Install proper starter overload heaters. Contact electrician.
13	Poor power regulation (unbalanced line).	Contact power company.
14	Drive belts too tight or misaligned.	Adjust belts to proper tension and alignment.
15	Compressor valves leaky, broken, carbonized or loose.	Inspect valves. Clean or replace as required. Install Valve/Gasket Step Saver Kit..
16	Automatic drain valve clogged, leaking or defective.	Inspect valve and clean, repair or replace as required.
17	Carbon build-up on top of piston(s).	Clean piston(s). Repair or replace as required.
18	Piston rings damaged or worn (broken, rough or scratched). Excessive end gap or side clearance. Piston rings not seated, are stuck in grooves or end gaps not staggered.	Install Ring/Gasket Step Saver Kit. Adjust piston rings.
19	Cylinder(s) or piston(s) scratched, worn or scored.	Repair or replace as required.
20	Connecting rod, piston pin or crankpin bearings worn or scored. Loose bearing spacer on crankshaft.	Inspect all. Repair or replace as required. Install Bearing/Connecting Rod Step Saver Kit.
21	Defective ball bearings on crankshaft or motor shaft.	Inspect bearings and replace if required. Install Bearing/Connecting Rod Step Saver Kit.
22	Wrong beltwheel direction of rotation.	Check motor wiring for proper connections. Reverse two leads on three-phase motors.
23	Leaking, broken or worn inlet unloader parts.	Inspect parts and replace as required.
24	Auxiliary valve dirty or seats worn.	Inspect parts. Clean, adjust or replace as required.
25	Crankshaft seal worn or crankshaft scored.	Replace seal. Install shaft sleeve if required. Install Bearing/Connecting Rod Step Saver Kit.
26	Leaking or maladjusted centrifugal pilot valve.	Replace pilot valve o-ring. Adjust pilot valve.
27	Leaking check valve or check valve seat blown out.	Replace check valve.
28	Extremely dusty atmosphere.	Install remote air inlet piping and route to source of cleaner air. Install more effective filtration.
29	Defective safety/relief valve.	Replace.
30	High pressure inlet valve leaking.	Inspect, clean or repair as required.
31	Low pressure discharge valve leaking.	Inspect, clean or repair as required.
32	Automatic start and stop mode is not suitable for air demand.	Adjust auxiliary valve for constant speed operation.
33	Pressure switch unloader leaks or does not work.	Realign stem or replace.
34	Ambient temperature too low.	Install crankcase heater kit. Convert to All Season Select lubricant. Relocate compressor to warmer environment.
35	Worn cylinder finish.	Deglaze cylinder with 180 grit flex-hone.
36	Beltwheel out of balance, tubes not braced or secured, wrong pulley speed.	Check vibration level, change pulley or beltwheel if required, tighten tube clamps.
37	Engine not grounded properly.	Ground battery to engine as recommended.
38	Gasoline exceeds storage time or contains water.	Replace gas, add fuel stabilizer.
39	No fuel in tank. Fuel valve closed.	See manufacturer's instructions for refueling. Open fuel valve.
40	Low oil pressure. Excessive condensate in receiver tank.	See manufacturer's instructions. Drain receiver tank with manual drain valve or install automatic drain valve.
41	Loose fittings/elbows/connectors	Re-torque fittings per specified torque requirements

DIAGRAMS & TABLES

FASTENER TORQUE TABLE

	2340	2475	2545	7100	15T	3000
High Pressure Head Bolts	75	75	75	75	75	75
Low Pressure Head Bolts	75	75	75	75	75	75
Cylinder Flange Bolts	30	50	50	50	50	50
Frame Cover Bolts	17	17	17	20	20	20
Shaft Cover Bolts	17	17	17	20	20	20
Crankpin Cap Screws	5.5	11	11	12-15	12-15	12-15
Unloader Cover Screws	—	—	11	11	20	11
High Pressure Inlet Valve Screws	11-15 LB-IN	11-15 LB-IN	11-15 LB-IN	5.5	—	5.5
Low Pressure Inlet Valve Screws	11-15 LB-IN	25-30 LB-IN	25-30 LB-IN	5.5	—	5.5
High Pressure Outlet Valve Screws	11-15 LB-IN	11-15 LB-IN	11-15 LB-IN	26	50	26
Low Pressure Outlet Valve Screws	25-30 LB-IN	25-30 LB-IN	25-30 LB-IN	26	90	26
Beltwheel Bolt	33	60	60	113	213	213
High Pressure Head Center Bolts	—	—	10	—	—	—
Low Pressure Head Center Bolts	—	—	14-16	—	—	—

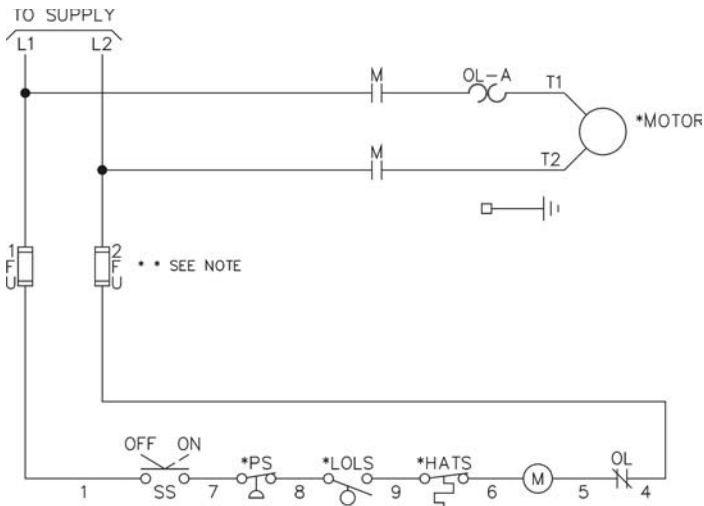
NOTE Tighten all fasteners evenly using a cross pattern in two stages.

BELT TENSION TABLE

MODEL	DEFLECTION (IN.)	TENSION (LB.)	BELT TYPE	HORSEPOWER	TENSION AT 1/64" DEFLECTION PER INCH OF SPAN
2340 (14" Span)	0.25	4.9 - 7.1			
2340 (19" Span)	0.29	4.9 - 7.1	B	7.5	7.0 - 10.0
2475 (14" Span)	0.25	4.9 - 7.1		10-15	8.0 - 12.0
2475 (19" Span)	0.29	4.9 - 7.1	C	20	12.0 - 18.0
2475F/X11GH	0.34	5.5 - 8.0		25-30	14.0 - 21.0
2475F/X9/11GK	0.25	11.25 - 13.0			
2475N5 (14.5" Span, Cogged belt)	0.23	4.5 - 6.5			
2545 (A Groove)	0.29	4.9 - 7.1			

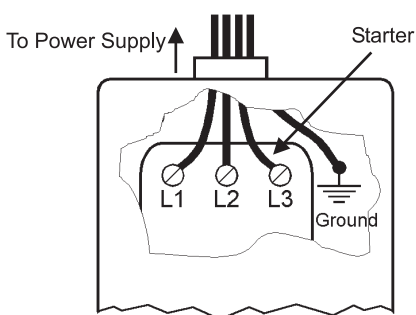
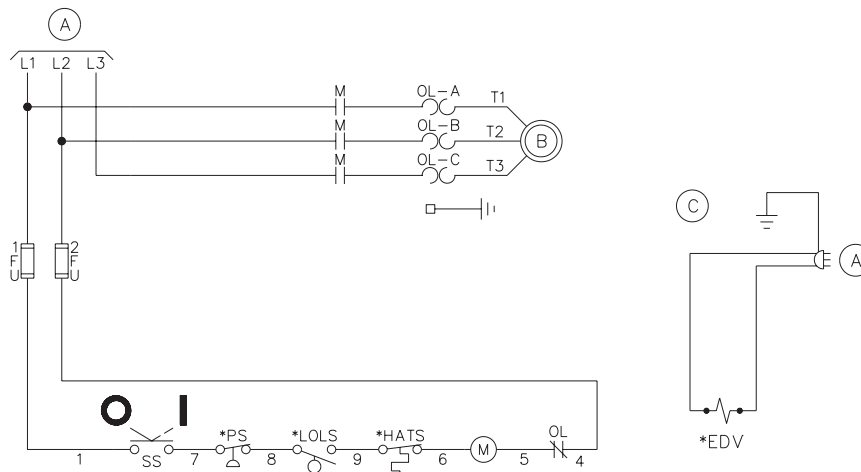
ELECTRICAL WIRING DIAGRAMS

Single Phase Wiring



A	To supply
C	Wiring for optional electric drain valve
EDV	Electric drain valve
T	Supply Line Terminal
L	Load Terminal
FU	Control Circuit Fuse
HATS	High Air Temperature Switch (#)
LOLS	Low Oil Level Switch (#)
M	Motor Starter Coil
OL	Motor Starter Overload
PS	Pressure Switch
SS	Selector Switch (#)
*	Alternate wiring for converting 3 phase starter to 1 phase application
(#)	= if provided

Three Phase Wiring

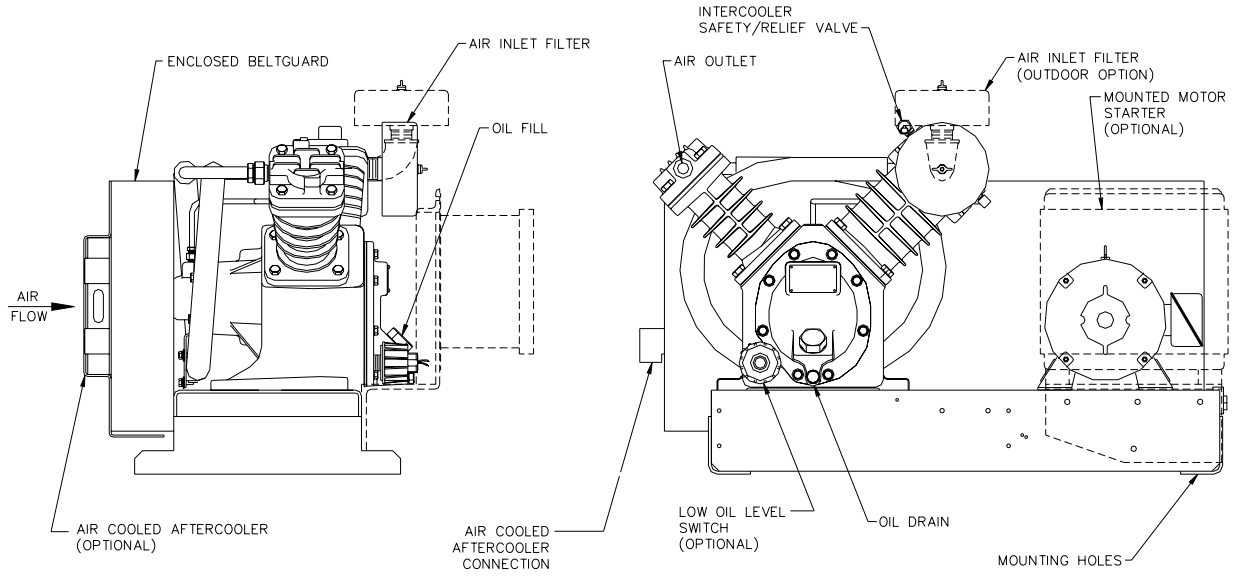


NOTE

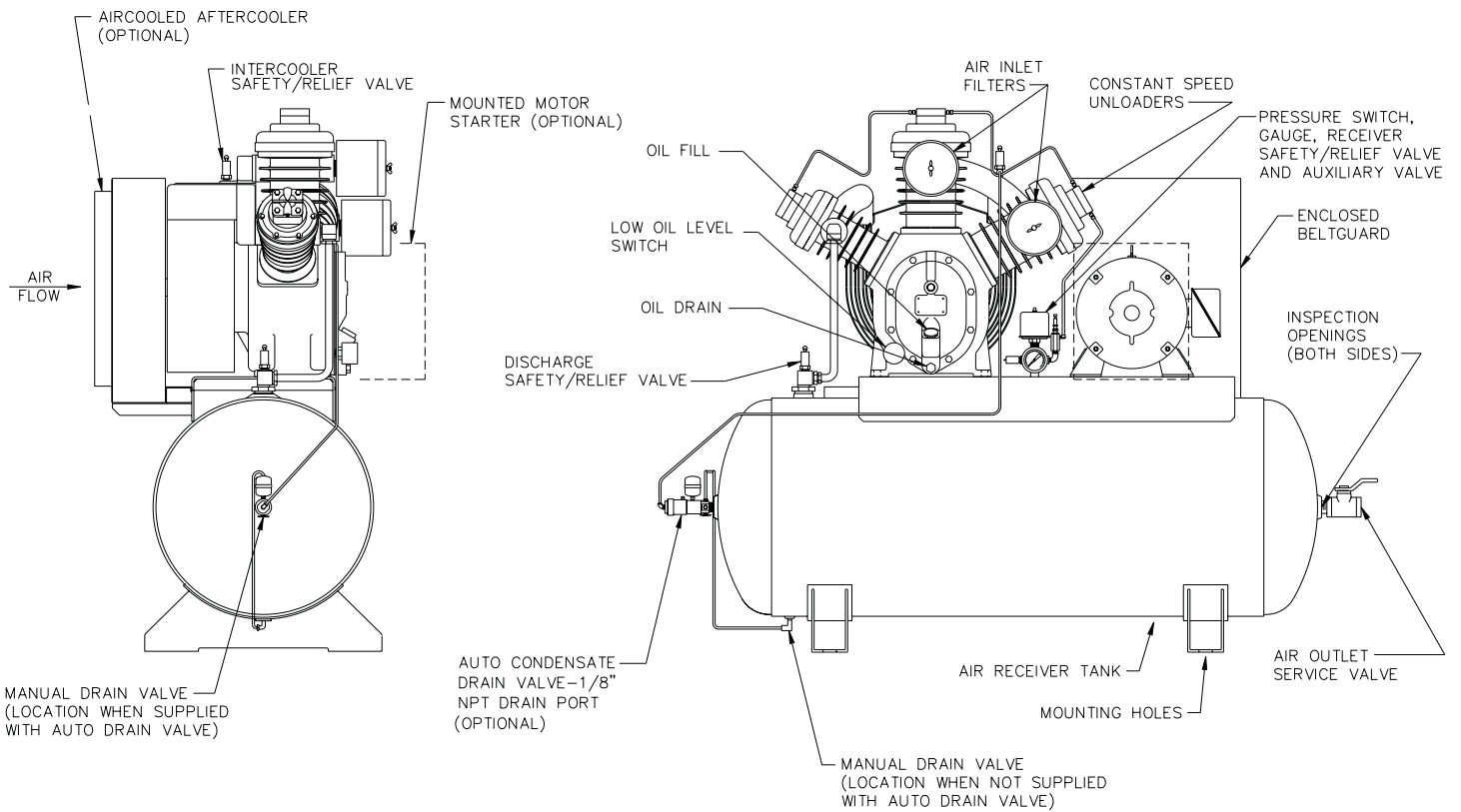
On units requiring a starter, connect line power to the starter. do not connect line power to the pressure switch.

- Connect ground wire to ground lug
- L3 used for 3-phase motors & starters only

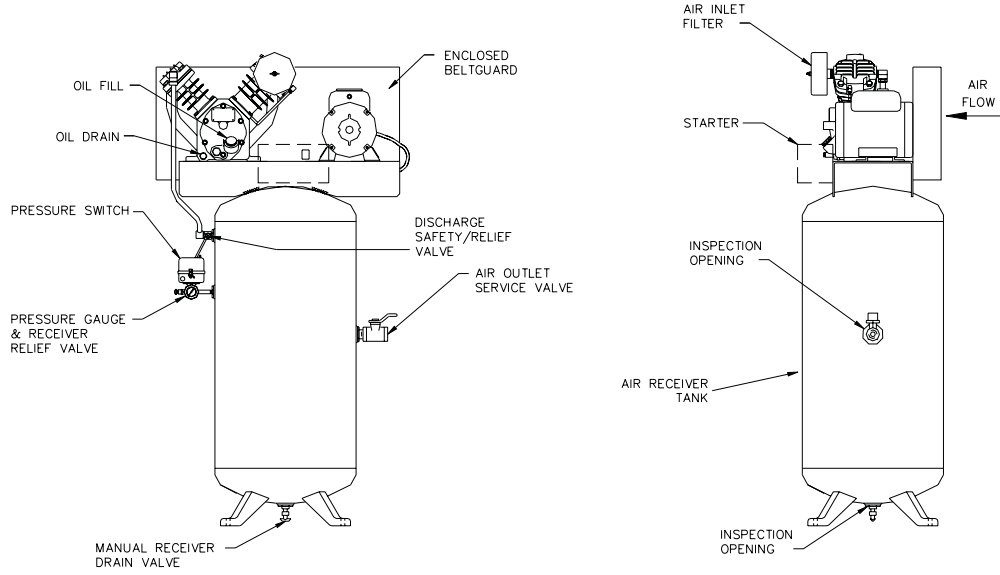
Typical Baseplate Unit



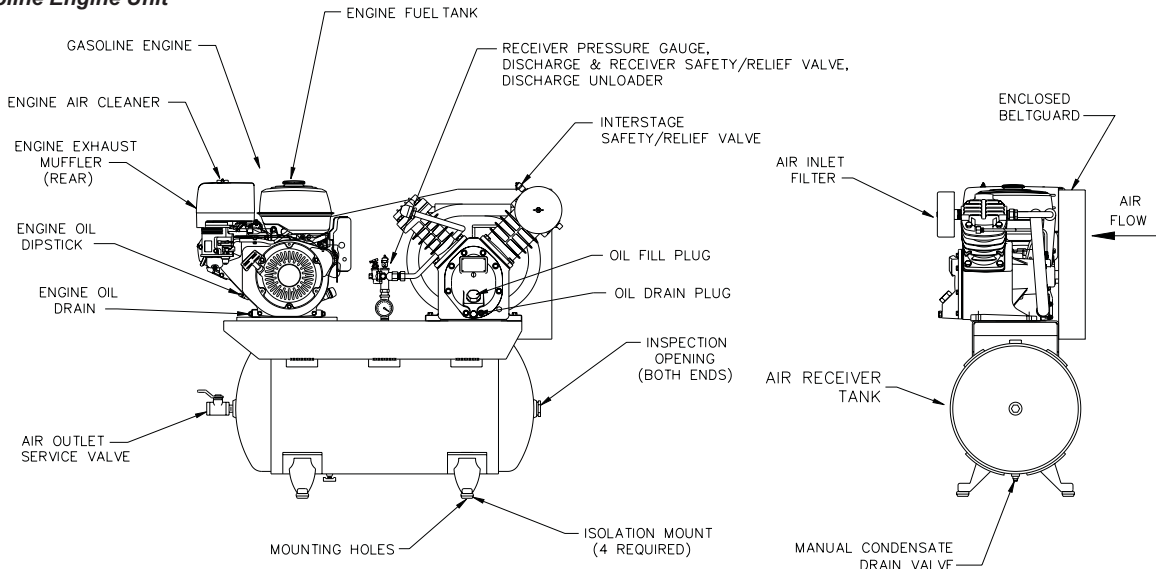
Typical Horizontal Simplex Unit



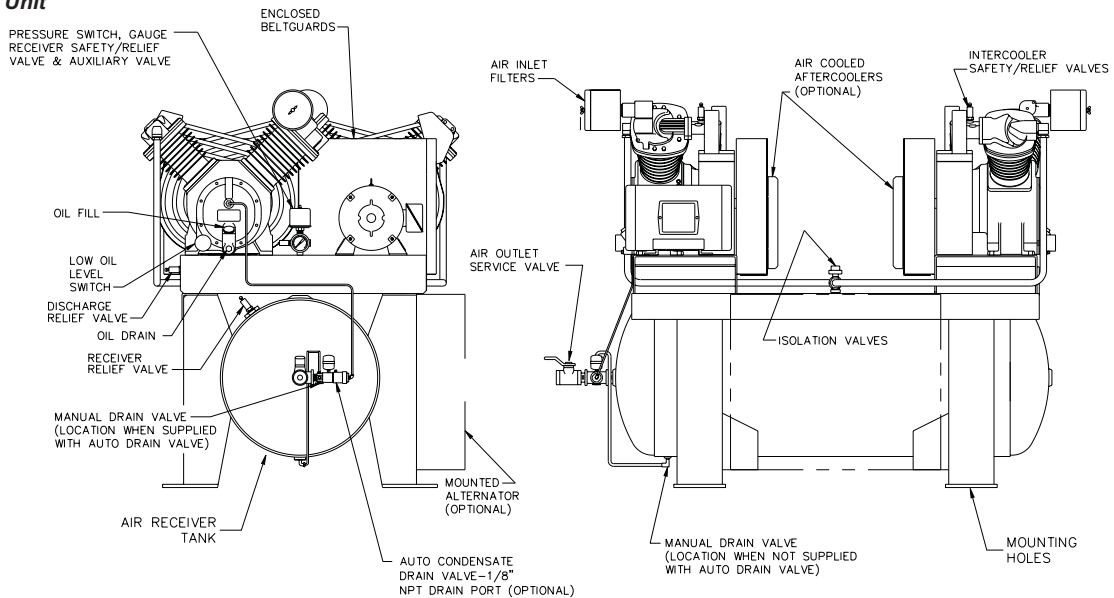
Typical Vertical Simplex Unit



Typical Gasoline Engine Unit



Typical Duplex Unit



WARRANTY

Ingersoll-Rand Company warrants that the Equipment manufactured by it and delivered hereunder shall be free of defects in material and workmanship for a period of twelve (12) months from the date of placing the Equipment in operation or eighteen (18) months from the date of shipment, whichever shall occur first. The foregoing warranty period shall apply to all Equipment, except for the following: (A) Compressors that are operated solely on All Season Select synthetic compressor lubricant will have their bare compressor warranted for the earlier of twenty-four (24) months from the date of initial operation or thirty (30) months from the date of shipment. (B) Replacement parts will be warranted for six (6) months from the date of shipment. Should any failure to conform to this Warranty be reported in writing to the Company within said period, the Company shall, at its option, correct such nonconformity by suitable repair to such Equipment, or furnish a replacement part F.O.B. point of shipment, provided the purchaser has installed, maintained and operated such equipment in accordance with good industry practices and has complied with specific recommendations of the Company. Accessories or equipment furnished by the Company, but manufactured by others, shall carry whatever warranty the manufacturer conveyed to Ingersoll-Rand Company and which can be passed on to the Purchaser. The Company shall not be liable for any repairs, replacements, or adjustments to the Equipment or any costs of labor performed by the Purchaser without the Company's prior written approval.

The Company makes no performance warranty unless specifically stated within its proposal and the effects of corrosion, erosion and normal wear and tear are specifically excluded from the Company's Warranty. In the event performance warranties are expressly included, the Company's obligation shall be to correct in the manner and for the period of time provided above.

THE COMPANY MAKES NO OTHER WARRANTY OF REPRESENTATION OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE HEREBY DISCLAIMED.

Correction by the Company of nonconformities, whether patent or latent, in the manner and for the period of time provided above, shall constitute fulfillment of all liabilities of the Company and its Distributors for such nonconformities with respect to or arising out of such Equipment.

LIMITATION OF LIABILITY

THE REMEDIES OF THE PURCHASER SET FORTH HEREIN ARE EXCLUSIVE, AND THE TOTAL LIABILITY OF THE COMPANY, ITS DISTRIBUTORS AND SUPPLIERS WITH RESPECT TO CONTRACT OR THE EQUIPMENT AND SERVICES FURNISHED, IN CONNECTION WITH THE PERFORMANCE OR BREACH THEREOF, OR FROM THE MANUFACTURE, SALE, DELIVERY, INSTALLATION, REPAIR OR TECHNICAL DIRECTION COVERED BY OR FURNISHED UNDER CONTRACT, WHETHER BASED ON CONTRACT, WARRANTY, NEGLIGENCE, INDEMNITY, STRICT LIABILITY OR OTHERWISE SHALL NOT EXCEED THE PURCHASE PRICE OF THE UNIT OF EQUIPMENT UPON WHICH SUCH LIABILITY IS BASED.

THE COMPANY, ITS DISTRIBUTORS AND ITS SUPPLIERS SHALL IN NO EVENT BE LIABLE TO THE PURCHASER, ANY SUCCESSORS IN INTEREST OR ANY BENEFICIARY OR ASSIGNEE OF THE CONTRACT FOR ANY CONSEQUENTIAL, INCIDENTAL, INDIRECT, SPECIAL OR PUNITIVE DAMAGES ARISING OUT OF THIS CONTRACT OR ANY BREACH THEREOF, OR ANY DEFECT IN, OR FAILURE OF, OR MALFUNCTION OF THE EQUIPMENT, WHETHER OR NOT BASED UPON LOSS OF USE, LOSS PROFITS OR REVENUE, INTEREST, LOST GOODWILL, WORK STOPPAGE, IMPAIRMENT OF OTHER GOODS, LOSS BY REASON OF SHUTDOWN OR NON-OPERATION, INCREASED EXPENSES OF OPERATION, COST OF PURCHASE OF REPLACEMENT POWER, OR CLAIMS OF PURCHASER OR CUSTOMERS OF PURCHASER FOR SERVICE INTERRUPTION WHETHER OR NOT SUCH LOSS OR DAMAGE IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, INDEMNITY, STRICT LIABILITY OR OTHERWISE.



Instrucciones de instalación, operación y mantenimiento para compresores de aire alternativos en dos etapas Modelos 2340, 2475, 2545, 7100, 15T y 3000

¡INFORMACIÓN IMPORTANTE! LEA Y SIGA ESTAS INSTRUCCIONES. GUÁRDELAS COMO REFERENCIA.

SEGURIDAD

DEFINICIONES

- △ **PELIGRO** CAUSARÁ la MUERTE, LESIONES GRAVES o graves daños a la propiedad.
- △ **ADVERTENCIA** PUEDE causar LA MUERTE, LESIONES GRAVES o graves daños a la propiedad.
- △ **PRECAUCIÓN** CAUSARÁ O PUEDE CAUSAR LESIONES MENORES o daños a la propiedad.

PRECAUCIONES GENERALES DE SEGURIDAD

- △ **PELIGRO** **AIRE DE ADMISIÓN.** Puede contener monóxido de carbono u otros contaminantes. Causará lesiones graves o la muerte. Los compresores de aire Ingersoll-Rand no están diseñados, destinados o aprobados para respirar aire. No se debe usar el aire comprimido para aplicaciones de aire respirable, a menos que se trate de acuerdo con todas las normas y reglamentos aplicables.
- △ **ADVERTENCIA** **VOLTAJE PELIGROSO.** Puede causar lesiones graves o la muerte. Desconecte la energía y purgue la presión del tanque antes de hacer mantenimiento. Bloquee/etiquete la máquina. El compresor se debe conectar a un circuito debidamente conectado a tierra. Vea las instrucciones de conexión a tierra en el manual. No opere el compresor en condiciones húmedas. Almacene en interiores.
PARTES MÓVILES. Pueden causar lesiones graves. No opere la máquina si se ha retirado el protector. La máquina puede empezar a funcionar automáticamente. Desconecte la energía ante de hacer mantenimiento. Bloquee/etiquete la máquina.
SUPERFICIES CALIENTES. Pueden causar lesiones graves. No tocar. Deje enfriar antes de hacer mantenimiento. No toque el compresor o la tubería caliente.
- AIRE DE ALTA PRESIÓN.** La derivación, modificación o retiro de las válvulas de seguridad/alivio puede causar lesiones graves o la muerte. No derive, modifique o retire las válvulas de seguridad/desahogo. No apunte el flujo de aire a las personas. Los tanques oxidados pueden causar una explosión y lesiones graves o la muerte. Vacíe el tanques diariamente o después cada uso. Válvula de drenaje ubicada al fondo del tanque.
- △ **PRECAUCIÓN** **RIESGO DE EXPLOSIÓN.** Utilice solamente piezas de manipulación de aire adecuadas que sean aceptables para presiones no inferiores a la presión máxima de trabajo admisible de la máquina.

INFORMACIONES GENERALES

INTRODUCCIÓN

Este manual ofrece instrucciones seguras y confiables para la instalación, operación y mantenimiento de su compresor de aire Ingersoll-Rand. Lea atentamente este manual antes de tratar de operarlo o hacer cualquier mantenimiento. Si no está seguro acerca de alguna de las instrucciones o procedimientos que aparecen en este manual, comuníquese con Ingersoll-Rand. Le recomendamos que guarde este manual y todas las publicaciones que vienen con su compresor de aire en un lugar accesible a todo el personal que opera y da servicio a su equipo compresor de aire.

APLICACIÓN

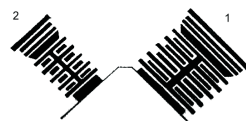
Los compresores de aire estándar lubricados de dos etapas Ingersoll-Rand son máquinas de simple efecto enfriadas por aire. Los compresores típicos se entregan como unidades compactas, autónomas, montadas en el tanque receptor, que se regulan e impulsan automáticamente por un motor eléctrico o motor a gasolina. Entre los accesorios opcionales que se pueden proveer se encuentra un posenfriador enfriado por aire, un interruptor de apagado por bajo nivel de aceite y una válvula de drenaje automático. También se dispone de bombas de compresión sin accesorios y unidades montadas en placa base.

Estos compresores se pueden usar para diversas aplicaciones de aire comprimido de hasta 250 PSIG (17,5 kg/cm²). La aplicación de estos compresores como fuente primaria o complementaria de aire es prácticamente ilimitada en plantas industriales, estaciones de servicio y talleres de auto reparación. El servicio complementario incluye usos como la provisión de aire a una presión que usualmente no se ofrece en las líneas regulares de los talleres, aire en lugares aislados y servicio de reserva de aire cuando se desconectan compresores más grandes..

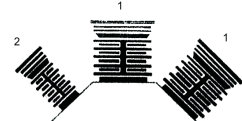
OPERACIÓN EN DOS ETAPAS

Los compresores de dos etapas constan de uno o dos cilindros de primera etapa con el mismo tamaño de diámetro interior y un cilindro de segunda etapa con un tamaño de diámetro interior más pequeño.

Unidad típica de dos etapas y dos cilindros



Unidad típica de dos etapas y tres cilindros



El principio básico de operación es el siguiente: En el recorrido de succión del o de los pistones de primera etapa, el aire a presión atmosférica entra a los cilindros a través del o de los filtros de admisión y luego a las válvulas de admisión ubicadas en la culata. En el recorrido de compresión del o de los pistones de primera etapa, el aire se comprime a una presión intermedia y se descarga a través de la o las

válvulas de descarga hacia el o los múltiples comunes. Desde el o los múltiples, el aire pasa a través de los tubos del interenfriador, donde se elimina el calor de la compresión de primera etapa. En el recorrido de succión del pistón de segunda etapa, este aire enfriado entra al cilindro de segunda etapa a través de la válvula de admisión. El recorrido de compresión del pistón de segunda etapa comprime el aire hasta la presión de descarga final y lo hace salir por la válvula de descarga hacia el tanque o sistema receptor. Si se debe enfriar el aire de descarga, se debe instalar un posenfriador enfriado por aire entre la descarga del compresor y el tanque o sistema receptor.

Para mantener la presión de aire del tanque o del sistema receptor dentro de límites predeterminados, se puede operar el compresor con un control automático de partida y parada o regulación de control de velocidad constante. El tipo de regulación que se use depende de la aplicación.

OTRAS REFERENCIAS

A menos que se indique otra cosa, las dimensiones, pesos y medidas se dan en medidas estándares de los EE.UU., seguidas entre paréntesis por la conversión al sistema métrico. Los valores de torsión dados se indican en pulgadas o pies libras, seguidos por el equivalente en Newton-metros entre paréntesis. Las características eléctricas se dan en voltaje-fase-hertzios.

RECIBO E INSPECCIÓN

Asegúrese de disponer de equipos de levantamiento adecuados para descargar y trasladar su compresor al sitio de instalación.

NOTA El equipo de levantamiento debe estar calibrado adecuadamente para el peso de la unidad.

⚠ **PRECAUCIÓN** Levante la unidad sólo por los patines de embarque. No use el orificio de izamiento del motor para levantar toda la unidad. El orificio de izamiento del motor está destinado exclusivamente para sacar el motor desde la unidad.

⚠ **¡PRECAUCIÓN!** No trabaje ni transite bajo la unidad mientras se encuentra suspendida.

Use un equipo de levantamiento adecuado (por ej., horquilla elevadora) para izar y transportar la unidad hasta el sitio de instalación. Asegúrese de que el equipo de levantamiento, correas, etc., sean capaces de soportar el peso de la unidad..

Antes de firmar el recibo de entrega, asegúrese de que no falten piezas ni hayan piezas dañadas. Si hay evidencia de daños o de que faltan piezas, haga la anotación respectiva en el recibo de entrega y luego firmelo. Comuníquese inmediatamente con el transportista para que realice una inspección.

Todo el material se debe mantener en el lugar de recepción para la inspección del transportista.

Los recibos de entrega firmados que no tienen anotación de daños o piezas faltantes se consideran como prueba de una entrega "sin problemas". Cualquier reclamo posterior se considerará como demanda por daños ocultos. Liquide cualquier demanda por daños con la empresa de transporte.

Si descubre algún daño después de recibir la unidad (daño oculto), debe notificar al transportista dentro de un plazo de 15 días después del recibo y solicitar por teléfono una inspección, con una confirmación por escrito. En las demandas por daños ocultos, la responsabilidad de establecer que la unidad se dañó durante el transporte recae en la persona que hace el reclamo.

Lea la placa de identificación del compresor para verificar que corresponde al modelo solicitado y lea la placa del motor para verificar que es compatible con sus condiciones eléctricas. Asegúrese de que las cajas y componentes eléctricos sean los adecuados para el entorno de instalación.

INSTALACIÓN

SELECCIÓN DE UNA UBICACIÓN

UNIDADES CON MOTOR ELÉCTRICO. Para la mayoría de las unidades con motor eléctrico, seleccione un área interior relativamente limpia y bien iluminada, con suficiente espacio para permitir una adecuada ventilación, flujo de aire de enfriamiento y accesibilidad. Deje 1.000 pies cúbicos de aire fresco por cada 5 caballos de fuerza. Ubique la unidad a una distancia de por lo menos 15 pulgadas (38 cm) de las paredes y asegúrese de que la alimentación principal está claramente identificada y sea accesible.

A menos que los componentes eléctricos de la unidad estén especialmente protegidos para su uso en exteriores, no instale una unidad con motor eléctrico a la intemperie ni en un área en que los componentes eléctricos queden expuestos a la lluvia, nieve o fuentes de humedad apreciables.

ADVERTENCIA PARA UNIDADES DOTADAS DE LA VÁLVULA DE DRENAJE ELÉCTRICO

⚠ **ADVERTENCIA** La válvula de drenaje eléctrico posee piezas que forman arcos o producen chispas, tales como interruptores de resorte, receptáculos y otros similares, que tienden a producir arcos o chispas. Por lo tanto, cuando se ubican en un garaje, el compresor debe estar en una habitación o recinto destinado a ese propósito, o la válvula de drenaje eléctrico debe estar a 18 pulgadas (457 mm) o más por encima del piso.

UNIDADES CON MOTOR A GASOLINA. Para las unidades con motor a gasolina, mantenga el motor a una distancia mínima de 3 pies (1 m) de las paredes y otros equipos. Instale la unidad en un lugar con suficiente espacio para permitir una adecuada ventilación, flujo de aire de enfriamiento y accesibilidad. No instale ni opere una unidad con motor a gasolina en un área cerrada.

CONSIDERACIONES SOBRE LA TEMPERATURA AMBIENTE.

Las temperaturas de operación ideales fluctúan entre los 32°F y los 100°F (0°C y 37,8°C). Si las temperaturas bajan sistemáticamente a menos de 32°F (0°C), ubique el compresor dentro de un área calefaccionada. Si esto no es posible, se deben proteger las válvulas de desahogo/seguridad y de drenaje contra el congelamiento. Si las temperaturas se mantienen de manera sistemática a menos de 40°F (4,4°C), considere la instalación de un juego de calefactores de cárter externos, especialmente si el compresor tiene dificultades para partir.

⚠ **PRECAUCIÓN** Nunca haga funcionar el compresor a temperaturas inferiores a -15°F (-26,1°C) o superiores a 125°F (51,0°C).

ÁREAS HÚMEDAS. En áreas frecuentemente húmedas, se puede acumular humedad en la bomba y producir sedimentos en el lubricante. Esto causará el desgaste prematuro de las piezas móviles. Es muy probable que se produzca un exceso de humedad si la unidad está ubicada en un área sin calefacción sujeta a grandes cambios de temperatura.

Dos signos de exceso de humedad son la condensación externa en la bomba cuando ésta se enfría y un aspecto "lechoso" del lubricante de petróleo.

Es posible que Ud. pueda evitar la acumulación de humedad en la bomba aumentando la ventilación, operando la máquina durante períodos más prolongados o instalando un juego de calefactores del cárter externos.

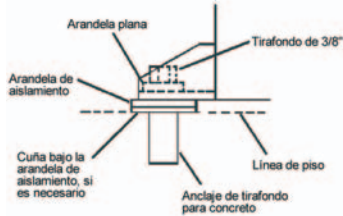
CONSIDERACIONES SOBRE EL RUIDO. Consulte a las autoridades locales sobre los niveles aceptables de ruido en su área. Para reducir el exceso de ruido, use silenciadores en la admisión o almohadillas aislantes de la vibración, ubique la unidad en otro lugar o construya recintos totalmente cerrados o paredes acústicas.

MONTAJE

△ **ADVERTENCIA** Antes del montaje, retire la unidad de los patines.

UNIDADES CON MOTOR ELÉCTRICO. Emperne la unidad a una base nivelada y firme (como un piso de concreto). No apriete excesivamente las patas desniveladas a la base, ya que esto causará una excesiva tensión sobre el tanque receptor. Si es necesario, use cuñas de metal bajo las patas más cortas.

Montaje permanente típico (ferretería suministrada por el cliente)



UNIDADES CON MOTOR A GASOLINA. Emperne la unidad a una base nivelada y firme. No apriete excesivamente las patas desniveladas a la base, ya que esto causará una excesiva tensión sobre el tanque receptor. Si es necesario, use cuñas de metal bajo las patas más cortas. Las unidades con motor a gasolina montadas sobre plataformas de camión se deben fijar firmemente sin aplicar una tensión excesiva sobre el tanque receptor. Recomendamos instalar un juego aislador de vibraciones en los modelos de motor a gasolina.

INSTALACIÓN DE LA TUBERÍA DE ADMISIÓN REMOTA DE AIRE

△ **PRECAUCIÓN** No haga funcionar la unidad sin un filtro de entrada de aire.

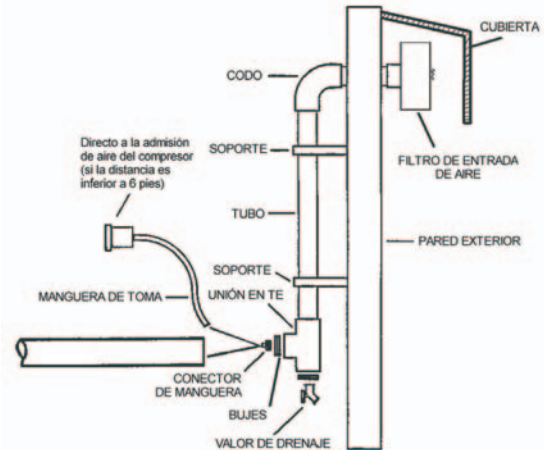
Si el aire alrededor de la unidad está relativamente libre de polvo, instale el filtro de entrada de aire en la conexión de toma de la bomba. Si el aire está sucio, conecte el filtro a una fuente de aire limpio. Use tubos plásticos de PVC para la tubería de admisión remota. No use tubos negros ni tubos galvanizados, ya que ellos fomentan la condensación y la oxidación. Considere la instalación de un filtro de tipo en línea para facilitar la limpieza y el reemplazo. Haga la línea lo más corta y directa posible y con el diámetro más grande posible o al menos superior al diámetro de la conexión de toma en la bomba. No instale tuberías con un diámetro inferior al de la toma de la bomba.

Aumente el diámetro de la tubería en un tamaño por cada 10 pies (3 m) de longitud o cada 90° de curvatura. Compruebe que la tubería está adecuadamente acodada.

Si conecta el filtro hacia el exterior, cúbralo con un sombrerete para evitar la entrada de lluvia o nieve.

Se dispone de equipos de filtración y elementos de filtro de uso intensivo para el polvo fino presente en el aire, como el polvo de roca y cemento.

Típica tubería de admisión remota de aire.



INSTALACIÓN DE TUBERÍA DE DESCARGA

△ **WARNING** No use tubería plástica, accesorios de cobre soldados, manguera de caucho o uniones soldadas con plomo-estaño en ninguna parte del sistema de aire comprimido.

△ **¡PRECAUCIÓN!** Si usa el lubricante sintético para compresores, todo el material de la tubería descendente y los componentes del sistema deben ser compatibles. Consulte la lista de compatibilidad de materiales que se indica a continuación. Si hay materiales incompatibles en su sistema o si hay materiales que no aparecen en la lista, comuníquese con Ingersoll-Rand para obtener recomendaciones..

LUBRICANTE SINTÉTICO PARA COMPRESORES LISTA DE COMPATIBILIDAD DE MATERIALES

ADECUADOS

Viton®, Teflon®, epoxia (relleno con vidrio), alquido resistente al aceite, fluorosilicona, fluorocarbono, polisulfuro, uretano de dos componentes, nilón, Delrin®, Celcon®, goma con alto contenido de nitrilo (Buna N, NBR con más de un 36% de acrilonitrilo), poliuretano, polietileno, epiclorhidrina, poliacrilato, melamina, polipropileno, fenólicos secados, epoxias, alquidos modificados

(® indica una marca registrada de DuPont Corporation)

NO RECOMENDADOS

Neoprén, goma natural, goma SBR, pintura acrílica, laca, barniz, poliestireno, PVC, ABS, policarbonatos, acetato de celulosa, goma con bajo contenido de nitrilo (BUNA N, NBR con menos de un 36% de acrilonitrilo), EPDM, acetato de vinilo etileno, látex, EPR, acrílicos, fenoxi, polisulfones, acrilonitrilo estireno (San), butilo

NOTA

Todos los sistemas de aire comprimido producen líquido condensado que se acumula en todos los puntos de drenaje (por ejemplo, tanques, filtros, tubos de goteo, posenfriadores, secadores, etc.). Este líquido condensado contiene aceite lubricante y/o otras materias que pueden estar sujetos a regulaciones y se deben desechar en conformidad con las leyes y normativas locales, federales y estatales.

REQUISITOS GENERALES. Las tuberías, accesorios, tanque receptor, etc., deben ser de seguridad certificada para al menos la presión de trabajo de la unidad. Use tuberías y accesorios de cobre o hierro fundido de acero roscado o soldadura dura que tengan seguridad certificada para la presión y temperatura de descarga del compresor.. **NO USE PLÁSTICO PVC EN LA LÍNEA DE DESCARGA DE AIRE COMPRIMIDO.** Use sellante de roscas en todas las roscas y junte herméticamente las uniones para evitar fugas de aire.

TUBERÍA DE DESCARGA DE LÍQUIDO CONDENSADO. Si instala una línea de descarga de líquido condensado, la tubería debe tener ser de al menos un tamaño más grande que la conexión, debe ser tan corta y directa como sea posible y debe estar adecuadamente encaminada a un punto de drenaje o contenedor de desechos adecuado. Se debe desechar el líquido condensado en conformidad con las leyes y normativas locales, federales y estatales.

△ **ADVERTENCIA** Si se añade un posenfriador, válvula de retención, válvula de bloqueo o cualquier otra restricción a la descarga del compresor, se debe instalar una válvula de seguridad/desahogo adecuadamente dimensionada y aprobada por ASME entre la descarga del compresor y la restricción.

INSTALACIÓN DE CABLEADO ELÉCTRICO (UNIDADES CON MOTOR ELÉCTRICO)

△ **ADVERTENCIA** La instalación y el servicio eléctrico deben ser realizados por un electricista calificado que esté familiarizado con todas las leyes y normativas locales, federales y estatales aplicables.

GENERALIDADES. La capacidad nominal del motor indicada en la placa del motor y la fuente de energía deben tener características compatibles de voltaje, fase y hertzios.

DIÁMETRO DEL CABLE. El cableado eléctrico entre la fuente de energía y el motor eléctrico varía de acuerdo con los caballos de fuerza del motor y otros factores. Instale conductores de corriente del tamaño adecuado como protección contra una excesiva caída de voltaje durante la puesta en marcha. Consulte el Código Eléctrico Nacional (NEC) para obtener información sobre la selección del tamaño apropiado del cable y la fijación de las conexiones eléctricas. Si conecta otros equipos eléctricos al mismo circuito, considere la carga eléctrica total cuando seleccione el tamaño apropiado de cable. **NO USE CABLES DE DIÁMETRO INSUFICIENTE.**

Si la distancia no excede los 50 pies (15,3 m) y no se dispone de información sobre tamaños de alambres, se puede usar como guía segura los tamaños de alambres que se indican en la siguiente tabla de selección de alambres. Para distancias más largas, pida recomendaciones a un contratista eléctrico o a la compañía eléctrica local.

MOTOR HP	MONOFASICO		TRIFASICO			
	115V	230V	200V	230V	460V	575V
1	12	14	14	14	14	14
1.5	10	14	14	14	14	14
2	8	14	14	14	14	14
3	8	12	14	14	14	14
5	4	8	10	12	14	14
7.5		6	8	10	14	14
10			8	8	12	14
15			4	6	10	10
20			3	4	8	10
25			1	2	6	8
30			0	1	6	8

ARRANCADOR MAGNÉTICO. Si el motor instalado en su unidad tiene un botón de reposición del motor, éste no requiere un arrancador magnético. Si el motor no tiene ese botón y la unidad no tiene un arrancador instalado en fábrica, instale un arrancador magnético con protección térmica contra sobrecarga. Para su instalación, siga las instrucciones del fabricante. Ingersoll-Rand no se hace responsable por daños derivados de la falta de una adecuada protección del motor.

FUSIBLES. Consulte el Código Eléctrico Nacional para determinar la capacidad nominal adecuada de los fusibles e interruptores automáticos que se requieren. Al seleccionar los fusibles, recuerde que la corriente de arranque momentánea de un motor eléctrico es mayor que su

corriente a plena carga. Se recomiendan fusibles temporizados o de acción retardada.

DISYUNTOR AUTOMÁTICO. En las unidades sin disyuntor automático instalado en fábrica, conecte el disyuntor automático según el esquema de instalación eléctrica pertinente en la sección DIAGRAMAS de este manual. Monte el disyuntor automático según recomendaciones del fabricante. La línea de conexión al tanque receptor debe ser tan corta y directa como sea posible y su seguridad debe estar certificada para al menos la presión de trabajo máxima de la unidad.

CONEXIÓN DE UNA BATERÍA (UNIDADES CON MOTOR A GASOLINA)

NOTA

Si usted va a hacer conexiones a una batería remota, el motor en la unidad compresora debe estar dotado de un alternador.

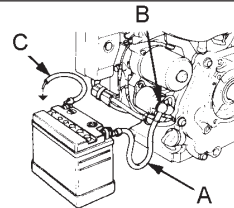
BATERÍA. Una batería de 12 voltios con una potencia nominal mínima de 250 CCA (amperios de arranque en frío) y una potencia nominal mínima de amperios-hora de 24 Ah debería ser suficiente para arrancar la mayoría de los motores de arranque eléctrico.

CABLES DE LA BATERÍA. Para obtener recomendaciones sobre longitud y tamaño, consulte la siguiente tabla.

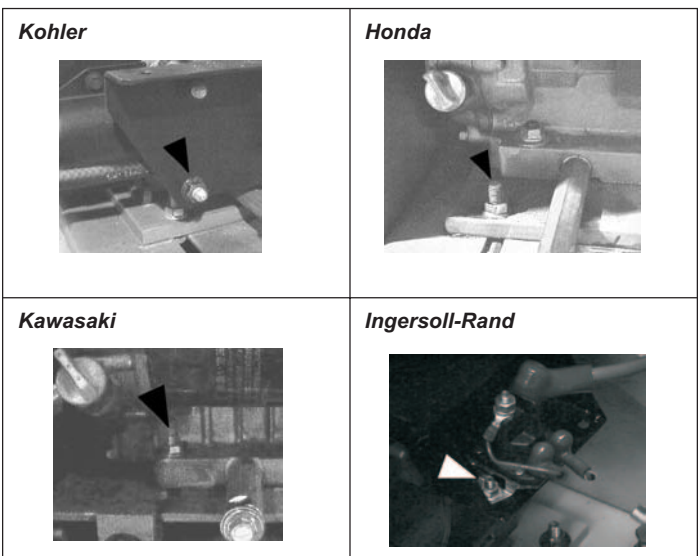
Tamaño de cable (DIÁ)	Longitud máxima
6	5' (1,5 m.)
4	7'-2,5" (2,1 m.)
2	12' (3,6 m.)

PROCEDIMIENTOS DE CONEXIÓN:

1. Conecte el cable positivo (+) de la batería (A) al terminal solenoide del arrancador (B).



2. Conecte el cable negativo (-) de la batería (C) al perno que se muestra en la siguiente ilustración. Fije el cable en su sitio atornillando una tuerca de tamaño adecuado en el perno y en el terminal.



3. Conecte el cable positivo (+) de la batería (A) al terminal positivo (+) de la batería.
4. Conecte el cable negativo (-) de la batería al terminal negativo (-) de la batería.
5. Cubra los terminales y extremos de cables con grasa preventiva de la corrosión.

△ **ADVERTENCIA** Antes de hacer mantenimiento, retire el cable del lado negativo (-) de la batería.

Para más información, consulte las instrucciones del fabricante del motor.

INSTALACIÓN DE LA BOMBA DE COMBUSTIBLE (UNIDADES CON MOTOR A GASOLINA)

Algunos motores usan una bomba de combustible opcional para suministrar directamente gasolina al motor desde el sistema de combustible a bordo de un vehículo. Instale la bomba de combustible dentro de una distancia de 12 pulgadas (30 cm) de la superficie inferior del tanque de combustible del vehículo. Proteja la bomba de la contaminación instalando una válvula de aislamiento de combustible y un filtro en línea entre el sistema de combustible de la bomba.

LUBRICACIÓN DEL COMPRESOR

△ **PRECAUCIÓN** No haga funcionar el compresor sin lubricante o con un lubricante inadecuado. Ingersoll-Rand no se hace responsable en caso de fallas del compresor causadas por una lubricación inadecuada.

LUBRICANTE SINTÉTICO PARA COMPRESORES. Ingersoll-Rand recomienda el lubricante sintético All Season Select desde la puesta en marcha. Consulte la sección GARANTÍA para obtener información respecto a la garantía ampliada.

OTROS LUBRICANTES. Puede usar XL-300 o un lubricante basado en petróleo comparable que sea de primera calidad, que no contenga detergentes, que contenga sólo agentes anticorrosivos, antioxidantes y antiespumantes como aditivos, con un punto de inflamación de 440°F (227°C) o superior y una temperatura de ignición de 650°F (343°C) o superior.

Consulte la tabla de viscosidad de lubricantes de petróleo a continuación. La tabla pretende servir sólo como guía general. Las condiciones de operación de uso intensivo requieren una mayor viscosidad. Consulte a Ingersoll-Rand para obtener recomendaciones sobre sus condiciones de operación específicas.

Temperatura alrededor del compresor		Viscosidad a 100°F (37,8°C)		Grado de viscosidad	
°F	°C	SUS	Centistokes	ISO	SAE
< 40	< 4,4	150	32	32	10
40-80	4,4-26,7	500	110	100	30
80-125	26,7-51,0	750	165	150	40

Si usted usa un lubricante en base a petróleo para compresores durante la puesta en marcha y posteriormente decide cambiar a All Season T30 Select, se debe descarboxilar y lavar la bomba antes de la conversión. Comuníquese con Ingersoll-Rand para más información.

PROCEDIMIENTOS DE LLENADO:

- Destornille y saque el tapón de llenado de aceite (A).
- Llene el cárter con lubricante.
- Vuelva a poner el tapón del aceite y APRIETE ÚNICAMENTE A MANO.

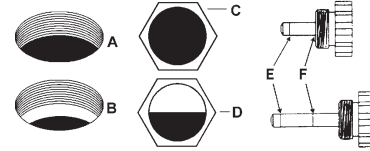
△ **PRECAUCIÓN** No retire el tapón de llenado de aceite mientras el compresor esté funcionando.



Con respecto a la capacidad del cárter, consulte la siguiente tabla.

Modelo	Capacidad de cárter
2340	28 oz. (827 ml.)
2475	41 oz. (1212 ml.)
2545	73 oz. (2158 ml.)
7100	80 oz. (2365 ml.)
15T, 3000	144 oz. (4258 ml.)

Use uno de los siguientes métodos ilustrados para determinar cuando el cárter está lleno.



A = Nivel FULL (lleno) en la rosca inferior del orificio de llenado de aceite en las unidades sin visor o sin indicador del nivel de aceite.

B = Nivel ADD (agregar) debajo de la rosca inferior del orificio de llenado de aceite en las unidades sin visor o sin indicador del nivel de aceite.

C = Nivel FULL en las unidades con visor.

D = Nivel ADD en las unidades con visor.

E = Nivel ADD en las unidades con indicador del nivel de aceite.

F = Nivel FULL en las unidades con indicador del nivel de aceite.

INTERRUPTOR DE BAJO NIVEL DE ACEITE

Se puede instalar un interruptor de bajo nivel de aceite activado por flotación, para proteger la unidad contra daños debido a un nivel insuficiente de aceite del compresor. Un nivel bajo de aceite en el cárter del compresor hace que los contactos del interruptor se abran, apagando la unidad hasta que se haya restaurado el nivel apropiado de aceite.

La protección apropiada contra un bajo nivel de aceite depende del ajuste apropiado del interruptor de bajo nivel de aceite. Durante la marcha inicial, detenga la unidad y vacíe un cuarto del aceite desde el cárter del compresor en un recipiente limpio adecuado. Escuche cómo el interruptor hace clic o revise el interruptor con un probador de continuidad.

A veces el flotador se activa o atasca durante el traslado. Si el flotador está activado o atascado, abra el interruptor de desconexión, vacíe el aceite restante, retire la cubierta del cárter y luego libere el flotador. Rearme y vuelva a usar el mismo aceite.

NOTA

Si el flotador está activo en la posición baja, la unidad no podrá arrancar.

OPERACIÓN

FÓRMULA DE USO INTERMITENTE

Los modelos que operan a más de 200 PSIG se deben operar según la "Fórmula de uso intermitente".

FÓRMULA DE USO INTERMITENTE

El tiempo de bombeo normalmente no debe ser superior a treinta (30) minutos ni inferior a diez (10) minutos. Los períodos de apagado entre ciclos de operación deben ser por lo menos iguales al tiempo de bombeo. **NOTA** Cuando el compresor se regula por medio de un control de velocidad constante, el período de apagado es el tiempo que el compresor opera sin carga.

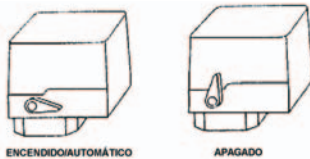
Se recomienda un límite de tiempo de bombeo con el siguiente período de enfriamiento para proteger las válvulas y las culatas contra altas temperaturas estables de operación, que pueden acumular rápidamente carbón en estas áreas.

Todas las consultas sobre la aplicación del compresor a alta presión donde el ciclo de "uso" difiera de la "Fórmula de uso intermitente" se deben referir a Ingersoll-Rand.

ARRANQUE (MODELOS DE MOTOR DE ACCIONAMIENTO ELÉCTRICO)

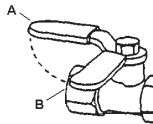
1. Cierre la válvula de servicio.
2. Deje escapar la presión que quede en el tanque, abriendo lentamente la válvula de drenaje manual.
3. Cierre la válvula de drenaje manual y aplique corriente al compresor. Si el disyuntor automático posee una palanca "ON/AUTO-OFF", lleve el interruptor a la posición "ON/AUTO". Si la unidad posee un interruptor "ON/OFF" en el panel de control, lleve el interruptor a la posición "ON".

Típica palanca del disyuntor automático (si lo hay)



4. Abra lentamente la válvula de servicio.

Típica válvula de servicio (A = abierta, B = cerrada)



⚠ **PRECAUCIÓN** Cualquier ruido o vibración poco comunes indican que hay un problema. No continúe con la operación hasta después de identificar y solucionar la causa del problema.

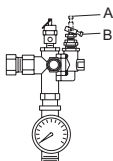
NOTA Compruebe que el sentido de rotación es correcto según la flecha del motor. Si la rotación es incorrecta en las unidades trifásicas, intercambie dos de los tres conductores.

ARRANQUE (UNIDADES CON MOTOR A GASOLINA)

⚠ **ADVERTENCIA** No opere las unidades con motor a gasolina en un área cerrada.

1. Deje escapar la presión que quede en el tanque, abriendo lentamente la válvula de drenaje manual.
2. Active el abastecimiento de gasolina del motor.
3. Ponga el estrangulador en la posición "on".
4. Cierre la válvula de servicio y ponga la palanca del descargador en la posición de "descarga" (A) para los modelos con motores Kawasaki y Honda, o en la posición "carga" (B) para los modelos con motor Kohler.
5. Arranque el motor, suelte el estrangulador y deje que el motor se caliente durante dos a tres minutos.
6. Devuelva la palanca del descargador a la posición "carga" (B) en los modelos con motores Kawasaki y Honda.

Típico descargador (A = descarga, B = carga)



NOTA Corte el suministro de gasolina cuando no esté usando el compresor.

NOTA Algunos compresores impulsados por motores a gasolina requieren 5-8 horas de operación de rodaje antes de alcanzar su plena capacidad y velocidad.

CONTROLES DEL COMPRESOR

CONTROL AUTOMÁTICO DE ARRANQUE Y PARADA. Este tipo de control se aplica a los modelos accionados por motor eléctrico de menos de 10 caballos de fuerza.

NOTA El control automático de arranque y parada está destinado al uso de motores que no arrancan más de 6 veces por hora.

Cuando la presión del tanque receptor alcanza la presión máxima preestablecida en fábrica (comúnmente 175 PSIG), el disyuntor automático detiene la unidad. Cuando la presión del tanque receptor baja a menos del mínimo preestablecido en la fábrica, el disyuntor automático se repone en cero y reanuda la unidad.

CONTROL DE VELOCIDAD CONSTANTE. Este tipo de control se aplica a las unidades con motor a gasolina.

Cuando la presión del tanque receptor alcanza la presión máxima preestablecida en fábrica (comúnmente 175 PSIG), el descargador disminuye la velocidad del motor y la unidad deja de bombear. Cuando la presión del tanque receptor baja a menos del mínimo preestablecido en la fábrica (comúnmente 145 PSIG), el descargador se restablece, el motor vuelve a velocidad plena y la unidad reinicia el bombeo.

CONTROL DOBLE. Este tipo de control se aplica a las unidades con motor eléctrico de más de 10 caballos de fuerza. Seleccione ya sea control automático de arranque y parada o control de velocidad constante ajustando la perilla de la válvula auxiliar. Para el control automático de arranque y parada, gire la perilla de la válvula auxiliar totalmente a la derecha para desactivar la válvula auxiliar. Entonces, el disyuntor automático arrancará y detendrá la unidad.

NOTA Para los modelos de control doble, se prefiere el arranque y parada automáticos.

Válvula auxiliar



HACIA LA DERECHA
HACIA LA IZQUIERDA

CONTROLES DE AJUSTE. Todos los disyuntores automáticos tienen un control de ajuste de gama (A). Algunos disyuntores automáticos también tienen un control de ajuste diferencial (B). En los disyuntores sin control de ajuste diferencial, el tramo entre los interruptores de niveles de presión de conexión y desconexión se establece en fábrica a 40 ± 4 PSIG y no se puede ajustar.

NOTA Algunos disyuntores automáticos están equipados con una palanca de encendido y apagado que se usa para abrir y cerrar los contactos eléctricos dentro del interruptor. ESTA PALANCA NO ES UN CONTROL DE AJUSTE DIFERENCIAL. Los disyuntores automáticos con palanca de encendido y apagado no tienen un control de ajuste diferencial.

PROCEDIMIENTOS DE AJUSTE (DISYUNTORES SIN CONTROL DE AJUSTE DIFERENCIAL):

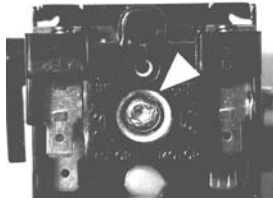
1. Retire la cubierta del disyuntor automático.
2. Ajuste la escala girando el tornillo de ajuste de escala a la derecha (hacia adentro) para aumentar el punto de desconexión o a la izquierda (hacia afuera) para reducir el punto de desconexión.

NOTA Un giro completo cambia el ajuste aproximadamente en 2 PSIG.

3. Vuelva a colocar la cubierta, reconecte la fuente de alimentación y arranque el compresor.

- Fíjese en la lectura del manómetro a la que se desconecta el compresor.
- Si es necesario, repita el procedimiento de ajuste.

Ajuste del rango del disyuntor neumático.



PROCEDIMIENTOS DE AJUSTE (DISYUNTORES CON CONTROL DE AJUSTE DIFERENCIAL):

- Retire la cubierta del disyuntor automático.
- Ajuste la presión de conexión con la tuerca de ajuste de escala. Gire la tuerca a la derecha (hacia adentro) para aumentar la presión o a la izquierda (hacia afuera) para reducir la presión.

NOTA Un giro completo cambia el ajuste en aproximadamente 2 PSIG.

- Ajuste la presión de desconexión con el ajuste diferencial. Gire la tuerca de ajuste diferencial a la derecha (hacia adentro) para aumentar la presión o a la izquierda (hacia afuera) para reducir la presión.

NOTA Un giro completo cambia el ajuste en aproximadamente 2 PSIG.

- Vuelva a colocar la cubierta, reconecte la fuente de alimentación y arranque la unidad.
- Fíjese en la lectura del manómetro a la que se desconecta la unidad.
- Si es necesario, repita el procedimiento de ajuste.

El diferencial mínimo posible es de aproximadamente un 20% de la presión de desconexión. Es aconsejable tener un diferencial lo más amplio posible para evitar frecuentes arranques y detenciones de la unidad. Fíjese en la lectura del manómetro a la que se desconecta la unidad y restablezca este punto si es necesario.

Observe la interacción entre los ajustes de escala y diferencial, esto es, si se aumenta la desconexión, el diferencial también aumentará, o si se estrecha el diferencial, se reducirá la desconexión, etc. Estos factores se deben tener en cuenta cuando se ajusta el interruptor y se deben hacer las correspondientes compensaciones.

SISTEMA DE DESCARGA EN EL ARRANQUE

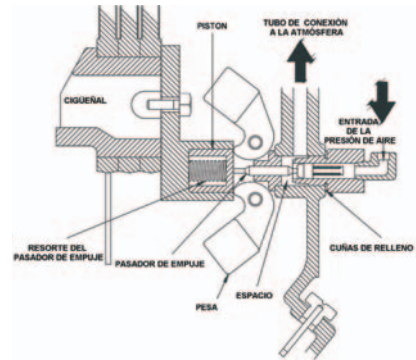
En determinados modelos existe la función de descarga en el arranque. El propósito de este sistema es aliviar la presión de los cilindros cuando la unidad se detiene, permitiendo que arranque con una carga ligera. Una carga ligera aumenta la vida del controlador y las correas y además reduce la posibilidad de que se gatille el relé de sobrecarga. El sistema opera de la siguiente manera:

El descargador centrífugo se conecta junto al extremo del cigüeñal, como se muestra en las siguientes ilustraciones.

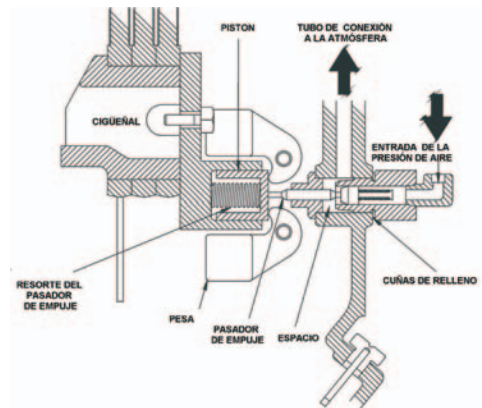
Cuando la unidad arranca, la fuerza centrífuga actúa sobre las pesas del descargador y éstas giran hacia afuera. Esto permite que el pasador de empuje y el pistón se muevan hacia adentro y que la válvula piloto se cierre. La trayectoria de escape a la atmósfera para la presión del cilindro ahora está cerrada y el compresor bombea aire de una manera normal.

Cuando la unidad se detiene, las pesas se retraen, permitiendo que el resorte del pasador de empuje mueva hacia afuera el pistón y el pasador de empuje. El pasador de empuje abre la válvula piloto y la presión del aire atrapado escapa del cilindro e del interenfriador a través de un pasaje en la cubierta del extremo del armazón, a través del tubo del descargador y a la atmósfera a través del silenciador/filtro de entrada.

Posición de la pesa y pasador cuando la unidad está en funcionamiento.



Posición de la pesa y pasador de empuje cuando se detiene la unidad.



AJUSTE DE LA VÁLVULA PILOTO

Si la línea del tubo de la válvula piloto está excesivamente caliente, es una buena indicación de que la válvula piloto tiene fugas y requiere un ajuste.

Para ajustar la válvula piloto, proceda como se indica a continuación:

- Detenga la unidad y desconecte y etiquete el suministro eléctrico para evitar un arranque accidental.
- Retire el tubo de la válvula piloto y los accesorios del tubo.
- Retire el cuerpo de la válvula piloto y todos los suplementos de ajuste existentes.
- Vuelva a atornillar el cuerpo de la válvula piloto en la cubierta del extremo de la armazón (sin suplementos de ajuste), hasta que sienta el contacto con el pasador de empuje. Avance el cuerpo de la válvula piloto en 1/4 a 1/2 vuelta más.

Si no siente el contacto con el pasador de empuje, pueden ser necesarios los siguientes pasos para localizar el punto de contacto:

- Inserte un instrumento pequeño (punzón, varilla, clavo, etc.) en el extremo de la válvula piloto hasta que toque el vástago de válvula.
- Mientras aún está insertado en la válvula piloto, haga una marca en el instrumento a nivel con el borde externo del cuerpo de la válvula piloto.
- Manteniendo el instrumento ligeramente oprimido contra el vástago de la válvula, atornille el cuerpo de la válvula piloto en la cubierta del extremo de la armazón. Cuando la marca en el instrumento comience a salir del borde del cuerpo de la válvula piloto, habrá hecho contacto con el pasador de empuje.
- Avance el cuerpo de la válvula piloto 1/4 a 1/2 vuelta más y continúe con el paso cinco.
- Mida el espacio entre el cuerpo de la válvula piloto y la cubierta del extremo de la armazón.
- Retire el cuerpo de la válvula piloto y agregue suficientes suplementos de ajuste para llenar el espacio medido en el paso cinco.
- Vuelva a atornillar el cuerpo de la válvula piloto en la cubierta del extremo de la armazón, hasta que el cuerpo quede apretado sobre los suplementos de ajuste.
- Vuelva a conectar el tubo de la válvula piloto y los accesorios del tubo.

DESVÍO DEL RESPIRADERO/DESCARGADOR

Las líneas de los tubos de desvío del respiradero/descargador eliminan la acumulación de presión de aire en la armazón del compresor, proporcionando un conducto para que escape el aire a través del descargador de admisión (si está abierto) o (si está cerrado) a través de la válvula de retención, pasando por alto de esta manera el descargador de admisión y escapando a la atmósfera a través del filtro de entrada/silenciador.

COMPROBACIÓN DEL CONSUMO DE ACEITE

Una regla empírica para determinar un "grado de aprobado" para el consumo de aceite es considerar como aceptable un consumo de 50 caballos de fuerza-horas o más por onza.

La fórmula es la siguiente:

$$\frac{\text{Caballos de fuerza} \times \text{Horas de operación}}{\text{Onzas de aceite utilizadas}} = \text{Horas de caballos de fuerza por onza}$$

Para aplicar esta fórmula, considere el tamaño de la máquina. En el ejemplo siguiente, un compresor de 5 caballos de fuerza usa 2 onzas de aceite cada 20 horas de operación.

$$\frac{5 \text{ caballos de fuerza} \times 20 \text{ horas de operación}}{2 \text{ onzas de aceite utilizadas}} = 50 \text{ horas de caballos de fuerza por onza}$$

El compresor del ejemplo pasa la prueba de consumo de aceite.

NOTA Las bombas de compresor nuevas o reacondicionadas descargarán cantidades de aceite más altas que lo normal hasta que se asienten los anillos del pistón (aproximadamente 100 horas de operación).

MANTENIMIENTO

⚠ ADVERTENCIA Antes de realizar el mantenimiento, suelte la presión de aire del sistema y desconecte, bloquee y etiquete el suministro de alimentación principal o desconecte el cable de la bujía del motor.

NOTA Todos los sistemas de aire comprimido contienen componentes sujetos a mantenimiento (por ejemplo, aceite lubricante, filtros, separadores) que se deben reemplazar periódicamente. Estos componentes usados pueden o no contener sustancias sujetas a regulación y se deben desechar en conformidad con las leyes y normativas locales, federales y estatales.

NOTA Tome nota de las posiciones y ubicaciones de las piezas durante el desmontaje para facilitar el reensamblaje. Las secuencias del montaje y las piezas ilustradas pueden diferir para su unidad particular.

NOTA Cualquier operación de servicio que no se incluya en esta sección debe ser ejecutada por un representante autorizado.

NOTA Para obtener información sobre cuidado del motor, consulte el manual del propietario del motor.

NOTA El siguiente calendario de mantenimiento rige en aplicaciones normales. Es necesario acortar los intervalos de mantenimiento en ambientes más extremos.

CALENDARIO DE MANTENIMIENTO

Diariamente o antes de cada operación

- Verifique que hay escapes de aceite.
- Revise el nivel del lubricante. Rellene según sea necesario.
- Vacíe el condensado del tanque receptor (si no hay un dispositivo de drenaje automático). Abra la válvula de drenaje manual, recoja y disponga del líquido condensado según corresponda.
- Verifique si hay vibraciones y ruidos inusuales.
- Asegúrese de que las guardabandas y las cubiertas estén bien sujetas en su lugar.
- Compruebe que el motor (si lo hay) esté lleno de combustible y lubricante según las recomendaciones del fabricante.
- Compruebe que el área alrededor del compresor esté libre de trapos, herramientas, escombros y materiales inflamables o explosivos.

Semanalmente

- Observe la operación de las válvulas de seguridad/desahogo mientras el compresor está funcionando. Reemplace las válvulas de seguridad/desahogo que no funcionen libremente.
- Inspeccione el o los elementos de filtro de aire. Limpie si es necesaria.

Mensualmente

- Verifique si hay fugas de aire. Ponga agua jabonosa alrededor de las juntas mientras el compresor está funcionando y observe si se producen burbujas.
- Revise el apriete de los tornillos y pernos. Vuelva a apretar si es necesario.
- Revise las correas de transmisión. Ajuste si es necesario.

3/500 *

- Limpie el exterior.
- Cambie el lubricante de petróleo mientras el cárter esté tibio.
- Vacíe el aceite del compresor y limpie el visor del aceite

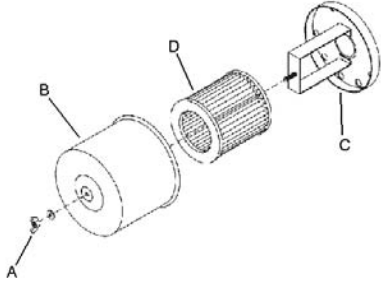
12/2000 *

- Instale el paquete de mantenimiento — o —
- Cambie el lubricante sintético mientras el cárter esté tibio.
- Reemplace el elemento de filtro.

* indica meses/horas de operación, lo que ocurra primero.

INSPECCIÓN Y LIMPIEZA DEL FILTRO

1. Destornille y saque la tuerca mariposa (A) que fija la caja del filtro (B) a su base (C).
2. Saque la caja del filtro y retire el elemento de filtro antiguo (D). Limpie el elemento con un chorro de aire o un aspirador.
3. Reinstale el elemento de filtro y la caja apretando la tuerca mariposa.



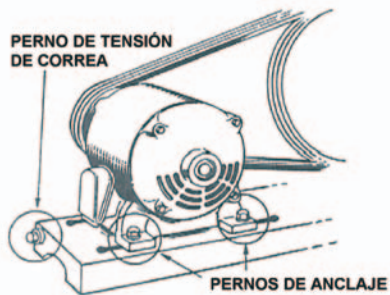
CAMBIO DE ACEITE

1. Saque el tapón de drenaje de aceite (A) y deje que el lubricante se vacíe en un contenedor adecuado.
2. Vuelva a poner el tapón de drenaje de aceite.
3. Siga los procedimientos de llenado de la sección OPERACIÓN.

AJUSTE DE LA CORREA

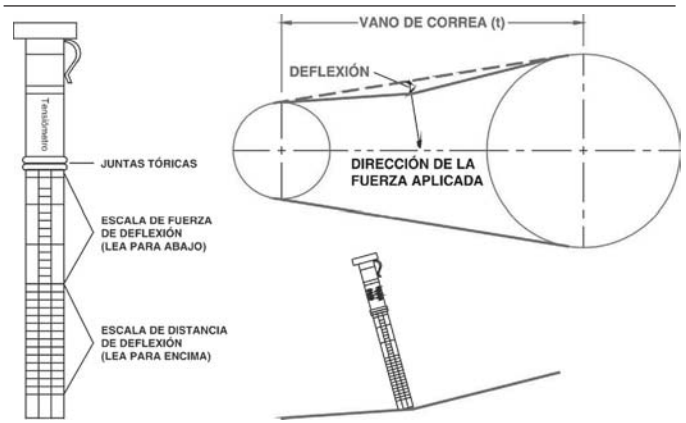
COMPROBACIÓN DE LA TENSIÓN DE LA CORREA. Compruebe ocasionalmente la tensión de la correa, especialmente si sospecha aflojamiento. Las correas nuevas también se deben tensar adecuadamente en el momento de su instalación.

TENSADO DE CORREAS. Se puede lograr el tensado de la correa aflojando los tornillos de anclaje del motor, alejando el motor de la bomba y volviendo a apretar los tornillos de anclaje del motor. Algunas unidades están provistas de un perno de tensado de correa que, cuando se gira, aleja el motor de la bomba. Si no lo tienen, el motor se puede mover fácilmente colocando bajo él una herramienta a modo de palanca. También puede ser útil un separador disponible en el comercio u otro aparato para tensar correas.



Siga los procedimientos que se indican más abajo para ajustar y medir correctamente la tensión de la correa en los modelos con motor

eléctrico y motor a gasolina como el 2340, 2475 y 2545 (sólo con el tipo de correa "A"). Para una representación visual, consulte la siguiente ilustración.



1. Apoye un borde recto en la superficie exterior superior de la transmisión de la correa, desde la polea a la roldana.
2. Al centro del tramo, en forma perpendicular a la correa, aplique presión a la superficie exterior de la correa con un medidor de tensión. Fuerce la correa a la flexión indicada en la TABLA DE TENSIÓN DE CORREA en la sección DIAGRAMAS Y TABLAS. Compare la lectura del medidor de tensión con la tabla.

Siga los procedimientos descritos más abajo para ajustar y medir correctamente la tensión en los modelos de 7,5 a 30 caballos de fuerza 2545, 7100, 15T y 3000 con tipos de correa "B" y "C".

1. Mida la longitud del tramo (t) de la transmisión.
2. Determine la cantidad de flexión (en pulgadas) que se requiere para medir la fuerza de flexión (en libras) multiplicando la longitud del tramo (t) por 1/64. Por ejemplo, una longitud de tramo de 32" multiplicada por 1/64 equivale a 1/2" de flexión necesaria para medir la fuerza de la flexión.
3. Apoye un borde recto en la superficie exterior superior de la transmisión de la correa, desde la polea a la roldana.
4. Al centro del tramo, en forma perpendicular a la correa, aplique presión a la superficie exterior de la correa con un medidor de tensión. Fuerce la correa a la flexión predeterminada que se calculó en el paso 2. Compare la lectura del indicador de tensión con la TABLA DE TENSIÓN DE CORREA en la sección DIAGRAMAS Y TABLAS.

Antes de volver a poner en marcha el compresor, compruebe que la polea y la roldana estén adecuadamente alineadas y que los tornillos de anclaje del motor se vuelvan a apretar adecuadamente.

△ PRECAUCIÓN Una alineación de la polea y la roldana y tensión de la correa inadecuadas pueden generar una sobrecarga del motor, un exceso de vibración y la falla prematura de la correa y/o el rodamiento.

Para evitar estos problemas, compruebe que la polea y la roldana estén alineadas y que la tensión de la correa sea satisfactoria después de instalar correas nuevas o de tensar correas existentes.

MANTENIMIENTO DEL DRENAJE ELÉCTRICO

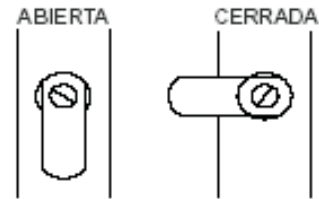
NOTA: Se ha desarrollado el siguiente programa de mantenimiento para las aplicaciones típicas. Se deben acortar los intervalos de mantenimiento en ambientes más rigurosos.

PROGRAMA DE MANTENIMIENTO DE LA VÁLVULA DE DRENAJE	
DIARIAMENTE	Pruebe que la válvula funcione correctamente. Limpie la pantalla del filtro si fuese necesario.
MENSUALMENTE (CADA 30 DÍAS)	Limpie la pantalla del filtro.

Para limpiar la pantalla del filtro, realice los siguientes pasos:

1. Cierre completamente la válvula de bola del colador para aislarla del tanque receptor de aire.
 2. Presione el botón TEST (PRUEBA) del cronómetro para ventilar la presión que quede en la válvula. Repita hasta que se elimine toda la presión.
- △ **¡PRECAUCIÓN! El aire de alta presión puede causar lesiones a causa de las impurezas en suspensión. Fíjese que la válvula de bola del colador esté completamente cerrada y se libere la presión de la válvula antes de la limpieza.**
3. Retire el tapón del colador con una llave adecuada. Si escucha que escapa aire del puerto de limpieza, DETÉNGASE INMEDIATAMENTE y repita los pasos 1 y 2.
 4. Retire la pantalla del filtro de acero inoxidable y límpiela. Retire todas las impurezas que hayan en el cuerpo del colador antes de volver a colocar la pantalla del filtro.
 5. Vuelva a colocar el tapón y apriételo con una llave.

Válvula de bola del colador



6. Al reiniciar el funcionamiento del EDV-2000, presione el botón TEST para confirmar su funcionamiento correcto.

INSPECCIÓN DEL TANQUE RECEPTOR

La vida útil de un tanque receptor de aire depende de varios factores, incluyendo, entre otras cosas, condiciones operativas, ambientales y nivel de mantenimiento. El efecto preciso de estos factores sobre la vida útil del tanque es difícil de predecir; por lo tanto, Ingersoll-Rand le recomienda programar una inspección certificada del tanque durante los primeros cinco años de uso del compresor. Para concertar una inspección de tanque, comuníquese con Ingersoll-Rand.

Si el tanque no se ha inspeccionado dentro de los primeros 10 años de uso del compresor, el receptor se debe dejar fuera de servicio hasta que haya pasado la inspección. Los tanques que no cumplen con los requisitos deben ser reemplazados.

△ **ADVERTENCIA** Si no se reemplaza un tanque receptor de aire oxidado, el resultado puede ser la ruptura o explosión de dicho tanque, lo que podría provocar importantes daños a la propiedad y graves lesiones a las personas o incluso la muerte. Nunca modifique ni repare el tanque. Consiga su reemplazo en el centro de servicio técnico.

LOCALIZACIÓN DE FALLAS

PROBLEMA	PUNTO DE COMPROBACIÓN
Desgaste anormal del cilindro, anillo o pistón	4, 8, 9, 19, 28, 35
La entrega de aire disminuye	1, 6, 15, 16, 18, 19, 29
La válvula de drenaje automática presenta filtraciones o no drena automáticamente	16
La válvula auxiliar tintinea o tiene filtraciones alrededor del vástago	23, 24
Tubos rotos en el interenfriador o posenfriador	36
El compresor no llega a la velocidad deseada	2, 6, 12, 15, 21
El compresor tarda en llegar a la velocidad deseada	26, 27, 33, 34
El compresor se calienta demasiado durante el funcionamiento	3, 14, 15, 22
El compresor no ejecuta el ciclo de descarga	23, 24, 26
El compresor no descarga cuando se detiene	26, 33
Ruido excesivo durante la operación	2, 6, 15, 16, 21, 27, 32
Demasiadas partidas y paradas	5, 11, 16, 32, 40
Golpea o tintinea	2, 15, 17, 19, 20, 21
Las luces destellean o se atenúan durante la operación	12, 13
Humedad en el cárter o apariencia "lechosa" en el lubricante de petróleo o herrumbre en los cilindros	9, 10
La sobrecarga del motor produce una desconexión o un consumo excesivo de corriente	5, 6, 12, 13, 14, 15, 16, 19, 20, 21, 34
Aceite en la descarga de aire (bombeo de aceite)	4, 7, 9, 18, 19, 25, 35
Escape de aceite del retén del eje	25
La válvula de seguridad/descarga "salta"	1, 5, 29, 30
Alta presión entre etapas	30
Baja presión entre etapas	31
La máquina chirría o no arranca	6, 14, 37, 38
El motor no arranca	12
La máquina no arranca	39
Escapes de aceite	41

SOLUCIÓN DE PROBLEMAS DEL DRENAJE ELÉCTRICO

Problema	Causa	Medida
La válvula no se cierra.	<ol style="list-style-type: none"> 1. Las impurezas que se encuentran en la válvula solenoide evitan que sesiente el diafragma. 2. Corte en el componente eléctrico. 	<ol style="list-style-type: none"> 1. Retire la válvula solenoide, desmóntela, límpiela y vuelva a montarla. 2. Revise y reemplace el cable de alimentación o el cronómetro según sea necesario.
No se activa el cronómetro.	<ol style="list-style-type: none"> 1. No hay suministro eléctrico. 2. El cronómetro no funciona bien. 3. Puerto obstruido. 4. La válvula solenoide no funciona bien. 5. Colador obstruido. 	<ol style="list-style-type: none"> 1. Aplique energía. 2. Reemplace el cronómetro. 3. Limpie la válvula. 4. Reemplace la válvula solenoide. 5. Limpie el colador.

PUNTO COMP.	POSIBLE CAUSA	POSIBLE SOLUCIÓN
1	Entrada y/o filtro del tubo de descarga sucios o atascados.	Limpie o reemplace.
2	Rueda de banda o polea del motor sueltas, juego excesivo en el eje del motor o bandas de transmisión sueltas.	Revise la tensión y alineación de la rueda de banda, polea del motor, cigüeñal y banda de transmisión. Repare o reemplace según sea necesario.
3	Ventilación inadecuada alrededor de la rueda de banda.	Ubique el compresor en una posición con mejor ventilación.
4	Lubricante poco viscoso.	Vacíe el lubricante existente y vuelva a llenar con uno adecuado.
5	Filtraciones de aire en la tubería de descarga de aire.	Revise la tubería y las conexiones. Apriete las uniones o reemplácelas según sea necesario.
6	Lubricante demasiado viscoso.	Vacíe el lubricante existente y vuelva a llenar con uno adecuado.
7	Exceso de lubricante.	Vacíe el exceso de lubricante.
8	Muy poco lubricante.	Agregue lubricante al cárter hasta el nivel adecuado.
9	Se está usando lubricante tipo detergente.	Vacíe el lubricante y vuelva a llenar con uno adecuado.
10	Ciclos de operación extremadamente cortos. Compresor ubicado en un área húmeda o mojada.	Opere el compresor con ciclos de operación más largos. Cambie de lugar el compresor o instale un juego de calefactores de cárter.
11	Diferencial del interruptor de presión demasiado estrecho.	Si cuenta con ajuste de diferencial, ajuste el interruptor de presión para aumentar el diferencial. Si desea ajuste de diferencial, instale un interruptor de presión con función de ajuste de diferencial.
12	Voltaje de línea incorrecto. Panel de servicio eléctrico o cableado demasiado pequeño. Contacto deficiente en los terminales del motor o conexiones del arrancador. Calefactores incorrectos de sobrecarga del arrancador.	Revise el voltaje de línea y mejore las líneas según sea necesario. Comuníquese con un electricista. Instale una caja de servicio o cableado de tamaño correcto. Comuníquese con un electricista. Asegure un buen contacto de los terminales del motor o conexiones del arrancador. Instale calefactores correctos de sobrecarga del arrancador. Comuníquese con un electricista.
13	Deficiente regulación de la potencia (línea desequilibrada).	Comuníquese con la compañía eléctrica.
14	Bandas de transmisión muy apretadas o mal alineadas.	Ajuste las bandas a la tensión y alineación adecuadas.
15	Compressor valves leaky, broken, carbonized or loose.	Inspeccione las válvulas. Limpie o reemplácelas según sea necesario. Instale el juego ahorrapasos de válvulas/empaquetaduras.
16	Válvulas del compresor rotas, carbonizadas, sueltas o con filtraciones.	Inspeccione la válvula y limpie, repare o reemplace según sea necesario.
17	Acumulación de carbono sobre el o los pistones.	Limpie el o los pistones. Repare o reemplace según sea necesario.
18	Anillos del pistón dañados o gastados (rotos, ásperos o con arañazos). Excesivo espacio final o separación lateral. Los anillos del pistón no están asentados, están pegados a las ranuras o los espacios finales no están escalonados.	Inspeccione la válvula y limpie, repare o reemplace según sea necesario. Instale el juego ahorrapasos de anillos/empaquetaduras.
19	Cilindros o pistones con arañazos, gastados o cortados.	Ajuste los anillos del pistón. Repare o reemplace según sea necesario.
20	Rodamientos de la varilla de unión, pasador del pistón o del cigüeñal gastados o cortados. Espaciador de rodamientos suelto en el cigüeñal.	Inspeccione todo. Repare o reemplace según sea necesario. Instale el juego ahorrapasos de rodamientos/biela de conexión.
21	Rodamientos de bolas defectuosos en el cigüeñal o eje del motor..	Inspeccione los rodamientos y reemplace si es necesario. Instale el juego ahorrapasos de rodamientos/biela de conexión.
22	Sentido erróneo de rotación de la rueda de banda.	Revise si las conexiones de cableado del motor son adecuadas. Invierta dos conductores en los motores trifásicos.
23	Filtraciones, roturas o desgaste en las piezas del descargador de toma.	Inspeccione las piezas y reemplace según sea necesario.
24	Válvula auxiliar sucia o asientos gastados.	Inspeccione las piezas. Limpie, ajuste o reemplace según sea necesario.
25	Retén del cigüeñal gastado o cigüeñal cortado.	Reemplace el retén. Si es necesario, instale un manguito de eje. Instale el juego ahorrapasos de rodamientos/biela de conexión.
26	Válvula piloto centrífuga desajustada o con filtraciones.	Reemplace la junta tórica de la válvula piloto. Ajuste la válvula piloto.
27	Válvula de retención con filtraciones o asiento de la válvula fundido.	Reemplace la válvula de retención.
28	Atmósfera extremadamente polvorienta.	Instale una tubería de admisión remota de aire y guíela a una fuente de aire más limpio. Instale un filtro más eficaz.
29	Válvula de seguridad/descarga defectuosa.	Reemplace.
30	Filtraciones en la válvula de admisión de alta presión.	Inspeccione, limpie o repare según sea necesario.
31	Filtraciones en la válvula de descarga de baja presión.	Inspeccione, limpie o repare según sea necesario.
32	El modo automático de parada y arranque no es adecuado para la demanda de aire.	Ajuste la válvula auxiliar para una operación de velocidad constante.
33	El descargador del interruptor de presión tiene filtraciones o no funciona.	Realinee el vástago o reemplace.
34	Temperatura ambiente demasiado baja.	Instale un juego de calentadores del cárter. Cambie el lubricante a All Season Select. Lleve el compresor a un entorno de mayor temperatura.
35	Capa superficial del cilindro desgastada.	Limpie el cilindro con flex-hone de 180 gránulos.
36	Rueda de banda desequilibrada, tubos sin acodar o fijar, velocidad de polea inadecuada.	Revise el nivel de vibración, cambie la polea o rueda de banda si es necesario, apriete las abrazaderas del tubo.
37	La máquina no tiene una conexión a tierra adecuada.	Haga la conexión a tierra de la batería a la máquina como se recomienda.
38	La gasolina ha sido almacenada por demasiado tiempo o contiene agua.	Reemplace la gasolina, agregue estabilizador de combustible.
39	No hay combustible en el tanque. Válvula de combustible cerrada. Baja presión de aceite.	Vea las instrucciones del fabricante para el reaprovisionamiento de combustible. Abra la válvula de combustible. Vea las instrucciones del fabricante.
40	Condensación excesiva en tanque receptor.	Vacíe el tanque de receptor con la válvula de drenaje manual o instale una válvula de drenaje automática.
41	Accesorios/codos/conectores sueltos	Aplique una torsión adecuada a los accesorios

DIAGRAMAS Y TABLAS

TABLA DE TORSIONES DE LOS FIJADORES

	2340	2475	2545	7100	15T	3000
Pernos prisioneros de alta presión	75	75	75	75	75	75
Pernos prisioneros de baja presión	75	75	75	75	75	75
Pernos de reborde del cilindro	30	50	50	50	50	50
Pernos de cubierta de la armazón	17	17	17	20	20	20
Pernos de cubierta del eje	17	17	17	20	20	20
Tornillos de cabeza del pasador de cigüeñal	5,5	11	11	12-15	12-15	12-15
Tornillos de cabeza del descargador	—	—	11	11	20	11
Tornillos de la válvula de admisión de alta presión	11-15 LB-PULG	11-15 LB-PULG	11-15 LB-PULG	5,5	—	5,5
Tornillos de la válvula de admisión de baja presión	11-15 LB-PULG	25-30 LB-PULG	25-30 LB-IPULG	5,5	—	5,5
Tornillos de la válvula de salida de alta presión	11-15 LB-PULG	11-15 LB-PULG	11-15 LB-PULG	26	50	26
Tornillos de la válvula de salida de baja presión	25-30 LB-IPULG	25-30 LB-PULG	25-30 LB-IPULG	26	90	26
Perno de la rueda de la banda	33	60	60	113	213	213
Pernos de centro de la culata de alta presión	—	—	10	—	—	—
Pernos de centro de la culata de baja presión	—	—	14-16	—	—	—

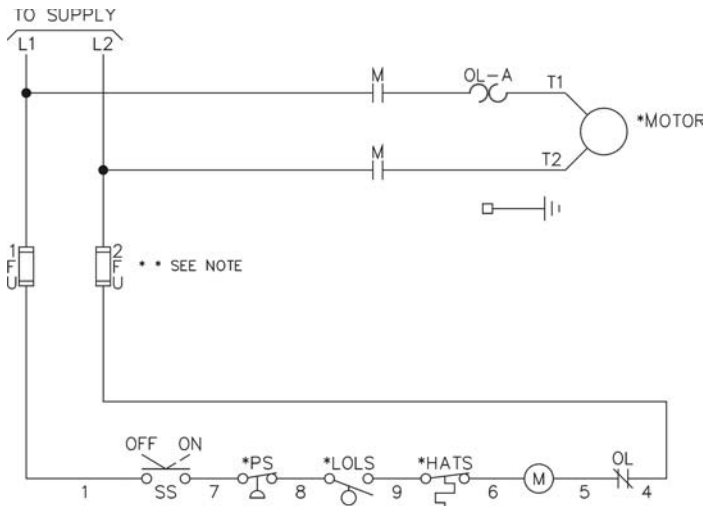
NOTA Apriete de manera uniforme todos los fijadores usando un patrón en cruz en dos etapas.

TABLA DE TENSIONES DE CORREA

MODELO	DEFLEXIÓN (PULG.)	TENSIÓN (LB.)	TIPO DE CORREA	CABALLOS DE FUERZA	TENSIÓN A UNA DEFLEXIÓN DE 1/64" POE PULGADA DE TRAMO
2340 (Intervalo Nominal 14")	0,25	4,9 - 7,1	B	7,5	7,0 - 10,0
2340 (Intervalo Nominal 19")	0,29	4,9 - 7,1		10-15	8,0 - 12,0
2475 (Intervalo Nominal 14")	0,25	4,9 - 7,1	C	20	12,0 - 18,0
2475 (Intervalo Nominal 19")	0,29	4,9 - 7,1		25-30	14,0 - 21,0
2475F/X11GH	0,34	5,5 - 8,0			
2475F/X9/11GK	0,25	11,25 - 13,0			
2475N5 (tramo de 14,5", correa dentada)	0,23	4,5 - 6,5			
2545 (ranura A)	0,29	4,9 - 7,1			

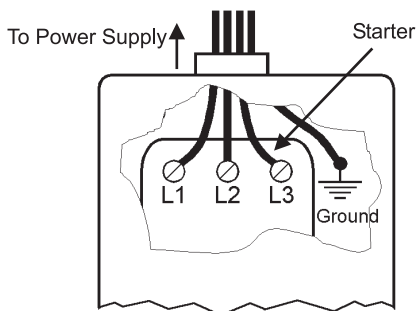
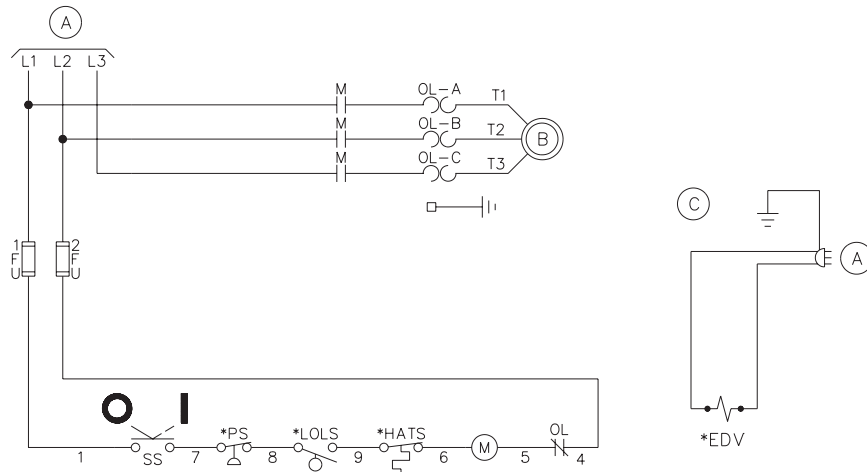
DIAGRAMAS DE CABLEADO ELÉCTRICO

Cableado monofásico



A	Al suministro
C	Cableado para la válvula de drenaje eléctrico opcional
EDV	Válvula de drenaje eléctrico
T	Terminal de línea de suministro
L	Terminal de carga
FU	Fusible del circuito de control
HATS	Interruptor de alta temperatura del aire (#)
LOLS	Interruptor de bajo nivel de aceite (#)
M	Bobina del arracador del motor
OL	Sobrecarga del arracador del motor
PS	Disyuntor automático
SS	Conmutador selector (#)
*	Cableado alternativo para convertir un arracador trifásico a una aplicación monofásica
(#)	= si lo hay

Cableado trifásico

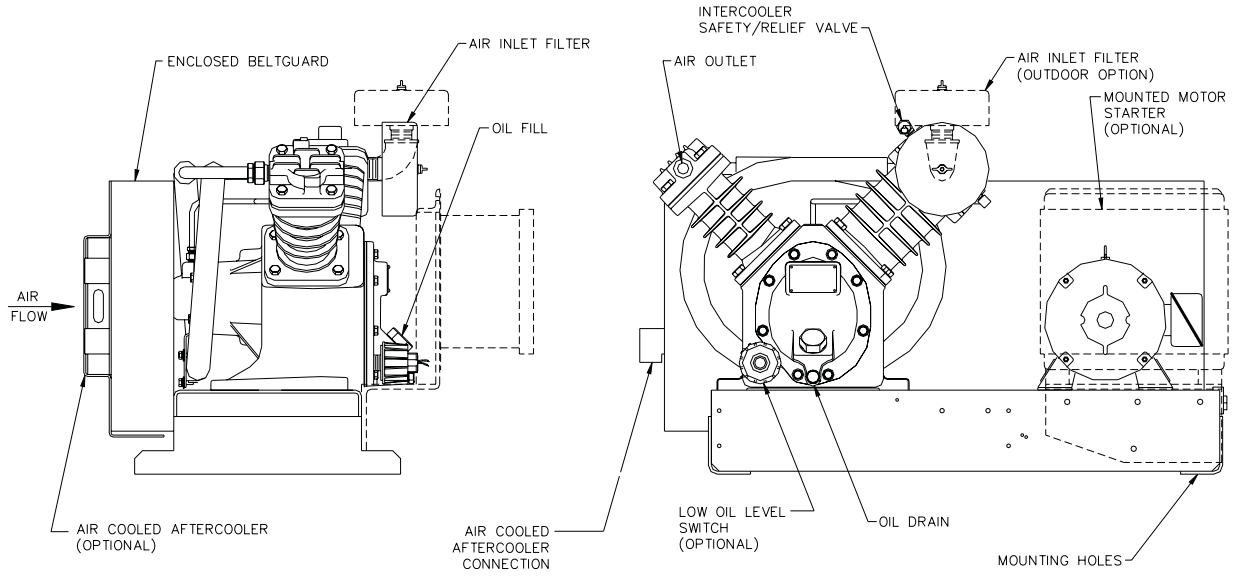


NOTA

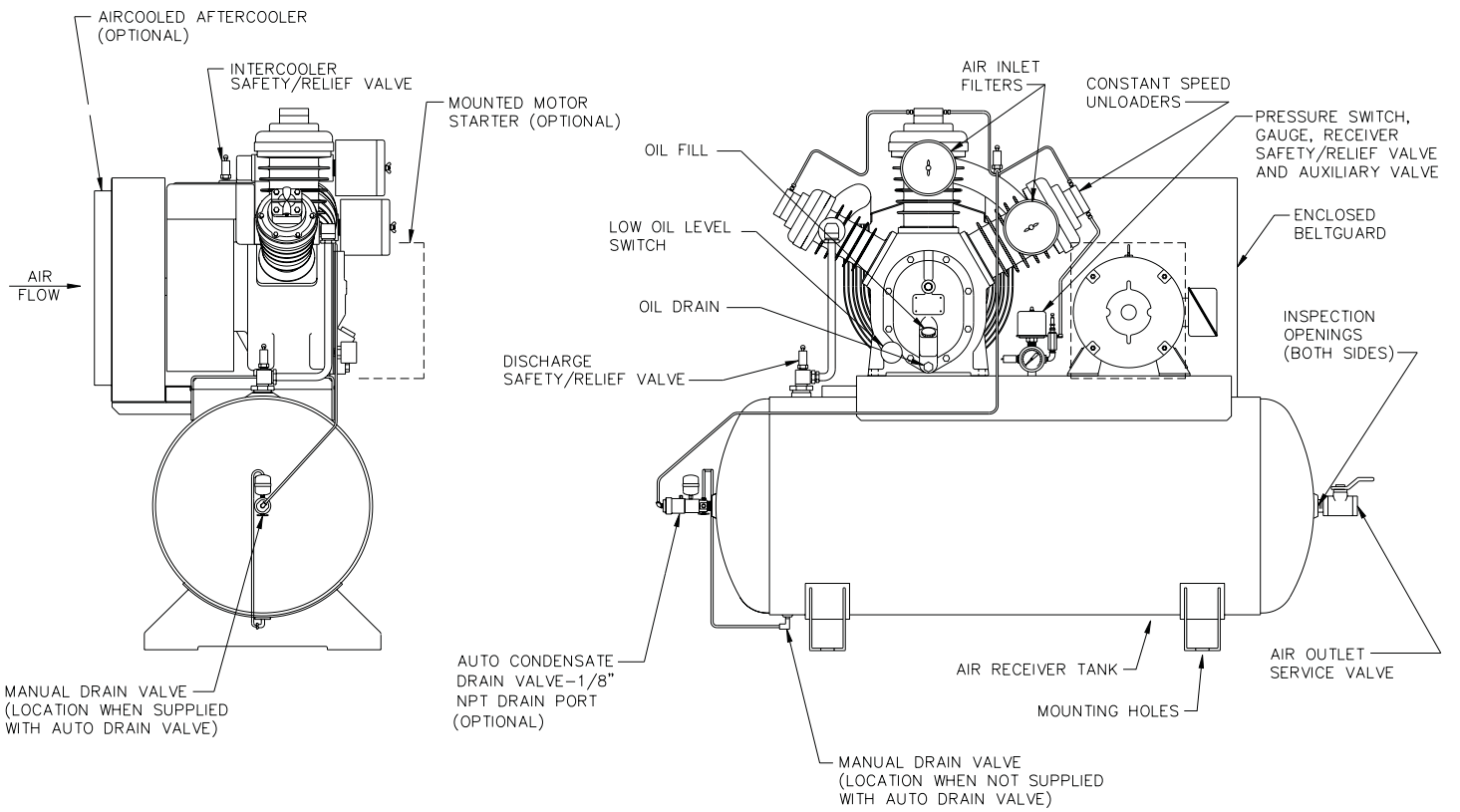
En las unidades que requieren un arracador, conecte la línea de alimentación al arracador. No conecte la línea de alimentación al interruptor de presión.

- Conecte el cable de conexión a tierra al terminal de tierra
- L3 se usa para los motores y arracadores trifásicos únicamente

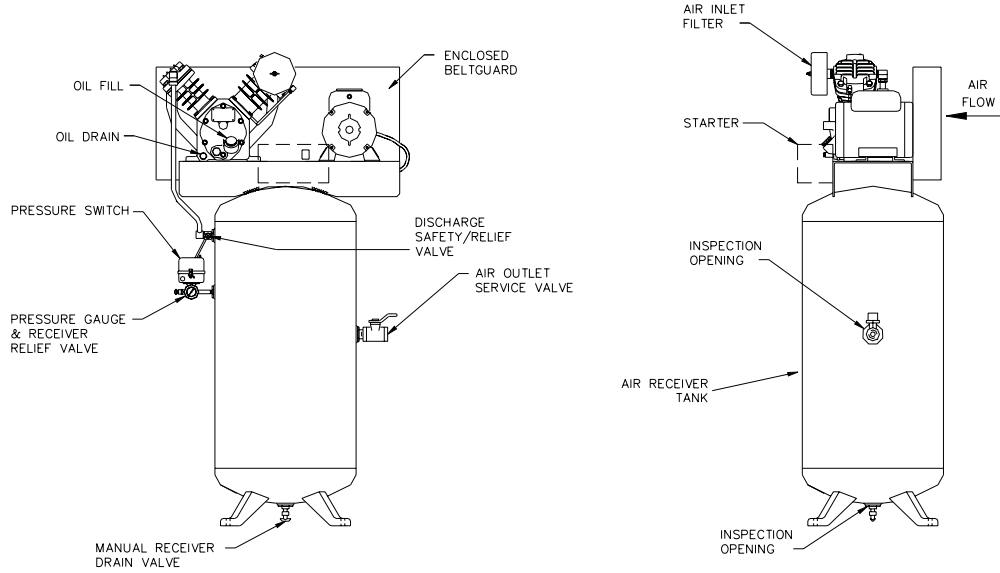
Típica unidad de placa base



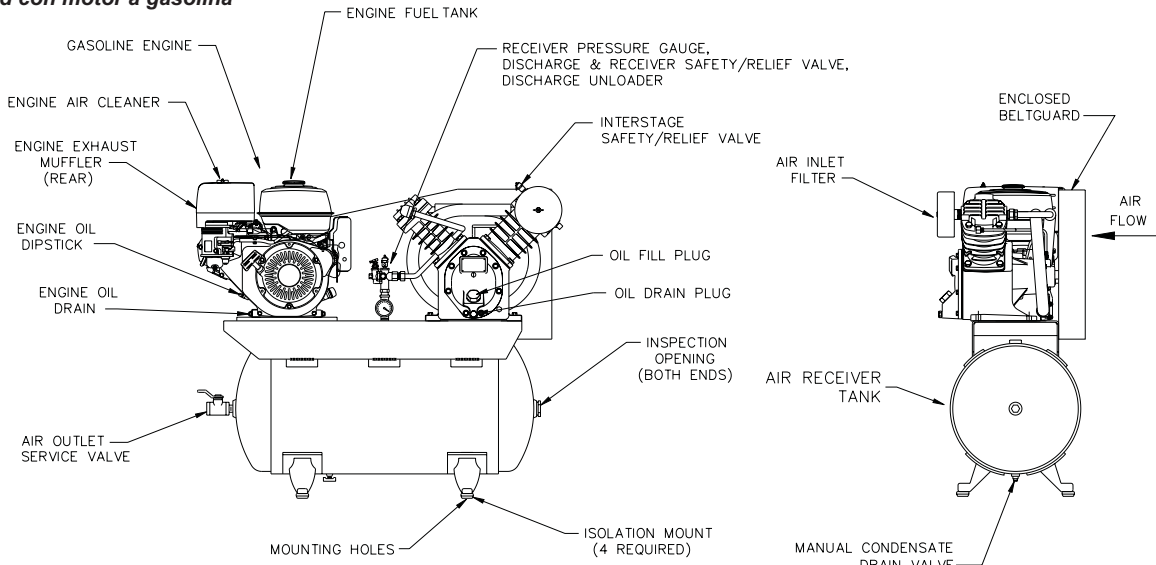
Típica unidad simplex horizontal



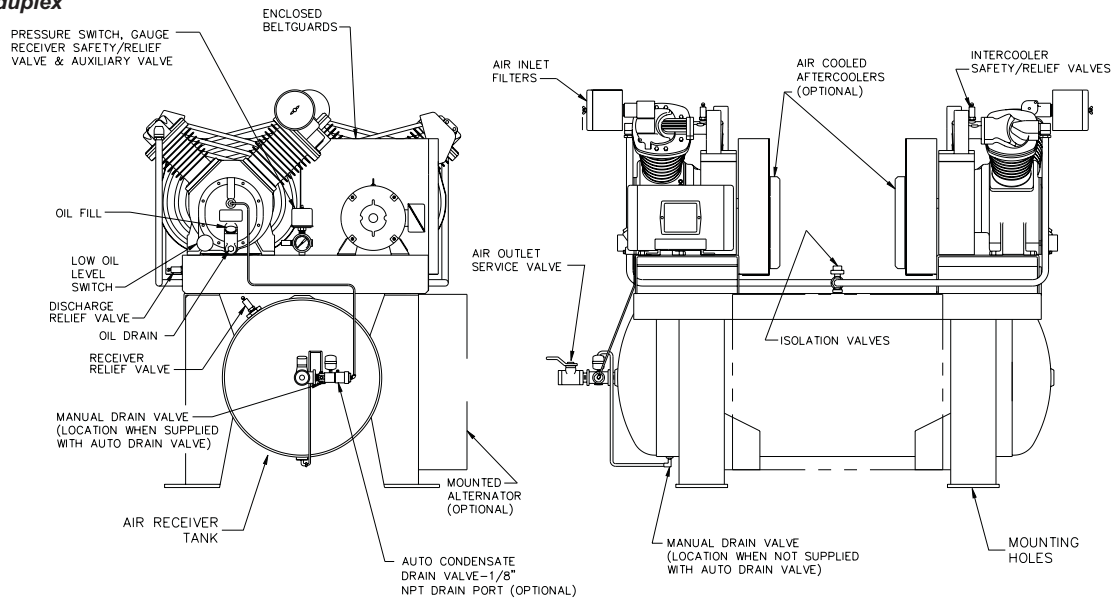
Típica unidad simplex vertical



Típica unidad con motor a gasolina



Típica unidad dúplex



GARANTÍA

Ingersoll-Rand Company garantiza que los equipos que fabrica y distribuye conforme a este documento estarán libres de defectos tanto en sus materiales como en su fabricación, durante un período de doce (12) meses desde la fecha en que los Equipos se ponen en operación o de dieciocho (18) meses desde el momento del embarque, lo que suceda primero. Este período de garantía se aplicará a todos los Equipos, salvo los siguientes: (A) Los compresores que funcionen exclusivamente con el lubricante sintético All Season Select para compresores, tendrán una garantía por el compresor, sin accesorios, de veinticuatro (24) meses desde la fecha de inicio de las operaciones o de treinta (30) meses desde la fecha de embarque, lo que ocurra primero. (B) Los repuestos tendrán una garantía de seis (6) meses desde la fecha de embarque Si dentro de dicho período se informa por escrito a la Compañía de algún tipo de incumplimiento de las condiciones de esta Garantía, la Compañía a su discreción corregirá dicho incumplimiento reparando el Equipo en forma apropiada o proporcionará un reemplazo F.O.B. en el punto de embarque, siempre y cuando el comprador haya instalado, mantenido y operado dicho Equipo en conformidad con prácticas industriales correctas y haya cumplido con las recomendaciones específicas de la Compañía. Los accesorios o equipos provistos por la Compañía pero fabricados por otros mantendrán todas las garantía traspasadas a Ingersoll-Rand Company por su fabricante y que puedan ser transferidas al Comprador. La Compañía no se hará responsable de reparaciones, reemplazos o ajustes a los Equipos o de ningún tipo de costo por mano de obra en que incurra el Comprador que no cuenten con la previa autorización por escrito de la Compañía.

La Compañía no otorga ningún tipo de garantía de buena ejecución, a menos que se estipule específicamente dentro de sus propuestas, y esta Garantía excluye específicamente los efectos de la corrosión, erosión y el desgaste normal. En aquellos casos donde expresamente se incluyan garantías de buena ejecución, la obligación de la Compañía será efectuar correcciones en la manera y durante el plazo estipulado más arriba.

LA COMPAÑÍA NO HACE NINGÚN OTRO TIPO DE DECLARACIÓN, EXPRESA O IMPLÍCITA, SALVO AQUELLA DE PROPIEDAD Y POR ESTE MEDIO SE DECLINAN TODAS LAS GARANTÍAS IMPLÍCITAS DE COMERCIABILIDAD Y APTITUD PARA UN FIN EN PARTICULAR.

La corrección de los incumplimientos de la Compañía, sean patentes o latentes, en la forma y durante el plazo estipulado más arriba, deberá constituir el cumplimiento de todas las responsabilidades de la Compañía y sus Distribuidores, para aquellos incumplimientos respecto a o que surjan de dichos Equipos.

LIMITACIÓN DE RESPONSABILIDADES

LOS RECURSOS DEL COMPRADOR ESTIPULADOS EN ESTE DOCUMENTO SON EXCLUSIVOS Y LA RESPONSABILIDAD TOTAL DE LA COMPAÑÍA, SUS DISTRIBUIDORES Y PROVEEDORES, CON RESPECTO AL CONTRATO O EQUIPOS Y SERVICIOS PROVISTOS, EN RELACIÓN CON LA EJECUCIÓN O SU FALTA DE CUMPLIMIENTO O QUE SURJAN DE LA FABRICACIÓN, VENTA, ENTREGA, INSTALACIÓN, REPARACIÓN O DIRECCIÓN TÉCNICA CUBIERTA O PROVISTA BAJO UN CONTRATO, YA SEA QUE SE BASEN EN UN CONTRATO, GARANTÍA, NEGLIGENCIA, INDEMNIDAD, RESPONSABILIDAD LIMITADA U OTRO, NO PODRÁN EXCEDER EL PRECIO DE COMPRA DE LA UNIDAD O EQUIPO EN LOS CUALES SE BASA DICHA RESPONSABILIDAD.

LA COMPAÑÍA, SUS DISTRIBUIDORES Y SUS PROVEEDORES NO SERÁN RESPONSABLES BAJO CIRCUNSTANCIA ALGUNA ANTE EL COMPRADOR, CUALQUIER SUCESOR O BENEFICIARIO O CESIONARIO DEL CONTRATO, POR NINGÚN DAÑO INDIRECTO, INCIDENTAL, ESPECIAL O PUNITIVO QUE SURJA DE ESTE CONTRATO O DE CUALQUIER INCUMPLIMIENTO DE ÉL, O DE CUALQUIER DEFECTO, FALLA O MAL FUNCIONAMIENTO DEL EQUIPO, YA SEA QUE SE BASE DICHO DAÑO O NO EN LA FALTA DE USO, LA PÉRDIDA DE INGRESOS O UTILIDADES, INTERESES, PÉRDIDA DE BUENA REPUTACIÓN, CESE DE TAREAS, DAÑO SOBRE OTROS BIENES, PÉRDIDAS PRODUCTO DEL CIERRE O LA FALTA DE FUNCIONAMIENTO, AUMENTO EN LOS COSTOS DE OPERACIÓN, COSTO DE LA COMPRA DE ENERGÍA DE REEMPLAZO O DEMANDAS DE LOS COMPRADORES O CLIENTES DEL COMPRADOR POR LA INTERRUPCIÓN DEL SERVICIO, SE ORIGINE O NO DICHA PÉRDIDA O DAÑO EN EL CONTRATO, GARANTÍA, NEGLIGENCIA, INDEMNIZACIÓN, RESPONSABILIDAD ABSOLUTA U OTRO.



INFORMATIONS IMPORTANTES ! VEUILLEZ LIRE ET SUIVRE LES INSTRUCTIONS CONTENUES DANS LE PRESENT MANUEL.
CONSERVEZ-LES À TITRE DE RÉFÉRENCE.

SÉCURITÉ

DÉFINITIONS

- △ **DANGER** OCCASIONNERA la MORT, des BLESSURES ou des dégâts matériels considérables.
- △ **MISE EN GARDE** POURRA occasionner la MORT, des BLESSURES ou des dégâts matériels considérables.
- △ **ATTENTION** OCCASIONNERA ou POURRA occasionner des BLESSURES MINEURES ou des dégâts matériels.

PRÉCAUTIONS DE SÉCURITÉ GÉNÉRALES

- △ **DANGER** **AIR D'ADMISSION.** Peut contenir du monoxyde de carbone ou d'autres contaminants. Cause des blessures ou la mort. Les compresseurs Ingersoll-Rand n'ont été conçus, ni destinés, ni approuvés pour la compression d'air respirable. L'air comprimé ne doit pas être utilisé pour la respiration à moins qu'il ait été traité d'après les normes et règlements en vigueur pour cette application.
- △ **MISE EN GARDE** **TENSION DANGEREUSE.** Peut causer des blessures graves ou la mort. Débrancher l'alimentation et purger la pression du réservoir avant de réparer. Verrouiller/étiqueter la machine. Le compresseur doit être branché sur un circuit correctement mis à la terre. Reportez-vous aux instructions de la mise à terre dans ce manuel. Ne pas faire fonctionner le compresseur dans des conditions humides. Stocker à l'intérieur.
PIÈCES TOURNANTES. Peut causer des blessures graves. Ne pas utiliser sans les dispositifs de protection. La machine peut démarrer automatiquement. Débrancher avant le service. Verrouiller/étiqueter la machine.
SURFACE CHAUDE. Peut causer des blessures graves. Ne pas toucher. Attendre le refroidissement avant de réparer. Ne pas toucher le compresseur ou la tuyauterie chaude.
AIR SOUS PRESSION ÉLEVÉE. Le contournement, la modification ou le retrait de soupapes de sécurité/décharge peut causer des blessures graves ou la mort. Ne pas contourner, modifier ou retirer les soupapes de sécurité/décharge. Ne pas diriger les ajutages d'air sur une personne. Les réservoirs corrodés peuvent occasionner une explosion et des blessures graves ou la mort. Vidanger le réservoir quotidiennement ou après chaque utilisation. La soupape de vidange se trouve au fond du réservoir.
- △ **ATTENTION** **RISQUE D'ÉCLATEMENT.** Utiliser seulement des pièces à manipulation d'air pouvant accepter des pressions non inférieures à la pression maximale de travail consentie par la machine.

INFORMATIONS GÉNÉRALES

INTRODUCTION

Le présent manuel fournit des instructions sûres et fiables pour l'installation, l'exploitation et l'entretien de votre compresseur d'air Ingersoll-Rand. Il est recommandé de lire le manuel avec soin avant de procéder à l'utilisation ou à l'entretien de votre appareil. Si vous avez des doutes concernant les instructions ou les procédures utilisées dans ce manuel, veuillez communiquer avec Ingersoll-Rand. Il est également recommandé de garder ce manuel et toute publication accompagnant votre compresseur d'air dans un endroit accessible à toutes les personnes utilisant ou réparant votre système d'air comprimé.

APPLICATION

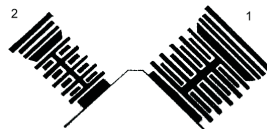
Les compresseurs d'air lubrifié à deux étages standard Ingersoll-Rand sont des dispositifs à simple effet, refroidis à l'air. Un compresseur typique est équipé d'unités de montage de réservoir d'air, compact et autonome, régulées et alimentées automatiquement par un moteur électrique ou un moteur à essence. Des accessoires en option sont disponibles comme par exemple : refroidisseur secondaire, contacteur de bas niveau d'huile, soupape de vidange automatique. Des pompes de compresseur sans accessoires ainsi que des dispositifs à montage sur socle sont également disponibles.

Ces compresseurs peuvent être utilisés dans toute une gamme d'applications à air comprimé d'un maximum de 250 PSIG (17,5 kg/cm²). Ils constituent une source d'air primaire ou secondaire utilisée dans pratiquement toutes les installations industrielles, les stations de service et les ateliers de réparation d'automobile. Comme source secondaire, un compresseur peut fournir de l'air à des pressions non disponibles dans les ateliers de réparation ou dans des endroits isolés ainsi qu'un service de secours d'air lorsque les compresseurs de plus grande capacité ne fonctionnent pas.

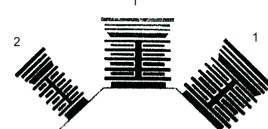
EXPLOITATION À DEUX PHASES

Un compresseur à deux étages se compose de un ou deux cylindres de premier étage de même alésage et d'un cylindre de second étage d'un alésage plus petit.

Dispositif typique deux étages, deux cylindres



Dispositif typique deux étages, trois cylindres



Le principe de fonctionnement de base est comme suit : Pendant la course descendante du ou des pistons de premier étage, l'air à la pression atmosphérique entre dans les cylindres via le ou les filtres d'admission puis dans les soupapes d'admission qui se trouvent dans la

culasse. Pendant la course ascendante du/des pistons de premier étage, l'air est comprimé à une pression intermédiaire et refoulé via la/les soupapes de décharge dans des manifolds communs. Au niveau des collecteurs, l'air passe dans les tubes de refroidisseur intermédiaire, où la chaleur de compression de premier étage est supprimée. Pendant la course descendante du piston de deuxième étage, l'air refroidi entre dans le cylindre de deuxième étage via la soupape d'admission. Pendant la course ascendante du piston de deuxième étage, l'air est comprimé à sa pression de refoulement finale et expulsé via la soupape de décharge dans le système de réservoirs. Si l'air de décharge doit être refroidi, un refroidisseur d'air de sortie doit être installé entre le refoulement du compresseur et le système de réservoirs.

Pour maintenir la pression d'air du système de réservoir dans les limites prédéterminées, le compresseur peut être utilisé avec la commande marche arrêt automatique ou une régulation de contrôle de vitesse constante. Le type de régulation utilisé dépend de l'application.

RÉFÉRENCES ADDITIONNELLES

À moins d'indication contraire, les dimensions, poids et mesures sont fournis en mesures U.S. standard suivies de sa conversion au système métrique entre parenthèses. Tout couple de serrage indiqué est fourni en livre par pouce ou pied suivi par son équivalent en newton-mètre entre parenthèses. Les caractéristiques électriques sont données en tension-phase-cycle.

RÉCEPTION ET INSPECTION

S'assurer qu'un équipement de levage approprié sera disponible pour décharger le compresseur et le déplacer là où il sera installé.

REMARQUE L'équipement de levage doit avoir la capacité requise pour soulever le poids du compresseur.

△ ATTENTION Soulever le dispositif par la cale d'expédition seulement. Ne pas utiliser l'œillet de levage de moteur pour soulever le dispositif tout entier. L'œillet de levage du moteur ne sert qu'à retirer le moteur du dispositif.

△ ATTENTION Ne pas travailler ou marcher sous le compresseur pendant qu'il est suspendu.

Utiliser un équipement de levage approprié (c.-à-d. un chariot à fourche) pour soulever et transporter le dispositif au site d'installation. S'assurer que l'équipement de levage, les sangles de levage etc. sont capables de prendre en charge le poids du dispositif.

Avant de signer le bon de livraison, inspecter l'équipement afin de s'assurer qu'il ne comporte pas de dommages ou de pièces manquantes. Si des dommages sont apparents ou des pièces sont manquantes, le noter sur le bon de livraison, puis le signer. Communiquer immédiatement avec le transporteur pour lui demander d'effectuer une inspection.

Tout le matériel doit rester au lieu de livraison pour être inspecté par le transporteur.

Les bons de livraison qui ont été signés sans notation de dommage ou pièces manquantes sont considérés comme faisant état d'une livraison parfaite. Toute demande d'indemnité ultérieure sera alors considérée comme une demande d'indemnité pour dommages dissimulés. Régler toute demande d'indemnité directement avec le transporteur.

Si des dommages sont découverts après réception du compresseur (dommages dissimulés), en aviser le transporteur dans les 15 jours suivant la date de livraison et effectuer une demande d'inspection par téléphone avec confirmation par écrit. Lors d'une demande d'indemnité pour dommages dissimulés, c'est le demandeur qui doit établir que le compresseur a été endommagé en transit.

Lire la plaquette signalétique du compresseur afin de vérifier qu'il correspond bien au modèle commandé. Lire la plaquette signalétique du moteur pour vérifier qu'il est bien compatible avec les équipements électriques. S'assurer que les boîtiers et les composants électriques sont appropriés pour l'environnement d'installation.

INSTALLATION

CHOIX DE L'EMPLACEMENT

DISPOSITIFS À MOTEUR ÉLECTRIQUE. Pour la majorité des dispositifs à moteur électrique, choisissez un endroit à l'intérieur relativement propre, sec et bien éclairé avec un espace suffisant pour assurer une ventilation, une circulation d'air de refroidissement et une accessibilité adéquates. Il faut allouer 1.000 pieds cubes d'air frais par 5 horse power. Situer le compresseur au moins à 15 pouces (38 cm) des murs.

À moins que les composants électriques du dispositif soient munis d'une protection spéciale pour utilisation extérieure, ne pas installer un moteur électrique à l'extérieur ou dans des endroits où les composants électriques sont exposés à la pluie, la neige ou toute autre source importante d'humidité.

AVERTISSEMENT CONCERNANT LES DISPOSITIFS MUNIS D'UN ROBINET DE PURGE ÉLECTRIQUE

△ AVERTISSEMENT Le robinet de purge électrique comporte des pièces pouvant produire des étincelles, comme un interrupteur à coupure brusque, une prise de courant et autres. Par conséquent, lorsque le compresseur est situé dans un garage, il est recommandé de le placer dans une pièce ou enceinte à cet effet ou de le placer de façon telle que le robinet de purge électrique se situe à une distance de 18 pouces (457 mm) ou plus au-dessus du plancher

DISPOSITIFS À MOTEUR À ESSENCE. Pour les dispositifs à moteur à essence, garder le moteur à une distance minimale de 3 pieds (1 m) des murs de la pièce ou de tout autre équipement. Installer le dispositif dans un endroit où l'espace est suffisant pour assurer une ventilation, une circulation d'air de refroidissement et une accessibilité adéquates. Ne pas installer ou exploiter un moteur à essence dans un espace clos.

CONSIDÉRATIONS EN MATIÈRE DE L'AIR AMBIANT. La température de marche idéale se situe entre 0 °C et 37,8 °C (32 °F et 100 °F). Si la température baisse souvent sous 0 °C (32 °F), situer l'unité à l'intérieur d'un bâtiment chauffé. Si cela n'est pas possible, il est essentiel de protéger les soupapes de sécurité/décharge et les soupapes de vidange contre le gel. Si la température atteint souvent les 4,4°C (40°F), il est recommandé d'installer une trousse de chauffage du carter principal, particulièrement si le compresseur démarre difficilement.

△ ATTENTION Ne pas faire fonctionner l'appareil à une température inférieure à -26,1°C (-15°F) ou supérieure à 51,0 °C (125 °F).

LIEUX HUMIDES. Dans un lieu qui est souvent humide, il est possible que de l'humidité se forme dans la pompe, entraînant la formation de boues dans le lubrifiant et l'usure prématurée des pièces mobiles. Une quantité excessive d'humidité aura tendance à se former si le compresseur est situé dans un lieu non chauffé qui est exposé à de grandes variations de température.

Voici deux signes d'humidité excessive : la formation de condensation sur la paroi extérieure du compresseur qui refroidit et un lubrifiant à base de pétrole dont l'aspect est laiteux.

On pourra empêcher la formation d'humidité dans la pompe en augmentant la ventilation, en faisant fonctionner l'appareil plus longtemps lors de chaque cycle ou en installant une trousse de chauffage du carter principal.

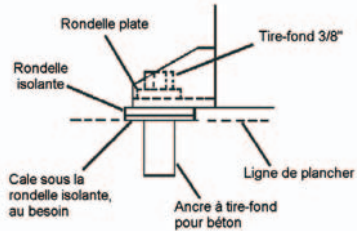
CONSIDÉRATIONS EN MATIÈRE DE BRUIT. Pour connaître la réglementation en vigueur concernant les niveaux de bruit acceptables, consulter les autorités locales. Pour réduire le bruit excessif, utiliser des amortisseurs de vibration (**sauf sur les Modèles 2000 et 2000P**) ou un silencieux d'aspiration, déplacer le compresseur ou construire des enceintes totales ou des murs déflecteurs.

MONTAGE

△ **MISE EN GARDE** Avant d'effectuer le montage, enlever le compresseur de la cale.

DISPOSITIFS À MOTEUR ÉLECTRIQUE. Boulonner le dispositif sur une base solide et de niveau (comme un plancher de béton). Ne pas boulonner solidement des pieds non-nivelés à la base afin d'éviter de provoquer une tension excessive au réservoir. Utiliser des cales métalliques sous les pieds au besoin.

Montage permanent typique (Quincaillerie fournie par le client)



DISPOSITIFS À MOTEUR À ESSENCE. Boulonner le dispositif sur une base solide et de niveau. Ne pas boulonner solidement des pieds non-nivelés à la base afin d'éviter de provoquer une tension excessive sur le réservoir. Utilisez des cales métalliques sous les pieds au besoin. Les dispositifs à moteur à essence montés sur une plate-forme de camion doivent être fixés solidement sans appliquer une tension excessive sur le réservoir. L'installation d'une trousse amortisseur de vibration est recommandée avec les modèles de moteur à essence.

INSTALLATION D'UNE CANALISATION D'ASPIRATION À DISTANCE

△ **ATTENTION** Ne pas utiliser l'appareil sans filtre d'aspiration.

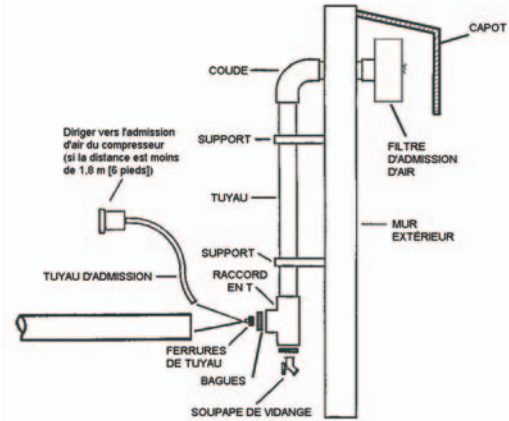
Si l'air autour du dispositif est relativement libre de poussières, installer le filtre d'aspiration au raccord d'admission de la pompe. Si l'air est poussiéreux, raccorder le filtre à une source d'air propre. Utiliser des tuyaux en plastique PVC pour la canalisation d'aspiration à distance. Ne pas utiliser de tuyau en fer noir ou de tuyau en acier galvanisé car ils contribuent au suintement et à la formation de rouille. Il est recommandé d'installer des filtres en ligne pour faciliter le nettoyage et le remplacement. Assurez-vous que la canalisation est aussi courte et directe que possible et aussi large ou plus large que le diamètre du raccord d'aspiration de la pompe. Ne jamais installer une tuyauterie dont le diamètre est plus petit que celui de la tuyauterie d'admission de la pompe.

Augmenter le diamètre du tuyau d'une catégorie pour chaque 10 pieds (3 m) de longueur ou chaque coude de 90°. S'assurer que la tuyauterie est solidement entretoisée.

Si vous raccordez le filtre à l'extérieur, recouvrez-le d'un capot pour empêcher la pluie ou la neige de pénétrer.

Des éléments filtrants ainsi que des dispositifs de filtration à usage industriel sont disponibles pour les fines poussières en suspension, comme les poussières de ciment et de roche.

Canalisation d'admission à distance typique.



INSTALLATION DE LA CANALISATION DE REFOULEMENT

△ **MISE EN GARDE** N'utiliser nulle part dans le circuit d'air comprimé des tuyaux de plastique, des raccords soudés en cuivre, des tubes de caoutchouc ou des joints soudés à l'étain au plomb.

△ **ATTENTION** Si le lubrifiant utilisé est du lubrifiant synthétique pour compresseur, la tuyauterie et les composants en aval du circuit doivent être composés d'un matériau compatible. Se reporter à la liste de matériaux compatibles ci-dessous. Si votre système contient des matériaux incompatibles, ou pour des matériaux non inclus dans la liste, communiquer avec Ingersoll-Rand pour toute information supplémentaire.

LUBRIFIANT SYNTHÉTIQUE POUR COMPRESSEUR LISTE DE COMPATIBILITÉ MATÉRIELLE

ACCEPTABLES :

Viton®, Teflon®, époxydes (chargés à la fibre de verre), alkydes résistants aux huiles, fluorosilicones, hydrocarbures fluorés, polysulfides, uréthanes à 2 composants, nylon, Delrin®, Celcon®, caoutchoucs à forte teneur en nitrile (Buna-N, NBR de plus de 36 % d'acrylonitrile), polyuréthane, polyéthylène, épichlorhydrine, polyacrylate, mélamine, polypropylène, résines phénoliques cuites, époxydes, alkydes modifiés
(® Marque déposée de DuPont Corporation)

NON RECOMMANDÉS :

Néoprène, caoutchouc naturel, caoutchouc SBR, peintures acryliques, laques, vernis, polystyrène, PVC, ABS, polycarbonates, acétate de cellulose, caoutchoucs à faible teneur en nitrile (Buna N, NBR de moins de 36 % d'acrylonitrile), EPDM, acétate de vinyle et d'éthylène, latex, caoutchoucs éthylène-propylène (EPR), acryliques, résines phénoxy, polysulfones (PSF), styrène-acrylonitrile, butyle

REMARQUE Tous les systèmes à air comprimé produisent du condensat s'accumulant dans un point de vidange (p. ex. réservoirs, filtres, points de purge, refroidisseurs de sortie, sècheurs). Ce condensat contient de l'huile lubrifiante et/ou des substances réglementées qui doivent être enlevées selon les lois et les règlements municipaux, provinciaux et fédéraux.

GÉNÉRALITÉS. La tuyauterie, les raccords, le réservoir, etc. doivent être homologués pour fonctionner à la pression maximale de service de l'unité. Utiliser des tubes d'acier ou de cuivre à filetage ou à soudage fort et des raccords en fonte dont l'homologation convient à la pression et à la température de refolement du compresseur. NE PAS UTILISER DE PLASTIQUE PVC DANS LA CONDUITE DE REFOLEMENT D'AIR COMPRIMÉ. Utiliser un matériau d'étanchéité sur tous les filetages de la tuyauterie et bien serrer les joints afin de prévenir toute fuite d'air.

CANALISATIONS DE REFOULEMENT DU CONDENSAT. Si une canalisation de refolement du condensat doit être installée, s'assurer que le diamètre de ses tuyaux est supérieur à celui du raccord d'au moins une catégorie, que son circuit est le plus court et le plus direct possible, qu'elle est fixée solidement en place et qu'elle est dirigée vers un point de purge convenable. Le condensat doit être éliminé en conformité avec les lois et règlements en vigueur au niveau municipal, provincial et fédéral.

△ MISE EN GARDE Si un refroidisseur de sortie, un clapet antiretour, un robinet de sectionnement ou toute autre restriction est ajoutée au circuit de refolement du condensat, installer entre cette restriction et le compresseur une soupape de sûreté/décharge homologuée ASME ayant le format qui convient.

INSTALLATION DU CÂBLAGE ÉLECTRIQUE (DISPOSITIFS À MOTEUR ÉLECTRIQUE)

△ MISE EN GARDE L'installation et les révisions du circuit électrique doivent être effectuées par un électricien agréé qui connaît les lois et les règlements municipaux, provinciaux et fédéraux en vigueur.

GÉNÉRALITÉS. Les caractéristiques nominales du moteur, indiquées sur la plaquette signalétique, et l'alimentation électrique doivent correspondre aux caractéristiques de la tension, des phases et des cycles.

CALIBRE DES FILS. Le câblage reliant l'alimentation électrique et le moteur varie en fonction de la puissance du moteur (HP) et d'autres facteurs. Installer des conducteurs de connexion de calibre adéquat pour protéger le dispositif contre toute chute de tension excessive lors du démarrage. Consulter le Code national de l'électricité pour de plus amples informations concernant la sélection du calibre de conducteur approprié et la fixation des connexions électriques. Si vous raccordez du matériel électrique supplémentaire au même circuit, vous devez prendre en compte la charge électrique totale lors de la sélection du calibre de conducteur approprié. **NE PAS UTILISER DE CONDUCTEURS TROP PETITS.**

Si les informations de calibre de fils ne sont pas disponibles, les calibres indiqués au tableau de sélection des fils ci-dessous peuvent être utilisés comme valeurs de référence sûres, si la distance ne dépasse pas 50 pieds (15,3 m). Pour des distances plus longues, consulter un entrepreneur en électricité ou la compagnie d'électricité locale pour obtenir de plus amples informations.

MOTEUR HP	MONOPHASÉ		TRIPHASÉ			
	115V	230V	200V	230V	460V	575V
1	12	14	14	14	14	14
1,5	10	14	14	14	14	14
2	8	14	14	14	14	14
3	8	12	14	14	14	14
5	4	8	10	12	14	14
7,5		6	8	10	14	14
10			8	8	12	14
15			4	6	10	10
20			3	4	8	10
25			1	2	6	8
30			0	1	6	8

DÉMARREUR MAGNÉTIQUE. Si le moteur installé sur votre dispositif est muni d'un bouton de réenclenchement, il n'est pas nécessaire d'installer un démarreur magnétique. Si le moteur ne dispose pas d'un bouton de réenclenchement et que le dispositif n'a pas de démarreur installé à l'usine, il faut installer un démarreur magnétique avec protection thermique contre les surcharges. Suivre les instructions d'installation du fabricant. Ingersoll-Rand n'est en aucun cas responsable de tout dommage résultant d'un manquement de fournir une protection adéquate des moteurs.

FUSIBLES. Se reporter au Code national de l'électricité afin de déterminer les caractéristiques nominales requises du fusible ou du disjoncteur. Au moment de la sélection des fusibles, prendre en compte

le fait que le courant de pointe lors du démarrage d'un moteur électrique est supérieur au courant de pleine charge. L'usage de fusibles à retardement ou à action retardée est recommandé.

PRESSOSTAT. Sur les dispositifs non munis de pressostat installé à l'usine, câbler un pressostat selon le schéma de branchement approprié sous la rubrique DIAGRAMMES du présent manuel. Effectuez le montage du pressostat en suivant les recommandations du fabricant. La ligne de raccordement au réservoir doit être aussi courte et directe que possible et homologuée pour la pression de service maximale du dispositif.

RACCORDEMENT D'UNE BATTERIE (DISPOSITIFS À MOTEUR À ESSENCE)

REMARQUE Dans le cas où le dispositif est connecté à une batterie à distance, le moteur du compresseur doit être muni d'un alternateur.

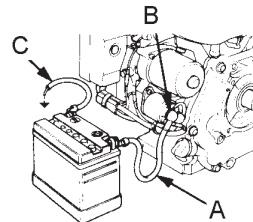
BATTERIE. Une batterie de 12 volts d'un courant nominal minimum de 250 A démarrage à froid et d'une intensité nominale par heure de 24 Ah devrait suffire pour le démarrage de la majorité des moteurs électriques.

CÂBLES DE BATTERIE. Consulter le tableau suivant pour les tailles et longueurs recommandées.

Calibres des câbles (CAL.)	Longueur maximum
6	5' (1,5 m.)
4	7'-2,5" (2,1 m.)
2	12' (3,6 m.)

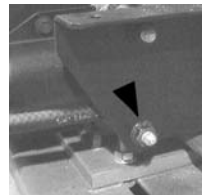
PROCÉDURES DE RACCORDEMENT :

1. Connecter le câble (A) positif (+) de la batterie à la borne du solénoïde de démarreur (B).

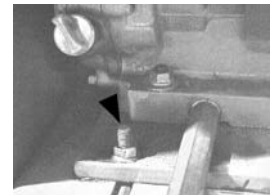


2. Connecter le câble (C) négatif (-) de la batterie au boulon indiqué dans l'illustration suivante. Fixer le câble en place en vissant un écrou de taille adéquate sur le boulon et finalement sur la borne.

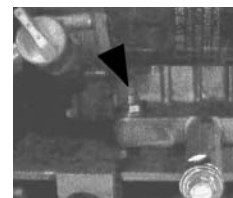
Kohler



Honda



Kawasaki



Ingersoll-Rand



3. Connecter le câble (A) positif (+) de la batterie à la borne positive (+) de la batterie.
4. Connecter le câble négatif (-) de la batterie à la borne négative (-) de la batterie.
5. Enduire les bornes et les extrémités de câble d'une graisse anticorrosive.

△ MISE EN GARDE Enlever le câble de la borne négative (-) de la batterie avant de procéder à l'entretien.

Consulter les instructions du fabricant du dispositif pour de plus amples informations.

INSTALLATION D'UNE POMPE À CARBURANT (DISPOSITIFS À MOTEUR À ESSENCE)

Certains moteurs utilisent une pompe à carburant en option pour fournir l'essence au moteur directement à partir d'un système d'alimentation de bord d'un véhicule. Installer la pompe à carburant à une distance de 12 pouces (30 cm) de la surface inférieure du réservoir de carburant du véhicule. Afin d'éviter toute contamination de la pompe, installer une soupape d'isolement du combustible ainsi qu'un filtre en ligne entre le système d'alimentation de la pompe.

LUBRIFICATION DU COMPRESSEUR

△ ATTENTION Ne pas faire fonctionner le compresseur sans lubrifiant ou avec un lubrifiant qui ne convient pas. Ingersoll-Rand décline toute responsabilité pour les pannes du compresseur causées par une lubrification inadéquate.

LUBRIFIANT SYNTHÉTIQUE POUR COMPRESSEUR. Ingersoll-Rand recommande dès la première utilisation le lubrifiant synthétique All Season Select. Pour de plus amples renseignements concernant la garantie prolongée, se reporter à la rubrique GARANTIE. Lubrifiants de rechange.

On peut utiliser un lubrifiant XL-300 ou à base de pétrole comparable à condition qu'il soit de qualité supérieure, qu'il ne contienne aucun détergent, qu'il contienne comme additifs seulement des agents antirouille, antioxydants et antimousse, que son point d'inflammation soit de 227 °C (440 °F) ou plus et que sa température d'inflammation spontanée soit de 343 °C (650 °F) ou plus.

Se reporter ci-dessous au tableau de viscosité des lubrifiants à base de pétrole. Il est fourni exclusivement à titre d'information. Des conditions de marche rigoureuses nécessitent une viscosité plus élevée. Pour obtenir des recommandations, discuter avec le distributeur des conditions réelles de fonctionnement.

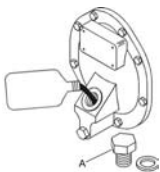
Température autour du compresseur		Viscosité à 100°F (37,8°C)		Catégorie de viscosité	
°F	°C	SUS	Centistokes	ISO	SAE
< 40	< 4,4	150	32	32	10
40-80	4,4-26,7	500	110	100	30
80-125	26,7-51,0	750	165	150	40

Si vous employez un lubrifiant pour compresseur à base de pétrole à la première utilisation et que vous décidez d'utiliser ensuite le lubrifiant All Season T30 Select, il faut décarburer et rincer la pompe avant d'utiliser le nouveau lubrifiant. Communiquer avec Ingersoll-Rand pour de plus amples informations.

PROCÉDURES DE REMPLISSAGE :

1. Dévisser et enlever le bouchon du réservoir à huile.
2. Remplir le carter de lubrifiant.
3. Refermer le bouchon d'huile et le SERRER SEULEMENT AVEC LES MAINS.

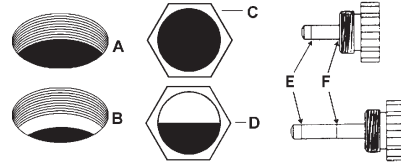
△ MISE EN GARDE Ne pas enlever le bouchon du réservoir à huile lorsque le compresseur est en marche.



Consulter le tableau suivant pour la capacité des carters.

Modèle	Capacité de carter
2340	28 oz. (827 ml.)
2475	41 oz. (1212 ml.)
2545	73 oz. (2158 ml.)
7100	80 oz. (2365 ml.)
15T, 3000	144 oz. (4258 ml.)

Utiliser l'une des méthodes illustrées pour déterminer le moment où le carter est plein.



A = niveau PLEIN au filetage inférieur de l'orifice de remplissage d'huile sur les dispositifs sans voyant en verre ou sans jauge graduée.

B = niveau AJOUTER en dessous du filetage inférieur de l'orifice de remplissage d'huile sur les dispositifs sans voyant en verre ou sans jauge graduée.

C = niveau PLEIN sur les dispositifs munis de voyant en verre.

D = niveau AJOUTER sur les dispositifs munis de voyant en verre.

E = niveau AJOUTER sur les dispositifs munis de jauge graduée.

CONTACTEUR DE BAS NIVEAU D'HUILE

Un contacteur de bas niveau d'huile à flotteur peut être installé afin de protéger le dispositif contre tout dommage résultant d'un niveau d'huile de compresseur insuffisant. Un niveau d'huile bas dans le carter du compresseur entraîne l'ouverture des contacts de l'interrupteur, interrompant le fonctionnement du dispositif jusqu'à ce que le niveau d'huile ait été restauré.

La protection adéquate contre les bas niveaux d'huile dépend du réglage correct du contacteur de bas niveau d'huile. Lors de la première utilisation, interrompre le fonctionnement du dispositif et purger environ 1 litre (un quart) d'huile du carter de compresseur dans un contenant propre adéquat. Tendre l'oreille pour entendre le clic du contacteur ou vérifier que celui-ci fonctionne à l'aide d'un dispositif d'essai de continuité électrique.

Il arrive que le flotteur soit mal positionné ou qu'il se bloque durant l'expédition. Si le flotteur est mal positionné ou bloqué, ouvrir le sectionneur, purger l'huile qui reste, enlever le couvercle de carter et libérer le flotteur. Effectuer le réassemblage du dispositif et utiliser la même huile.

REMARQUE Si le flotteur est bloqué en position basse, il est impossible de faire démarrer le dispositif.

MODE D'EMPLOI

FORMULE À CHARGE VARIABLE

Les dispositifs fonctionnant au-dessus de 200 PSIG doivent être exploités selon la "Formule à charge variable."

FORMULE À CHARGE VARIABLE

Le temps de remplissage ne devrait normalement pas excéder trente (30) minutes ou prendre moins que dix (10) minutes. Les périodes d'interruption entre les cycles d'exploitation devraient être au moins égales aux périodes de remplissage. REMARQUE : Lorsque le compresseur est contrôlé par une régulation de vitesse constante, la période d'interruption est égale au temps d'exploitation du compresseur sans charge.

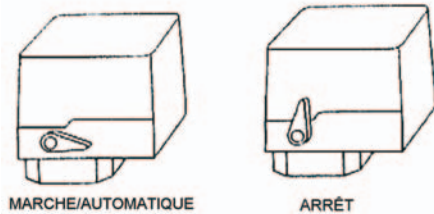
Une limite de temps de remplissage suivie d'une période de refroidissement est recommandée pour protéger les soupapes et les culasses contre des températures de service élevées stabilisées, ce qui pourrait entraîner une accumulation rapide de carbone dans ces pièces.

Toute question concernant les applications de compresseur à pression élevée où le cycle "d'exploitation" est différent de la "Formule à charge variable" doit être adressée à Ingersoll-Rand.

DÉMARRAGE (MODÈLES ALIMENTÉS PAR MOTEUR ÉLECTRIQUE)

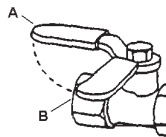
1. Fermer la soupape de service.
2. Déchargez toute la pression restante dans le réservoir en ouvrant lentement la soupape de vidange manuelle.
3. Fermer la soupape de vidange manuelle et mettre le compresseur sous tension. Si le pressostat est muni d'un levier "MARCH/AUTOMATIQUE/ARRÊT", le faire basculer dans la position "MARCHE/AUTOMATIQUE". Si le dispositif est muni d'un interrupteur de marche/arrêt (ON/OFF) sur le panneau de commande, mettre l'interrupteur en position "ON" (Marche).

Levier de pressostat typique (si fourni)



4. Ouvrir lentement la soupape de service.

Robinet de service typique (A = ouvert, B = fermé)



△ ATTENTION Un bruit inhabituel ou des vibrations indiquent qu'il y a un problème. Cesser de faire fonctionner l'appareil jusqu'à ce que la source du problème ait été identifiée et corrigée.

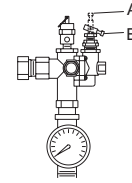
REMARQUE S'assurer que la direction de rotation est correcte en observant la flèche sur le moteur. Si la rotation est incorrecte sur un dispositif à trois phases, échanger deux des trois conducteurs.

DÉMARRAGE (DISPOSITIFS À MOTEUR À ESSENCE)

△ MISE EN GARDE Ne pas faire fonctionner les dispositifs à moteur à essence dans un endroit fermé.

1. Déchargez toute la pression restante dans le réservoir en ouvrant lentement la soupape de vidange manuelle.
2. Actionner l'alimentation en gaz du moteur.
3. Placer l'étrangleur dans la position "marche".
4. Fermer la soupape de service et placer le levier du dispositif de délestage dans la position de "déchargement" (A) pour les modèles alimentés par moteur Kawasaki et Honda et Ingersoll-Rand, ou dans la position de "chargement" (B) pour les modèles alimentés par moteur Kohler.
5. Faire démarrer le moteur, relâcher l'étrangleur et laisser le moteur se réchauffer pendant deux à trois minutes.
6. Remettre le levier de délestage dans la position de "chargement" (B) sur les modèles alimentés par moteur Kawasaki et Honda et Ingersoll-Rand.

Dispositif de délestage typique (A = déchargement, B = chargement)



REMARQUE Fermer l'alimentation en gaz lorsque le compresseur n'est pas utilisé.

REMARQUE Certains compresseurs à moteur à essence nécessitent de 5-8 heures de rodage avant d'atteindre leur pleine capacité et vitesse.

COMMANDES DU COMPRESSEUR

COMMANDE DE DÉMARRAGE ET D'ARRÊT AUTOMATIQUE. Ce type de commande s'applique aux modèles à moteur électrique en dessous de 10 HP.

REMARQUE La commande de démarrage et d'arrêt automatique est à l'intention des utilisations où le moteur effectue un maximum de 6 démarrages par heure.

Lorsque la pression du réservoir atteint le maximum préétabli en usine (normalement 175 PSIG), le pressostat met le dispositif en arrêt. Lorsque la pression du réservoir tombe en dessous du minimum préétabli en usine (normalement 135 PSIG), le pressostat réinitialise et relance le compresseur.

RÉGULATION DE VITESSE CONSTANTE. Ce type de régulation de vitesse s'applique aux dispositifs à moteur à essence.

Lorsque la pression du réservoir atteint le maximum préétabli en usine (normalement 175 PSIG), le dispositif de délestage ralentit le moteur et le dispositif cesse de pomper. Lorsque la pression du réservoir tombe en dessous du minimum préétabli en usine (normalement 145 PSIG), le dispositif de délestage se réinitialise, le moteur reprend son plein régime et le dispositif se remet à pomper.

DOUBLE COMMANDE. Ce type de commande double s'applique aux dispositifs à moteur électrique de plus de 10 HP. Sélectionner démarrage et arrêt automatique ou vitesse constante par le réglage de la poignée sur le distributeur auxiliaire. Pour un démarrage et arrêt automatique, tourner la poignée sur le distributeur auxiliaire dans le sens horaire complet pour désactiver le distributeur auxiliaire. Le pressostat fait ensuite démarrer et arrêter le dispositif.

REMARQUE Pour les modèles à double commande, il est préférable d'utiliser le démarrage et l'arrêt automatique.

Distributeur auxiliaire.



Choisissez une régulation de vitesse constante si le dispositif redémarre dans des intervalles inférieures à 10 minutes ou s'il est utilisé pendant plus de 40 minutes par heure. Tourner la poignée dans le sens antihoraire complet pour faire fonctionner le dispositif continuellement. Lorsque la pression du réservoir atteint 170 PSIG, le dispositif fonctionne mais il ne pompe pas.

REMARQUE Le distributeur auxiliaire est pré-réglé en usine à une valeur inférieure de 5 PSIG au réglage à l'usine du pressostat.

- △ **ATTENTION** Ne pas faire fonctionner sans charge pour plus de 20 minutes par heure ou plus de 15 minutes continuellement sous une régulation de vitesse constante pour éviter d'entraîner le pompage de l'huile.

RÉGLAGE DU PRESSOSTAT

- △ **MISE EN GARD** Lorsque le bloc d'alimentation est connecté, un haut voltage existe aux contacts du pressostat. Il faut déconnecter, verrouiller et étiqueter le bloc d'alimentation principal avant d'effectuer tout réglage.

- △ **ATTENTION** Ne jamais régler le pressostat pour qu'il excède la pression de refoulement maximale du dispositif.

- REMARQUE** N'effectuer le réglage du pressostat que si cela est absolument nécessaires.

ENCLÈCHEMENT & DÉCLÈCHEMENT. Le point de déclenchement (arrêt du compresseur) est la pression à laquelle les contacts du pressostat s'ouvrent, et l'enclenchement (redémarrage du compresseur) la pression à laquelle les contacts du pressostat se ferment. Voir COMMANDES DU COMPRESSEUR.

COMMANDES DE RÉGLAGE. Tous les pressostats disposent d'une commande de réglage de gamme (A). Certains pressostats disposent également d'une commande de réglage différentiel (B). Dans le cas de pressostats sans commande de réglage différentiel, la portée entre les capteurs de niveau de pression d'enclenchement et de déclenchement est réglée en usine pour 40 ± 4 PSIG et ne peut être réglée.

- REMARQUE** Certains pressostats sont munis d'un levier de marche-arrêt utilisé pour ouvrir et fermer les contacts électriques à l'intérieur. CE LEVIER N'EST PAS UNE COMMANDE DE RÉGLAGE DIFFÉRENTIEL. Un pressostat muni d'un levier de marche-arrêt n'a pas de commande de réglage différentiel.

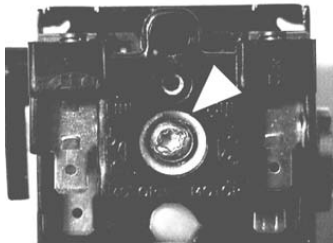
PROCÉDURES DE RÉGLAGE (PRESSOSTAT SANS COMMANDE DE RÉGLAGE DIFFÉRENTIEL):

1. Enlever le couvercle du pressostat.
2. Effectuer le réglage de la portée en tournant la vis de réglage de portée dans le sens horaire (visser) pour augmenter le point de déclenchement ou dans le sens anti-horaire (dévisser) pour réduire le point de déclenchement.

REMARQUE : Un tour complet modifie le réglage d'environ 2 PSIG.

3. Remettre le couvercle en place, reconnecter le bloc d'alimentation et faire démarrer le compresseur.
4. Prendre note de la valeur de pression à laquelle le compresseur atteint le point de déclenchement.
5. Effectuer de nouveau la procédure de réglage au besoin.

Réglage de plage de pressostat.



PROCÉDURES DE RÉGLAGE (PRESSOSTAT AVEC COMMANDE DE RÉGLAGE DIFFÉRENTIEL):

1. Enlever le couvercle du pressostat.
2. Régler la pression d'enclenchement à l'aide de l'écrou de réglage de portée. Tourner l'écrou dans le sens horaire (visser) pour augmenter la pression ou dans le sens anti-horaire (dévisser) pour diminuer la pression.

REMARQUE : Un tour complet modifie le réglage d'environ 2 PSIG.

3. Régler la pression de déclenchement à l'aide de la commande de réglage différentiel. Tourner l'écrou de réglage différentiel dans le sens horaire (visser) pour augmenter la pression ou dans le sens anti-horaire (dévisser) pour diminuer la pression.

REMARQUE : Un tour complet modifie le réglage d'environ 2 PSIG.

4. Remettre le couvercle en place, reconnecter le bloc d'alimentation et faire démarrer le compresseur.
5. Prendre note de la valeur de pression à laquelle le dispositif atteint le point de déclenchement.
6. Effectuer de nouveau la procédure de réglage au besoin.

Le différentiel possible minimum est d'environ 20% de la pression de déclenchement. Un différentiel aussi large que possible est recommandé pour éviter les arrêts et démarrages fréquents du dispositif. Prendre note de la valeur de pression de point de déclenchement du compresseur et redéfinir ce point au besoin.

Prendre note de l'interaction entre la portée et les réglages différentiels, c'est-à-dire si le point de déclenchement est augmenté, le différentiel augmente également, ou si le différentiel est réduit, le déclenchement est également réduit, etc. Il faut prendre ces facteurs en considération lors du réglage du pressostat et compenser en conséquence.

SYSTÈME DE DÉMARRAGE-DÉLESTAGE

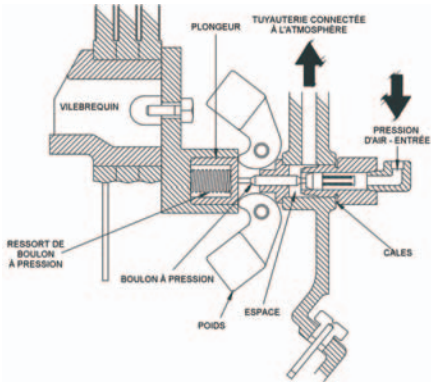
La fonction démarrage-délestage est disponible sur certains modèles. La fonction de ce système est de réduire la pression des cylindres lorsque le dispositif est en arrêt, permettant ainsi de le faire démarrer contre une charge réduite. Une charge réduite augmente la durée de vie du système d'entraînement et des courroies et réduit également la possibilité de déclencher le relais de surcharge. Le système fonctionne de la façon suivante :

Le dispositif de délestage centrifuge est raccordé à l'extrémité du vilebrequin comme l'indique les illustrations suivantes.

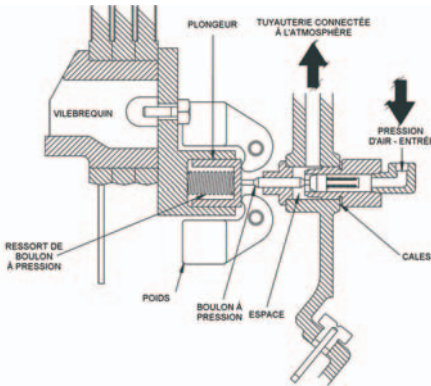
Au démarrage du dispositif, la forge centrifuge agit sur les poids du dispositif de délestage et ceux-ci pivotent vers l'extérieur. Ceci permet au plongeur et au boulon à pression de se déplacer vers l'intérieur et de fermer la soupape pilote. Le chemin d'échappement dans l'atmosphère de la pression du cylindre est maintenant fermé et le compresseur effectue le pompage de l'air normalement.

À l'arrêt du dispositif, le poids se rétracte, permettant ainsi au ressort du boulon de pression de déplacer le plongeur et le boulon de pression vers l'extérieur. Le boulon de pression ouvre la soupape pilote et la pression d'air enfermé s'échappe du cylindre et du refroidisseur intermédiaire à travers un passage dans le couvercle extrémité bâti, à travers le tube de délestage et dans l'atmosphère via le filtre/silencieux d'admission.

Position du poids et du boulon à pression lorsque le dispositif est en marche.



Position du poids et du boulon à pression lorsque le dispositif est en arrêt.



- Mesurer l'espace entre le boîtier de soupape pilote et le couvercle extrémité bâti.
- Enlever le boîtier de soupape pilote et caler suffisamment pour remplir l'espace mesuré à l'étape 5.
- Visser de nouveau le boîtier de soupape pilote dans le couvercle extrémité bâti jusqu'à ce que le boîtier soit bien serré entre les cales.
- Raccorder le tube de la soupape pilote ainsi que les raccords de tuyauterie.

DÉRIVATION DE RENIFLARD/DISPOSITIF DE DÉLESTAGE

La conduite de dérivation du reniflard/dispositif de délestage élimine les remontées de pression d'air dans le bâti du compresseur en permettant à l'air de s'échapper via le dispositif de délestage d'admission (si ouvert) ou (si fermé) via la soupape à clapet, contournant ainsi le dispositif de délestage d'admission pour s'échapper finalement dans l'atmosphère via le filtre/silencieux d'admission.

VÉRIFICATION DE LA CONSOMMATION D'HUILE

Une règle simple pour vérifier la consommation d'huile est de considérer qu'une consommation à ou supérieure à 50 HP par heure par once est acceptable.

La formule est comme suit :

$$\frac{\text{Cheval vapeur} \times \text{Heures de fonctionnement}}{\text{Onces d'huile utilisées}} = \text{Cheval vapeur-heure par once}$$

Pour l'application de cette formule, considérez la taille de la machine. Dans l'exemple suivant, un compresseur de 5 HP utilise 2 onces d'huile pour chaque 20 heures de fonctionnement.

$$\frac{5 \text{ Cheval vapeur} \times 20 \text{ heures de fonctionnement}}{2 \text{ onces d'huile utilisées}} = 50 \text{ Cheval vapeur-heure par once}$$

Le compresseur dans cet exemple passe le test de consommation d'huile.

REMARQUE Une pompe de compresseur neuve ou reconditionnée écoulera une quantité d'huile plus élevée qu'à l'ordinaire jusqu'à ce que les segments de piston soient bien assis (environ 100 heures de fonctionnement).

RÉGLAGE DE LA SOUPAPE PILOTE

Si la conduite de soupape pilote est excessivement chaude, cela indique probablement que la soupape pilote fuit et que des réglages sont nécessaires.

Pour effectuer le réglage de la soupape pilote, procéder comme suit :

- Mettre le dispositif en arrêt puis déconnecter et étiqueter le disjoncteur principal de l'alimentation électrique pour empêcher tout démarrage accidentel.
- Enlever le tube de la soupape pilote ainsi que les raccords de tuyauterie.
- Enlever le boîtier de soupape pilote ainsi que les cales existantes.
- Visser de nouveau le boîtier de soupape pilote dans le couvercle extrémité bâti (sans aucune cale) jusqu'au contact avec le boulon à pression. Faire avancer le boîtier de soupape pilote de 1/4 à 1/2 tour de plus.

Si le contact avec le boulon à pression n'est pas effectué, il sera peut-être nécessaire d'effectuer la procédure suivante pour localiser le point de contact :

- Insérer un petit objet (poinçon, tige, clou, etc.) dans l'extrémité de la soupape pilote jusqu'au contact avec la tige de soupape.
- Avec l'objet toujours inséré dans la soupape de pilote, faire une marque sur l'objet où il croise le rebord extérieur du boîtier de soupape pilote.
- Tout en gardant l'objet appuyé légèrement contre la tige de soupape, visser le boîtier de soupape pilote dans le couvercle extrémité bâti. Lorsque la marque sur l'objet commence à s'éloigner du rebord du boîtier de soupape de pilote, le contact avec le boulon à pression a été effectué.
- Faire avancer le boîtier de soupape pilote de 1/4 à 1/2 tour de plus et procéder à l'étape 5.

ENTRETIEN

△ MISE EN GARDE Avant d'effectuer l'entretien, relâcher la pression d'air du circuit puis couper, bloquer et identifier l'alimentation principale ou déconnecter le fil de la bougie d'allumage du moteur.

REMARQUE Tous les systèmes d'air comprimé comportent des éléments (par ex. l'huile lubrifiante, les filtres, les séparateurs) qui sont remplacés périodiquement. Ces éléments peuvent être ou peuvent contenir des substances réglementées qui doivent être éliminées en conformité avec les lois et les règlements en vigueur au niveau municipal, provincial et fédéral.

REMARQUE Lors du démontage, prendre note de la position et de l'emplacement des pièces afin de faciliter leur assemblage éventuel. Les séquences d'assemblage ainsi que les pièces figurant dans les illustrations peuvent ne pas correspondre à votre appareil.

REMARQUE Tout entretien ne figurant pas dans la présente section doit être effectué par un agent d'entretien autorisé.

REMARQUE Consulter le manuel de l'utilisateur du moteur pour de plus amples informations sur son entretien.

REMARQUE Le programme d'entretien suivant a été développé pour une application type. La fréquence des entretiens devra augmenter dans des conditions plus difficiles.

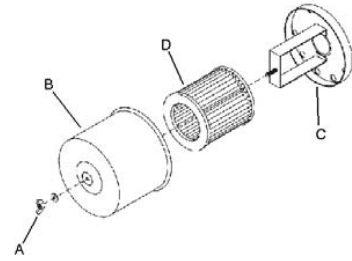
PROGRAMME D'ENTRETIEN

- | | |
|---|--|
| Tous les jours ou avant chaque mise en marche | <ul style="list-style-type: none"> ● Vérifier s'il y a des fuits d'huile. ● Vérifier le niveau de lubrifiant. Remplir au besoin. ● Vidanger le condensat du réservoir (si un dispositif de vidange automatique n'est pas fourni). Ouvrir la soupape de vidange manuelle, capter le condensat et l'éliminer de la manière appropriée. ● Vérifier si l'appareil émet un bruit ou des vibrations inhabituels. ● S'assurer que les carters de courroie et les couvercles sont fixés solidement en place. ● S'assurer que le moteur (s'il est fourni) contient suffisamment de carburant et de lubrifiant selon les recommandations du fabricant. ● S'assurer que l'espace autour du compresseur ne comporte pas de chiffons, d'outils, de débris et de matières inflammables ou explosives. |
| Une fois par semaine | <ul style="list-style-type: none"> ● Observer le fonctionnement des soupapes de sûreté/décharge avec le compresseur en marche. Remplacer toute soupape de sûreté/décharge ne fonctionnant pas librement. ● Inspecter les éléments de filtre à air. Les nettoyer au besoin. |
| Une fois par mois | <ul style="list-style-type: none"> ● Vérifier s'il y a des fuites d'air. Asperger de l'eau savonneuse autour des joints pendant que le compresseur est en marche et vérifier si des bulles se forment. ● S'assurer que les vis et les boulons sont bien serrés. Les serrer au besoin. ● Inspecter les courroies d'entraînement. Les ajuster au besoin. |
| 3/500 * | <ul style="list-style-type: none"> ● Nettoyer l'extérieur. ● Vidanger le lubrifiant à base de pétrole pendant que le carter principal est encore tiède. |
| 12/2000 * | <ul style="list-style-type: none"> ● Vidanger l'huile du compresseur et nettoyer ● Installer la trousse d'entretien — ou — ● Vidanger le lubrifiant synthétique pendant que le carter principal est encore tiède. ● Remplacer l'élément filtrant. |

* indique le nombre de mois ou d'heures de fonctionnement, selon la première éventualité.

INSPECTION ET NETTOYAGE DES FILTRES

1. Dévisser et retirer l'écrou à ailettes (A) qui tient le capot du filtre (B) en place sur la base (C).
2. Détacher le capot du filtre et retirer l'élément filtrant (D). Nettoyer l'élément avec un jet d'air sous pression ou un aspirateur.
3. Remettre en place l'élément filtrant et le capot du filtre et fixer-le avec l'écrou à ailettes.



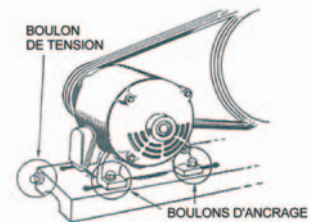
VIDANGE D'HUILE

1. Ouvrir le bouchon de vidange d'huile (A) et laisser le lubrifiant s'écouler dans un contenant propice.
2. Refermer le bouchon de vidange d'huile.
3. Suivre les directives de remplissage de la section MODE D'EMPLOI.

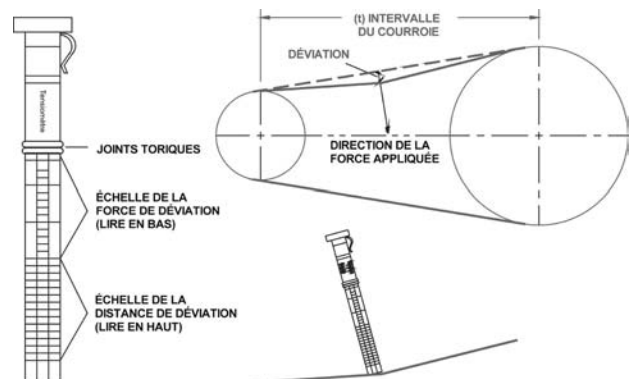
AJUSTEMENT DE LA COURROIE

VÉRIFICATION DE LA TENSION. Vérifier occasionnellement la tension de la courroie, particulièrement si elle semble lâche. Effectuer le réglage de la tension des nouvelles courroies lors de leur installation.

TENSIONNEMENT D'UNE COURROIE. Pour effectuer le réglage de la tension d'une courroie, dévisser les boulons d'ancrage du moteur, puis écarter le moteur de la pompe en le glissant le long de la base, pour ensuite serrer à nouveau les boulons. Certains dispositifs sont munis d'une vis de tension de courroie qui lorsque vissée, fait sortir le moteur de la pompe. Le moteur se déplace facilement en plaçant un levier dessous. Il est également possible de se procurer dans le commerce une barre d'écartement ou autre dispositif de tension de courroie.



Suivre les procédures décrites ci-dessous pour déterminer et mesurer correctement la tension des courroies des modèles à moteur électrique ou à essence y compris 2340, 2475 et 2545 (avec type de courroie "A" seulement). Consulter l'illustration suivante pour une représentation visuelle.



1. Déposer une règle le long de la surface supérieure extérieure de la courroie, entre la poulie motrice et le volant.
2. À mi-chemin entre les deux et perpendiculairement à la courroie, jauger la pression à la surface extérieure de la courroie en y appuyant un dynamomètre de tension. Forcer la courroie à la valeur de déflexion indiquée dans la TABLE DE TENSION DE COURROIE sous la rubrique DIAGRAMMES & TABLEAUX. Comparer la tension lue sur l'instrument à celle qui figure au tableau.

Suivre les procédures décrites ci-dessous pour régler et mesurer correctement la tension sur les modèles de 7,5 à 30 HP 2545, 7100, 15T et 3000 munis de types de courroie "B" et "C".

1. Mesurer la longueur de portée (t) du dispositif.
2. Déterminer la valeur de déflexion (en pouces) requise pour mesurer la force de déflexion (en livres) en multipliant la longueur de portée (t) par 1/64. Par exemple, une longueur de portée de 32" multipliée par 1/64 est égale à 1/2" de la déflexion requise pour la mesure de la force de déflexion.
3. Déposer une règle le long de la surface supérieure extérieure de la courroie, entre la poulie motrice et le volant.
4. À mi-chemin entre les deux et perpendiculairement à la courroie, jauger la pression à la surface extérieure de la courroie en y appuyant un dynamomètre de tension. Forcer la courroie à la déflexion prédéterminée calculée à l'étape 2. Comparer la tension lue sur l'instrument avec la TABLE DE TENSION DE COURROIE sous la rubrique DIAGRAMMES & TABLEAUX.

Avant de faire démarrer le compresseur, assurer l'alignement exact du centre des rainures de la poulie motrice et du volant ainsi que le serrage des boulons d'ancrage du moteur.

⚠ ATTENTION Un alignement incorrect de la poulie et du volant ou un tensionnement inadéquat de la courroie pourrait entraîner une surcharge du moteur, des vibrations excessives et un bris prématuré de la courroie ou du palier.

Afin de prévenir ces problèmes, s'assurer, après avoir installé une nouvelle courroie ou tensionné une courroie existante, que la poulie et le volant sont bien alignés et que la tension de la courroie est adéquate.

ENTRETIEN DU ROBINET DE PURGE ÉLECTRIQUE

REMARQUE : le programme d'entretien suivant a été développé pour des applications typiques. Les intervalles d'entretien doivent être réduits dans des conditions d'utilisation difficiles.

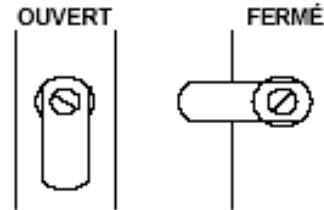
PROGRAMME D'ENTRETIEN DE LA SOUPAPE DE PURGE	
CHAQUE JOUR	Vérifier la soupape afin de vous assurer qu'elle fonctionne correctement. Nettoyer la crépine au besoin.
CHAQUE MOIS (TOUS LES 30 JOURS)	Nettoyer la crépine.

Pour nettoyer la crépine, effectuer la procédure suivante :

1. Fermer complètement la soupape à bille de la crépine afin de l'isoler du réservoir d'air.
 2. Appuyer sur le bouton TEST de la minuterie pour purger la pression qui reste dans la soupape. Répéter la procédure jusqu'à ce que toute la pression ait été éliminée.
- ⚠ ATTENTION !** L'air à haute pression peut entraîner des blessures causées par la projection de débris. S'assurer que la soupape à bille de la crépine est complètement fermée et que la pression a été évacuée de la soupape avant de procéder au nettoyage.

3. Enlever le bouchon de la crépine à l'aide de la clé appropriée. Si de l'air s'écoule de l'orifice de nettoyage, ARRÊTER IMMÉDIATEMENT et effectuer les étapes 1 et 2 de nouveau.
4. Enlever la crépine en acier inoxydable puis nettoyer-la. Enlever tout débris présent dans l'ensemble de crépine avant de la remettre en place.
5. Remettre le bouchon en place et serrer à l'aide d'une clé.

Soupape à bille de crépine



6. Lors de la remise en service du EDV-2000, appuyer sur le bouton TEST pour confirmer le fonctionnement approprié.

INSPECTION DU RÉSERVOIR

La longévité du réservoir dépend de plusieurs facteurs, y compris, sans s'y restreindre, les conditions d'exploitation, le milieu ambiant et le niveau d'entretien. L'effet exact propre à chacun de ces facteurs est difficile à juger ; voilà pourquoi IngersollRand vous recommande de prévoir une inspection agréée du réservoir dans les cinq premières années de service du compresseur. Pour effectuer une inspection du réservoir, communiquer avec Ingersoll-Rand.

Un réservoir qui n'a pas subi d'inspection au cours des 10 premières années de service du compresseur doit être retiré du service jusqu'à ce qu'il ait été inspecté. Un réservoir qui ne répond pas aux normes doit être remplacé.

⚠ MISE EN GARDE Si un réservoir rouillé n'est pas remplacé, il risque d'éclater ou d'exploser, entraînant la possibilité de dommages importants, de blessures graves ou même de décès. Ne jamais modifier ou réparer un réservoir : obtenir un réservoir de rechange dans un centre de service.

DÉPANNAGE

PROBLÈME	POINT DE CONTRÔLE
Usure anormale des pistons, des segments ou des cylindres	4, 8, 9, 19, 28, 35
Chute du débit d'air	1, 6, 15, 16, 18, 19, 29
Soupape de purge automatique qui coule ou ne se vidange pas automatiquement	16
Soupape auxiliaire qui vibre ou qui fuit au niveau de la tige	23, 24
Tuyaux de refroidisseur secondaire ou de refroidisseur intermédiaire défectueux	36
Le compresseur n'atteint pas sa vitesse de marche	2, 6, 12, 15, 21
Le compresseur met trop de temps à atteindre sa vitesse de marche	26, 27, 33, 34
Le compresseur devient extrêmement chaud	3, 14, 15, 22
Le compresseur n'effectue pas son cycle de délestage	23, 24, 26
Le compresseur n'effectue pas de délestage en position d'arrêt	26, 33
Bruit excessif à l'usage	2, 6, 15, 16, 21, 27, 32
Arrêts et démarrages trop fréquents	5, 11, 16, 32, 40
Cognements ou cliquetis	2, 15, 17, 19, 20, 21
Les voyants clignotent ou s'affaiblissent lors du fonctionnement	12, 13
Humidité dans le carter principal ou aspect laiteux du lubrifiant à base de pétrole ou rouille dans les cylindres	9, 10
Surcharge du moteur se déclenche ou tire un courant excessif	5, 6, 12, 13, 14, 15, 16, 19, 20, 21, 34
De l'huile dans l'air de refoulement (pompage d'huile)	4, 7, 9, 18, 19, 25, 35
Fuite du joint d'huile	25
La soupape de sûreté/décharge crépite	1, 5, 29, 30
Pression intermédiaire élevée	30
Pression intermédiaire basse	31
Moteur démarre lentement ou ne démarre pas du tout	6, 14, 37, 38
Moteur ne démarre pas	12
Moteur ne démarre pas	39
Fuites d'huile	41

DÉPANNAGE DU ROBINET DE PURGE ÉLECTRIQUE

Problème possible	Cause possible	Solution
La soupape ne se ferme pas.	<ol style="list-style-type: none"> Des débris dans l'électrovanne empêchent l'appui correct de la membrane. Composant électrique court-circuité 	<ol style="list-style-type: none"> Enlever l'électrovanne afin de la démonter, de la nettoyer, puis de la réassembler. Vérifier et remplacer le cordon d'alimentation ou la minuterie au besoin.
La minuterie ne fonctionne pas	<ol style="list-style-type: none"> Pas d'alimentation électrique. Mauvais fonctionnement de la minuterie Orifice bouché. Mauvais fonctionnement de l'électrovanne Crépine encrassée. 	<ol style="list-style-type: none"> Mettre sous tension. Remplacer la minuterie. Nettoyer la soupape. Remplacer l'électrovanne. Nettoyer la crépine.

POINT CONTR.	CAUSE POSSIBLE	SOLUTION POSSIBLE
1	Filtre sale à l'aspiration et/ou au refoulement.	Nettoyer ou remplacer.
2	Poulie motrice ou volant de courroie mal serré, trop de jeu dans l'arbre moteur ou courroies d'entraînement lâches.	Vérifier le volant, la poulie motrice, le vilebrequin, la tension et l'alignement de la courroie d'entraînement. Réparer ou remplacer au besoin.
3	Ventilation insuffisante autour du volant de la courroie.	Déplacer le compresseur pour un débit d'air amélioré.
4	Viscosité trop faible du lubrifiant.	Vidanger le lubrifiant actuel et le remplacer par un lubrifiant qui convient.
5	Fuites d'air dans les canalisations de refoulement.	Vérifier les tubes et les raccords. Serrer les joints ou remplacer au besoin.
6	Viscosité trop élevée du lubrifiant.	Vidanger le lubrifiant actuel et le remplacer par un lubrifiant qui convient.
7	Viscosité trop élevée du lubrifiant.	Vidanger le lubrifiant en excès.
8	Niveau de lubrifiant trop faible.	Verser du lubrifiant dans le carter principal jusqu'au niveau requis.
9	Le lubrifiant utilisé est du type à détergent.	Vidanger le lubrifiant actuel et le remplacer par un lubrifiant qui convient.
10	Cycles de marche extrêmement légers. Le compresseur est situé dans un lieu humide.	Faire fonctionner le compresseur par cycles plus longs. Déplacer le compresseur ou installer une trousse de chauffage du carter principal.
11	Différentiel du pressostat trop étroit.	Ajuster le pressostat pour augmenter le différentiel, si l'ajustage du différentiel est possible. Installer un pressostat avec une fonctionnalité d'ajustage du différentiel, si l'ajustage du différentiel est souhaité.
12	Tension de ligne inadéquate. Câblage ou panneau de service électrique trop petit. Mauvais contact sur les bornes du moteur ou mauvaises connexions du démarreur. Mauvais réchauffeurs de surcharge du démarreur.	Check line voltage and upgrade lines as required. Contact electrician. Installer un fil ou boîte de service proprement dimensionné. Contacter un électricien. Assurer un contact adéquat sur les bornes du moteur ou les connexions du démarreur. Installer des réchauffeurs de surcharge de démarreur adéquats. Contacter un électricien.
13	Mauvaise régulation de puissance (ligne déséquilibrée).	Contacteur la compagnie d'électricité.
14	Courroies d'entraînement trop lâches ou mal alignées.	Ajuster les courroies pour leur donner la tension et l'alignement qui convient.
15	Fuites, bris ou accumulation de calamine dans les soupapes du compresseur.	Inspecter les soupapes. Les nettoyer ou les remplacer au besoin. Installer une trousse d'entretien rapide de soupape/joint.
16	Robinet de purge automatique encrassé, qui fuit ou qui est défectueux.	Inspecter le robinet et nettoyer, réparer ou remplacer au besoin.
17	Accumulation de calamine sur le fond des pistons.	Nettoyer les pistons. Réparer ou remplacer au besoin..
18	Segments de pistons endommagés ou usés (cassés, rugueux ou égratignés). Coupe ou dégagement latéral trop grand. Les segments sont hors de leur logement ou coincés dans leurs gorges ou leurs coupes ne sont pas décalées.	Installer une trousse d'entretien rapide de segment/joint. Ajuster les segments.
19	Les cylindres ou les pistons sont égratignés, usés ou entaillés.	Réparer ou remplacer au besoin.
20	Une bielle, un axe de piston ou des coussinets du maneton sont usés ou entaillés. Bague d'espacement desserrée sur le vilebrequin.	Tout inspecter. Réparer ou remplacer au besoin. Installer une trousse d'entretien rapide de coussinet/bielle.
21	Paliers à billes défectueux sur le vilebrequin ou l'arbre moteur.	Inspecter les coussinets et remplacer au besoin. Installer une trousse d'entretien rapide de coussinet/bielle.
22	Direction de rotation du volant à contre-voie.	Vérifier le câblage du moteur pour des connexions adéquates. Inverser deux conducteurs sur les moteurs triphasés.
23	Pièces du dispositif de délestage d'admission qui fuient ou qui sont cassées ou usées.	Inspecter les pièces et remplacer au besoin.
24	Distributeur auxiliaire encrassé ou sièges usés.	Inspecter les pièces. Les nettoyer, les ajuster ou les remplacer au besoin.
25	Le joint d'huile est usé ou le vilebrequin est entaillé.	Remplacer le joint. Installer une chemise d'arbre au besoin. Installer une trousse d'entretien rapide de coussinet/bielle.
26	Soupape pilote centrifuge qui fuit ou est mal réglée.	Remplacer le joint torique de soupape pilote. Régler la soupape pilote.
27	Fuite de la soupape de sûreté ou siège de soupape usé.	Remplacer la soupape de sûreté.
28	Atmosphère chargée de poussières.	Installer une canalisation d'aspiration à distance et l'acheminer vers une source d'air propre. Installer un système de filtration plus efficace.
29	Soupape de sûreté/décharge défectueuse.	Remplacer.
30	Soupape d'admission haute pression qui fuit.	Inspecter, nettoyer ou réparer au besoin.
31	Soupape de refoulement basse pression qui fuit.	Inspecter, nettoyer ou réparer au besoin.
32	Mode de démarrage et d'arrêt automatique n'est pas adéquat pour la demande d'air.	Régler le soupape auxiliaire pour un fonctionnement à vitesse constante.
33	Le dispositif de délestage du pressostat fuit ou est défectueux.	Réaligner la tige ou remplacer.
34	La température de l'air ambiant est trop faible.	Installer une trousse de chauffage du carter principal. Utiliser le lubrifiant All Season Select. Déplacer le compresseur dans un lieu plus chaud.
35	Paroi de cylindre usée.	Roder le cylindre à l'aide d'un rodoir flexible de 180 grains
36	Volant déséquilibré, tuyaux non ceinturés ou non attachés, mauvaise vitesse de poulie.	Vérifier le niveau de vibration, changer la poulie ou le volant au besoin, serrer les colliers de tuyau.
37	Moteur mis à la terre incorrectement.	Connecter la batterie à la masse du moteur tel que recommandé.
38	Essence dépassant le temps d'entreposage ou contenant de l'eau.	Remplacer le carburant, ajouter un stabilisateur de carburant.
39	Pas de carburant dans le réservoir. Soupape de carburant fermée. Pression d'huile basse.	Consulter les instructions du fabricant pour le ravitaillement en carburant. Ouvrir la soupape de carburant. Consulter les instructions du fabricant.
40	Trop de condensat dans le réservoir.	Vidanger le réservoir à l'aide de la soupape de vidange manuel ou installer une soupape de vidange automatique.
41	Raccords/coudes/connecteurs desserrés	Resserrer les raccords au couple spécifié

DIAGRAMMES ET TABLEAUX

TABLEAU DE COUPLE DE TORSION

	2340	2475	2545	7100	15T	3000
Boulons à tête haute pression	75	75	75	75	75	75
Boulons à tête basse pression	75	75	75	75	75	75
Boulons de bride de vérin	30	50	50	50	50	50
Boulons de couvercle de bâti	17	17	17	20	20	20
Boulons de couvercle de palier	17	17	17	20	20	20
Vis à tête cubique de maneton	5,5	11	11	12-15	12-15	12-15
Vis de couvercle de dispositif de délestage	—	—	11	11	20	11
Vis de soupape d'admission haute pression	11-15 LB-PO	11-15 LB-PO	11-15 LB-PO	5,5	—	5,5
Vis de soupape d'admission basse pression	11-15 LB-PO	25-30 LB-PO	25-30 LB-PO	5,5	—	5,5
Vis de soupape d'évacuation haute pression	11-15 LB-PO	11-15 LB-PO	11-15 LB-PO	26	50	26
Vis de soupape d'évacuation basse pression	25-30 LB-PO	25-30 LB-PO	25-30 LB-PO	26	90	26
Boulon de volant	33	60	60	113	213	213
Boulons à tête de centrage haute pression	—	—	10	—	—	—
Boulons à tête de centrage basse pression	—	—	14-16	—	—	—

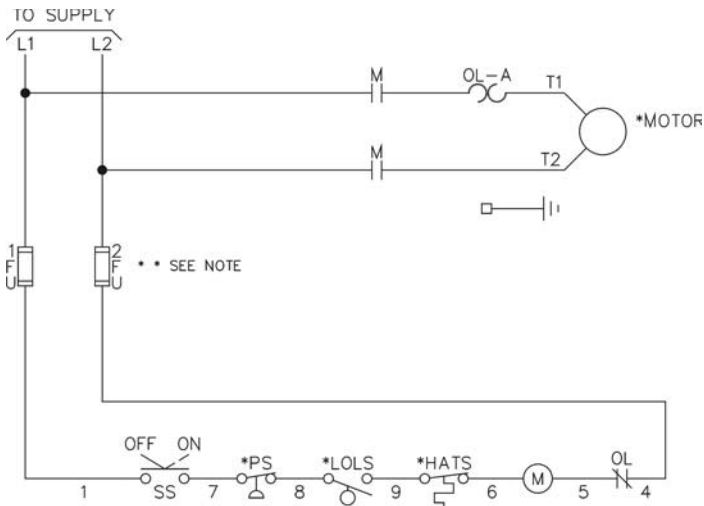
REMARQUE Serrer tous les éléments de fixation uniformément et transversalement en deux étapes.

TABLEAU DE TENSION DE COURROIE

MODÈLE	DÉFLEXION (PO.)	TENSION (LB.)	TYPE DE COURROIE	CHEVAL	TENSION À UNE DÉFLEXION DE 1/64" PAR POUCE DE PORTÉE
2340 (14" Span)	0,25	4,9 - 7,1	B	7,5	7,0 - 10,0
2340 (19" Span)	0,29	4,9 - 7,1		10-15	8,0 - 12,0
2475 (14" Span)	0,25	4,9 - 7,1	C	20	12,0 - 18,0
2475 (19" Span)	0,29	4,9 - 7,1		25-30	14,0 - 21,0
2475F/X11GH	0,34	5,5 - 8,0			
2475F/X9/11GK	0,25	11,25 - 13,0			
2475N5 (14,5" Span, Cogged belt)	0,23	4,5 - 6,5			
2545 (A Groove)	0,29	4,9 - 7,1			

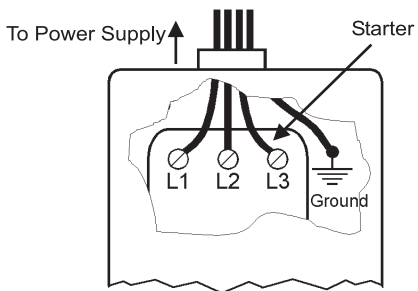
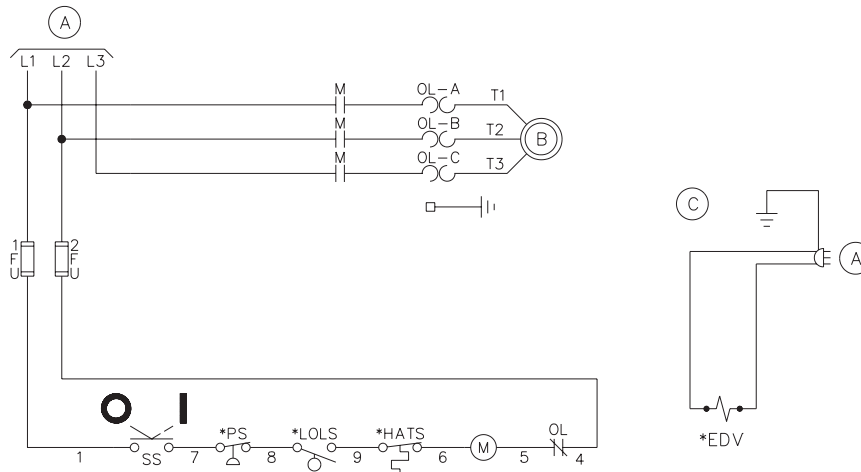
DIAGRAMMES DES CÂBLES ÉLECTRIQUES

Câblage monophasé



A	À l'alimentation
C	Câblage pour la soupape de drainage électrique en option
EDV	Soupape de drainage électrique
T	Borne de ligne d'alimentation
L	Borne de charge
FU	Fusible de circuit de commande
CHTA	Contacteur haute température d'air (#)
CBNH	Contacteur bas niveau d'huile (#)
M	Bobine de démarreur
OL	Surcharge de bobine de démarreur
PS	Pressostat
SS	Sélecteur (#)
*	Câblage de remplacement pour la conversion d'un démarrage triphasé à une application monophasée
(#)	= si fourni

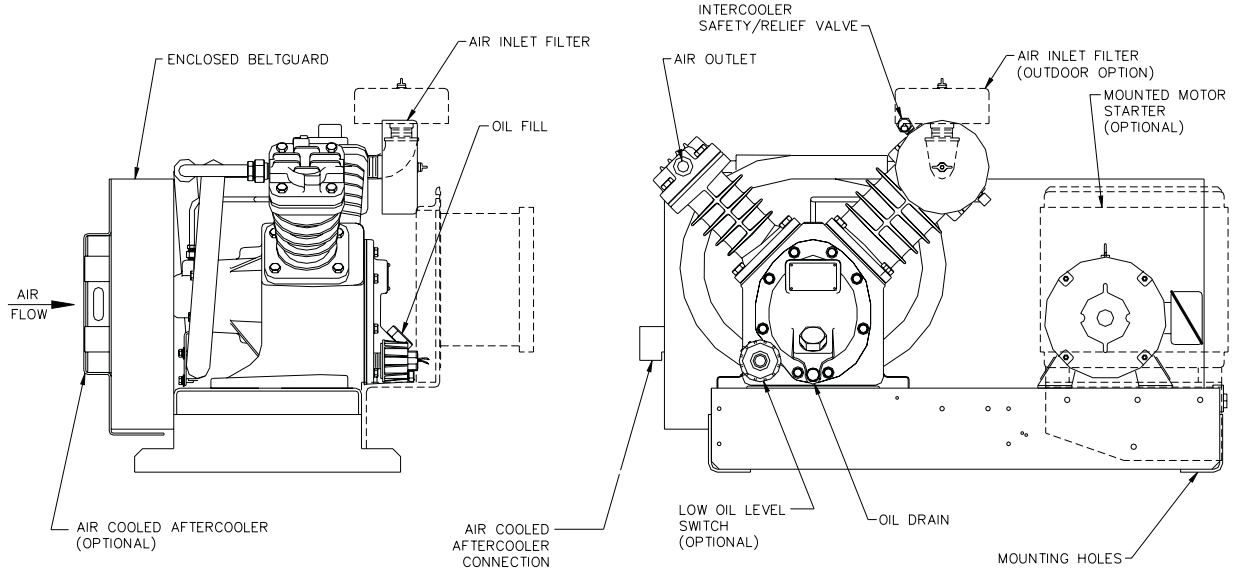
Câblage triphasé



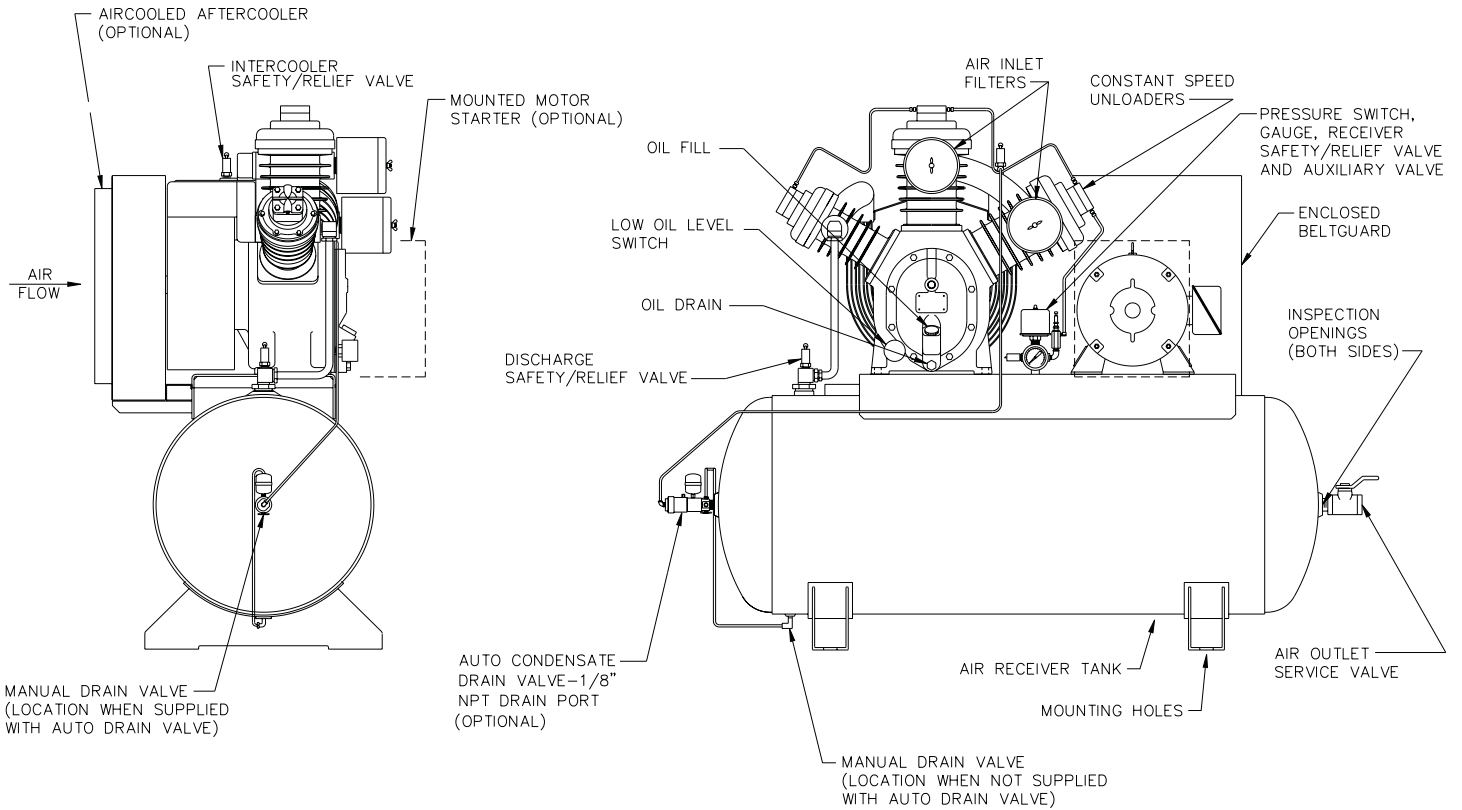
REMARQUE Sur les dispositifs nécessitant un démarreur, raccorder la ligne électrique au démarreur et non au pressostat.

- Connecter le fil de masse à la borne de mise à la masse
- utilisé pour moteurs et démarreurs triphasés seulement

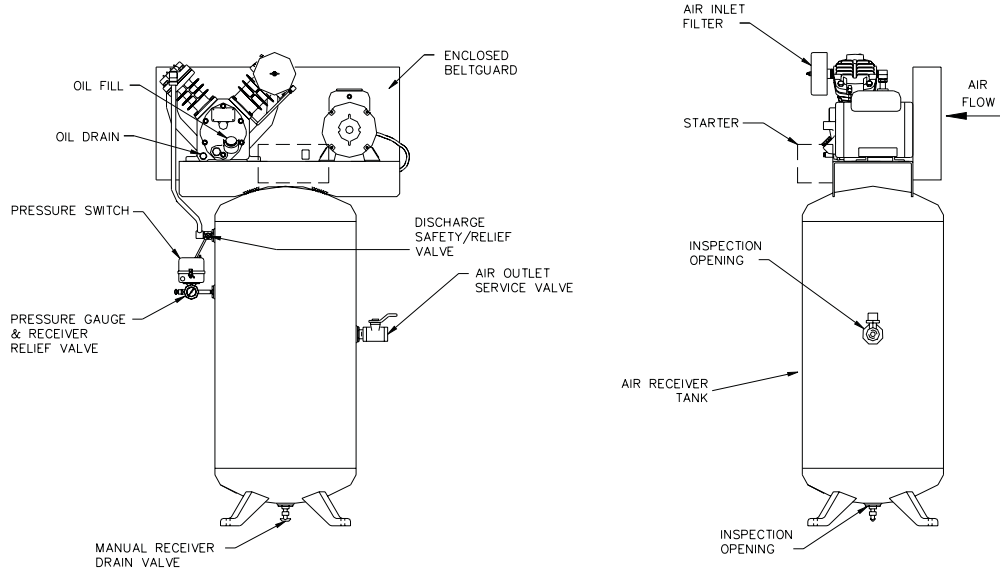
Dispositif typique à plaque de base



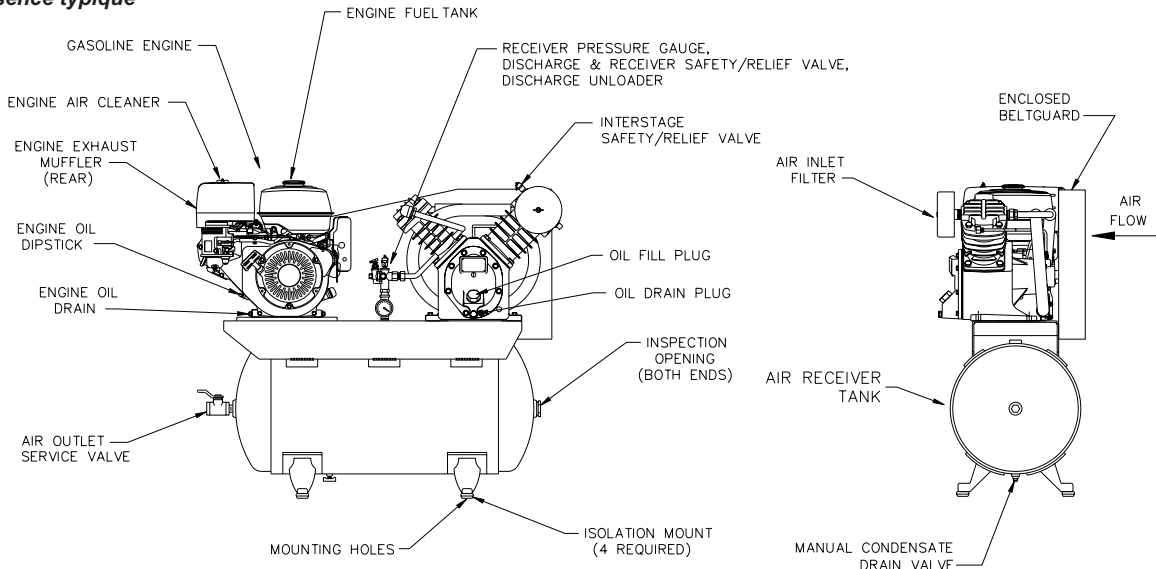
Dispositif simplex horizontal typique



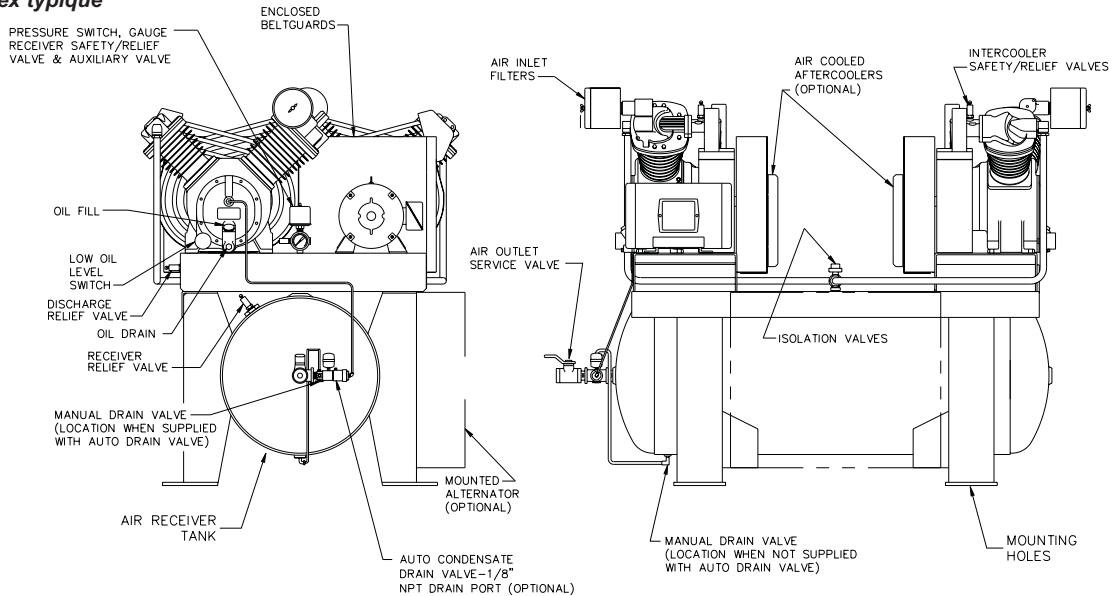
Dispositif simplex vertical typique



Moteur à essence typique



Dispositif duplex typique



GARANTIE

La société Ingersoll-Rand garantit que l'équipement fabriqué et livré par les présentes ne comporte aucun défaut de matériel ou de malfaçon et ce pendant une période douze (12) mois à partir de la date de mise en service de l'équipement ou de dix-huit (18) mois à partir de la date de livraison, selon la première éventualité. Cette période de garantie s'appliquera à tout équipement, sauf les suivants : (A) dans le cas de compresseurs fonctionnant exclusivement avec le lubrifiant synthétique All Season Select, le châssis nu du compresseur sera garanti pendant une période de vingt-quatre (24) mois à partir de la date de mise en service de l'équipement ou de trente (30) mois à partir de la date de livraison, selon la première éventualité. (B) les pièces de rechange seront garanties pendant six (6) mois à partir de la date de livraison. Si la société est avisée par écrit d'une violation des dispositions de la présente garantie à l'intérieur de la période requise, alors la société s'engage, à son gré, à y remédier soit en réparant correctement l'équipement, soit en fournissant une pièce de rechange FAB du point d'origine, pourvu que l'acheteur ait installé, exploité et entretenu l'équipement conformément aux pratiques acceptées de l'industrie et qu'il ait suivi les recommandations particulières de la société. Les accessoires et les équipements fournis par la société mais fabriqués par un tiers seront protégés par la garantie obtenue du tiers par Ingersoll-Rand et ayant pu être cédée à l'acheteur. La société ne sera en aucun cas tenue responsable des réparations, des remplacements ou des réglages effectués à l'équipement ou du coût de main-d'œuvre engagé par l'acheteur sans l'autorisation écrite préalable de la société.

La société ne fait aucune garantie quant à la performance, exception faite des déclarations particulières faites dans sa proposition. Les effets de la corrosion, de l'érosion ainsi que de l'usure normale sont explicitement exclus des protections assurées par la garantie. Si des garanties de performance ont été explicitement incluses, alors les obligations de la société seront limitées à assurer un correctif de la manière et durant la période précisées ci-dessus.

LA SOCIÉTÉ NE FAIT AUCUNE AUTRE GARANTIE OU DÉCLARATION DE QUELQUE SORTE QUE CE SOIT, DE NATURE IMPLICITE OU EXPLICITE, SAUF EN CE QUI CONCERNE LE TITRE, ET ELLE RENONCE PAR LES PRÉSENTES À TOUTE GARANTIE IMPLICITE DE QUALITÉ LOYALE ET MARCHANDE.

La correction par la société de tout vice, qu'il soit apparent ou caché, de la manière et pendant la période établie ci-dessus, constituera l'accomplissement de toutes les responsabilités de la société et de ses distributeurs en vertu de tout vice qui concerne l'équipement ou qui en découle.

LIMITATION DE RESPONSABILITÉ

LES RECOURS DE L'ACHETEUR EN VERTU DE LA PRÉSENTE SONT EXCLUSIFS ET LA RESPONSABILITÉ TOTALE DE LA SOCIÉTÉ, DE SES DISTRIBUTEURS ET DE SES FOURNISSEURS EN CE QUI CONCERNE L'EXÉCUTION OU LA VIOLATION DU CONTRAT OU DE L'ÉQUIPEMENT ET DES SERVICES FOURNIS, OU EN CE QUI CONCERNE LA FABRICATION, LA VENTE, LA LIVRAISON, L'INSTALLATION, LA RÉPARATION OU LA DIRECTION TECHNIQUE PRÉVUE AU CONTRAT OU FOURNIE EN VERTU DE CE DERNIER, QUE CE SOIT EN VERTU D'UN CONTRAT, D'UNE GARANTIE, DE LA NÉGLIGENCE, D'UNE INDEMNISATION, DE LA RESPONSABILITÉ STRICTE OU AUTREMENT, NE POURRA PAS DÉPASSER LE PRIX D'ACHAT DE L'UNITÉ D'ÉQUIPEMENT SUR LAQUELLE LA RESPONSABILITÉ EST FONDÉE.

LA SOCIÉTÉ, SES DISTRIBUTEURS ET SES FOURNISSEURS NE SERONT DANS AUCUNE ÉVENTUALITÉ TENUS RESPONSABLES ENVERS L'ACHETEUR, SES AYANTS DROIT, SES BÉNÉFICIAIRES OU SES CESSIONNAIRES EN VERTU D'UN CONTRAT DES DOMMAGES-INTÉRÊTS INDIRECTS, ACCESSOIRES, FORTUITS, PARTICULIERS OU EXEMPLAIRES SURVENANT EN VERTU DU PRÉSENT CONTRAT OU DE SA VIOLATION OU D'UN DÉFAUT, D'UNE DÉFECTUOSITÉ OU D'UNE ANOMALIE DE L'ÉQUIPEMENT, QU'ILS SOIENT FONDÉS SUR LA PERTE DE JOUISSANCE, LA PERTE DE PROFITS OU DE REVENUS, L'INTÉRÊT, LA PERTE D'ACHALANDAGE, L'ARRÊT DU TRAVAIL, LES DOMMAGES À D'AUTRES BIENS, LES PERTES EN RAISON D'UN ARRÊT DE FONCTIONNEMENT, L'ACCROISSEMENT DES DÉPENSES D'EXPLOITATION, LE COÛT D'ACHAT D'UNE ALIMENTATION DE RECHANGE OU LES RÉCLAMATIONS DE CLIENTS OU D'ACHETEURS DE CLIENTS EN RAISON D'UNE INTERRUPTION DE SERVICE, PEU IMPORTE QUE TELLE PERTE OU QUE DE TELS DOMMAGES SOIENT FONDÉS SUR UN CONTRAT, UNE GARANTIE, UNE NÉGLIGENCE, UNE INDEMNITÉ, UNE RESPONSABILITÉ STRICTE OU AUTREMENT





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A series of horizontal lines for writing, starting from the top line and extending down to the bottom of the page.



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Ingersoll-Rand®

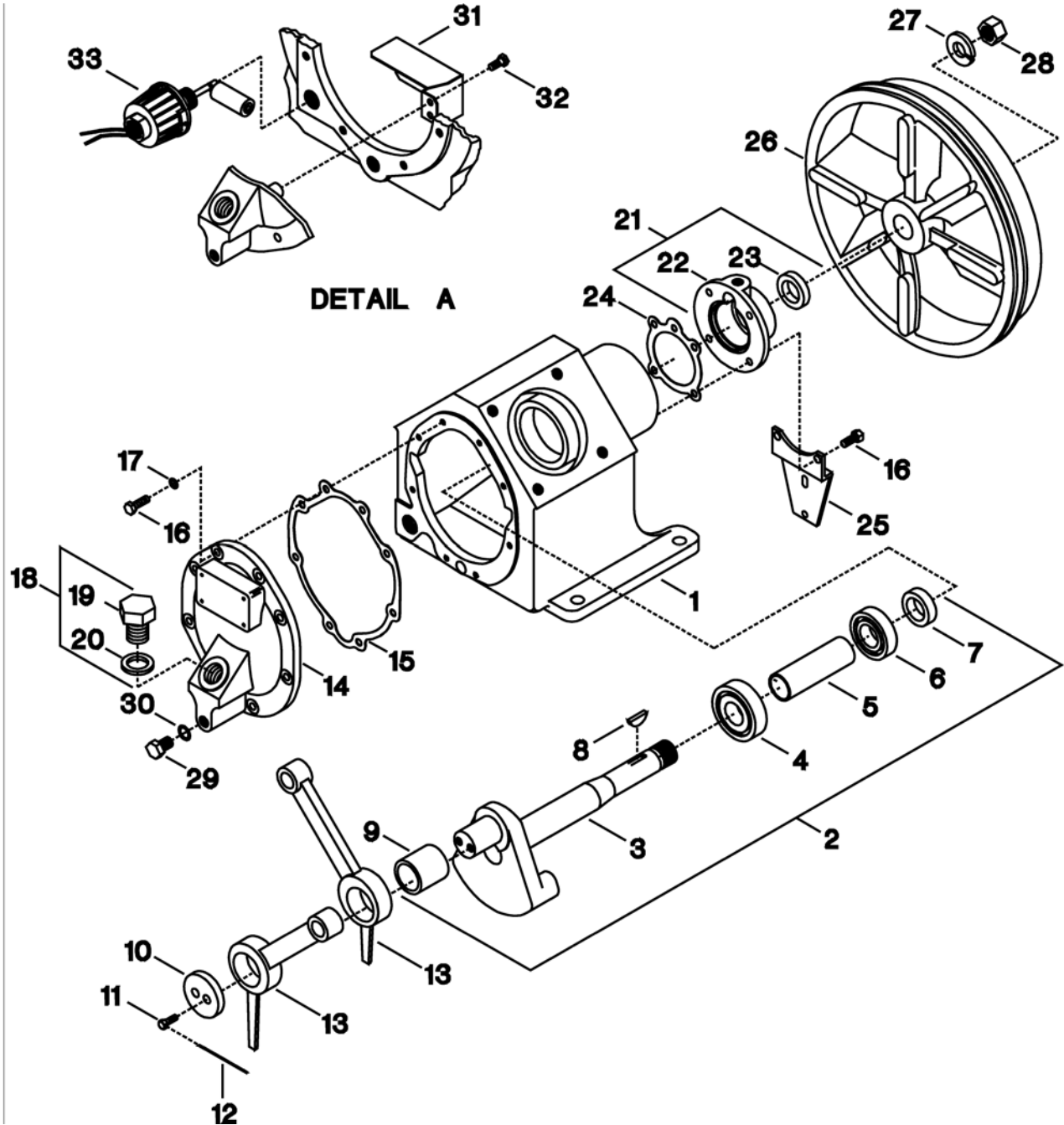
2475
Air Compressor
Parts List

C.C.N : 22400394
REV. : A
DATE : JANUARY 2004



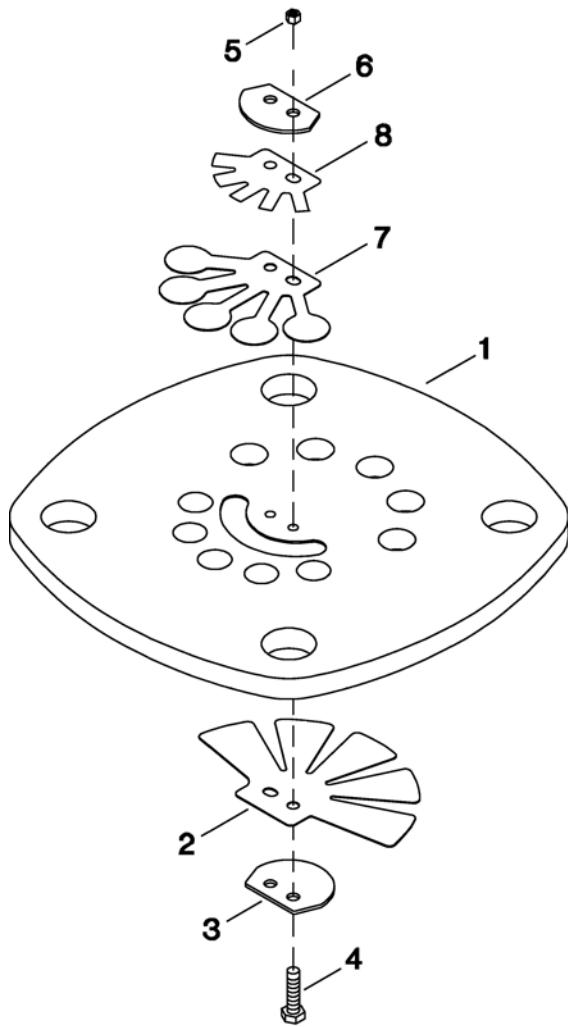
A series of horizontal lines for writing, starting from the top right of the pen icon and extending across the width of the page. The lines are evenly spaced and cover most of the page's vertical space.

FIGURE 1. COMPRESSOR FRAME ASSEMBLY.



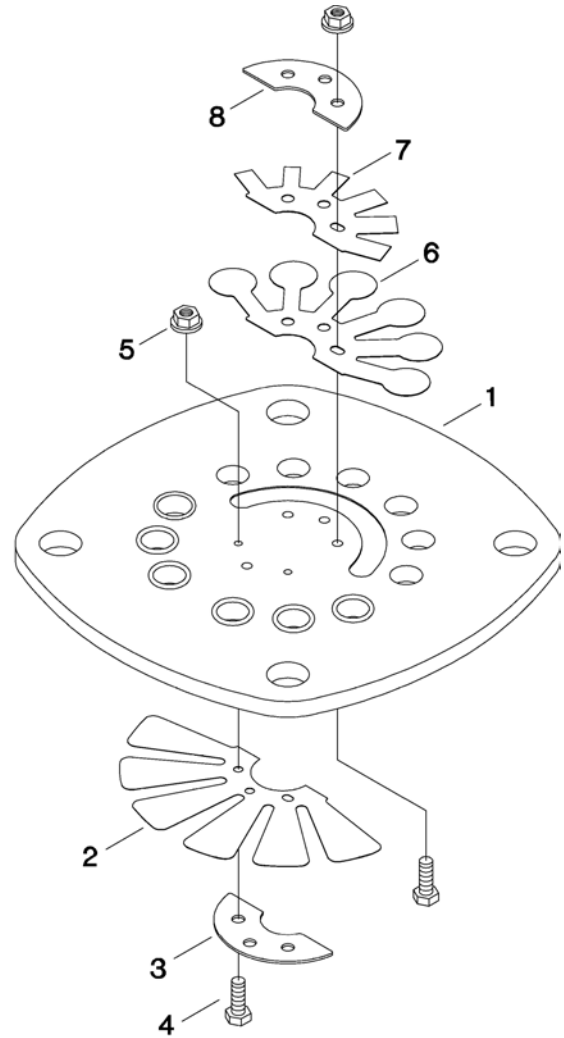
ITEM	CCN	DESCRIPTION	QTY	ITEM	CCN	DESCRIPTION	QTY
1-1	32247728	FRAME, COMPRESSOR	1	1-16	95105250	CAPSCREW, HEX - 5/16-18 X 1"	12
1-2	32496507	ASSEMBLY, CRANKSHAFT COMPLETE	1	1-17	95674651	GASKET, COPPER WASHER - 5/16"	8
1-3	NSS	• CRANKSHAFT	1	1-18	32279549	PLUG, OIL FILLER - COMPLETE	1
1-4	32248122	• BEARING, BALL	1	1-19	NSS	PLUG, OIL FILLER	1
1-5	32006496	• SPACER, CRANKSHAFT BEARING	1	1-20	32247850	O-RING, OIL FILLER PLUG	1
1-6	95134185	• BEARING, BALL WITH SNAP RING	1	1-21	97331060	ASSEMBLY, SHAFT END COVER	1
1-7	37127669	• RING, BEARING RETAINER	1	1-22	NSS	L COVER, SHAFT END	1
1-8	95433173	• KEY, WOODRUFF	1	1-23	32499923	L SEAL	1
1-9	30210199	• BUSHING, CRANKPIN	1	1-24	32247876	GASKET, SHAFT END COVER	1
1-27	95081808	• LOCKWASHER, SPRING - 3/4"	1	1-25	32157349	BRACKET, INTERCOOLER CLAMP	1
1-28	95076816	• NUT, HEX	1	1-26	32496432	BELT WHEEL ELECTRIC MOTOR DRIVE	1
1-10	30210298	CAP, CRANKPIN	1	1-26	32496424	BELT WHEEL GASOLINE ENGINE DRIVE	1
1-11	95101911	CAPSCREW	2	1-29	95053526	CAPSCREW, HEX - 1/2-13 X 3/4"	1
1-12	37605193	LOCKWIRE	1	1-30	95674701	GASKET, COPPER	1
1-13	32004152	ROD, CONNECTING	2	1-31	32295222	BAFFLE, OIL LEVEL SWITCH	1
1-14	32496663	COVER, FRAME END	1	1-32	95053070	CAPSCREW	2
1-15	32247884	GASKET, FRAME END COVER	1	1-33	22102388	KIT, LOW OIL LEVEL SWITCH	1

FIGURE 2. HIGH PRESSURE VALVE PLATE ASSEMBLY.



ITEM	CCN	DESCRIPTION	QTY
REF.	32310799	ASSEMBLY, VALVE PLATE - HIGH PRESSURE	1
2-1	NSS	PLATE, VALVE - HIGH PRESSURE	1
2-2	32236671	VALVE, FINGER - INLET	1
2-3	32297343	RETAINER, VALVE HP	1
2-4	97511042	SCREW, HEX HEAD - M3 X 16	2
2-5	97511059	NUT, HEX - M3 WITH LOCKWASHER	2
2-6	32295461	RETAINER, FINGER VALVE - DISCHARGE	1
2-7	32241010	VALVE, FINGER - DISCHARGE	1
2-8	32295479	VALVE, DAMPER - DISCHARGE	1

FIGURE 3. LOW PRESSURE VALVE PLATE ASSEMBLY.



ITEM	CCN	DESCRIPTION	QTY
REF.	32248205	ASSEMBLY, VALVE PLATE	1
3-1	NSS	PLATE, VALVE - LOW PRESSURE	1
3-2	32248130	VALVE, FINGER - INLET	1
3-3	32248148	RETAINER, FINGER VALVE - INLET	1
3-4	32247512	SCREW, HEX HEAD - M4 X 12	6
3-5	32248171	NUT, HEX - M4 WITH LOCKWASHER	6
3-6	32248155	VALVE, FINGER - DISCHARGE	1
3-7	32294464	VALVE, DAMPER - DISCHARGE	1
3-8	32248163	VALVE, RETAINER - DISCHARGE	1

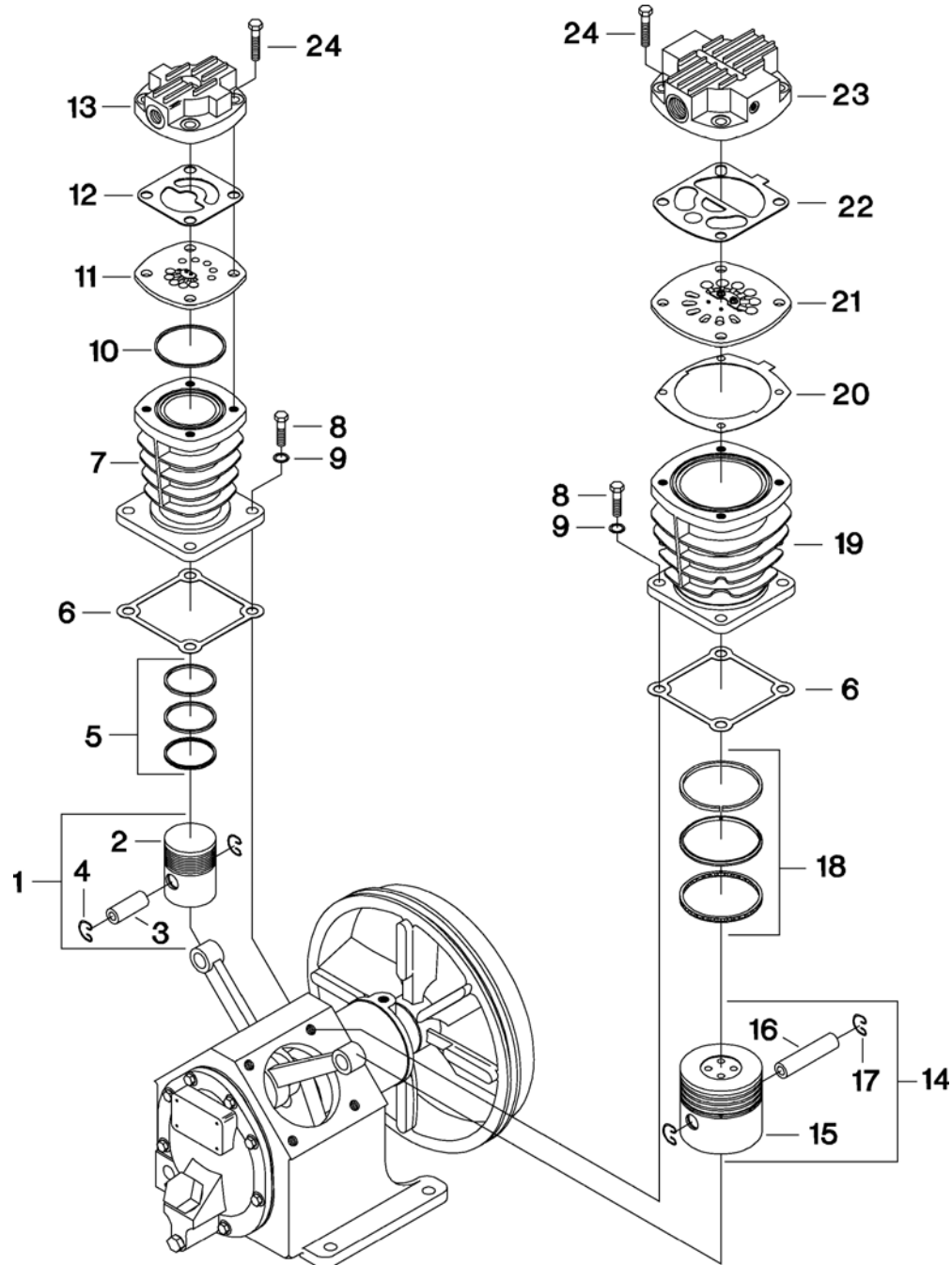
FASTENER TORQUE REQUIREMENTS FOR BARE COMPRESSOR PUMP

Torque values for critical nut, bolt, and capscrew fasteners are listed below.

Gradually and evenly in two stages, tighten each fastener to the final torque using a criss-cross tightening sequence. Use only calibrated torque wrenches.

THREADED FASTENER LOCATION	TORQUE
HIGH PRESSURE HEAD BOLT	75
LOW PRESSURE HEAD BOLT	75
CYLINDER FLANGE	50
FRAME END COVER	17
SHAFT END COVER	17
CRANKPIN CAP	11
HIGH PRESSURE VALVE - IN	11-15 IN LB
LOW PRESSURE VALVE - IN	25-30 IN LB
HIGH PRESSURE VALVE - OUT	11-15 IN LB
LOW PRESSURE VALVE - OUT	25-30 IN LB
BELT WHEEL	60

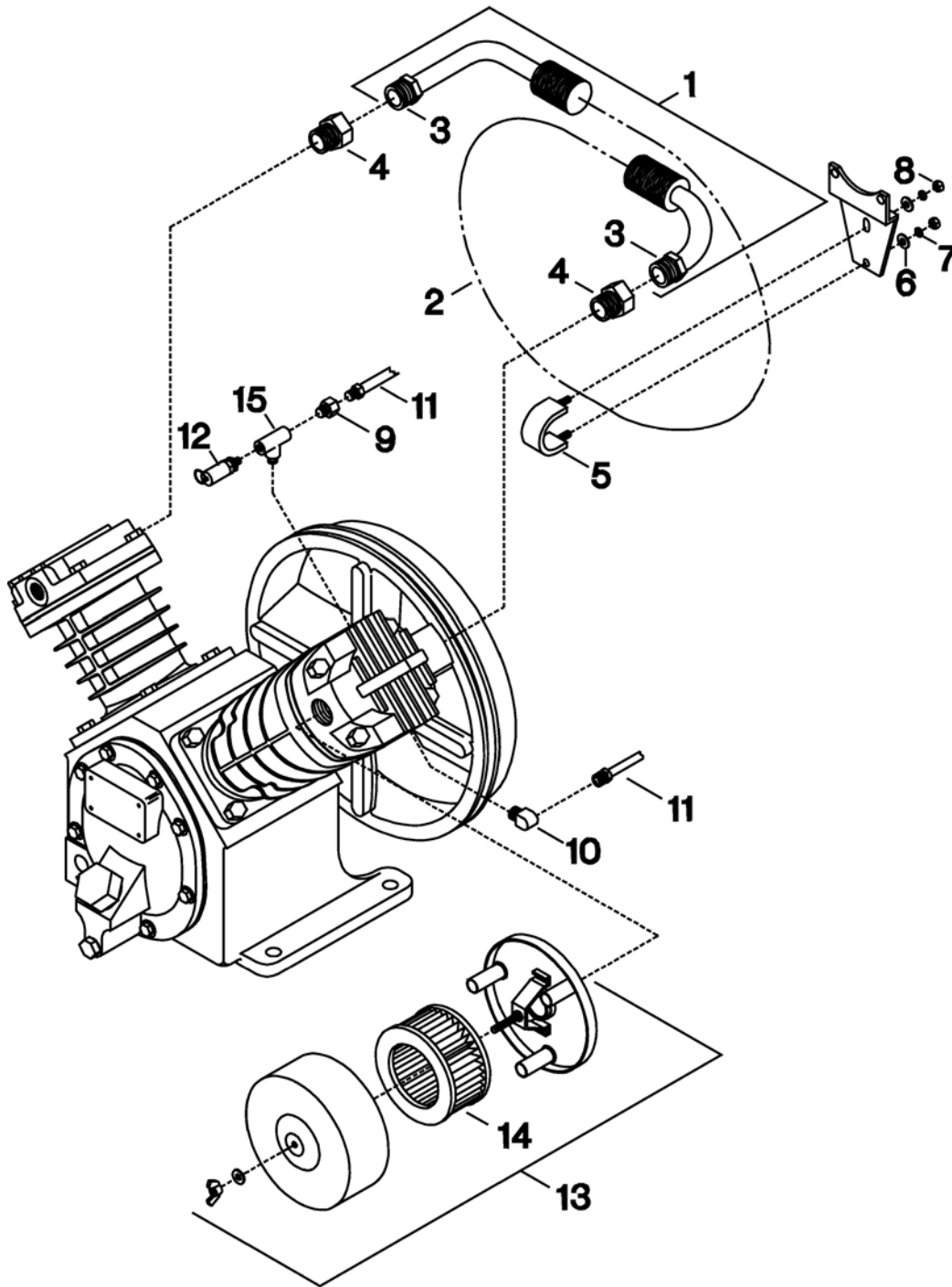
FIGURE 4. MODEL 2475 BARE COMPRESSOR PUMP.



ITEM	CCN	DESCRIPTION	QTY
4-1	32496598	PISTON, AIR - COMPLETE - 2.5" HIGH PRESSURE	1
4-2	NSS	PISTON - AIR - 2.5"	1
4-3	30287783	PIN, PISTON	1
4-4	30298020	RING, LOCK	2
4-5	32307910	SET, PISTON RING - 2.5"	1
4-6	32247868	GASKET, CYLINDER/FLANGE	2
4-7	32247652	CYLINDER - 2.5" - HIGH PRESSURE	1
4-8	95053567	CAPSCREW, HEX - 1/2-13 X 1-1/4"	8
4-9	95674701	GASKET, COPPER - 1/2"	8
4-10	32246878	O-RING, VALVE PLATE - HIGH PRESSURE	1
4-11	32310799	ASSEMBLY, VALVE PLATE - HIGH PRESSURE (SEE FIGURE 2)	1
4-12	32247926	GASKET, AIRHEAD - HIGH PRESSURE	1

ITEM	CCN	DESCRIPTION	QTY
4-13	32247827	AIRHEAD - HIGH PRESSURE	1
4-14	32496564	PISTON, AIR - COMPLETE - 4" - LOW PRESSURE	1
4-15	NSS	PISTON, AIR - 4"	1
4-16	30288393	PIN, PISTON	1
4-17	30298020	RING, LOCK	2
4-18	32307928	SET, PISTON RING - 4"	1
4-19	32293540	CYLINDER, - 4" LOW PRESSURE	1
4-20	32248197	GASKET, VALVE PLATE - LOW PRESSURE	1
4-21	32248205	ASSEMBLY, VALVE PLATE - LOW PRESSURE (SEE FIGURE 3)	1
4-22	32248189	GASKET, AIRHEAD - LOW PRESSURE	1
4-23	32293557	AIRHEAD - LOW PRESSURE	1
4-24	95104188	CAPSCREW, HEX - 1/2-13 X 1-3/4"	8

FIGURE 5. TYPICAL MODEL 2475 INTERCOOLER ASSEMBLY.



ITEM	CCN	DESCRIPTION	QTY	ITEM	CCN	DESCRIPTION	QTY
5-1	32499196	ASSEMBLY, INTERCOOLER	1	5-11	32247892	ASSEMBLY, TUBE - BREATHER	1
5-2	NSS	• INTERCOOLER	1	5-12	72062185	VALVE, RELIEF - 80 PSIG	1
5-3	95108577	• NUT, TUBE - 3/4"	2	5-13	32170953	FILTER, INLET - COMPLETE - 10 MICRON	1
5-4	95083275	CONNECTOR, TUBE	2	5-14	32170979	ELEMENT, FILTER - 10 MICRON	1
5-5	32247942	CLAMP, INTERCOOLER	1	5-13	37170834	FILTER, INLET - COMPLETE - 4 MICRON	1
5-6	95094298	WASHER, FLAT - 1/4"	2	5-14	32165466	ELEMENT, FILTER - 4 MICRON	1
5-7	95648150	LOCKWASHER, SPRING - 1/4"	2	5-15	37143542	ELBOW, STREET	1
5-8	95416335	NUT, HEX - 1/4-20	2				
5-9	95082483	CONNECTOR, TUBE	1				
5-10	95031860	ELBOW, TUBE	1				

SIMPLEX ELECTRIC MOTOR MODELS

AIR COMPRESSOR PUMP

CCN	DESCRIPTION	QTY
32304370	AIR COMPRESSOR PUMP GROUP	1
95114476	PUMP, BARE COMPRESSOR CAPSCREW, HEX - 1/2-13 X 1-1/2 (TO MOUNT PUMP TO BASE)	4
95458808	NIPPLE, CLOSE 3/4 X 1-3/8	1
95716890	LOCKWASHER, SPRING - 1/2 (FOR PUMP MOUNTING CAPSCREWS)	4

CONTROLS

CCN	DESCRIPTION	QTY
	COMMON	
31385693	VALVE, SAFETY / RELIEF - 200 PSIG	1
32174286	VALVE, SAFETY / RELIEF (DISCHARGE) - 325 PSIG	1
32499816	GAUGE, AIR PRESSURE - 0-300 PSIG, 1/4 NPT, 9 O'CLOCK	1
32179038	PLUG, PIPE - 1/4	1
	CENTER DISCHARGE UNITS	
56288772	SWITCH, PRESSURE - SIEMENS W / UNLOADER VALVE & LEVER	1
32333072	ASSEMBLY, TUBE - PRESSURE SWITCH TO CHECK VALVE	1
32499626	ASSEMBLY, DISCHARGE TUBE	1
85582229	VALVE, CHECK - 5/8 T X 3/4 NPT	1
32145088	ELBOW, TUBE - 3/4 X 3/4 WITH PORT	1
95031795	TUBE ELBOW - 5/8 X 1/2	1
95426714	NIPPLE, CLOSE - 1/4 X 7/8	1
	FULLY PACKAGED UNITS	
56288764	SWITCH, PRESSURE - SIEMENS W / UNLOADER VALVE (FULLY PACKAGED UNITS)	1
32221228	TEE, MALE BRANCH -1/4	1
32322281	ASSEMBLY, TUBE - PRESSURE SWITCH TO CHECK VALVE 2475N NEMA 1 IFCV	1
32322299	ASSEMBLY, TUBE - PRESSURE SWITCH TO CHECK VALVE 2475D NEMA 1 IFCV	1
32323172	ASSEMBLY, TUBE - UNL 2475N7.5 PRESS SW TO CK VLV W/ROT SWITC	11
32323396	ASSEMBLY, TUBE - MM/CK VLV/ACA C 2475N (INV CK VLV)	1
32323404	ASSEMBLY, TUBE - N4 PS/CK VLV 2475D (INV CK VLV)	1
32323412	ASSEMBLY, TUBE - MM/CK VLV/TEB G 2475N	1
32333098	ASSEMBLY, TUBE - PRESSURE SWITCH TO CHECK VALVE 2475N (SIEMENS)	1
32333106	ASSEMBLY, TUBE - PRESSURE SWITCH TO CHECK VALVE 2475D (SIEMENS)	1
32333114	ASSEMBLY, TUBE - PRESSURE SWITCH TO CHECK VALVE 2475N7.5 (SIEMENS)	1
32334849	ASSEMBLY, TUBE - PRESSURE SWITCH TO CHECK VALVE 2475N5	1
32334872	ASSEMBLY, TUBE - PRESSURE SWITCH TO CHECK VALVE 2475N7.5	1
32334880	ASSEMBLY, TUBE - PRESSURE SWITCH TO CHECK VALVE 2475D5	1
32209157	NIPPLE, LONG - 1/4 X 5	1
95082467	CONNECTOR, MALE - 1/4 X 1/4	1

AIR RECEIVER TANK

CCN	DESCRIPTION	QTY
97336259	TANK, AIR RECEIVER - 80 GALLON VERTICAL (CENTER DISCHARGE UNITS)	1
32496499	TANK, AIR RECEIVER - 80 GALLON VERTICAL (FULLY PACKAGED UNITS)	1
32498768	TANK, AIR RECEIVER - 80 GALLON HORIZONTAL (175 PSIG UNITS)	1
32251837	TANK, AIR RECEIVER - 80 GALLON HORIZONTAL (250 PSIG UNITS)	1
32223596	VALVE, BALL - 3/4 (CENTER DISCHARGE UNITS)	1
32106569	VALVE, BALL - 3/4 (FULLY PACKAGED UNITS)	1
32027120	VALVE, MANUAL DRAIN (CENTER DISCHARGE UNITS)	1

BASEPLATE

CCN	DESCRIPTION	QTY
32195224	BASEPLATE PACKAGE GROUP	1
32333445	ASSEMBLY, SUBBASE	1
32048993	ASSEMBLY, PRESSURE SWITCH TUBE CLAMP	2

STARTERS

CCN	DESCRIPTION	QTY
	CENTER DISCHARGE UNITS	
56272305	STARTER, 5HP - 200-1-60	1
56272040	STARTER, 5HP - 230-1-60	1
56272057	STARTER, 5HP - 200-3-60	1
56272222	STARTER, 5HP - 230-3-60	1
56272230	STARTER, 5HP - 460-3-60	1
56272164	STARTER, 5HP - 575-3-60	1
56272297	STARTER, 7.5HP - 230-1-60	1
56272198	STARTER, 7.5HP - 200-3-60	1
56272131	STARTER, 7.5HP - 230-3-60	1
56272149	STARTER, 7.5HP - 460-3-60	1
56272214	STARTER, 7.5HP - 575-3-60	1
97330229	PLATE, STARTER MOUNT FULLY PACKAGED UNITS	1
56272305	STARTER, 5HP - 200-1-60	1
56272040	STARTER, 5HP - 230-1-60	1
56272057	STARTER, 5HP - 200-3-60	1
81292468	STARTER, 5HP - 230/460-3-60	1
56272222	STARTER, 5HP - 230-3-60	1
56272164	STARTER, 5HP - 575-3-60	1
81292450	STARTER, 7.5HP - 230/460-3-60	1
56272297	STARTER, 7.5HP - 230-1-60	1
56272198	STARTER, 7.5HP - 200-3-60	1
56277214	STARTER, 7.5HP - 575-3-60	1

ELECTRIC DRAIN

CCN	DESCRIPTION	QTY
	COMMON	
54393335	ELBOW, STREET - 1/2	1
54579248	DRAIN, EDV ELECTRIC	1
95989638	CONNECTOR, SWIVEL - FEMALE VERTICAL TANK UNITS	1
32237851	NIPPLE, LONG - 1/2 X 4-1/2	1
54386974	COUPLING, BRASS - 1/2	1
95242517	NIPPLE, LONG - 1/2 X 6	1

DRIVE

CCN	DESCRIPTION	QTY
	MOTORS - CENTER DISCHARGE UNITS	
32288631	MOTOR, 5HP - 230-1-60	1
97331656	MOTOR, 5HP - 230/460-3-60	1
97331649	MOTOR, 5HP - 200-3-60	1
97331664	MOTOR, 5HP - 575-3-60	1
32065526	MOTOR, 5HP - 200-1-60	1
97331656	MOTOR, 5HP - 230-3-60	1
32309437	MOTOR, 7.5HP - 230-1-60	1
97331680	MOTOR, 7.5HP - 230/460-3-60	1
97331672	MOTOR, 7.5HP - 200-3-60	1
	BELTS	
95099479	BELT, V - A62 (5HP CENTER DISCHARGE UNITS)	1
95099511	BELT, V - A70 (5HP FULLY PACKAGED UNITS)	1
95099461	BELT, V - A60 (7.5HP CENTER DISCHARGE UNITS)	1
	MOTORS - FULLY PACKAGED UNITS	
32065526	MOTOR, 5HP - 200-1-60	1
32288631	MOTOR, 5HP - 230-1-60	1
32036790	MOTOR, 5HP - 200-3-60	1
32036857	MOTOR, 5HP - 230/460-3-60	1
32036865	MOTOR, 5HP - 575-3-60	1
	SHEAVE SETS	
32281768	SET, SHEAVE (5HP)	1
54507975	SET, SHEAVE (7.5HP, 230-1-60)	1
54507967	SET, SHEAVE (7.5HP, ALL EXCEPT 230-1-60)	1
	COMMON	
32175556	CAPSCREW, SERRATED WASHER HEAD - 3/8-16 X 1 (MOTOR MOUNTING)	4
54370523	NUT, CONICAL KEPS - 3/8 (MOTOR MOUNTING)	VAR

AIR COOLED AFTERCOOLER (ACAC)

CCN	DESCRIPTION	QTY
32174286	VALVE,SAFETY(DISCH)325PS SA25-0A325	1
32188450	TUBE ASSY,COMPR/ACAC 242 2420/2475	1
32322265	TUBE ASSY, ACAC/RECVR 2475N IFCV	1
32322273	TUBE ASSY, ACAC/RECVR 2475D IFCV	1
95031795	TUBE ELBOW 5/8X1/2 75A10B20	1
32498149	249IFHD10-8	1
85582229	COIL, AFTERCOOLER MODINE 2475 5HP	1
	VALVE, CHECK 3/4" X 5/8T W/ 1/4" & 1/4T PORTS	1

BELTGUARD

CCN	DESCRIPTION	QTY
	WIRE STYLE (CENTER DISCHARGE UNITS)	
32499162	BACK, BELTGUARD - WIRE	1
32499170	FRONT, BELTGUARD - WIRE	1
32496093	CLIP, PVC COATED	4
95916078	WASHER, FLAT - 1/4 ZINC	3
97173595	CAPSCREW, SELF-TAP - 1/4-20 X 1/2	3
97330013	BRACE, WIRE BELTGUARD	1
	SHEET METAL STYLE (FULLY PACKAGED UNITS)	
32281040	BACK, BELTGUARD - SHEET METAL	1
32281057	BRACE, SHEET METAL BELTGUARD (ATTACH TO LOW PRESSURE HEAD)	1
32281065	BRACE, SHEET METAL BELTGUARD (ATTACH TO HIGH PRESSURE HEAD)	1
32281073	COVER, AIR COOLED AFTERCOOLER	1
32000705	SCREW, SELF-TAPPING - 3/8-16 X 3/4	4
32187056	SCREW, SELF-DRILL - 1/4-14	14

DUPLEX ELECTRIC MOTOR MODELS

AIR COMPRESSOR PUMP

CCN	DESCRIPTION	QTY
32304370	PUMP, BARE COMPRESSOR	2
95114476	CAPSCREW, HEX - 1/2-13 X 1-1/2 (TO MOUNT PUMP TO BASE)	8
95716890	LOCKWASHER, SPRING - 1/2 (FOR PUMP MOUNTING CAPSCREWS)	8

CONTROLS

CCN	DESCRIPTION	QTY
56288764	SWITCH, PRESSURE - WITH UNLOADER VALVE	1
56288798	SWITCH, PRESSURE	1
95426714	NIPPLE, CLOSE	1
32013872	GAUGE, PRESSURE	1
32179038	PLUG, PIPE	4
32301483	ASSEMBLY, SHUTTLE VALVE	1
32333528	ASSEMBLY, TUBE - IC/IC 2-2475D TANK (LEAD/LAG)	1
32333015	ASSEMBLY, TUBE - PL.UNL SH VLV/DUP SIEMENS 2-2475D	1

BASE PACKAGE

CCN	DESCRIPTION	QTY
32251894	TANK, AIR RECEIVER - 2-2475D	1
32251902	TANK, AIR RECEIVER - 2-2475E	1
32223596	ASSEMBLY, BALL VALVE - 3/4" (2-2475D)	1
32223604	ASSEMBLY, BALL VALVE - 1" (2-2475E)	1
32116295	ASSEMBLY, TUBE - REC / MTD BLOCK RIGHT HAND (2-2475E7.5)	1
32116303	ASSEMBLY, TUBE - REC / MTD BLOCK LEFT HAND (2-2475E7.5)	1
32118382	ASSEMBLY, TUBE - REC / MTD BLOCK RIGHT HAND (2-2475D5)	1
32118390	ASSEMBLY, TUBE - REC / MTD BLOCK LEFT HAND (2-2475D5)	1
32333551	ASSEMBLY, TUBE - REC / MTD BLOCK RIGHT HAND (2-2475E5)	1
32333544	ASSEMBLY, TUBE - REC / MTD BLOCK LEFT HAND (2-2475E5)	1
31385693	VALVE, SAFETY/ RELIEF - 200 PSIG	1
32157554	CONNECTOR, MALE - 5/16 X 1/4	2
32179038	PLUG, PIPE - 1/4 (2-2475E)	1
32236333	ASSEMBLY, TUBE - SHUTTLE VALVE / I/C TEE (2-2475E)	1
95007522	TEE, MALE TUBE - 5/16 X 1/8	1
95037453	BUSHING, REDUCER - 3/4 X 1/4	1
95037826	BUSHING, REDUCING - 1-1/2 X 1	1

MOTORS

CCN	DESCRIPTION	QTY
32036931	MOTOR, 7.5 HP - 200-3-60	2
32036972	MOTOR, 7.5 HP - 230/460-3-60	2
32036980	MOTOR, 7.5 HP - 575-3-60	2
32175556	CAPSCREW, 3/8-16 X 1	8
37177052	CLAMP, MOTOR	2
37177656	BOLT, BELT TIGHTENER	2
37179207	CLIP, BELT TIGHTENER	2
54370523	NUT, CONICAL KEPS - 3/8	4
56271406	SET, SHEAVE	2
95677324	BELT, V - A74	2

ALTERNATORS

CCN	DESCRIPTION	QTY
56272917	ALTERNATOR, 7.5 HP - 200-3-60	1
56272966	ALTERNATOR, 7.5 HP - 230-3-60	1
56273030	ALTERNATOR, 7.5 HP - 460-3-60	1
56273063	ALTERNATOR, 7.5 HP - 575-3-60	1
95074266	SCREW, TAPPING - 1/4-20 X 1/2	3
32298705	BRACKET, ALTERNATOR	1
32000705	SCREW, SELF-TAPPING - 3/8-16 X 3/4	4
VAR.	HEATER	6

AIR COOLED AFTERCOOLER

CCN	DESCRIPTION	QTY
95037826	BUSHING, REDUCING - 1-1/2 X 1	1

CCN	DESCRIPTION	QTY
95006565	TEE, PIPE - 1"	1
95640074	NIPPLE, CLOSE 1 X 1-1/2	1
32186421	BUSHING, REDUCING - 1 X 3/4	2
85582112	VALVE, CHECK - 3/4 X 3/4	2
32174286	VALVE, SAFETY / RELIEF - DISCHARGE (325 PSIG)	2
32324295	ASSEMBLY, TUBE - ACAC / TANK	2
32324287	ASSEMBLY, TUBE - PUMP / ACAC	2
32498065	COIL, AFTERCOOLER - 7.5HP	2

BELTGUARD

CCN	DESCRIPTION	QTY
32281040	BACK, BELTGUARD - SHEET METAL	2
32281057	BRACE, SHEET METAL BELTGUARD (ATTACH TO LOW PRESSURE HEAD)	2
32281065	BRACE, SHEET METAL BELTGUARD (ATTACH TO HIGH PRESSURE HEAD)	2
32281073	COVER, AIR COOLED AFTERCOOLER	2
32000705	SCREW, SELF-TAPPING - 3/8-16 X 3/4	8
32187056	SCREW, SELF-DRILL - 1/4-14	28

PNEUMATIC DRAIN VALVE

CCN	DESCRIPTION	QTY
32311102	ASSEMBLY, PNEUMATIC DRAIN VALVE	1
32496325	TEE, MALE RUN	1
32335457	ASSEMBLY, TUBE - DRAIN VALVE TO COMPRESSOR	1
32311128	ASSEMBLY, TUBE - CONDENSATE	1
95110441	ELBOW, TUBE - 5/16 X 1/4	1

GASOLINE ENGINE MODELS

CCN	DESCRIPTION	QTY	CCN	DESCRIPTION	QTY
32343733	TUBING GROUP ASSEMBLY, DISCHARGE TUBE - KOHLER BASEPLATE MOUNTED UNITS	1	32497919	BRACE, BELTGUARD - LP- KAWASAKI UNITS	1
32343709	ASSEMBLY, DISCHARGE TUBE - KOHLER TANK MOUNTED UNITS	1	32308686	BRACE, BELTGUARD - HONDA UNITS	1
32343741	ASSEMBLY, DISCHARGE TUBE - KAWASAKI BASEPLATE MOUNTED UNITS	1	32281065	BRACE, BELTGUARD - HP - KOHLER UNITS	1
32343717	ASSEMBLY, DISCHARGE TUBE - KAWASAKI TANK MOUNTED UNITS	1	32497414	BRACE, BELTGUARD - HP - KAWASAKI UNITS	1
32343758	ASSEMBLY, DISCHARGE TUBE - HONDA BASEPLATE MOUNTED UNITS	1	32000705	SCREW, SELF-TAPPING - 3/8-16 X 3/4	VAR
32343725	ASSEMBLY, DISCHARGE TUBE - HONDA TANK MOUNTED UNITS	1	32187056	SCREW, SELF-DRILLING - 1/4-14	VAR
54398508	CONTROLS GROUP CONTROL, THROTTLE SLOWDOWN - KOHLER BASEPLATE MOUNTED UNITS	1	95916094	WASHER, FLAT - 3/8 - KAWASAKI UNITS	2
54398144	CONTROL, THROTTLE SLOWDOWN - KOHLER TANK MOUNTED UNITS	1		ENGINE & DRIVE GROUP	
54398169	CONTROL, THROTTLE SLOWDOWN - KAWASAKI UNITS	1	97337901	ENGINE, KOHLER - NO ALTERNATOR	1
54398151	CONTROL, THROTTLE SLOWDOWN - HONDA UNITS	1	97337919	ENGINE, KOHLER - WITH ALTERNATOR	1
49816283	VALVE, AUXILIARY	1	32497331	ENGINE, KAWASAKI - NO ALTERNATOR	1
32174286	* VALVE, SAFETY / RELIEF - 325 PSIG DISCHARGE	1	32497349	ENGINE, KAWASAKI - WITH ALTERNATOR	1
31385693	* VALVE, SAFETY / RELIEF - 200 PSIG RECEIVER	1	81297467	ENGINE, HONDA	1
37155751	* MUFFLER, DISCHARGE UNLOADER	1	32295891	BELT, DRIVE - KOHLER UNITS	1
32013898	GAUGE, PRESSURE - BASEPLATE MOUNTED UNITS	1	32497869	BELT, DRIVE - KAWASAKI UNITS	1
81296253	GAUGE, PRESSURE - TANK MOUNTED UNITS	1	32310153	BELT, DRIVE - HONDA UNITS	1
95031795	TUBE ELBOW 5/8X1/2 (ALL)	1	56276207	SHEAVE, KOHLER ENGINE	1
95481982	NIPPLE, PIPE - 1/2" X 3" (KAWASAKI TANK MOUNTED)	1	32497554	SHEAVE, KAWASAKI ENGINE	1
32262545	NIPPLE, PIPE - 1/2" X 4" (KOHLER / HONDA TANK MOUNTED)	1	81297475	SHEAVE, HONDA ENGINE	1
	AIR RECEIVER TANK GROUP		32497935	CLAMP, ENGINE - KAWASAKI UNITS	1
32175507	TANK, AIR RECEIVER - BASEPLATE MOUNTED UNITS	1	32497877	TENSIONER, BELT - KAWASAKI UNITS (INCL CLAMP, MOUNTING CAPSCREWS, TENSIONING BOLT & CLIP)	1
32496697	TANK, AIR RECEIVER - KOHLER / HONDA TANK MOUNTED UNITS	1	32145898	TENSIONER, BELT - KOHLER & HONDA UNITS	1
32497372	TANK, AIR RECEIVER - KAWASAKI TANK MOUNTED UNITS	1	30219802	CLIP, BELT TIGHTENER - KOHLER & HONDA UNITS	1
32223588	VALVE, SERVICE	1	32308140	BRACE, ENGINE / COMPRESSOR - HONDA UNITS	1
32027120	VALVE, MANUAL DRAIN	1	32246621	BRACE, ENGINE / COMPRESSOR - KOHLER UNITS	1
32309346	KIT, VIBRATION MOUNT - HONDA TANK MOUNTED UNITS	1	95203444	KEY, KOHLER & HONDA UNITS	1
32209165	BRACKET, TANK MOUNTING - BASEPLATE MOUNTED UNITS	2		MISCELLANEOUS HARDWARE & FITTINGS	
32034134	BOLT, U - BASEPLATE MOUNTED UNITS	2	95417507	NIPPLE, CLOSE - 1/2 X 1-1/8 - KAWASAKI BASEPLATE MOUNTED UNITS	1
32140576	BASEPLATE UNIT GROUP SUBBASE, KOHLER BASEPLATE MOUNTED UNITS	1	32224909	ELBOW, STREET - 1/8 X 1/8 - KAWASAKI BASEPLATE MOUNTED UNITS	1
32309221	SUBBASE, HONDA BASEPLATE MOUNTED UNITS	1	32499139	CAPSCREW, 5/16-18 X 1-3/4 - KAWASAKI UNITS	2
32497356	SUBBASE, KAWASAKI BASEPLATE MOUNTED UNITS	1	39128558	NUT, WHIZ-LOCK - 5/16-18 - KAWASAKI UNITS	4
95944633	BUSHING, 3/4 X 1/4 (BASEPLATE MOUNTED UNITS)	2	32175556	CAPSCREW, 3/8-16 X 1 - HONDA UNITS	1
32178998	BUSHING, REDUCING - 3/4 X 1/2 (BASEPLATE MOUNTED UNITS)	1	95077053	CAPSCREW, 3/8-16 X 1-1/2 - KOHLER & HONDA UNITS	3
95043766	CAPSCREW, HEX - 3/8-16 X 1-1/2 (BASEPLATE MOUNTED UNITS)	4	95104014	CAPSCREW, 7/16-14X1-1/4 - KOHLER BASEPLATE MOUNTED UNITS	1
95675526	LOCKWASHER, 5/16 (BASEPLATE MOUNTED UNITS)	4	95916854	CAPSCREW, HEX - 7/16 X 1-1/4 - KOHLER TANK MOUNTED UNITS	1
39128558	NUT, WHIZ-LOCK - 5/16-18 (BASEPLATE MOUNTED UNITS)	4	39128566	NUT, WHIZ-LOCK - 3/8-16 (KOHLER / HONDA)	4
	BELTGUARD GROUP		95423695	NUT, HEX - 1/2 - KOHLER & HONDA UNITS	1
56278906	BACK, BELTGUARD - KOHLER UNITS	1	95916094	WASHER, FLAT - 3/8 - KAWASAKI UNITS	VAR
32497398	BACK, BELTGUARD - KAWASAKI UNITS	1	32130387	WASHER, FLAT - 7/16 (2475X12.5G)	1
32308124	BACK, BELTGUARD - HONDA UNITS	1	95751582	LOCKWASHER, 7/16 - KOHLER UNITS	1
56278922	FRONT, BELTGUARD - KOHLER UNITS	1		COMPRESSOR PUMP GROUP	
32497406	FRONT, BELTGUARD - KAWASAKI UNITS	1	32313322	PUMP, BARE COMPRESSOR (INCL STD FILTER & INTERCOOLER SAFETY / RELIEF VALVE)	1
32308116	FRONT, BELTGUARD - HONDA UNITS	1	95114476	CAPSCREW, HEX - 1/2-13 X 1-1/2	4
32281057	BRACE, BELTGUARD - LP - KOHLER UNITS	1	95716890	LOCKWASHER, SPRING - 1/2	4

SERVICE AND ACCESSORY PARTS AND KITS

SERVICE

START-UP KITS

Each Start-Up Kit contains the necessary quantities of All-Season Select Lubricant and standard air filter element(s) to start-up and maintain your compressor for the first year. Start-Up Kits for engine driven models include a replacement engine air filter, engine oil filter and engine oil. See the engine manufacturer's instructions for more detailed engine care information.

CCN	DESCRIPTION	MODELS
32305880	KIT, START-UP	ELECTRIC MOTOR MODELS
32312936	KIT, START-UP	HONDA ENGINE MODELS
32305872	KIT, START-UP	KOHLER ENGINE MODELS
32498511	KIT, START-UP	KAWASAKI ENGINE MODELS

MAINTENANCE PAKS

Maintenance paks contain all the parts necessary for one complete routine maintenance of your compressor. All-Season Select Lubricant, air filter elements and gaskets are included.

CCN	DESCRIPTION
38485330	PAK, MAINTENANCE

STEP SAVER KITS

Step Saver Kits provide all the parts required to perform common repair or scheduled maintenance tasks, such as piston ring replacement or valve replacement.

CCN	DESCRIPTION
32301426	KIT, VALVE
32301517	KIT, RING
32301509	KIT, BEARING & ROD*
32301434	KIT, GASKET

* To repair grooved crankshaft journals, order Shaft Repair Kit 32499949 along with the Bearing & Rod Kit.

OVERHAUL KITS

CCN	DESCRIPTION
32319469	KIT, OVERHAUL

RECOMMENDED SPARES

ITEM	CCN	DESCRIPTION	QTY
1-15	32247884	GASKET, FRAME END COVER	1
1-20	32247850	O-RING, OIL FILLER PLUG	1
1-23	32499923	L SEAL	1
1-24	32247876	GASKET, SHAFT END COVER	1
REF.	32310799	ASSEMBLY, VALVE PLATE - HIGH PRESSURE	1
REF.	32248205	ASSEMBLY, VALVE PLATE	1
4-1	32496598	PISTON, AIR - COMPLETE - 2.5" HIGH PRESSURE	1
4-5	32307910	SET, PISTON RING - 2.5"	1
4-6	32247868	GASKET, CYLINDER/FLANGE	2
4-10	32246878	O-RING, VALVE PLATE - HIGH PRESSURE	1
4-12	32247926	GASKET, AIRHEAD - HIGH PRESSURE	1
4-14	32496564	PISTON, AIR - COMPLETE - 4" - LOW PRESSURE	1
4-18	32307928	SET, PISTON RING - 4"	1
4-20	32248197	GASKET, VALVE PLATE - LOW PRESSURE	1
4-22	32248189	GASKET, AIRHEAD - LOW PRESSURE	1

GASOLINE ENGINE PARTS

CCN	DESCRIPTION	MODELS
32305674	FILTER, OIL	KOHLER ENGINE MODELS
32305682	FILTER, AIR	KOHLER ENGINE MODELS
32305690	PRE FILTER	KOHLER ENGINE MODELS
38487039	KIT, MUFFLER	KOHLER ENGINE MODELS
32498545	FILTER, OIL	KAWASAKI
32498537	FILTER, AIR	KAWASAKI
32498529	PRE FILTER	KAWASAKI

COMPRESSOR LUBRICANT

All Season T30 Select is a synthetic fluid specifically formulated to protect and preserve your Ingersoll-Rand small reciprocating air compressor through a broad range of temperature as well as better start-up in colder climate conditions. With its outstanding formulation, All Season T30 Select enables you to run 2000 hours of service between changeouts under normal operating conditions.

PART NO.	DESCRIPTION
32318875	LUBRICANT, ALL SEASON SELECT - QUART
32318883	LUBRICANT, ALL SEASON SELECT - CASE OF 12 QUARTS

ACCESSORIES

INSTALLATION KITS

Each Installation Kit combines vibration pads and flexible hose into one kit. The kit consists of (4) 5 X 5 vibration pads and (1) 3/4 X 13 flexible hose.

CCN	DESCRIPTION
38002242	KIT, INSTALLATION

SILENCERS

Silencers provide excellent noise reduction (2 DBA or 35% reduction in operating noise level) with no pressure drop.

CCN	DESCRIPTION
32323552	SILENCER

VIBRATION PADS

Vibration pads are designed to absorb 40-60% of the sound and vibration of your compressor.

CCN	DESCRIPTION
32320681	PAD, VIBRATION — 4 X 4 STEEL PLATE
32320699	PAD, VIBRATION — 5 X 5 STEEL PLATE
32321002	PAD, VIBRATION — 4 X 4 CORK
32321028	PAD, VIBRATION — 5 X 5 CORK
32321010	PAD, VIBRATION — 6 X 6 CORK

FLEX HOSES

Flex Hoses give flexibility to compressed air piping systems. They provide thermal growth absorption, misalignment compensation, vibration isolation, reduced stress forces on compressor housings and noise reduction.

CCN	DESCRIPTION
32323586	HOSE, FLEX — 1/2 X 11
38335295	HOSE, FLEX — 1/2 X 36
38338778	HOSE, FLEX — 1/2 X 72
32323594	HOSE, FLEX — 3/4 X 13
38323309	HOSE, FLEX — 3/4 X 24
38335303	HOSE, FLEX — 3/4 X 36
38338638	HOSE, FLEX — 3/4 X 72
32323602	HOSE, FLEX — 1 X 14
38334033	HOSE, FLEX — 1 X 24
38335311	HOSE, FLEX — 1 X 36
38338646	HOSE, FLEX — 1 X 72
32323610	HOSE, FLEX — 1-1/2 X 18
38323317	HOSE, FLEX — 1-1/2 X 20-1/2
38323325	HOSE, FLEX — 1-1/2 X 24

Y-STRAINERS

Y-Strainers are designed to prevent foreign particles and sludge from moving downstream.

CCN	DESCRIPTION
32323628	Y-STRAINER, 1/4
32323636	Y-STRAINER, 1/2

INTERCOOLER SEPARATOR KITS

Intercooler Separator Kits remove condensate between the first and second stages.

CCN	DESCRIPTION
32337826	KIT, INTERCOOLER SEPARATOR

EXTERNAL CRANKCASE HEATER KITS

External crankcase heaters are recommended when ambient temperatures are consistently below 32°F (0°C). An easy-to-install external crankcase heater kit is intended for aftermarket use. Two kits may be required for some applications.

CCN	DESCRIPTION
97330385	KIT, EXTERNAL CRANKCASE HEATER

CONSTANT SPEED CONVERSION KITS

Extend the life of your compressor in hot and humid operating conditions by installing Constant Speed Control.

CCN	DESCRIPTION	MODELS
81294621	KIT, CONSTANT SPEED CONVERSION	2475N5/7.5 W/4-FOOT RECEIVER
81294639	KIT, CONSTANT SPEED CONVERSION	2475N7.5 W/3-FOOT RECEIVER
81294688	KIT, CONSTANT SPEED CONVERSION	2475D5
81295867	KIT, CONSTANT SPEED CONVERSION	2475N5 W/3-FOOT RECEIVER

BATTERY SUPPORT KITS

The Battery Support Kit will allow a battery to be conveniently mounted on the Kohler, Honda and Kawasaki engine driven compressors. The kit contains the battery support, battery hold-down frame and attachment hardware.

CCN	DESCRIPTION	MODELS
32095663	KIT, BATTERY SUPPORT	KOHLER, HONDA, KAWASAKI ENGINE MODELS

VINYL COVERS

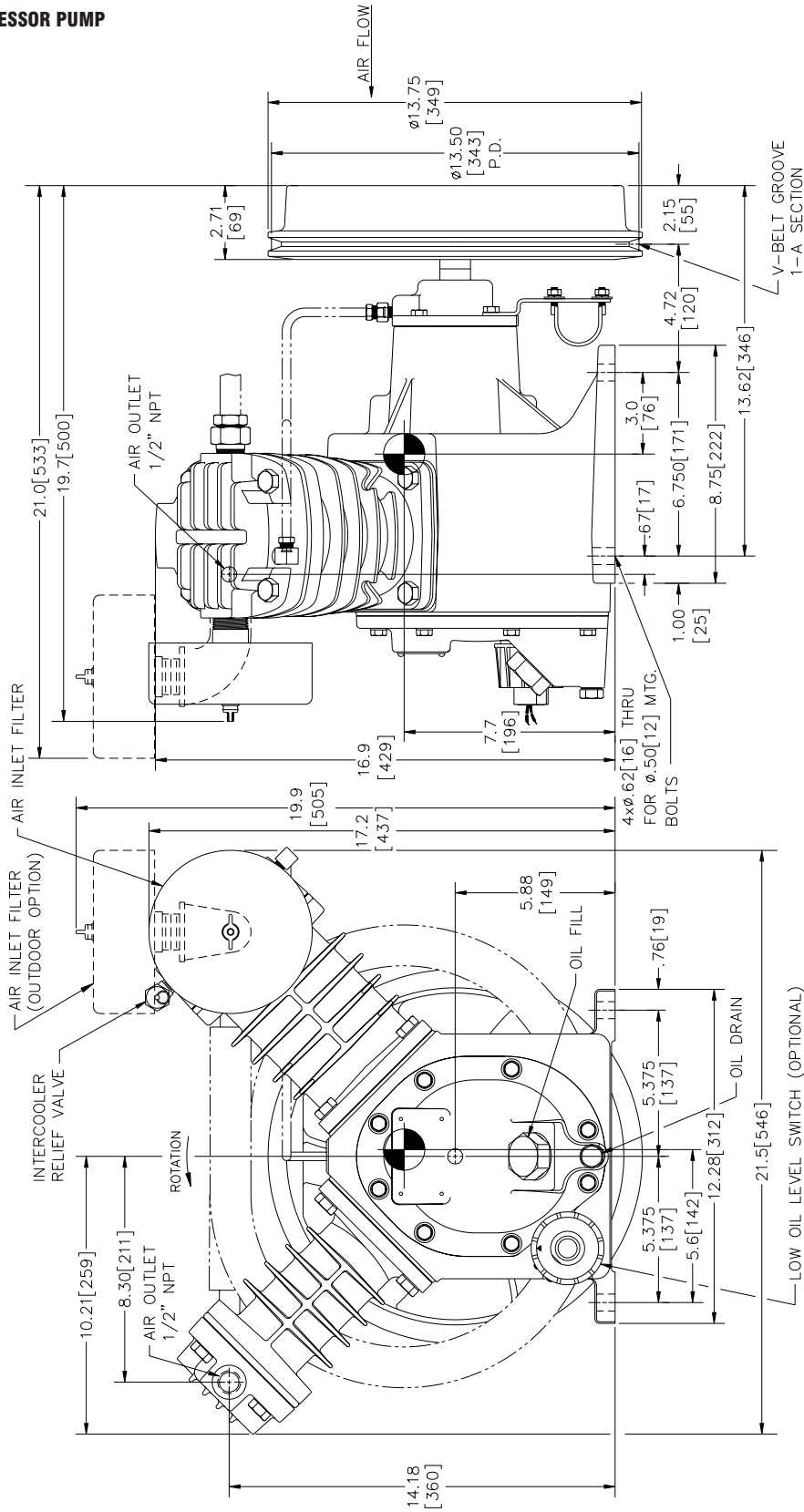
Flame retardant vinyl covers are designed to protect gasoline engine compressors from the elements.

CCN	DESCRIPTION	MODELS
97339337	COVER, VINYL	KOHLER, HONDA, KAWASAKI ENGINE MODELS

GENERAL ARRANGEMENT DRAWINGS

BARE COMPRESSOR PUMP

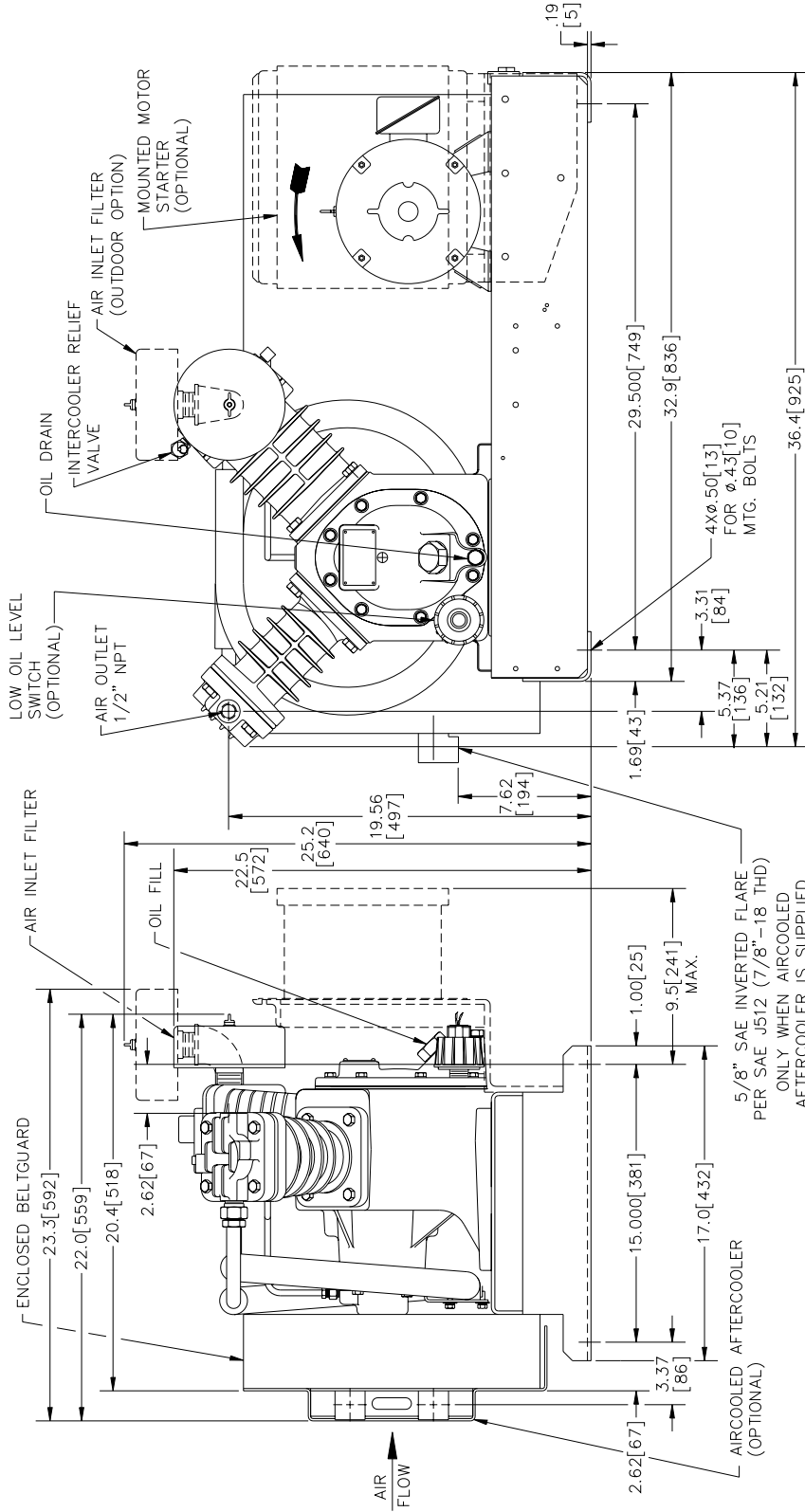
G2111000-04



- NOTES:
1. CUSTOMER MUST SUPPLY MTG. ARRANGEMENT WITH AT LEAST 2.00[51] MIN. BELT TAKE-UP.
 2. ALL DIMENSIONS GIVEN IN INCHES.
 3. LEAVE AT LEAST 12.00[305] MIN. CLEARANCE ON ALL SIDES FOR PROPER AIR CIRCULATION.
 4. WEIGHT: 147 LBS.[67kg] DRY (NO LUBRICATION)
 5. ALL UNSPECIFIED TOLERANCES:
 XXX = ±.03[1]
 XX = ±.12[3]
 X = ±.25[6]
 6. DIMENSIONS IN [] ARE MILLIMETER DIMENSIONS UNLESS OTHERWISE SPECIFIED.

BASEPLATE MOUNTED UNIT WITH ELECTRIC MOTOR

G2211000-05



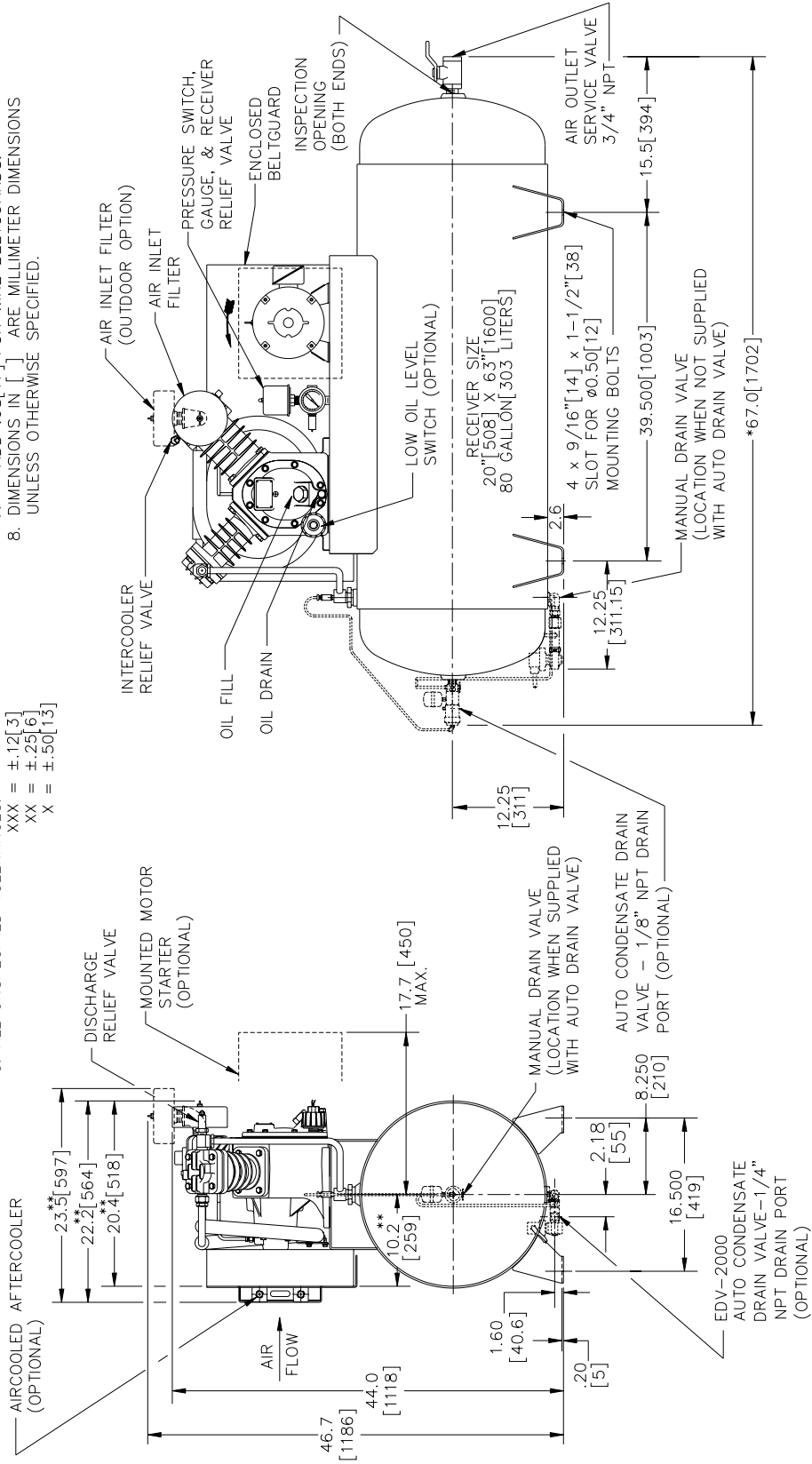
- NOTES:
1. FOUNDATION OR FLOOR MUST BE LEVEL AND SUPPORT ALL FEET EQUALLY; IF NECESSARY SHIM OR GROUT THE FOURTH FOOT.
 2. FOUNDATION BOLTS SHOULD PROJECT THRU NUTS AT LEAST 1/2" [13] TO ALLOW FOR LEVELING.
 3. ALLOW AT LEAST 12.00"[305] CLEARANCE MINIMUM ON ALL SIDES FOR PROPER AIR CIRCULATION.
 4. APPROXIMATE NET WEIGHT: 350 LBS.[159kg]
 5. ALL UNSPECIFIED DIMENSIONS: XXX = .125[3] XX = .25[6] X = .50[13]
 6. DIMENSIONS IN [] ARE MILLIMETER DIMENSIONS UNLESS OTHERWISE SPECIFIED.

80-GALLON HORIZONTAL TANK MOUNTED UNIT

G2311000-05

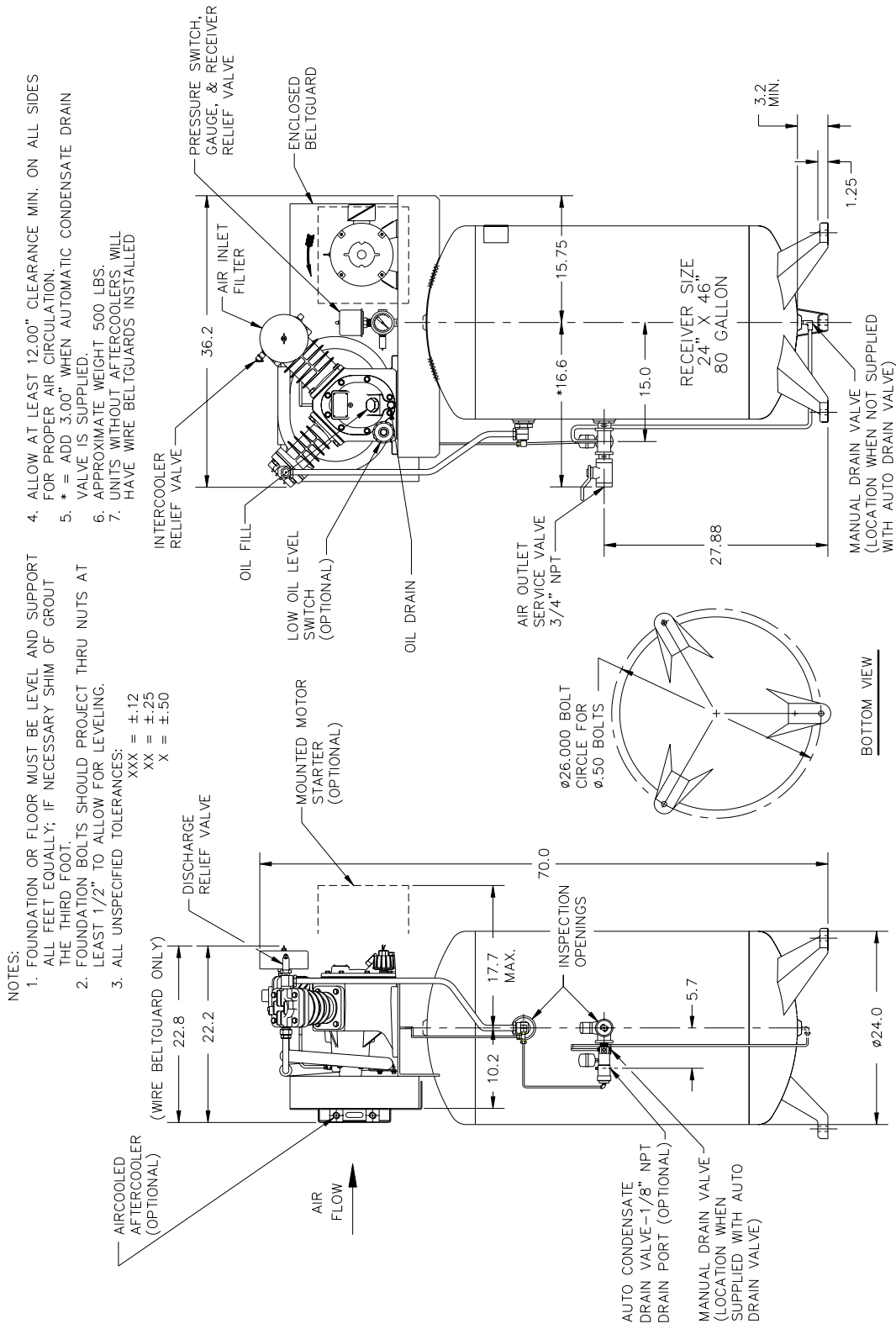
NOTES:

1. FOUNDATION OR FLOOR MUST BE LEVEL AND SUPPORT ALL FEET EQUALLY; IF NECESSARY SHIM OF GROUT THE FOURTH FOOT.
2. FOUNDATION BOLTS SHOULD PROJECT THRU NUTS AT LEAST 1/2"[13] TO ALLOW FOR LEVELING.
3. ALL UNSPECIFIED TOLERANCES:
 XXX = ±.12[3]
 XX = ±.25[6]
 X = ±.50[13]
4. ALLOW AT LEAST 12.00"[305] CLEARANCE MIN. ON ALL SIDES FOR PROPER AIR CIRCULATION.
5. * = ADD 6.00"[152] WHEN AUTOMATIC CONDENSATE DRAIN VALVE IS SUPPLIED.
6. APPROXIMATE WEIGHT 535 LBS.[243kg]
7. UNITS WITHOUT AFTERCOOLER WILL HAVE WIRE BELTGUARDS.
8. ** = ADD .68[17] FOR WIRE BELTGUARDS.
 *** = ADD .68[17] FOR WIRE BELTGUARDS.
 UNLESS OTHERWISE SPECIFIED.



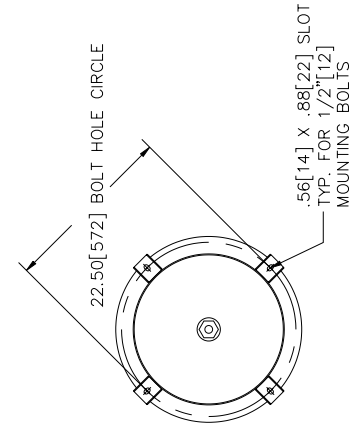
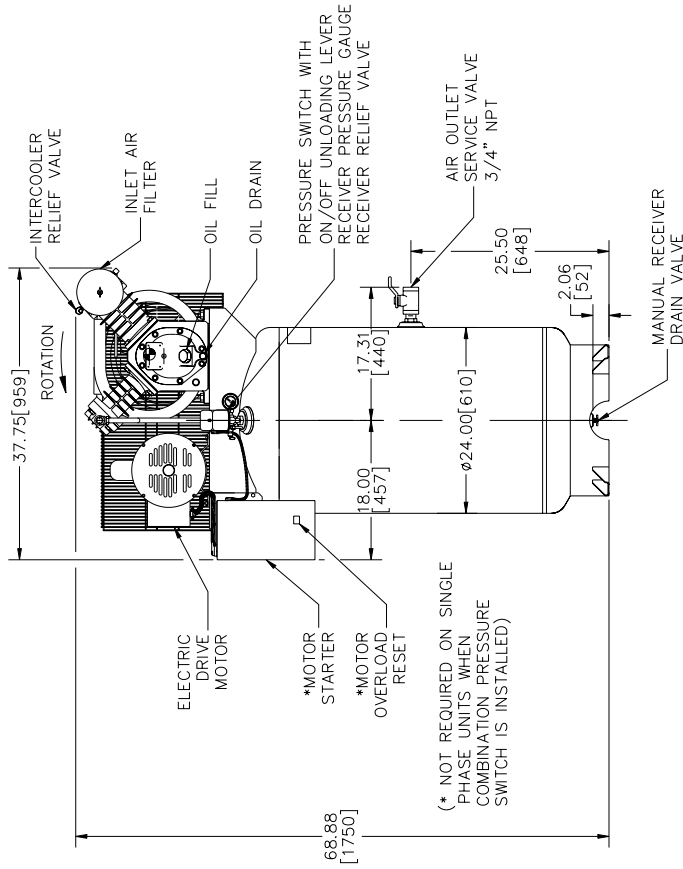
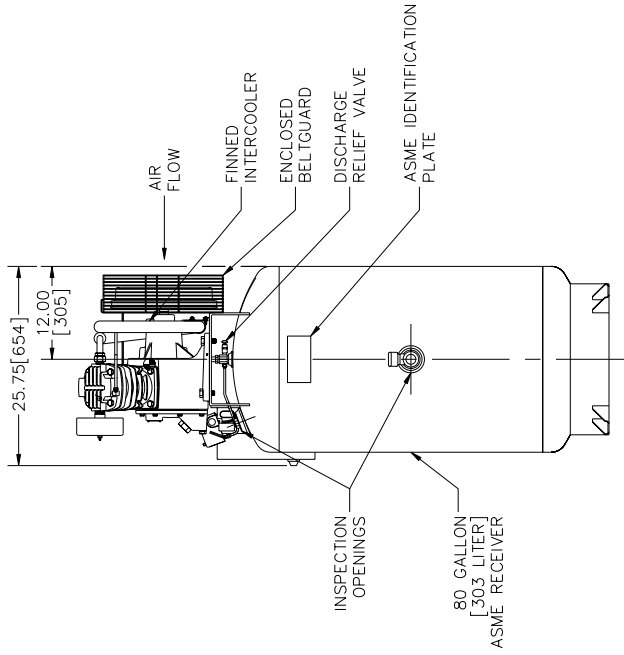
80-GALLON VERTICAL TANK MOUNTED UNIT — FULLY PACKAGED

G2811300-01



80-GALLON VERTICAL TANK MOUNTED UNIT

G2811302-02

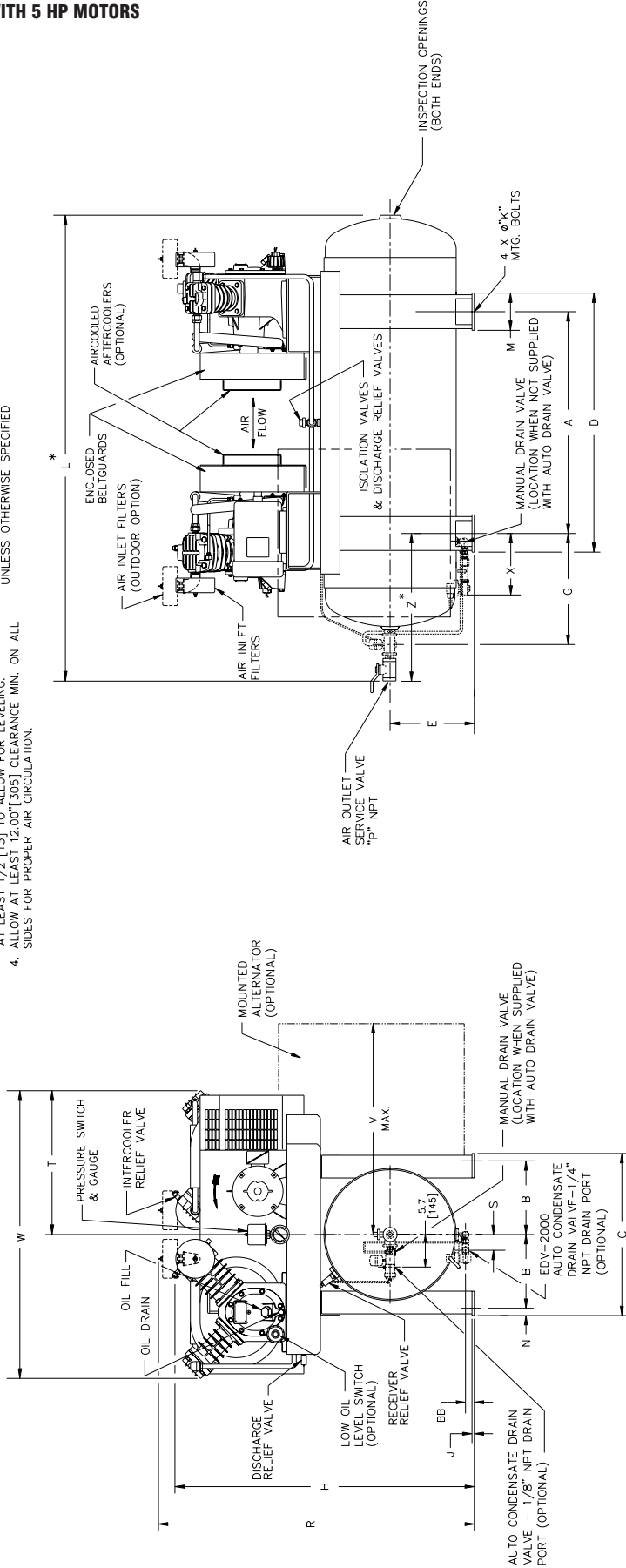


- NOTES:
1. FOUNDATION OR FLOOR MUST BE STRUCTURALLY SOUND, SUPPORT ALL FEET EQUALLY. IF NECESSARY SHIM OR GROUT THE FEET TO LEVEL.
 2. FOUNDATION BOLTS MUST PROJECT THROUGH THE FEET AT LEAST 1/2" [13] TO ALLOW FOR LEVELING
 3. ALL UNSPECIFIED TOLERANCES:
 .XXX = ±.12 [3]
 .XX = ±.25 [6]
 .X = ±.5 [13]
 4. ALLOW AT LEAST 12" [305] ON ALL SIDE OF THE MACHINE TO ALLOW PROPER AIR CIRCULATION AND MAINTENANCE
 5. APPROXIMATE WEIGHT 500 LBS. [227]
 6. DIMENSIONS IN [] ARE MILLIMETER DIMENSIONS UNLESS OTHERWISE SPECIFIED

TANK MOUNTED DUPLEX UNIT WITH 5 HP MOTORS

NOTES:

1. FOUNDATION OR FLOOR MUST BE LEVEL AND SUPPORT ALL FEET EQUALLY; IF NECESSARY SHIM OR GROUT THE FOURTH FOOT.
2. THE COMPRESSOR ARRANGEMENT SHOWN IS REPRESENTATIVE OF ALL THE UNITS LISTED. SPECIFIED ACCESSORY ITEMS ARE NOT NECESSARILY SHOWN BUT WILL NOT INCREASE THE DIMENSION.
3. FOUNDATION BOLTS SHOULD PROJECT THRU NUTS AT LEAST 1/2" [13] TO ALLOW FOR LEVELING.
4. ALLOW AT LEAST 12.00" [305] CLEARANCE MIN. ON ALL SIDES FOR PROPER AIR CIRCULATION.
5. * = ADD ".4" WHEN AUTOMATIC CONDENSATION DRAIN VALVE IS SUPPLIED.
6. ALL UNSPECIFIED TOLERANCES: XXX = ± .12 [3] XX = ± .25 [6] X = ± .50 [13]
7. UNITS WITHOUT AFTERCOOLERS WILL HAVE WIRE BELTGUARDS.
8. DIMENSIONS IN [] ARE MILLIMETER DIMENSIONS UNLESS OTHERWISE SPECIFIED.



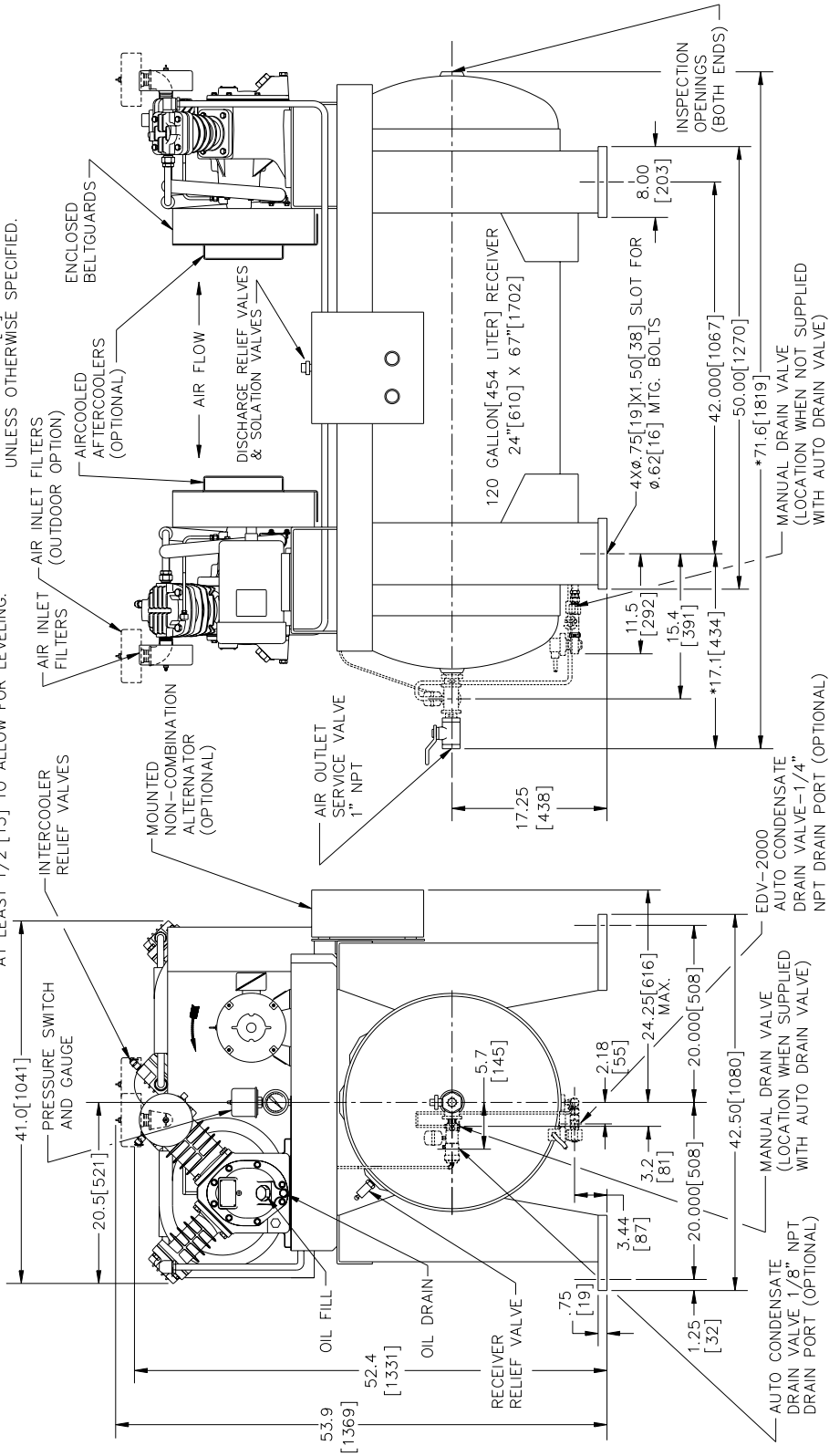
MODEL	NET WT. (kg)	RECEIVER SIZE	GAL [LITER]	DIMENSIONS IN INCHES [MM]																					
				A	B	BB	C	D	E	G	H	J	K	L	M	N	P	R	S	T	V	W	X	Y	Z
2-2475D5	950 [431]	20" X 6 3/4" [508 X 1600]	80 [303]	34.250 [870]	11.375 [289]	1.50 [38]	25.00 [635]	40.50 [1029]	13.00 [330]	16.2 [411]	46.0 [1168]	46.0 [1168]	.38 [10]	.50 [12]	66.1 [1679]	6.25 [159]	1.13 [29]	47.5 [1207]	2.18 [55]	22.2 [564]	35.7 [907]	44.5 [1130]	15.87 [403]	3.00 [76]	17.5 [445]
2-2475E5	1300 [596]	24" X 6 7/8" [610 X 1702]	120 [454]	42.000 [1067]	20.000 [508]	3.44 [87]	42.50 [1080]	50.00 [1270]	17.25 [438]	15.9 [404]	52.6 [1336]	52.6 [1336]	.75 [19]	.62 [16]	72.4 [1839]	8.25 [210]	1.25 [32]	54.1 [1374]	2.18 [55]	22.2 [564]	26.7 [678]	44.5 [1130]	11.50 [292]	4.25 [108]	17.6 [447]

G2411300-03

TANK MOUNTED DUPLEX UNIT WITH 7.5 HP MOTORS

G2411301-02

- NOTES: 1. FOUNDATION OF FLOOR MUST BE LEVEL AND SUPPORT ALL FEET EQUALLY; IF NECESSARY SHIM OF GROUT THE FOURTH FOOT.
 2. ACCESSORY ITEMS THAT ARE NOT NECESSARILY SHOWN WILL NOT INCREASE THE OVERALL DIMENSIONS.
 3. MAXIMUM COMPRESSOR RPM @ 1500.
 4. FOUNDATION BOLTS SHOULD PROJECT THRU NUTS AT LEAST 1/2"[13] TO ALLOW FOR LEVELING.
 5. ALLOW AT LEAST 12.00"[305] CLEARANCE MIN. ON ALL SIDES FOR PROPER AIR CIRCULATION.
 6. * = ADD 3.50"[89] WHEN AUTOMATIC CONDENSATE DRAIN VALVE IS SUPPLIED.
 7. ALL UNSPECIFIED TOLERANCES: XXX = ±.125[3]
 XX = ±.25[6]
 X = ±.50[13]
 8. DIMENSIONS IN [] ARE MILLIMETER DIMENSIONS UNLESS OTHERWISE SPECIFIED.

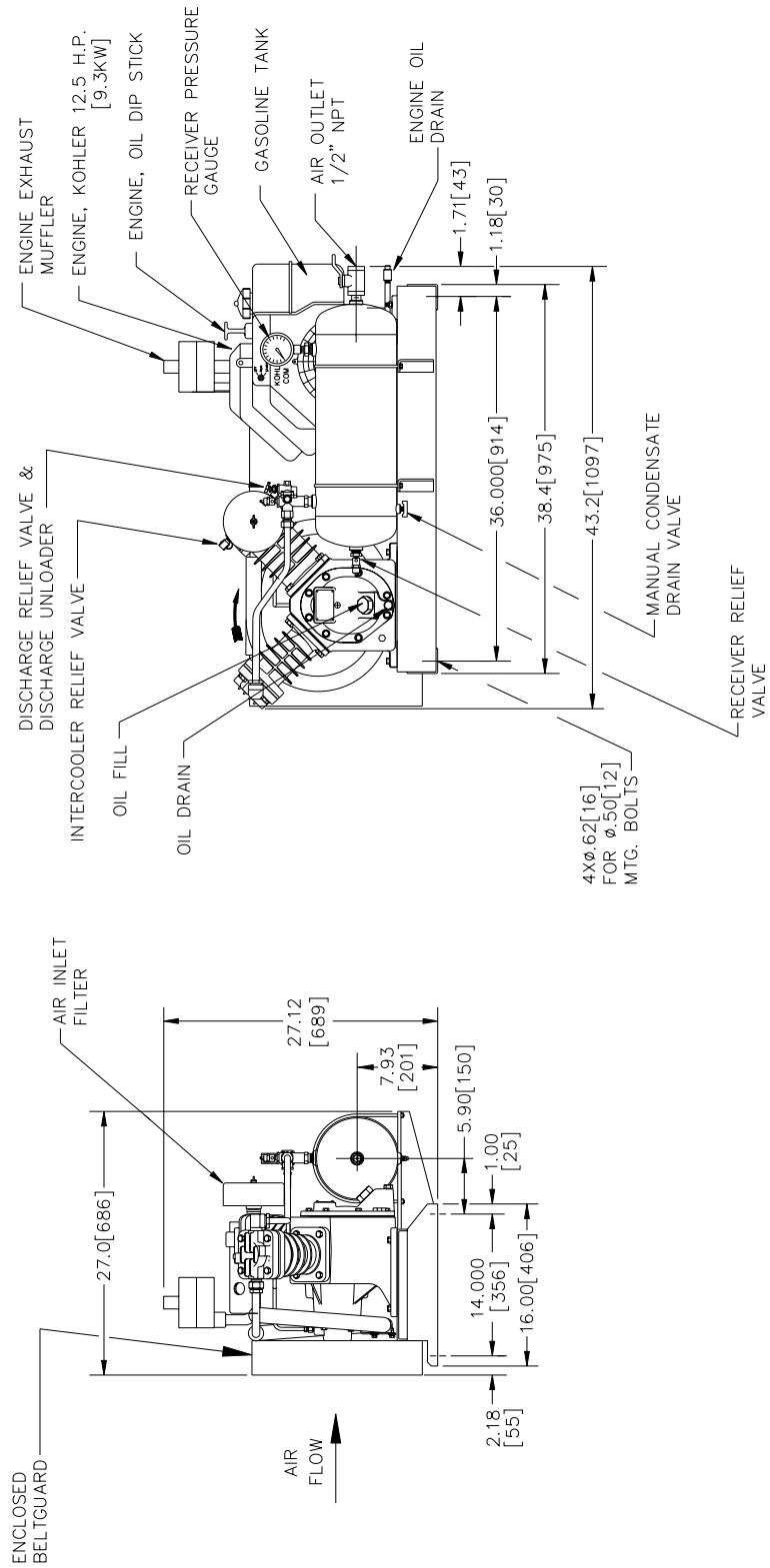


BASEPLATE MOUNTED UNIT WITH KAWASAKI ENGINE

G2611003-01

NOTES:

1. FOUNDATION OR FLOOR MUST BE LEVEL AND SUPPORT ALL FEET EQUALLY; IF NECESSARY SHIM OR GROUT THE FOURTH FOOT.
2. FOUNDATION BOLTS SHOULD PROJECT THRU NUTS AT LEAST 1/2"[13] TO ALLOW FOR LEVELING.
3. ALLOW AT LEAST 12.00[305] CLEARANCE MIN. ON ALL SIDES FOR PROPER AIR CIRCULATION.
4. ALL UNSPECIFIED TOLERANCES: XXX = ±.12[3]
XX = ±.25[6]
X = ±.50[13]
5. DIMENSIONS IN [] ARE MILLIMETER DIMENSIONS UNLESS OTHERWISE SPECIFIED.

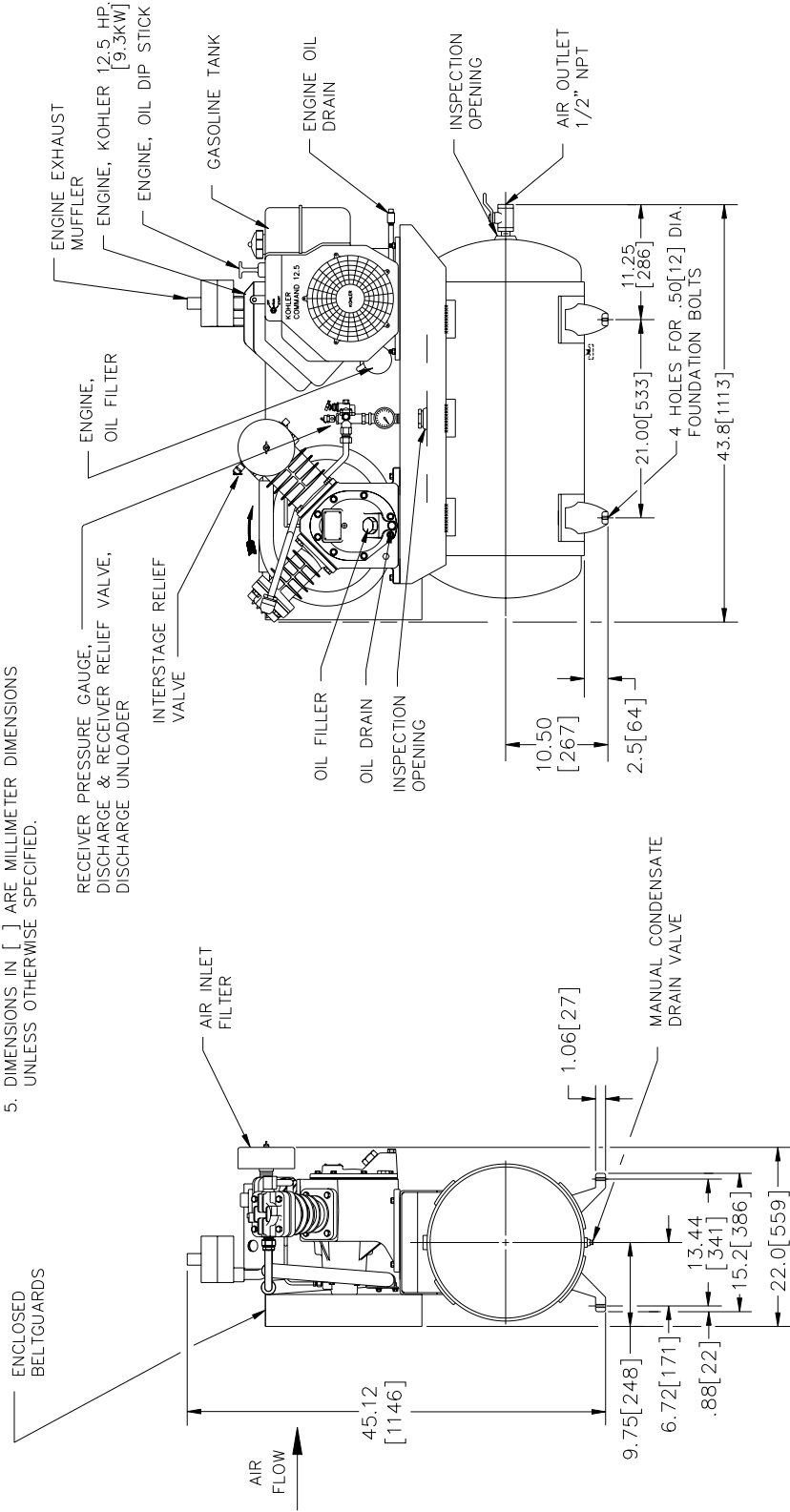


TANK MOUNTED UNIT WITH KOHLER ENGINE

G2711004-01

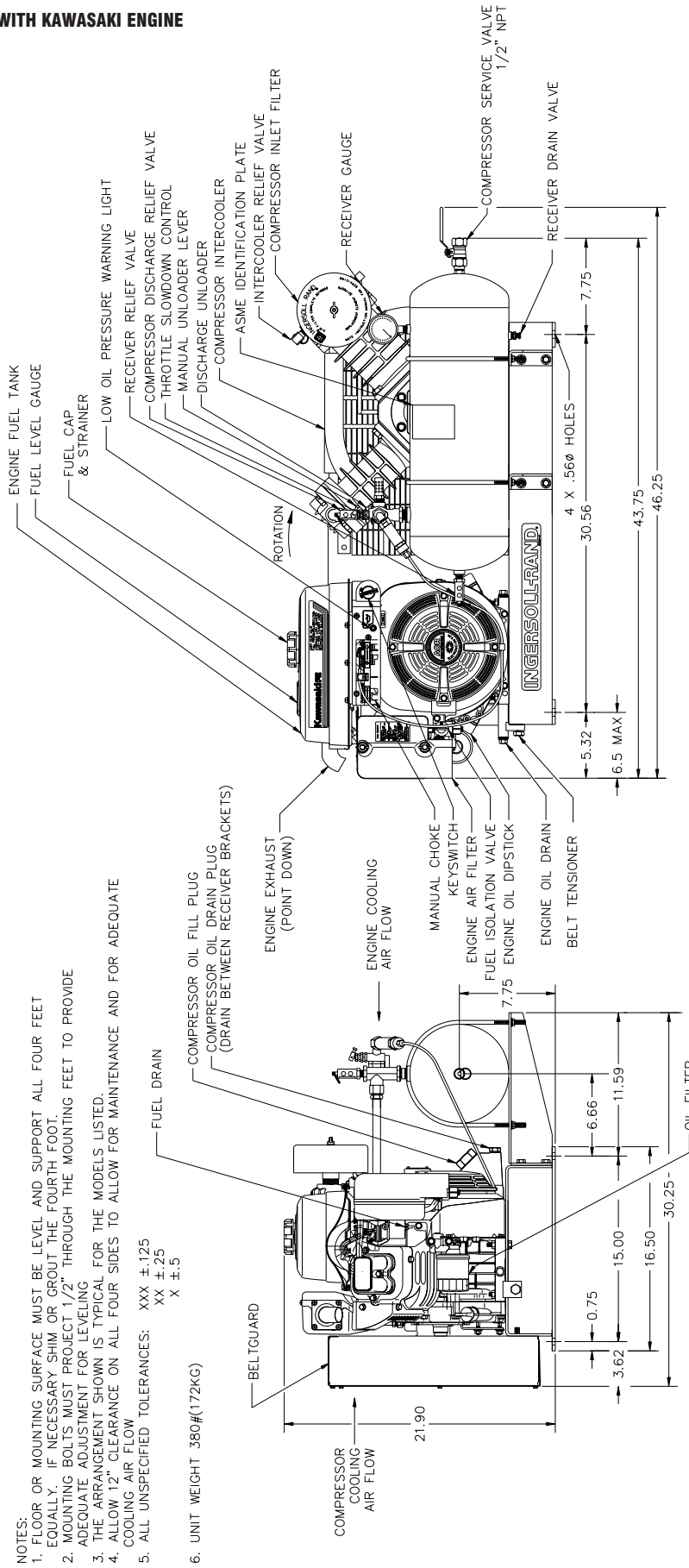
NOTES:

1. FOUNDATION OR FLOOR MUST BE LEVEL AND SUPPORT ALL FEET EQUALLY; IF NECESSARY SHIM OR GROUT THE FOURTH FOOT.
2. FOUNDATION BOLTS SHOULD PROJECT THRU NUTS AT LEAST 1/2"[13] TO ALLOW FOR LEVELING.
3. ALLOW AT LEAST 12.00[305] CLEARANCE MIN. ON ALL SIDES FOR PROPER AIR CIRCULATION.
4. ALL UNSPECIFIED TOLERANCES: XXX = ±.12[3]
XX = ±.25[6]
X = ±.50[13]
5. DIMENSIONS IN [] ARE MILLIMETER DIMENSIONS UNLESS OTHERWISE SPECIFIED.



BASEPLATE MOUNTED UNIT WITH KAWASAKI ENGINE

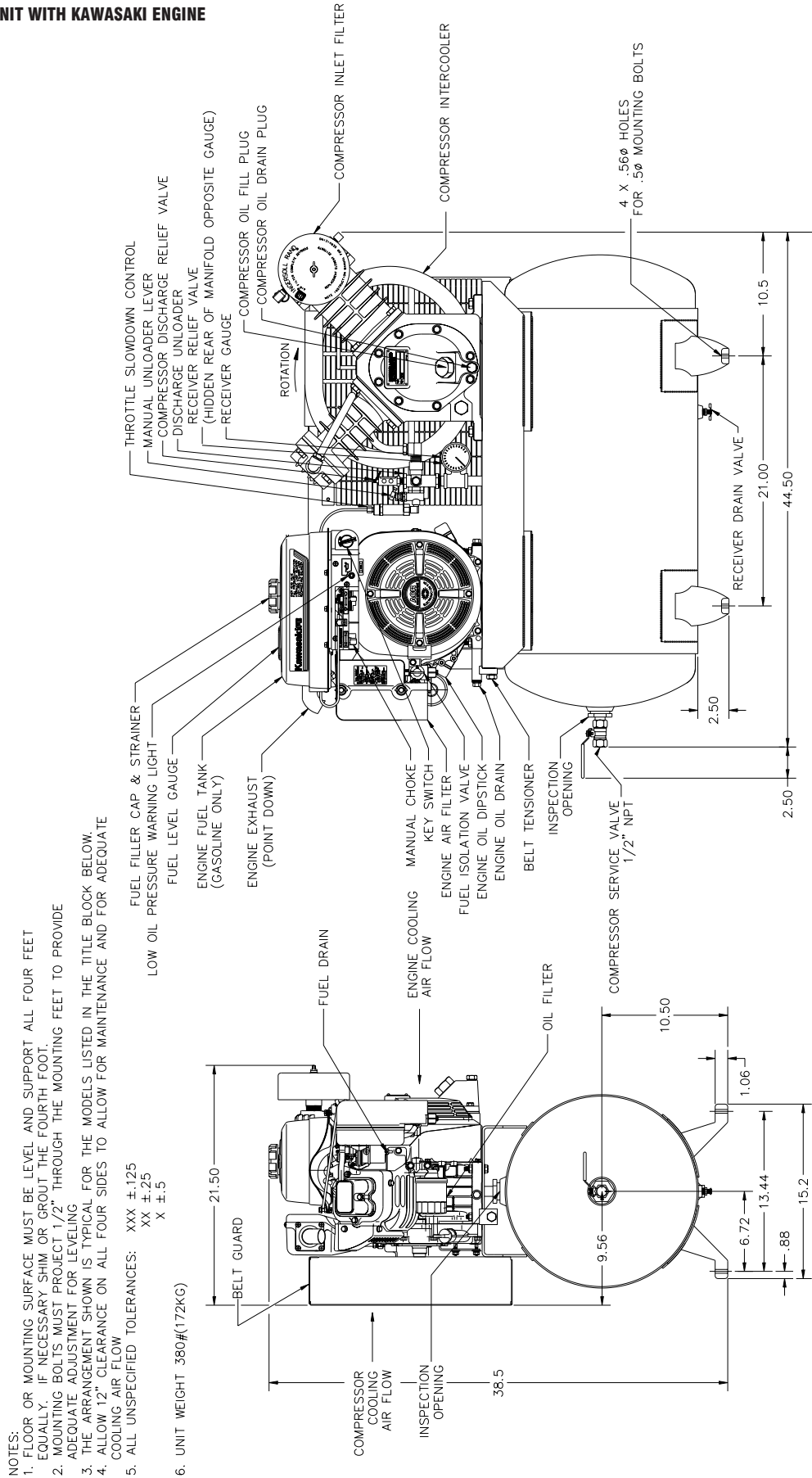
G2611002-00



- NOTES:
1. FLOOR OR MOUNTING SURFACE MUST BE LEVEL AND SUPPORT ALL FOUR FEET EQUALLY. IF NECESSARY SHIM OR GROUT THE FOURTH FOOT.
 2. MOUNTING BOLTS MUST PROJECT 1/2" THROUGH THE MOUNTING FEET TO PROVIDE ADEQUATE ADJUSTMENT FOR LEVELING
 3. THE ARRANGEMENT SHOWN IS TYPICAL FOR THE MODELS LISTED.
 4. ALLOW 12" CLEARANCE ON ALL FOUR SIDES TO ALLOW FOR MAINTENANCE AND FOR ADEQUATE COOLING AIR FLOW
 5. ALL UNSPECIFIED TOLERANCES: XXX \pm .125
XX \pm .25
X \pm .5
 6. UNIT WEIGHT 380#(172KG)

TANK MOUNTED UNIT WITH KAWASAKI ENGINE

G2711003-01

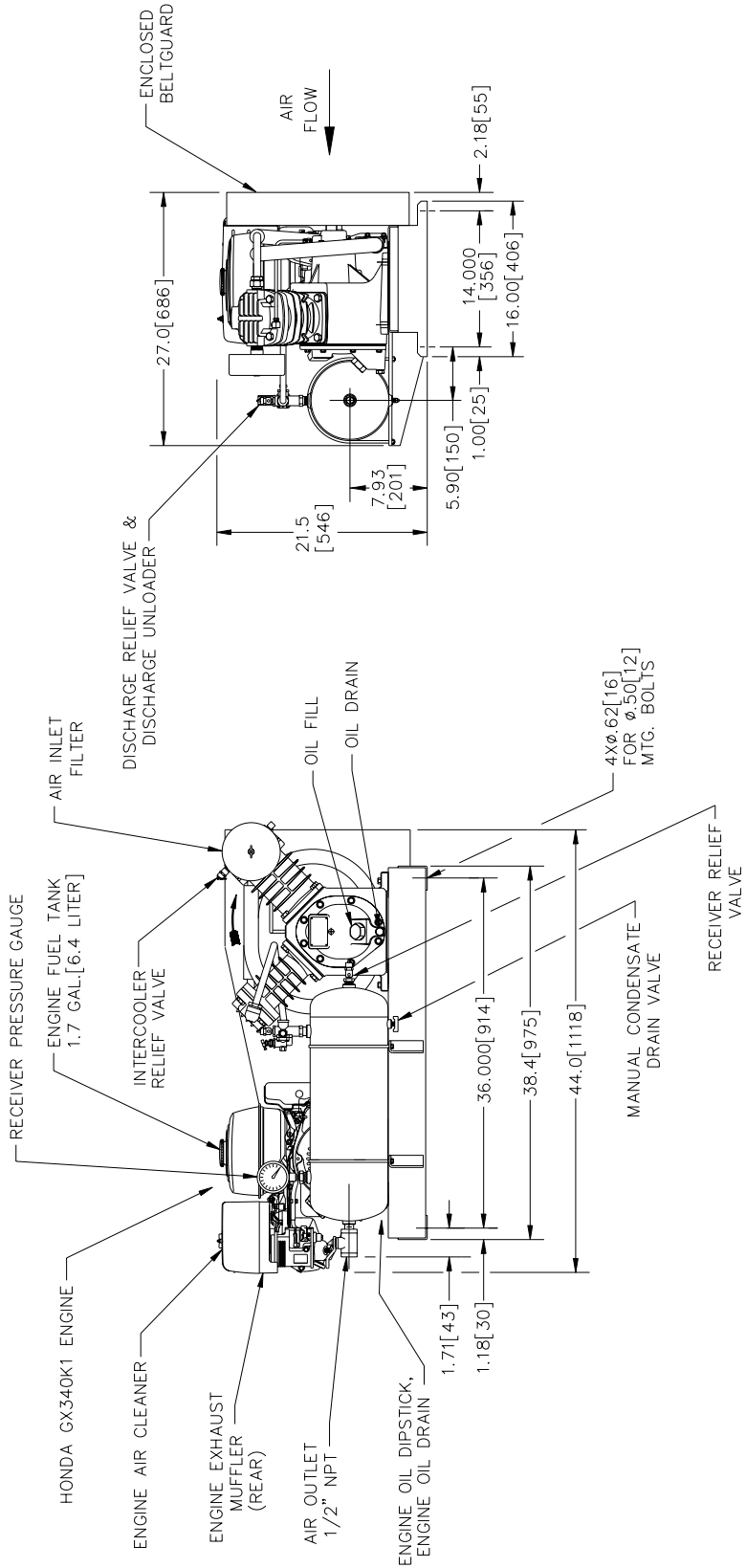


BASEPLATE MOUNTED UNIT WITH HONDA ENGINE

G2611000-01

NOTES:

1. FOUNDATION OR FLOOR MUST BE LEVEL AND SUPPORT ALL FEET EQUALLY; IF NECESSARY SHIM OR GROUT THE FOURTH FOOT.
2. FOUNDATION BOLTS SHOULD PROJECT THRU NUTS AT LEAST 1/2 [13] TO ALLOW FOR LEVELING.
3. ALLOW AT LEAST 12.00 [305] CLEARANCE MIN. ON ALL SIDES FOR PROPER AIR CIRCULATION.
4. ALL UNSPECIFIED TOLERANCES: XXX = ±.12 [3] XX = ±.25 [6] X = ±.50 [13]
5. DIMENSIONS IN [] ARE MILLIMETER DIMENSIONS UNLESS OTHERWISE SPECIFIED.

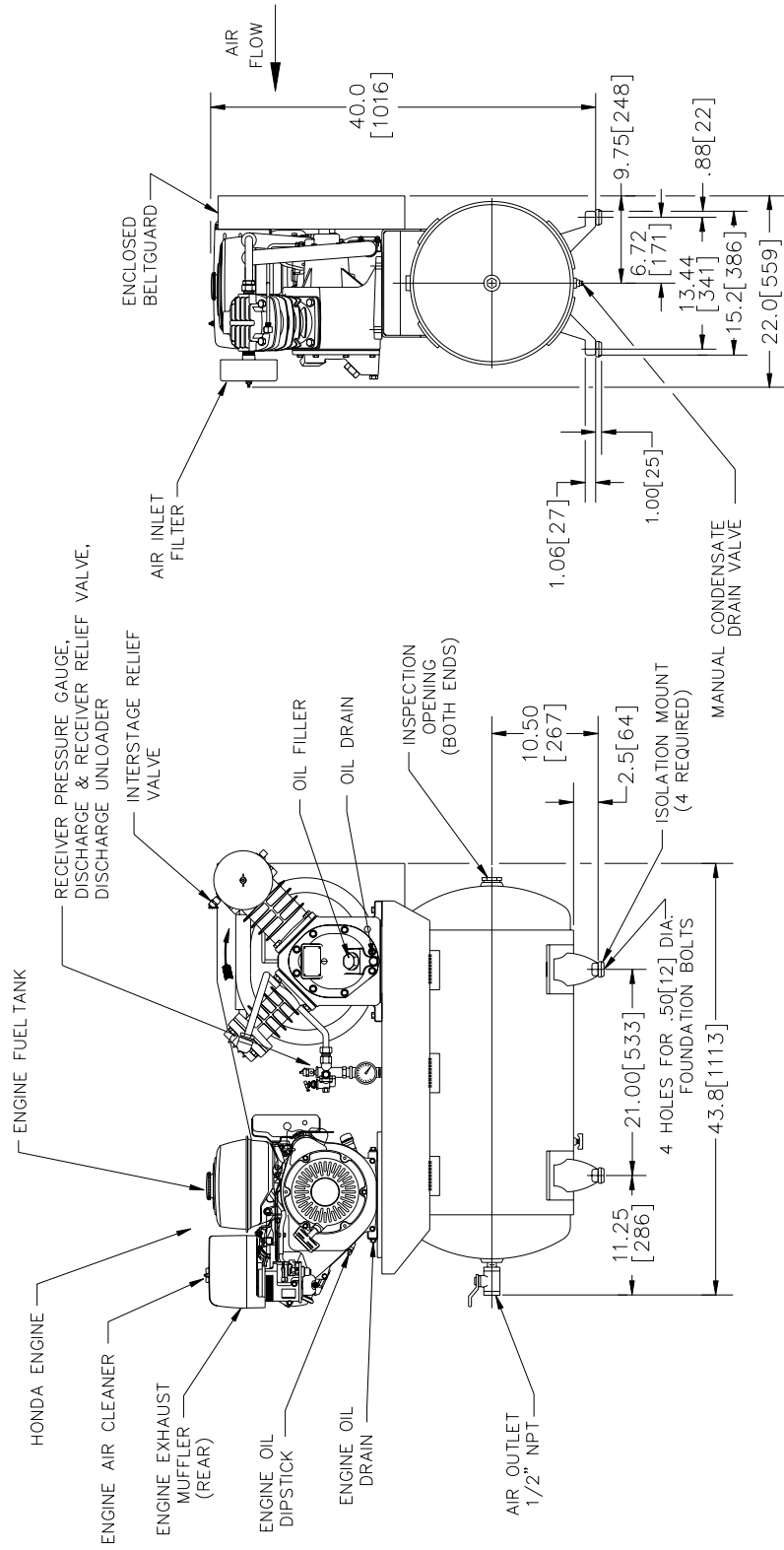


TANK MOUNTED UNIT WITH HONDA ENGINE

G2711000-02

NOTES:

1. FOUNDATION OR FLOOR MUST BE LEVEL AND SUPPORT ALL FEET EQUALLY; IF NECESSARY SHIM OR GROUT THE FOURTH FOOT.
2. FOUNDATION BOLTS SHOULD PROJECT THRU NUTS AT LEAST 1/2"[13] TO ALLOW FOR LEVELING.
3. UNIT MUST BE INSTALLED WITH 32308652 ISOLATION MOUNTS BETWEEN FEET & MOUNTING STRUCTURE.
4. ALLOW AT LEAST 12.00[305] CLEARANCE MIN. ON ALL SIDES FOR PROPER AIR CIRCULATION.
5. ALL UNSPECIFIED TOLERANCES: XX = ±.25[6]
X = ±.50[13]
6. DIMENSIONS IN [] ARE MILLIMETER DIMENSIONS UNLESS OTHERWISE SPECIFIED.





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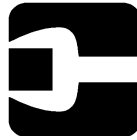
A series of horizontal lines for writing, starting from the top right of the pen icon and extending across the width of the page. The lines are evenly spaced and cover the majority of the page's vertical space.

LOOK WHAT INGERSOLL-RAND CAN DO FOR YOU!



Efficient Field Service

We maintain a highly trained staff of technicians to service your equipment for preventive maintenance, or to assist you should emergencies ever occur.



Complete Repair Service

Our trained technicians will repair or overhaul your equipment to factory specifications, using only genuine I-R parts.



Special Engineering Service

We can help you identify and solve your problems by evaluating your needs and recommending the proper equipment to give you maximum efficiency.



Spare Parts

By stocking genuine I-R spare parts, we can help you avoid costly delays or substituting inferior parts. Using genuine I-R parts on your I-R equipment will help to keep even older equipment running in good-as-new condition.



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A SUBSTITUTE IS NOT A REPLACEMENT!

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NOTE: THE USE OF REPAIR PARTS OTHER THAN THOSE INCLUDED WITHIN THE INGERSOLL-RAND COMPANY APPROVED PARTS LIST MAY CREATE UNSAFE CONDITIONS OR MECHANICAL FAILURES OVER WHICH INGERSOLL-RAND COMPANY HAS NO CONTROL. INGERSOLL-RAND COMPANY SHALL BEAR NO RESPONSIBILITY FOR EQUIPMENT ON WHICH NON-APPROVED REPAIR PARTS ARE INSTALLED.





OPERATION and MAINTENANCE MANUAL

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This manual is subject to revision without prior notice. Please periodically check our website for a newer revision.

Revision	Date	Approved by	Translated from	Comment
0	Sept-2010		N/A	<i>This document uses Arial, Wingdings, Wingdings 2, Wingdings 3, Gl2k fonts. Printing of this document to PDF should only be done if these fonts are present. "Whitespace" has been removed from many of the graphical images and the images are otherwise "cropped" to reduce the total number of pages. These alterations of the actual screen images do not detract from the technical content presented</i> ^{1st} Release of this manual
A1	Dec. 2010	MC	N/A	Minor Corrections to formatting and troubleshooting. Cold weather option section added.
A2	Jan 2011	MC	N/A	Added steps for connecting calibration gas, added heater to spare parts
A3	March 2011	MC	N/A	Formatting changes
A4	Sept 2011	MC	N/A	Added information to appendix, removed option 2-01
A5	Sept 2013	MC	N/A	Updated ambient temperature range specification to mention cold weather package, and add new membrane separator.
A6	May 2014	MC	N/A	Update troubleshooting and spare parts sections
A7	Nov 2015	MC	N/A	Update for ECOTEC, CSA Version and removal of rack mount option

SAFETY SUMMARY

Protective systems may be compromised if the equipment is used in a manner not indicated by this manual.

AUTHORIZED PERSONNEL

Read and understand this manual before operating or servicing this equipment. Save these instructions.

WARNING

HAZARDOUS GASES

The FAU-TDL instruments are normally used for measuring gases from landfill sites. Inhalation of any gas may be harmful to health and in some cases may be fatal. It is the responsibility of the user to ensure that they are adequately trained in the safety aspects of the gases being used and that appropriate procedures be followed. In particular, where hazardous gases are being monitored or used the gas exhausted from the analyzer must be piped to an area where it is safe to discharge the gas. Hazardous gas can also be expelled from the instrument when purging with clean air or any time the sample line is opened.

WARNING

PARTS INTEGRITY

Substituting unauthorized parts or tampering with the equipment may have an adverse effect on the operation of this system. Only factory-approved parts should be used for repair.

CAUTION

HOT SURFACES

This instrument may include electrical heat tape. Be careful when working around heat tape as burns could occur.

DANGER

ELECTRICAL SHOCK HAZARD

Be sure doors are closed before operating this equipment. To ensure safe operation and optimal performance, this equipment must be wired to a properly grounded three-wire power source.

WARNING

EXPLOSION HAZARD

Explosive gas may be measured by this equipment. Sample tubing should be checked during installation and prior to start-up, during maintenance and any time there is a failure of the sampling train.

General Safety Instructions

- Local, national and/or international electrical codes should be followed during all electrical work.
- Prior to installation of this equipment, read the instructions in this manual and any cautionary labels on the equipment.
- Use insulated tools while installing or working around this equipment to reduce the occurrence of short-circuits.
- Take off all jewelry. The accidental exposure to live circuits will greatly be reduced.

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1 Introduction

ECOTEC is the premier manufacturer of products, instruments and software for gas analysis and regulatory monitoring compliance. ECOTEC provides technologically innovative family of products for gas analysis and reporting. These products are the result of field-proven experience in design, operation and maintenance around the world.

The Field Analytical Unit –Tunable Diode Laser (FAU-TDL) is a methane specific fixed position analyzer. The use of Tunable Diode Lasers allows for methane specific analysis that is uncommon in instruments utilizing Flame Ionization Detectors (FID) and Non-Dispersive Infra-Red (NDIR). The analyzer is intended to be installed in general purpose areas and require only minimal service and maintenance.

1.1 Receiving

Every effort has been made to ensure the equipment is not damaged during shipping and arrives at the site in operating condition. However it is important that it be inspected prior to accepting delivery and any damage to shipping materials or the equipment be noted on the shipping documents. Immediately notify shipping company if the equipment or shipping materials are damaged upon receipt.

1.2 Installation

While installation and start up should be straight forward it is critical that it be done correctly. The instrument is intended to be installed in a general purpose area. There are two connections that must be made and two additional connections that may be desired. The required connections consist of; 1) the main power to the instrument and 2) the gas sample line to the instrument. Please refer to the installation and wiring drawings provided with the instrument for specific connection locations and type. There are several optional connections including; the sample gas exhaust from the instrument, signal output wiring from the instrument, certified zero and span gas connections to the instrument and others that may be available based on the options purchased with the instrument.

For questions regarding start up, commissioning and training please contact ECOTEC at:

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service@ecotecco.com

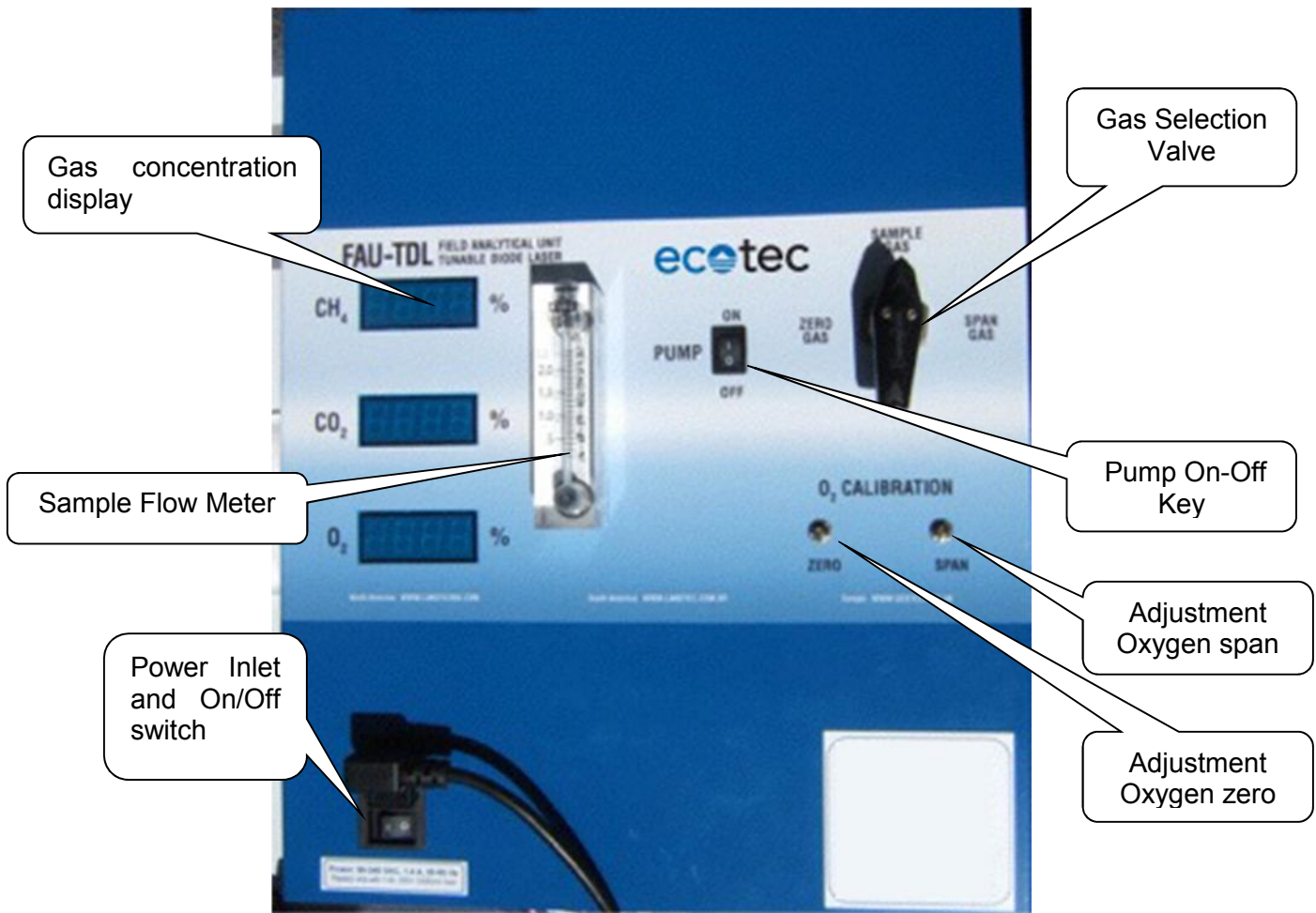
Web: www.ECOTECCO.com

2 FAU-TDL Options

The FAU-TDL ECOTEC part number "FAU-TDL-E". Is available with several options and have accessories that can expand the instruments capabilities.

2.1 FAU-TDL-E

The FAU-TDL is a wall mount version of instrument designed to be installed vertically and is available in several enclosure options. The instrument is available with one or more of the following gas channels; Methane, Carbon Dioxide and Oxygen. Methane and Carbon Dioxide are detected by TDL technology and Oxygen is detected by an electrochemical cell. The figure below shows a three gas analyzer. Please see instrument drawings for specific installation and wiring details.



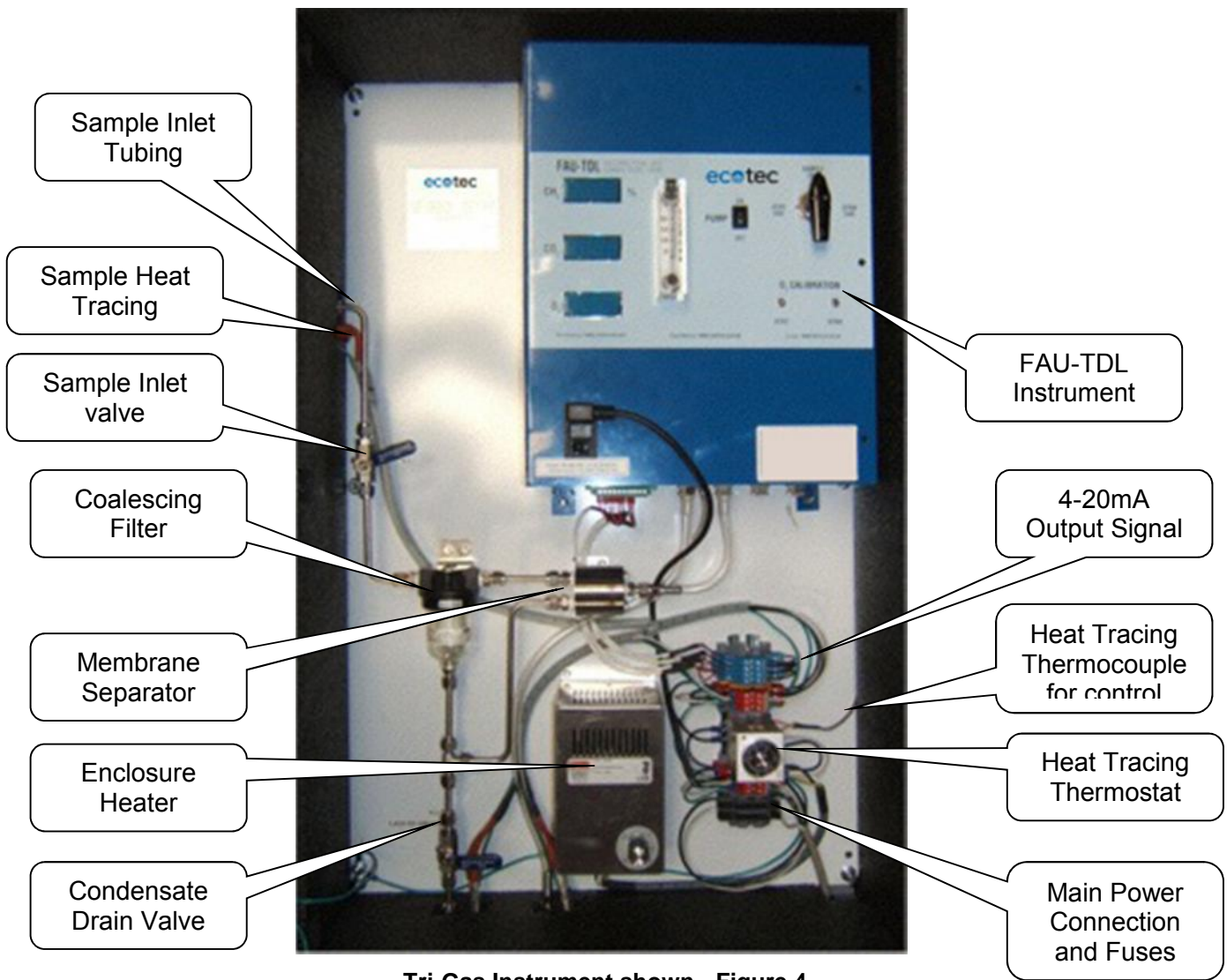
FAU-TDL (W/O Enclosure) - Figure 3

2.2.1 FAU-TDL Options

The FAU-TDL is available with one (1), two (2) or three (3) gas channels consisting of any combination of Methane, Carbon Dioxide and Oxygen. It is also available in several enclosure options with and without integral gas conditioning systems and cold weather packages. While it is not necessary to purchase the gas conditioning system from ECOTEC it is critical to have a gas conditioning system that removes particulate and liquid upstream of the analyzer. The sample gas does not need to be dried but must be free of liquid.

2.2.2 FAU-TDL Cold Weather Option

The FAU-TDL is available with a cold weather option which consists of insulation in the NEMA enclosure, heat tracing and insulation for the sample, exhaust and drain lines. The stainless steel tubing is not included and the system is designed to work with 1/4" stainless steel tubing. Please see installation drawings for specifics of how the tubing should be installed.



Tri-Gas Instrument shown - Figure 4

2.2.3 FAU-TDL Accessories

The FAU-TDL is designed to monitor gas after it goes through a conditioning system to remove particulate and any liquid. The gas does not need to be dried but must be free of liquid. A gas conditioning system that removes particulate and liquid must be installed upstream of the analyzer. ECOTEC offers gas conditioning systems both as options and accessories for the FAU-TDL instrument. The FAU-TDL is capable of reading and providing a 4-20mA output for gas temperature if the temperature probe accessory is purchased. ECOTEC also offers a sun shade as an accessory for enclosures that are mounted outdoors.

3 General Operation

The FAU-TDL is designed to be a fixed position instrument that operate with minimal user interaction. The instrument is designed to sample gas continuously and provide 4-20mA output of gas concentration and temperature, when equipped with the temperature probe accessory. The gas flow through the instrument can be manually read from the flow meter on the front of the instrument. The gas concentrations are viewable on LED displays. The instrument can be operated with the internal sample pump on or off, the pump is manually turned on and off.

3.1 Instrument location

The instruments are intended to be installed in general purpose areas. If no enclosure is purchased with the instrument it must be mounted in an area protected from the environment. The instrument itself is not rated for outdoor use and cannot be subjected to rain or other moisture. The FAU-TDL is available in NEMA 4 and NEMA 4X enclosures; however even the weather rated enclosures are recommended to be installed in an area that is protected from exposure to direct sunlight. Typically a sun cover or roof is sufficient to prevent the enclosures from acting as a solar oven and provide protection so the enclosure can be opened in inclement weather.

The instrument should be installed close to the sample location to minimize potential for blockage of the sample or exhaust line. If there is a possibility of liquid being in the main line which the sample is taken from the sample line should be connected to the top of the pipe to minimize the potential for liquid being pulled into the sample line. The exhaust line connection should be located at least three inches downstream of the sample inlet connection.

3.2 Cross-Gas Effects

The Methane and Carbon Dioxide TDLs are tuned specifically to the absorption frequency of Methane and Carbon Dioxide. The TDL has a much more precise absorption frequency than NDIR instruments so there are no cross gas effects from other hydrocarbons (e.g. ethane, propane, butane, etc.) that have similar absorption frequencies and typical cause cross gas effect with NDIR instruments.

The Oxygen sensor is a galvanic cell type and suffers virtually no influence from CO₂, CO, H₂S, NO₂, SO₂ or H₂, unlike many other types of Oxygen cells.

4 Service and Maintenance

The FAU-TDL family of instruments has been designed to require minimal service and maintenance. One of the advantages of the TDL technology is that it does not require adjustment over time to maintain calibration. Once the instrument is build and factory calibrated the laser channels (CH₄ and CO₂) should not need any adjustments in the field. If the instrument includes an Oxygen channel that channel will need to be adjusted periodically to maintain calibration as Oxygen is monitored using galvanic cell technology which will require periodic adjustments and replacement.

4.1 Factory Calibration and Service

The FAU-TDL will not require factory calibration and service however it is recommended that the instrument be checked for proper operation at least annually. If the instrument includes the Oxygen channel option it is recommended that the accuracy of this channel be checked at least quarterly and adjusted as necessary to keep it in calibration. It is expected that the Oxygen cell will need to be replaced every two years. If the internal pump is continually used it may require replacement every two years as well. It is recommended that this service be performed by ECOTEC or ECOTEC approved/trained technician.

4.2 Field Calibration Check

The FAU-TDL is equipped with input ports and a multi-position valve to facilitate field calibration checks on zero and span gases to periodically check the accuracy of the instrument. During calibration checks the display and output will register the gas concentration being ran through the instrument. The internal pump can be used however if pressurized gas is being used to perform the calibration check the internal pump is not needed. Below are the recommended steps for running pressurized calibration gas through the instrument. Note the quick connect fittings on the instrument box have valves built in them so it is necessary to have the exhaust connected while calibrating to ensure flow through the instrument.

- 1) Turn the sample pump off
- 2) Connect the calibration gas to the appropriate port (zero or span)
- 3) Ensure that the exhaust port is connected to vent the gas
- 4) Turn the gas selector valve to the same port the gas was connected to in step 2 above
- 5) Open the calibration gas valve and let gas flow through the instrument for a minimum of 60 seconds or until the gas reading has stabilized for 15 to 20 seconds.
- 6) Close the calibration gas valve and disconnect
- 7) Turn the gas selector valve back to sample
- 8) Turn the pump back on.

2.4.1 Calibration Gas Flow and Pressures

During calibration checks the pressure and flow of calibration gas used is important. The gas flow should be between 0.5 and 2.5 liters per minute and the pressure should be between -2psig and +4 psig. ECOTEC's standard portable calibration gas cylinders and regulators are designed to work seamlessly with the instrument. Other gas cylinders and regulators can be used as long as the pressure and flow meets the above stated specifications. Low flows will not affect the accuracy of the instruments readings but will increase the time required for the instrument to reach an accurate reading. It is necessary for exhaust gas to be released from the instrument during calibrations.

2.4.2 Manual Field Calibration

If the FAU-TDL is equipped with an Oxygen channel field calibrations will be necessary as the Oxygen cell ages or when it is replaced. Note: The Methane and Carbon Dioxide channels will not require field or factory calibration adjustments. When performing a field calibration a certified oxygen free gas should be used to check the Oxygen zero. If the instrument is not reading sufficiently close to zero adjust the reading to zero using the "zero" adjustment screw under the "O2 Calibration" heading. Next flow a known concentration of Oxygen through the instrument and adjust the "span" if necessary. When calibrating the Oxygen channel ensure the reading has stabilized before adjusting. Time for the reading to reach stabilization will vary depending on the flow rate however if the reading stays constant for 20 to 30 seconds it is stable.

4.3 Field Maintenance

The FAU-TDL has been designed to require minimal maintenance. The instrument should have a gas conditioning system that may require minor maintenance including draining condensate and replacing filters. The instrument and gas conditioning system should be checked periodically. If liquids are found in the coalescing filter bowl they should be drained.

4.3.1 Replacing the Filter Element and Membrane Separator Membrane

The following is to be followed when replacing the coalescing filter element:

1. Turn off the FAU-TDL instrument pump
2. Close sample inlet valve
3. Disconnect the liquid drain line
4. Unscrew the filter bowl exposing the filter element and support assembly. Inspect O-ring for any damage. Unscrew element and support from the filter body and remove used element and replace with new element (ECOTEC Part Number 3-FAUCU-0016-E). Reinstall assembly and screw filter bowl back on.
5. Reinstall liquid drain line and tighten securely.
6. Leak check the connections with a suitable test liquid such as SNOOP™ prior to placing unit back in service.

The following procedure is to be followed when replacing membrane separator membrane. Please note: There are two types of membrane housings used. Both hold the membrane between two stainless steel portions. The two parts are held together by either four screws or internal “standard” right hand threads:

1. Turn off the FAU-TDL instrument internal pump
2. Close sample inlet valve
3. Disconnect the sample inlet tubing. Then remove the separator from the mounting bracket.
4. Either use a 5/32 hex wrench to remove the four assembly screws or unscrew the separator to separate the two halves of the separator.
5. Remove the membrane O-ring carefully and thoroughly inspect. If O-ring is damaged, obtain a replacement O-ring (ECOTEC Part Number 3-FAUCU-0018-E) and set aside.
6. Install a new membrane (ECOTEC Part Number 3-FAUCU-0017-E) over the membrane support. Next, replace O-ring removed earlier or new replacement O-ring on O-ring groove and center. Then press one side of the O-ring into the groove. Repeat for the opposite side and so on until the O-ring fits snugly in the groove.
7. Reassemble the separator by aligning the four assembly screws. To prevent damage to the threads from over tightening, first hand tighten the screws and then turn the screws ½ turn with the 5/32 hex wrench.
8. Reinstall the membrane separator to the mounting bracket and reconnect the sample tubing and tighten securely.
9. Leak check the connections prior to placing the unit back into service.

5 Troubleshooting

Problem	Corrective Action/Reason
Unit does not turn on	<ul style="list-style-type: none"> • No Power - check power to instrument. • Fuses Blown – check fuse in power switch assembly • Contact Factory Service.
Gas reading is not correct	<ul style="list-style-type: none"> • Check reading with known gas, air or calibration gas.
Display is reading about - 25% (always).	<ul style="list-style-type: none"> • 4-20mA Output circuit is open – check output circuit or jumpers at instrument and output connections.
If instrument reads correctly on Calibration gas	<ul style="list-style-type: none"> • Sample gas may not be flowing through instrument check gas flow. • Gas concentration may not be as expected, check for leaks if CH₄ and/or CO₂ are lower than expected and/or O₂ is higher than expected. • Check manual ball valve 2 (drain valve) ensure that valve is normally closed.
If gas reading on Calibration gas is incorrect	<ul style="list-style-type: none"> • Check output wiring; instrument provides signal power and should not be connected to 24VDC power. • Contact Factory Service
Instrument always reading same value (non-zero)	<ul style="list-style-type: none"> • Check output mA. If mA output varies as expected display may be damaged. If mA output does not change output board may be damaged. • Contact Factory Service
No gas flow going through instrument	<ul style="list-style-type: none"> • The inlet/exhaust is blocked - remove blockage and retry. • The particulate filter or water trap filter is blocked -replace as necessary. • Pump is turned off or multi-position valve is not on “Sample Gas” – turn on pump or adjust valve. • Contact Factory Service. •

Problem	Corrective Action/Reason
Display reads over 100% when first started.	<ul style="list-style-type: none">• This is normal during the first several seconds of instrument operation. If display doesn't drop below 100% after 30 seconds of operation there may be blockage of laser beam.• Purge instrument with air or calibration gas.• Contact Factory Service.
Temperature Probe output reads 20mA	<ul style="list-style-type: none">• Check Temperature probe connection/line the signal is not getting to the instrument.
Liquid blockage or ingress	<ul style="list-style-type: none">• Check coalescing filter for blockage or saturation.• Check membrane filter for blockage or damage.• Check manual ball valve 2 (drain valve) ensure that valve is normally closed.• Ensure gas sample line is connected to the top of the gas conveyance pipe.• Ensure the sample line runs vertically for a foot or more.• If instrument is equipped with cold weather option ensure the heater and heat tracing is set correctly.• Contact Factory Service.

6 Specifications

6.1 Physical

Weight: Enclosure Instrument	Varies with option; 33-133 lbs. (15 - 60 kg) Varies with model and options; 11- 22 lbs. (5-10 kg)
Size: Enclosure Instrument	36" H x 24" W x 8" D (914mm X 910 mm X 203 mm) Varies with Model; 5.25" H x 19" W x 14" D (133 mm X 483 mm X 355 mm) Rack 6" H x 13" W x 16" D (152 mm X 330 mm X 406 mm)
Case material: Enclosure Instrument	Varies with option; Powder coated Steel or Stainless steel. Powder Coated Steel.

6.2 General

Power Supply	90 -240 VAC, 50/60 Hz 1.4A (instrument only)
Temperature measurement	With optional probe -22°F to 266°F (-30°C to 130°C).
Temperature accuracy	±2°F (±1 °C).

6.3 Gas Ranges

Detection principle	CO ₂ and CH ₄ Tunable Diode Laser O ₂ by internal electrochemical cell.
Oxygen cell lifetime	Approximately 24 months in air.
Instrument resolution	Gas Resolution CH ₄ 0.1% CO ₂ 0.1% O ₂ 0.1%
Typical Accuracy 0 - Full Scale	Gas Accuracy CH ₄ ±1.0% CO ₂ ±1.0% O ₂ ±1.0%
Response time, T90	≤30 seconds
Range	CH ₄ 0-100% CO ₂ 0-100% O ₂ 0-25%

6.4 FAU Instrument Pump

Typical flow	500-2000 cc/min.
Vacuum \ Pressure	±120 inches H ₂ O.
Life expectancy	24 months (continual operation)

2.9.5 Operating Conditions

Operating temp range	35°F to 140°F (2°C to 60°C) standard -4°F to 140°F (-20°C to 60°C) with cold weather package
Relative humidity	0-95% non-condensing.
Atmospheric pressure range	700-1200 mbar.

7 Recommended Spare Parts

The FAU-TDL is designed of predominantly solid state parts that should not need replacement or service. Therefore minimal spare parts are required. If the instrument is purchased with a gas conditioning system replacement of filters and parts for that system are recommended.

7.1 FAU-TDL Instrument Parts

ITEM	PART NO.	DESCRIPTION	QTY
1	3-43000-20141-E	POWER SUPPLY FUSE FOR FAU-TDL	4
2	2-35602-24250-E	PUMP ASSEMBLY, FAU-TDL, 24 VDC	1
3	3-00000-5181-E	OXYGEN SENSOR (does have shelf life)	1
4	3-00000-1202-E	QUICK COUPLING INSERT 1/4" QC X 1/4" HOSE BARB	4
5	3-00000-0006-E	TUBING 1/4" CLEAR VINYL	2 FEET

7.2 FAU-TDL Optional Gas Conditioning System Parts

ITEM	PART NO.	DESCRIPTION	QTY
1	3-FAUCU-0005-E	COALESCING FILTER	1
2	3-FAUCU-0016-E	REPLACEMENT ELEMENT FOR COALESCING FILTER	3
3	3-FAUCU-0021-E	REPLACEMENT O-RING FOR COALESCING FILTER	1
4	3-FAUCU-0017-E	REPLACEMENT MEMBRANE FOR MEMB. SEPARATOR	3
5	3-FAUCU-0018-E	REPLACEMENT O-RING FOR MEMB. SEPARATOR	1
6	3-43000-20500-E	FUSE FOR ENCLOSURE POWER SUPPLY	4
7	3-00000-1202-E	QUICK COUPLING INSERT 1/4"	2
8	3-00000-0006-E	TUBING 1/4" CLEAR VINYL	2 FEET
9	3-FAUCU-0001-E	BALL VALVE, 1/4" STAINLESS STEEL	1
10	3-FMS00-0023-E	HUMIDISORB AND X-CORRODE PACKET	2

7.3 FAU-TDL Optional Heat Tracing Spare Parts

ITEM	PART NO.	DESCRIPTION	QTY
1	3-FAU00-0163-E	TEMP CONTROLLER TYPE K	1
2	3-FMS00-0024-E	ELECTRIC HEATER 400 WATTS 115 VAC	1

8 Components Instructions and Datasheets

NEW PRODUCT

N412C ULTIMATE SERIES ENCLOSURES NEMA 4 & 12 SINGLE DOOR WALL-MOUNT



N41216206C

Industry Standards

UL 508, Types 4, 12, & 13
CSA Certified, Types 4, 12, & 13
NEMA/EEMAC Type 4, 12, & 13
JIC EL-1-71

UL UL Files E64791

CSA CSA File LL66C78

FEATURES-SPECIFICATIONS

Applications

N412C ULTIMATE Series Enclosures are designed to house and protect electrical and electronic components from harsh, dirty environments. For use in installations where dirt, dust, oil, water, or other contaminants are present. Streamlined styling, flush latching, and attractive durable finish complement any high tech electronic equipment.

Construction

- Bodies and doors fabricated from 14 gauge steel
- Continuously Plasma welded seams
- Increased tub opening for better access

- Concealed hinges
- Doors are interchangeable and easily removable
- Grounding provisions provided
- 1/4-turn semi-flush oil tight latches are supplied to hold door securely closed
- Print pocket is provided
- Doors are sealed with poured-in-place polyurethane gasket**
- Mounting holes in rear of enclosure
- Studs for mounting optional back panel (the Ultimate back panels have increased in size to accommodate larger foot-print installations)

Finish

- ANSI 61 gray polyester powder inside and out over phosphatized surfaces
- Optional back panels are white polyester powder over phosphatized surfaces

Accessories

- Back panels (see NEW PRODUCT reference tables)
- Window door (see NEW PRODUCT reference tables)
- Other accessories see Section J1-J18
- Optional N412MFK mounting foot kit

N412C ULTIMATE SERIES SINGLE DOOR ENCLOSURES							
CATALOG NUMBER	BODY/DOOR STEEL GAUGE	ENCLOSURE SIZE H X W X D	BACK PANEL CATALOG NUMBER*	DOOR & BOX STIFFENERS	BACK PANEL SIZE A & B	C	E
N412121206C	14/14	12.00x12.00x3.00 (305x305x152)	NP1212C	No	10.2x10.2 (259x259)	6.00 (152)	—
N412161206C	14/14	16.00x12.00x3.00 (406x305x152)	NP1612C	No	14.2x10.2 (361x259)	8.00 (203)	—
N412161606C	14/14	16.00x16.00x3.00 (406x406x152)	NP1616C	No	14.2x14.2 (361x361)	8.00 (203)	—
N412162006C	14/14	16.00x20.00x3.00 (406x508x152)	NP2016C	No	14.2x18.2 (361x462)	8.00 (203)	—
N412201606C	14/14	20.00x16.00x3.00 (508x406x152)	NP2016C	No	18.2x14.2 (462x361)	10.00 (254)	—
N412202006C	14/14	20.00x20.00x3.00 (508x508x152)	NP2020C	No	18.2x18.2 (462x462)	10.00 (254)	—
N412241606C	14/14	24.00x16.00x3.00 (610x406x152)	NP2416C	No	22.2x14.2 (564x361)	12.00 (305)	—
N412242006C	14/14	24.00x20.00x3.00 (610x508x152)	NP2420C	No	22.2x18.2 (564x462)	12.00 (305)	—
N412242406C	14/14	24.00x24.00x3.00 (610x610x152)	NP2424C	No	22.2x22.2 (564x564)	4.00 (102)	16.00 (406)
N412161208C	14/14	16.00x12.00x8.00 (406x305x203)	NP1612C	No	14.2x10.2 (361x259)	8.00 (203)	—
N412161608C	14/14	16.00x16.00x8.00 (406x406x203)	NP1616C	No	14.2x14.2 (361x361)	8.00 (203)	—
N412162008C	14/14	16.00x20.00x8.00 (406x508x203)	NP2016C	No	14.2x18.2 (361x462)	8.00 (203)	—
N412201608C	14/14	20.00x16.00x8.00 (508x406x203)	NP2016C	No	18.2x14.2 (462x361)	10.00 (254)	—
N412241608C	14/14	24.00x16.00x8.00 (610x406x203)	NP2416C	No	22.2x14.2 (564x361)	12.00 (305)	—
N412202008C	14/14	20.00x20.00x8.00 (508x508x203)	NP2020C	No	18.2x18.2 (462x462)	10.00 (254)	—
N412242008C	14/14	24.00x20.00x8.00 (610x508x203)	NP2420C	No	22.2x18.2 (564x462)	12.00 (305)	—
N412302008C	14/14	30.00x20.00x8.00 (762x508x203)	NP3020C	No	28.2x18.2 (716x462)	4.00 (102)	22.00 (559)
N412202408C	14/14	20.00x24.00x8.00 (508x610x203)	NP2420C	No	18.2x22.2 (462x564)	10.00 (254)	—

Continued on next page

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**N412C ULTIMATE SERIES ENCLOSURES
NEMA 4 & 12 SINGLE DOOR WALL-MOUNT**

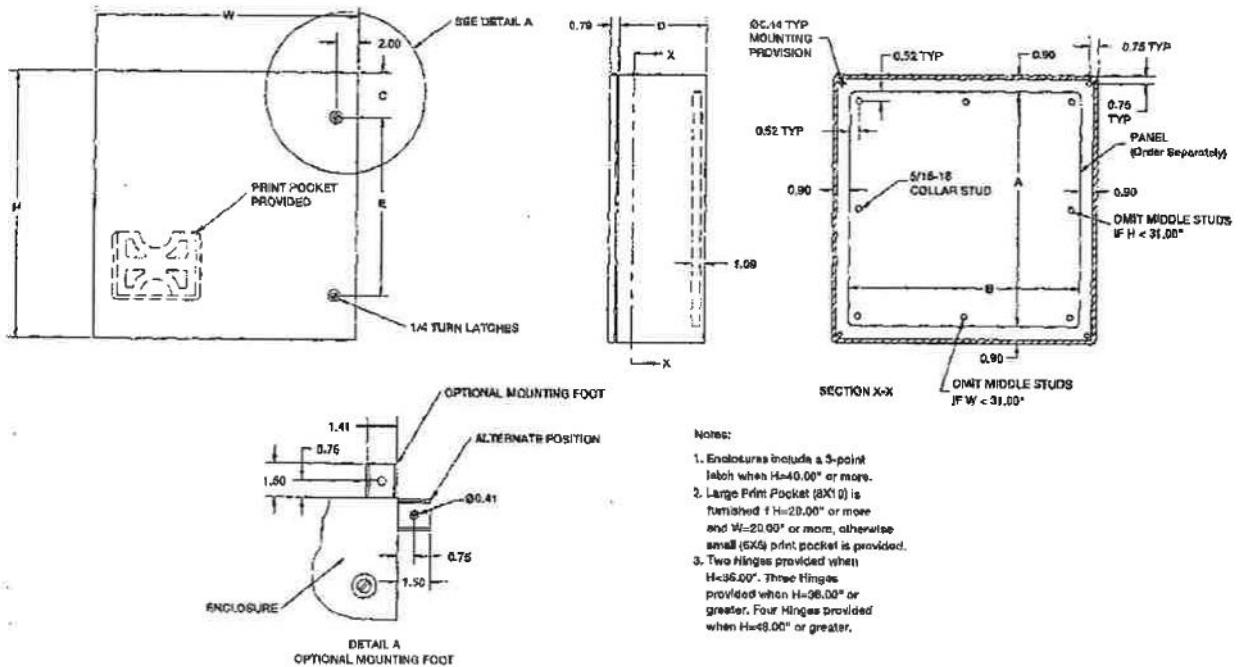
NEW PRODUCT

N412C ULTIMATE SERIES SINGLE DOOR ENCLOSURES (CONT.)							
CATALOG NUMBER	BODY/DOOR STEEL GAUGE	ENCLOSURE SIZE H X W X D	BACK PANEL CATALOG NUMBER*	DOOR & BOX STIFFENERS	BACK PANEL SIZE A & B	C	E
N412242408C	14/14	24.00x24.00x8.00 (810x810x203)	NP2424C	No	22.2x22.2 (564x564)	4.00 (102)	16.00 (406)
N412302408C	14/14	30.00x24.00x8.00 (762x810x203)	NP3024C	No	28.2x22.2 (716x564)	4.00 (102)	22.00 (559)
N412362408C	14/14	36.00x24.00x8.00 (914x810x203)	NP3624C	No	34.2x22.2 (869x564)	4.00 (102)	28.00 (711)
N412243008C	14/14	24.00x30.00x8.00 (810x762x203)	NP3024C	No	22.2x28.2 (564x716)	4.00 (102)	16.00 (406)
N412303008C	14/14	30.00x30.00x8.00 (762x762x203)	NP3030C	No	28.2x28.2 (716x716)	4.00 (102)	22.00 (559)
N412363008C	14/14	36.00x30.00x8.00 (914x762x203)	NP3630C	No	34.2x28.2 (869x716)	4.00 (102)	28.00 (711)
N412303608C	14/14	36.00x36.00x8.00 (914x914x203)	NP3636C	No	34.2x34.2 (869x869)	4.00 (102)	28.00 (711)
N412202012C	14/14	20.00x20.00x12.00 (508x508x305)	NP2020C	No	18.2x18.2 (462x462)	10.00 (254)	—
N412242012C	14/14	24.00x20.00x12.00 (610x508x305)	NP2420C	No	22.2x18.2 (564x462)	12.00 (305)	—
N412242412C	14/14	24.00x24.00x12.00 (610x610x305)	NP2424C	No	22.2x22.2 (564x564)	4.00 (102)	16.00 (406)
N412302412C	14/14	30.00x24.00x12.00 (762x610x305)	NP3024C	No	28.2x22.2 (716x564)	4.00 (102)	22.00 (559)
N412363012C	14/14	36.00x30.00x12.00 (914x762x305)	NP3630C	No	28.2x28.2 (716x716)	4.00 (102)	22.00 (559)
N412362412C	14/14	36.00x24.00x12.00 (914x610x305)	NP3624C	No	34.2x22.2 (869x564)	4.00 (102)	28.00 (711)
N412402412C	14/14	40.00x24.00x12.00 (1016x610x305)	NP4024C	No	38.2x22.2 (970x564)	20.00 (508)	—
N412363012C	14/14	36.00x36.00x12.00 (914x914x305)	NP3636C	No	34.2x28.2 (869x716)	4.00 (102)	28.00 (711)
N412363612C	14/14	36.00x36.00x12.00 (914x914x305)	NP3636C	No	34.2x34.2 (869x869)	4.00 (102)	28.00 (711)
N412423612C	14/14	42.00x36.00x12.00 (1067x914x305)	NP4236C	No	40.2x34.2 (1021x869)	21.00 (533)	—
N412482412C**	14/14	48.00x24.00x12.00 (1219x610x305)	NP4824C	No	46.2x22.2 (1173x564)	24.00 (610)	—
N412483612C**	14/14	48.00x36.00x12.00 (1219x914x305)	NP4836C	No	46.2x34.2 (1173x869)	24.00 (610)	—
N412603012C**	14/14	60.00x36.00x12.00 (1524x914x305)	NP6036C	No	58.2x34.2 (1478x869)	30.00 (762)	—
N412242416C**	14/14	24.00x24.00x16.00 (810x810x408)	NP2424C	No	22.2x22.2 (564x564)	4.00 (102)	16.00 (406)
N412363016C**	14/14	36.00x30.00x16.00 (914x762x408)	NP3630C	No	34.2x28.2 (869x716)	4.00 (102)	28.00 (711)
N412483616C**	14/14	48.00x36.00x16.00 (1219x914x408)	NP4836C	No	46.2x34.2 (1173x869)	24.00 (610)	—
N412242420C**	14/14	24.00x24.00x20.00 (610x610x508)	NP2424C	No	22.2x22.2 (564x564)	4.00 (102)	16.00 (406)
N412302420C**	14/14	30.00x24.00x20.00 (762x610x508)	NP3024C	No	28.2x22.2 (716x564)	4.00 (102)	22.00 (559)
N412363020C**	14/14	36.00x30.00x20.00 (914x762x508)	NP3630C	No	34.2x28.2 (869x716)	4.00 (102)	28.00 (711)

← NEW PRODUCT IN 2004

*Back panels must be ordered separately.

**Enclosures are supplied with closed cell neoprene gasket (not foam-in-place).



DATA SUBJECT TO CHANGE WITHOUT NOTICE

Finite® Instrumentation and Gas Sampling Filters

Instrumentation
and Steam Filter

Finite's instrumentation and point-of-use product line offers compressed air/gas filtration solutions for food processing, medical, chemical processing, and compressed natural gas applications.

Typical installations include contaminant removal for breathing air, protection of gas analyzers and prefilters for instrument air dryers.



Our UNI-CAST element technology allows us to vacuum form high-efficiency particulate and coalescing filter elements. Our elements are designed with high void

volumes to provide longer element life while yielding lower pressure drops.

Made directly from the highest quality microglass fibers available, **Finite's** elements are constructed in 5 porosity grades and 9 media types to meet nearly all compressed air/gas applications.

Finite's instrumentation filter housings are carefully engineered to meet critical application specifications. A complete line of stainless steel housings are available with a variety of pressure ratings

and flows for corrosive applications. Combination aluminum head/nylon bowl assemblies are offered for lower operating pressures and temperatures, while disposable plastic in-lines are offered for low flow and OEM applications.

If you have a specific need or are unable to find the compressed air/gas filter your application requires, call us!

How to select your Finite® Filter...

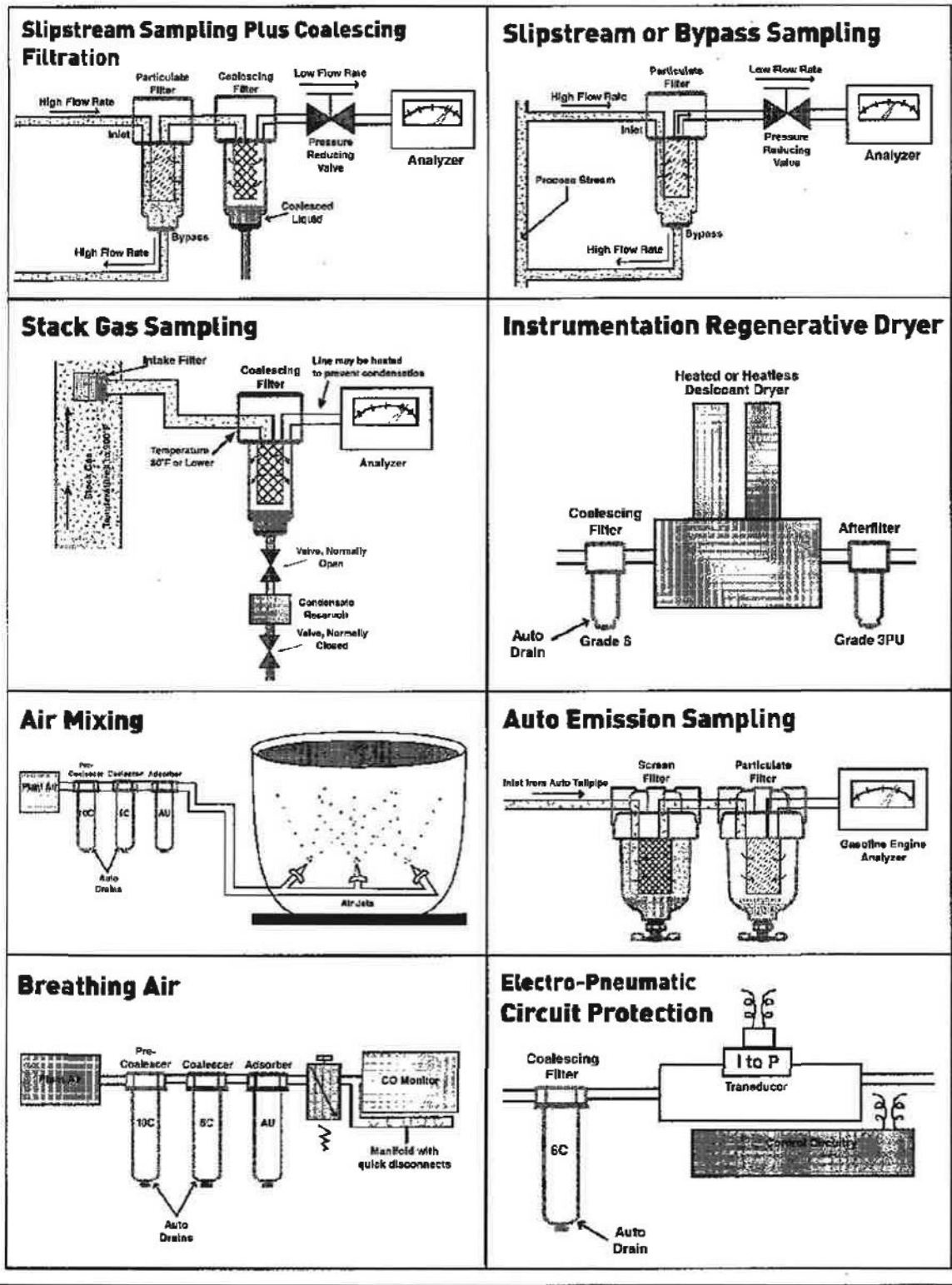
The following steps will help you to choose the correct filter for your application. If there are other factors involved or if you have special requirements, call Finite's technical support.

1. Evaluate the requirements of your application. The sketches on page 49 depict popular Examples of gas sampling, process filtration, instrument air and breathing air applications.
2. What type of filtration is needed? (See pages 50-51) Coalescing filter media remove solid and liquid contaminants from gas streams. Particulate filter media removes solids from gas streams. Adsorbent media removes hydrocarbon vapors from gas streams.
3. Are you searching for a specific micron rating ... or efficiency rating? If so, page 51 provides a complete breakdown of **Finite's** filter media grades and their performance specifications.
4. What are the operating conditions of your application? Key criteria to consider: flow, pressure, materials of construction ... stainless steel, nylon, aluminum, etc. Pages 52-53 provide detailed descriptions of the various products available.
5. Sizing - The flow chart on pages 59-60 lists the flow rates (SCFM) at various operating pressures. Filters are available with flows up to 3366 SCFM and pressure ratings up to 5000 PSIG.



Finite® Instrumentation Applications

Instrumentation and Steam Filter



Finite Media Types, Grades and Efficiencies

Coalescing elements:

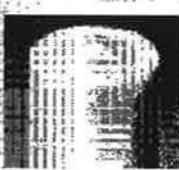
Coalescing elements are specially designed for the removal of liquid contaminants from gaseous flows. These media types flow from the inside of the element to the outside. Coalesced liquid (water and oil) collects in the bowl where it is drained, while clean air or gas exits the housing through the outlet port. Particulate contaminants are captured and held in the media.

Water Separator element:



Type C

Finite element composed of an expanded borosilicate glass mesh. The mesh is contained in a rigid plastic housing. This element is used in applications with low or constant flow rates.



Type H

Coalescing element similar to type 'C', however no rigid retainer is used. Typically used in applications with low or constant flow rates.



Type Q

Finite element with a metal housing. The mesh is contained in a rigid plastic housing. This element is used in applications with low or constant flow rates.



Type 7CVP

Coalescing element made of pleated glass media. Metal retained for added strength. Includes metal end caps and fluorocarbon gaskets for proper sealing. Only available in grade 7.



Type 100WS

Finite stainless steel mesh element used for water separation. This element is used in applications with low or constant flow rates.

Grade 4 → Grade 6

Grade 7CVP Grade 8

Grade 10

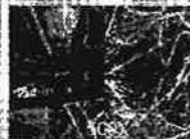
Media Grades



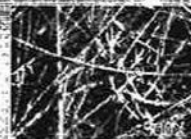
Grade 4 filter elements are very high efficiency coalescers for elevated pressures or lighter weight gases. Recommended when system pressure exceeds 500 PSIG.



Grade 6 filter elements are used when total removal of liquid aerosols and suspended fines is required. Because of its overall performance characteristics, this grade is most often recommended below 500 PSIG.



Grade 7CVP filter elements are made with two layers. The inner layer (left) effectively traps dirt particles, protecting and extending the life of the outer layer. The coalescing outer layer (right) consists of a dense matrix of glass fibers, providing highly efficient aerosol removal.



Grade 8 filter elements provide high efficiency filtration in combination with high flow rate and long element life.



Grade 10 filters are used as prefilters for grade 6 to remove gross amounts of aerosols or tenacious aerosols which are difficult to clean. This grade is often used as a coarse coalescer.

Particulate elements:

Particulate filters such as G, F, T and 3P flow from the outside of the element to the inside. Particles collect in the element, while the clean air exits through the outlet port.



Type 3P

Pleated cellulose particulate removal element. Includes molded elastomeric end seals (3PE). Some models offer the option of metal end caps and fluorocarbon gaskets.



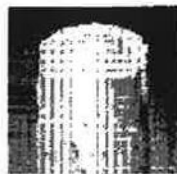
Type G

Particulate removal element constructed of the same fiber matrix as type 'C', but with no rigid retainer or drain layer.



Type F

Particulate removal element like 'C' tube, except fluidic seals, saturant replaces epoxy.



Type T

Particulate removal element like 'G' tube, except high temperature fluorocarbon saturant replaces epoxy.



Type A

Hydrocarbon vapor removal element. Ultrafine grained, highly concentrated activated carbon (see media) includes molded elastomeric end seals (A/E). Some models offer the option of metal end caps and fluorocarbon gaskets.

Finite[®] media grades and specifications

Finite media grades determine the filtration efficiency. Specific efficiency values available up to 99.999% at micron ratings range from 0.01 to 3 microns. The column shows weight retention on the wet and dry pressure drops.

Media Grade	Coalescing Efficiency 0.5 to 0.8 Microns Particles	Coalescing Filters - C, H, G, F, CVF Maximum Oil Capacity per PSI/m ²	Particulate Filters - 3P, G, F, T Micron Rating	Pressure Drop (PSID) @ Rate Flow	
				Media Wet Weib	Media Dry Weib
4	99.995%	0.03	0.01	0.25	3-4
6	99.995%	0.03	0.01	0.25	2-3
7CVF	99.5%	0.03	0.05	0.25	0.5-0.8
8	98.5%	0.03	0.05	0.25	0.5-0.8
10	95%	0.03	0.05	0.25	0.5-0.8
10CVF/5	N/A	N/A	1/2" Nominal	0.25	N/A
3P	N/A	N/A	3/4" Nominal	0.25	N/A
3P-A	95%	N/A	3/4" Nominal	0.25	N/A

Grade 3P



Three micron pleated cellulose filters are used for particulate interception where very high dirt holding capacity and a relatively fine pore structure are required.

Grade A

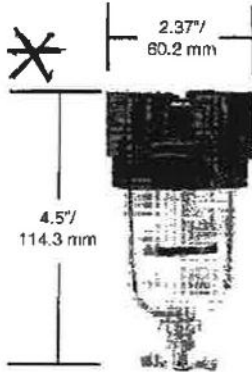


A (Adsorption) filters are used to remove hydrocarbon vapor, most typically in preparation for breathing air. (Must be preceded by grade 6C coalescer.)

Tested per ADS-100 at 40 in. H₂O.
 Add 1/2" wet for total pressure drop.
 Oil vapor removal efficiency is given for A media.

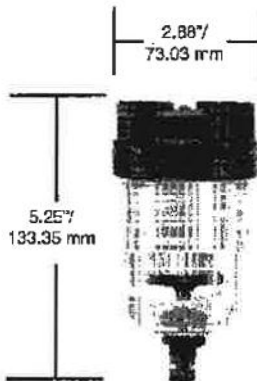
Compact Nylon Filter With Clear Bowl

Instrumentation
and Steam Filter



Application: KN1S and KN5S filters are an economical way to provide high-efficiency filtration for protection of emission analyzers, air-logic systems and low-flow point-of-use pneumatic components. Includes manual, tee-valve drain. (1/8" NPT port)

Nylon Filter With Clear Bowl



Application: The P1N offers economical high efficiency filtration for point-of-use, instrument systems or OEM circuit protection. The P1N is also used when sump and element visibility are required. Includes manual twist drain.

How to Order:

P 1 N — 10-025
 Media Media Element Size
 Grade Type
 Leave blank for G
 3PU and AU T
 4 F
 6 H
 8 C
 10 CU
 QU
 3PU
 AU

For Example: P1N-4QU10-025 for complete assembly, including element.
 P1NX 1 for an empty housing.

Specifications:

Model Number	Part Size (NPT)	Max. Pressure	Max. Temp (Element Type)	Materials of Construction Head	Materials of Construction Internals	Bowl	Seals	Shipping Weight
KN5S, KN1S	1/8", 1/4"	150 PSIG/ 10 bar	125°F (All media types)	Glass Filled Nylon	Acetal Plastic, Steel	Clear Polyurethane	Buna N	.3 lbs./ .14 kgs.
P-N	1/4"	100 PSIG/ 7 bar	125°F (All media types)	Acetal Plastic	Acetal Plastic, Stainless Steel	Clear Polyurethane	Buna N	.49 lbs./ .22 kgs.



GENIE®

membrane separator

Model 101



U.S. Patent 5,476,586

Applications

- Protection against liquids
- On-line and portable analyzers
- GC's, Mass Specs, O₂, H₂S, Moisture, and others
- Spot, composite, or continuous gas sampling in any process industry including natural gas, petrochemical, and oil refining

Benefits

- Superior analyzer protection
- Helps preserve sample integrity
- Economical
- Improves analyzer reliability
- Reduces analyzer maintenance

Features

- Genie® Membrane Technology™
- Low internal volume
- MRP and Liquid Block™ can be retrofitted
- Universal Assembly option

Quick Study

The Series 100 Genie® Membrane Separators™ remove 100% of entrained liquid and particulate in gas samples, which allows only gas sample to flow to analyzers. This action protects analyzers and sample system components against liquid damage. The original Genie® Series 100 models are available in several body styles with different membrane types to accommodate a wide variety of applications. The Genie® Supreme Series™ 100 models accommodate the same applications, yet they offer an improved housing design for easy maintenance and the innovative Liquid Block Technology™ that prevents liquid from being forced across the membrane should sample line pressure conditions become upset.

The Model 101 protects gas sample systems with relatively low sample flow requirements and small amounts of liquid present on a continuous basis. It is comparable to the Genie® Supreme Series™ Model 120 and offers a 1" diameter membrane, ideal for removing liquid aerosol or droplets from gas samples; it is also perfect for protecting components such as on-line analyzers, gas chromatographs, or BTU analyzers. Please note that special assemblies may be ordered, such as a Universal Assembly or Liquid Block™ retrofit. Additional information such as Application Notes is available.

Technical Specifications

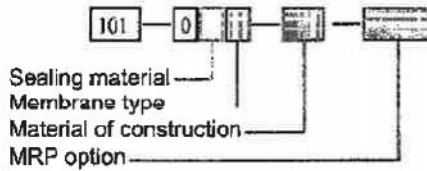
Maximum allowable working pressure	Stainless Steel Polypropylene Kynar	1,000 psig 50 psig 50 psig
Maximum recommended supply pressure	Lowest possible pressure consistent with application* *Must not exceed "Pressure rating" listed above	
Maximum temperature	185 °F (85 °C) for Type 5 & BTU membrane 212 °F (100 °C) for Hi-Flow/Hi-Flow Backed membrane* *Applies to Polypropylene & Kynar housing 302 °F (150 °C) for Hi-Flow/Hi-Flow Backed membrane* *Applies to Stainless Steel housing	
Maximum recommended membrane flow rate (For higher flow rates contact the factory)	1,440 cc/min for Type 5 & BTU membrane* 5,000 cc/min for Hi-Flow/Hi-Flow Backed membrane* *Maximum flow results in approximately 2 psi membrane differential pressure	
Port sizes	Inlet, Outlet, & Bypass: 1/4" female NPT	
Internal volume	Inlet: 0.30 cubic inches Outlet: 0.09 cubic inches	
Wetted materials	Machined parts: 316 stainless steel / NACE compliant All other metal parts: stainless steel / NACE compliant O-ring: Viton® (other materials available upon request) Membrane: Inert	

Model Numbering & Additional Part Numbers

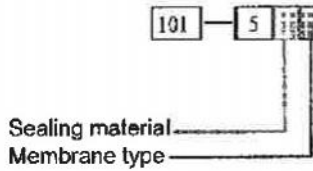
Your model number is determined by your specific needs. Choose options below.

Sealing material	0 = Viton®	1 = Kalrez®	(other materials available upon request)	
Membrane type	2 = Hi-Flow	5 = Type 5	6 = BTU	7 = Hi-Flow Backed
Material of construction	SS = Stainless Steel	PP = Polypropylene	K = Kynar	
MRP option	Blank = No MRP	MRP = MRP [®] Installed		
Mounting bracket accessory	Part # 101-509-SS (sold separately)			

How to build the model number:

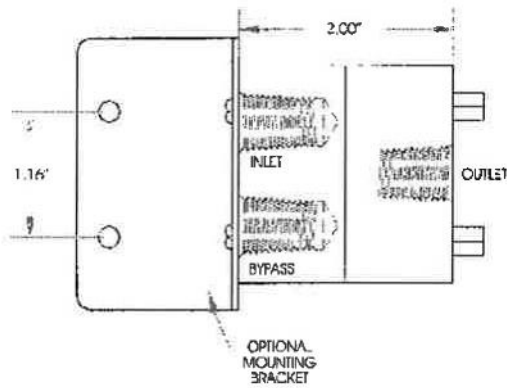


How to build the replacement membrane kit number:

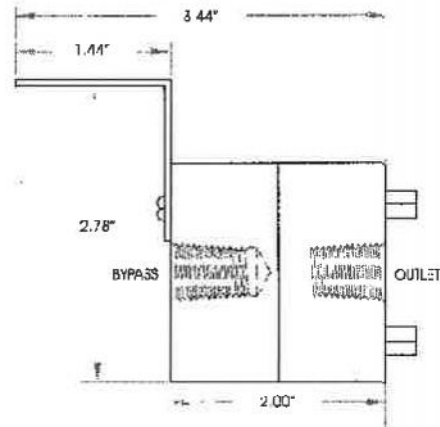


Dimensions

Side View



Top View



Local Distributor:

7520 & 7530 Series

Economical machined cast acrylic block construction makes these meters great for OEM use. Optional inlet metering valve available

Description

Metering Tube
Machined Cast Acrylic

Internal Components
316L Stainless Steel

Inlet/Outlet Fittings
NPT, Horizontal
control valve optional

Fitting Material
Standard: PVC (Brass for 2C
block size)
Optional: 316L Stainless Steel
or Brass

Elastomers
Standard: EPR
Optional: Buna N, Viton, and
Kalrez®

Options

Certified Calibrations
Conform to ISA RP 16.6

Scales
Can be produced in any
volumetric unit



Acrylic Tube

Performance

Capacities
7 GPH to 20 GPM – Water
2.6 SCFH to 60 SCFM – Air

Scale
50mm, 75mm, 100mm, 127mm, 250mm
Direct reading

Accuracy
± 6% of Full Scale Flow, 50 mm scale
± 4% of Full Scale Flow, 75 mm scale
± 4% of Full Scale Flow, 100 mm scale
± 7% of Full Scale Flow, 6C-04, 6C-06
± 3% of Full Scale Flow, 127 mm scale
± 2% of Full Scale Flow, 250 mm scale

Turndown
10:1 to 12.5:1 unless otherwise indicated

Repeatability
3%, 50 mm scale
2%, 75 mm scale
2%, 100 mm scale
4%, 6C-04, 6C-06
2%, 127 mm scale
1/2%, 250 mm scale

Max Temperature
130° F (54° C) - Liquid
100° F (38° C) - Gases

Max Pressure
Water – 125 psig
Air – 100 psig

Ambient Temperature
33° F to 125° F (1° C to 52° C)

Materials Of Construction

Model #	7520	7520	7530	7530
Block #	2C	3C, 5C, 6C & 7C	2C	3C, 5C, 6C & 7C
Meter Tube	Cast Acrylic	Cast Acrylic	Cast Acrylic	Cast Acrylic
Fittings	PVC Brass* 316L SS	PVC* Brass 316L SS	PVC* Brass* 316L SS	PVC* Brass 316L SS
O-Rings	EPR* Buna-N Viton®	EPR* Buna-N Viton®	EPR* Buna-N Viton®	EPR* Buna-N Viton®
Valve Assembly	Not Available	Not Available	Brass* 316L SS	Brass* 316L SS

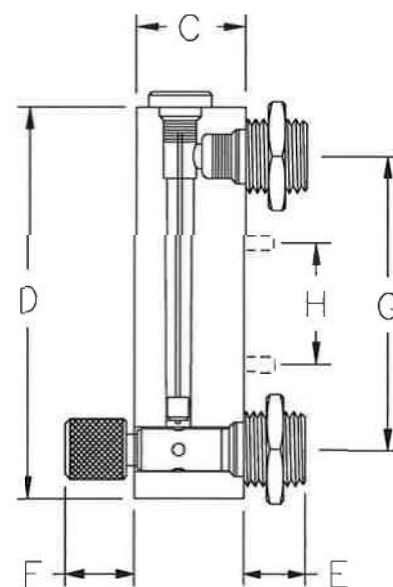
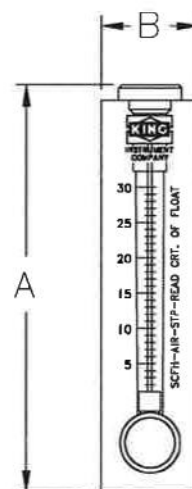
*Denotes standard construction

7520 & 7530 Series

Acrylic Tube

Specifications:

Order Number	Flow Water	Order Number	Flow Air	Dimensions (Inches)						
				A	B	C	D	E	F	G
Block #2C, 50mm (2 Inch) Scale										
-	-	2C-01	2.6 SCFH	4.125	1	1.25	4	.50	1.125	3
-	-	2C-03	5 SCFH	4.125	1	1.25	4	.50	1.125	3
-	-	2C-05	10 SCFH	4.125	1	1.25	4	.50	1.125	3
-	-	2C-07	20 SCFH	4.125	1	1.25	4	.50	1.125	3
2C-02	7 GPH	2C-09	30 SCFH	4.125	1	1.25	4	.50	1.125	3
2C-04	12 GPH	2C-11	60 SCFH	4.125	1	1.25	4	.50	1.125	3
2C-06	22 GPH	2C-13	100 SCFH	4.125	1	1.25	4	.50	1.125	3
2C-08	44 GPH	2C-15	180 SCFH	4.125	1	1.25	4	.50	1.125	3
2C-10	60 GPH	2C-17	4 SCFM	4.125	1	1.25	4	.50	1.125	3
2C-12	75 GPH	-	-	4.125	1	1.25	4	.50	1.125	3
Block #3C, 75mm (3 Inch) Scale										
3C-02	1 GPM	3C-01	4 SCFM	6.812	1.25	1.375	6.625	1	1.25	5
3C-04	2 GPM	3C-03	8 SCFM	6.812	1.25	1.375	6.625	1	1.25	5
3C-06	3.5 GPM	3C-05	15 SCFM	6.812	1.25	1.375	6.625	1	1.25	5
3C-08	5 GPM	3C-07	23 SCFM	6.812	1.25	1.375	6.625	1	1.25	5
Block #5C, 127mm (5 Inch) Scale										
5C-10	10 GPH	5C-11	42 SCFH	8.375	1.25	1.375	8.25	1	1.25	6.437
5C-12	20 GPH	5C-13	100 SCFH	8.375	1.25	1.375	8.25	1	1.25	6.437
5C-14	40 GPH	5C-15	175 SCFH	8.375	1.25	1.375	8.25	1	1.25	6.437
5C-02	1 GPM	5C-01	4 SCFM	8.375	1.25	1.375	8.25	1	1.25	6.437
5C-04	100 GPH	5C-03	6.8 SCFM	8.375	1.25	1.375	8.25	1	1.25	6.437
5C-06	2 GPM	5C-05	8.2 SCFM	8.375	1.25	1.375	8.25	1	1.25	6.437
5C-08	5 GPM	5C-07	22 SCFM	8.375	1.25	1.375	8.25	1	1.25	6.437
Block #6C, 100mm (4 Inch) Scale										
6C-02	10 GPM	6C-01	40 SCFM	9.125	1.75	1.812	8.875	1.25	1.875	6.50
6C-04	15 GPM	6C-03	60 SCFM	9.125	1.75	1.812	8.875	1.25	1.875	6.50
6C-06	20 GPM	-	-	9.125	1.75	1.812	8.875	1.25	1.875	6.50
Block #7C, 250mm (10 Inch) Scale										
7C-02	2 GPM	7C-01	8 SCFM	14.50	1.75	1.812	14.25	.75	1.875	12.25
7C-04	3.5 GPM	7C-03	14.4 SCFM	14.50	1.75	1.812	14.25	.75	1.875	12.25
7C-06	5 GPM	7C-05	20 SCFM	14.50	1.75	1.812	14.25	.75	1.875	12.25
7C-08	10 GPM	7C-07	42 SCFM	14.50	1.75	1.812	14.25	.75	1.875	12.25



(FULL OPEN)

Connections & Mounting

Block Number	Connection Size	Centerline H	Thread J	Diameter
				L
2C	1/4" FNPT	-	-	0.625
3C	1/2" MNPT x 1/4" FNPT	3	.25 - 20	1
5C	1/2" MNPT x 1/4" FNPT	3.937	.25 - 20	1
6C	1" MNPT	4	.25 - 20	1.375
7C	1/2" FNPT	8.75	.375 - 24	1.25

Block 2C is supplied with .875" hex mounting nuts on plumbing connections. Blocks 3C, 5C, 6C and 7C have mounting studs depicted in dimension "H" and thread "J".

Ordering:

Use the following guide to determine the specific product number you require.



Meter Series	Fitting Material	O-Ring Material	Valve Material	Order Number
7520 No valve	Brass - 1	EPR - 1	Brass - 1	See Specifications Table
7530 With valve	PVC - 2	Buna-N - 2	316L SS - 2	
	316L SS - 3	Viton® - 3	Without Valve - 0	

Example: 7520 - 1 - 1 - 0 - 5C06

Instruction Manual

IMR01J01-E5

Thank you for purchasing this RKC product. In order to achieve maximum performance and ensure proper operation of your new instrument, carefully read all the instructions in this manual. Please place the manual in a convenient location for easy reference.

SYMBOLS

WARNING : This mark indicates precautions that must be taken if there is danger of electric shock, fire, etc., which could result in loss of life or injury.

CAUTION : This mark indicates that if these precautions and operating procedures are not taken, damage to the instrument may result.



: This mark indicates that all precautions should be taken for safe usage.



: This mark indicates important information on installation, handling and operating procedures.



: This mark indicates supplemental information on installation, handling and operating procedures.



: This mark indicates where additional information may be located.



WARNING

- To prevent injury to persons, damage to instrument and equipment, a suitable external protection device shall be required.
- All wiring must be completed before power is turned on to prevent electric shock, fire or damage to instrument and equipment.
- This instrument must be used in accordance with the specifications to prevent fire or damage to instrument and equipment.
- This instrument is not intended for use in locations subject to flammable or explosive gases.
- Do not touch high-voltage connections such as power supply terminals, etc. to avoid electric shock.
- RKC is not responsible if this instrument is repaired, modified or disassembled by other than factory-approved personnel. Malfunction can occur and warranty is void under these conditions.

CAUTION

- This product is intended for use with industrial machines, test and measuring equipment. (It is not designed for use with medical equipment and nuclear energy.)
- This is a Class A instrument. In a domestic environment, this instrument may cause radio interference, in which case the user may be required to take additional measures.
- This instrument is basic insulation between the power supply and the input/output. Provide reinforced insulation between the wire for the input signal and the wires for instrument power supply, source of power and loads.
- Be sure to provide an appropriate surge control circuit respectively for the following:
 - If input/output or signal lines within the building are longer than 30 meters.
 - If input/output or signal lines leave the building, regardless the length.

- This instrument is designed for installation in an enclosed instrumentation panel. All high-voltage connections such as power supply terminals must be enclosed in the instrumentation panel to avoid electric shock by operating personnel.
- All precautions described in this manual should be taken to avoid damage to the instrument or equipment.
- All wiring must be in accordance with local codes and regulations.
- All wiring must be completed before power is turned on to prevent electric shock, instrument failure, or incorrect action. The power must be turned off before repairing work for input break and output failure including replacement of sensor, contactor or SSR, and all wiring must be completed before power is turned on again.
- To prevent instrument damage as a result of failure, protect the power line and the input/output lines from high currents with a suitable overcurrent protection device with adequate breaking capacity such as a fuse, circuit breaker, etc.
- Prevent metal fragments or lead wire scraps from falling inside instrument case to avoid electric shock, fire or malfunction.
- Tighten each terminal screw to the specified torque found in the manual to avoid electric shock, fire or malfunction.
- For proper operation of this instrument, provide adequate ventilation for heat dispensation.
- Do not connect wires to unused terminals as this will interfere with proper operation of the instrument.
- Turn off the power supply before cleaning the instrument.
- Do not use a volatile solvent such as paint thinner to clean the instrument. Deformation or discoloration will occur. Use a soft, dry cloth to remove stains from the instrument.
- To avoid damage to instrument display, do not rub with an abrasive material or push front panel with a hard object.
- Do not connect modular connectors to telephone line.
- When high alarm with hold action/re-hold action is used for Alarm function, alarm does not turn on while hold action is in operation. Take measures to prevent overheating which may occur if the control device fails.

NOTICE

- This manual assumes that the reader has a fundamental knowledge of the principles of electricity, process control, computer technology and communications.
- The figures, diagrams and numeric values used in this manual are only for purpose of illustration.
- RKC is not responsible for any damage or injury that is caused as a result of using this instrument, instrument failure or indirect damage.
- RKC is not responsible for any damage and/or injury resulting from the use of instruments made by imitating this instrument.
- Periodic maintenance is required for safe and proper operation of this instrument. Some components have a limited service life, or characteristics that change over time.
- Every effort has been made to ensure accuracy of all information contained herein. RKC makes no warranty expressed or implied, with respect to the accuracy of the information. The information in this manual is subject to change without prior notice.
- No portion of this document may be reprinted, modified, copied, transmitted, digitized, stored, processed or retrieved through any mechanical, electronic, optical or other means without prior written approval from RKC.

1. PRODUCT CHECK

SA100□□□□ - □□ - □ * □□ - □□/□□/□
 (1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11)

(1) Control action

- F: PID action with autotuning (Reverse action)
- D: PID action with autotuning (Direct action)
- W: Heat/Cool PID action with autotuning (Water cooling)
- A: Heat/Cool PID action with autotuning (Air cooling)

(2) Input type/Range code

Refer to 10. INPUT RANGE TABLES.

(3) Output 1 (Control output, Alarm output or Transmission output)

- M: Relay contact output
- V: Voltage pulse output
- 7: Current output (0 to 20 mA DC)
- 8: Current output (4 to 20 mA DC)

(4) Output 2 (Control output or Alarm output)

- N: No output
- M: Relay contact output
- V: Voltage pulse output

(5) Power supply voltage

- 3: 24 V AC/DC
- 4: 100 to 240 V AC

(6) Alarm 1 (ALM1) and (7) Alarm 2 (ALM2)

- N: No alarm
- H: Process high alarm
- A: Deviation high alarm
- J: Process low alarm
- B: Deviation low alarm
- K: Process high alarm¹
- C: Deviation high/low alarm
- L: Process low alarm¹
- D: Band alarm
- R: Control loop break alarm²
- E: Deviation high alarm¹
- V: SV high alarm
- F: Deviation low alarm¹
- W: SV low alarm
- G: Deviation high/low alarm¹

(8) Optional function

- N: No function
- D: Contact input (RUN/STOP, STEP)
- 5: RS-485 (RKC communication)
- 6: RS-485 (Modbus)

(9) Waterproof/Dustproof

- N: No Waterproof/Dustproof
- 1: Waterproof/Dustproof

(10) Output assignment code

No symbol: Standard output³

- 03: PID action + ALM1
[OUT1: Control output OUT2: ALM1 output⁴]
- 04: PID action + ALM1, ALM2
[OUT1: Control output OUT2: AND output of ALM1 and ALM2⁵]
- 05: PID action + ALM1, ALM2
[OUT1: Control output OUT2: OR output of ALM1 and ALM2⁴]
- 06: PID action + ALM1, ALM2
[OUT1: Control output OUT2: AND output of ALM1 and ALM2⁴]
- 07: PID action + ALM1, ALM2 or ALM1 only
[OUT1: Control output OUT2: No output (The alarm state can be checked via communication or by lamp lighting)]
- 08: PID action + ALM1, ALM2
[OUT1: Control output OUT2: ALM1 output⁵
(ALM2 can be checked via communication or by lamp lighting)]
- 09: ALM1 + ALM2
[OUT1: ALM1 output⁵ OUT2: ALM2 output⁵]
- 10: ALM1 + ALM2
[OUT1: ALM1 output⁵ OUT2: ALM2 output⁴]
- 11: ALM1 + ALM2
[OUT1: ALM1 output⁴ OUT2: ALM2 output⁴]
- 12: Transmission output + PID action
[OUT1: Transmission output OUT2: Control output]
- 13: Transmission output + ALM1, ALM2
[OUT1: Transmission output OUT2: OR output of ALM1 and ALM2⁵]
- 14: Transmission output + ALM1, ALM2
[OUT1: Transmission output OUT2: OR output of ALM1 and ALM2⁴]
- 15: Transmission output + ALM1, ALM2
[OUT1: Transmission output OUT2: AND output of ALM1 and ALM2⁵]
- 16: Transmission output + ALM1, ALM2
[OUT1: Transmission output OUT2: AND output of ALM1 and ALM2⁴]
- 17: Transmission output + ALM1
[OUT1: Transmission output OUT2: ALM1⁵]
- 18: Transmission output + ALM1
[OUT1: Transmission output OUT2: ALM1⁴]
- 19: Heat/Cool PID action
[OUT1: Cool-side control output OUT2: Heat-side control output]

¹With hold action

²LBA can be selected for only ALM1.

³PID action:

OUT1: Control output,
OUT2: No alarm, ALM1 (Energized), or OR output of ALM1 and ALM2 (Energized)

Heat/Cool PID action:
OUT1: Heat-side control output, OUT2: Cool-side control output

⁴De-energized

⁵Energized

(11) Version symbol

No code: For Japanese domestic market /Y: For International market

2. MOUNTING



WARNING

To prevent electric shock or instrument failure, always turn off the power before mounting or removing the instrument.

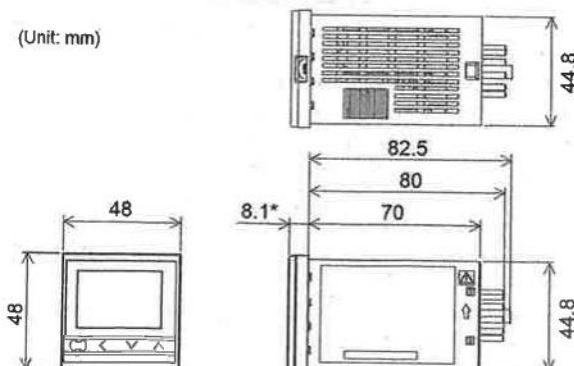
2.1 Mounting Cautions

- (1) This instrument is intended to be used under the following environmental conditions. (IEC61010-1)
[OVERVOLTAGE CATEGORY II, POLLUTION DEGREE 2]
- (2) Use this instrument within the following environment conditions:
 - Allowable ambient temperature: 0 to 50 °C
 - Allowable ambient humidity: 45 to 85 %RH
(Absolute humidity: MAX. W. C 29.3 g/m³ dry air at 101.3 kPa)
 - Installation environment conditions: Indoor use, Altitude up to 2000 m
- (3) Avoid the following when selecting the mounting location:
 - Rapid changes in ambient temperature which may cause condensation.
 - Corrosive or inflammable gases.
 - Direct vibration or shock to the mainframe.
 - Water, oil, chemicals, vapor or steam splashes.
 - Excessive dust, salt or iron particles.
 - Excessive induction noise, static electricity, magnetic fields or noise.
 - Direct air flow from an air conditioner.
 - Exposure to direct sunlight.
 - Excessive heat accumulation.
- (4) Mount this instrument in the panel considering the following conditions:
 - Provide adequate ventilation space so that heat does not build up.
 - Do not mount this instrument directly above equipment that generates large amount of heat (heaters, transformers, semi-conductor functional devices, large-wattage resistors.)
 - If the ambient temperature rises above 50 °C, cool this instrument with a forced air fan, cooler, etc. Cooled air should not blow directly on this instrument.
 - In order to improve safety and the immunity to withstand noise, mount this instrument as far away as possible from high voltage equipment, power lines, and rotating machinery.
High voltage equipment: Do not mount within the same panel.
Power lines: Separate at least 200 mm.
Rotating machinery: Separate as far as possible.
- (5) In case this instrument is connected to a supply by means of a permanent connection, a switch or circuit-breaker shall be included in the installation. This shall be in close proximity to the equipment and within easy reach of the operator. It shall be marked as the disconnecting device for the equipment.

2.2 Dimensions

External dimension

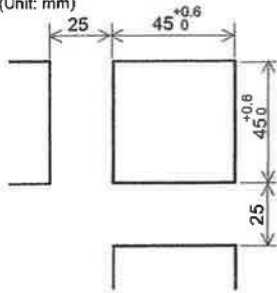
(Unit: mm)



* Waterproof/Dustproof (IP66) type: 9.1 mm

■ Panel cutout

(Unit: mm)



Installation Conditions:
The display cannot be seen from the outside of the visual field range. The visual field range of SA100 is 40° to the upper side, and 30° to the lower side from the center of the display vertically.

For mounting of the SA100, panel thickness must be between 1 to 10 mm.

2.3 Mounting Procedures

■ DIN rail mounting

1. Mounting the socket to the DIN rail. (Fig. 1)
2. Wiring to the socket. Then, mounting the instrument to the socket.
3. Secure the instrument by locking it with the hooks at the top and bottom of the socket. (Fig. 2)

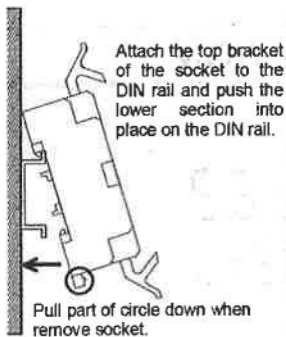


Fig. 1

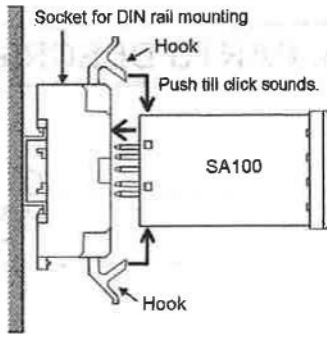
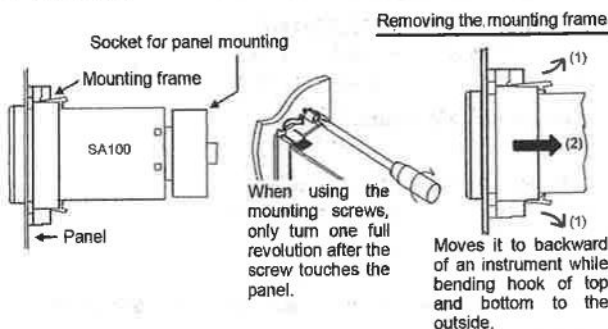


Fig. 2

Please prepare socket with a customer.
Recommended socket for DIN rail mounting:
ATC180041 (Panasonic product)

■ Panel mounting

1. Prepare the panel cutout as specified in 2.2 Dimensions.
2. Insert the instrument through the panel cutout.
3. Insert the mounting frame into the mounting from the rear of the instrument.
4. Push the mounting frame forward until the frame is firmly secured to the panel.
5. Mounting the socket to the instrument.



Please prepare mounting frame and socket with a customer.

Mounting frame type:
KCA100-526 (RKC product, Sold separately)
Recommended socket for panel mounting:
AT78051 (Panasonic product)

The waterproof/dustproof option on the front of the instrument conforms to **IP66** when mounted on the panel. For effective waterproof/dustproof, the gasket must be securely placed between instrument and panel without any gap. If gasket is damaged, please contact RKC sales office or the agent.

3. WIRING

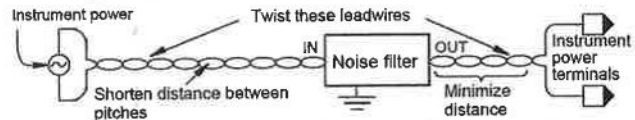


WARNING

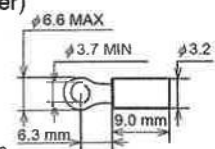
To prevent electric shock or instrument failure, do not turn on the power until all wiring is completed. Make sure that the wiring is correct before applying power to the instrument.

3.1 Wiring Cautions

- For thermocouple input, use the appropriate compensation wire.
- For RTD input, use low resistance lead wire with no difference in resistance between the three lead wires.
- To avoid noise induction, keep input signal wire away from instrument power line, load lines and power lines of other electric equipment.
- Signal connected to Voltage input and Current input shall be low voltage defined as "SELV" circuit per IEC 60950-1.
- If there is electrical noise in the vicinity of the instrument that could affect operation, use a noise filter.
 - Shorten the distance between the twisted power supply wire pitches to achieve the most effective noise reduction.
 - Always install the noise filter on a grounded panel. Minimize the wiring distance between the noise filter output and the instrument power supply terminals to achieve the most effective noise reduction.
 - Do not connect fuses or switches to the noise filter output wiring as this will reduce the effectiveness of the noise filter.

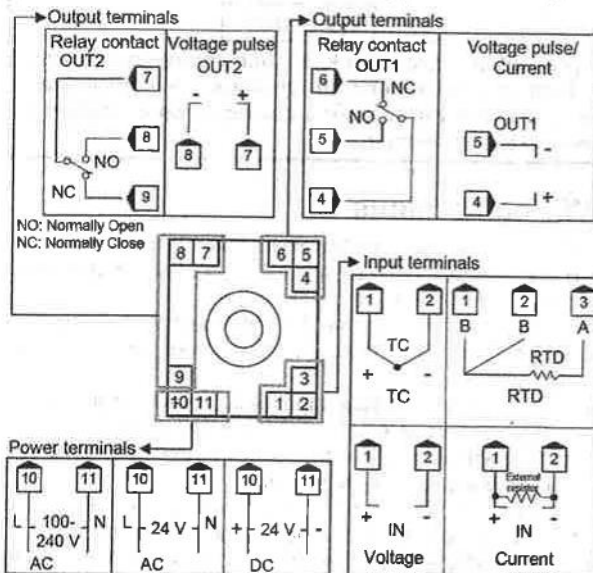


- The instrument has a basic insulation between the power supply and inputs/outputs. Additional Supplementary insulation is required between the mains supply and the mains connections on the SA100 (mains input and relay outputs) by adding a separating safety transformer, providing at least a supplementary insulation for 240 V AC in accordance with IEC/UL/CSA 61010-1.
- Allow approximately 4 seconds for contact output when the instrument is turned on. Use a delay relay when the output line is used for an external interlock circuit.
- Power supply wiring must be twisted and have a low voltage drop.
- This instrument with 24 V power supply is not provided with an overcurrent protection device. For safety install an overcurrent protection device (such as fuse) with adequate breaking capacity close to the instrument.
 - Fuse type: Time-lag fuse
(Approved fuse according IEC60127-2 and/or UL248-14)
 - Fuse rating: Rated current 0.4 A
- For an instrument with 24 V power supply input, supply power from "SELV" circuit defined as IEC 60950-1.
- For the current input specification, a resistor of $250 \Omega \pm 0.02 \%$ (Temperature characteristics: $\pm 10 \text{ ppm}/^\circ\text{C}$, Rated power: 0.25 W or more) must be connected between the input terminals. This resistor must be provided by the customer.
- The input and output terminals for the voltage pulse output/current output are not isolated. Always use an isolating type SSR and operating unit. If the grounded type sensor is used, do not ground output wiring. Do not connect any output wires to the terminals with any other output wires.
- Use the solderless terminal appropriate to the screw size.
 - Screw size:
M3.5 × 7 (with 7.4 × 7.4 square washer)
 - Recommended tightening torque:
0.8 N·m [8 kgf·cm]
 - Specified solderless terminals:
With isolation
 - Applicable wire:
Solid/twisted wire of 0.25 to 1.65 mm²
- Make sure that during field wiring parts of conductors cannot come into contact with adjacent conductive parts.

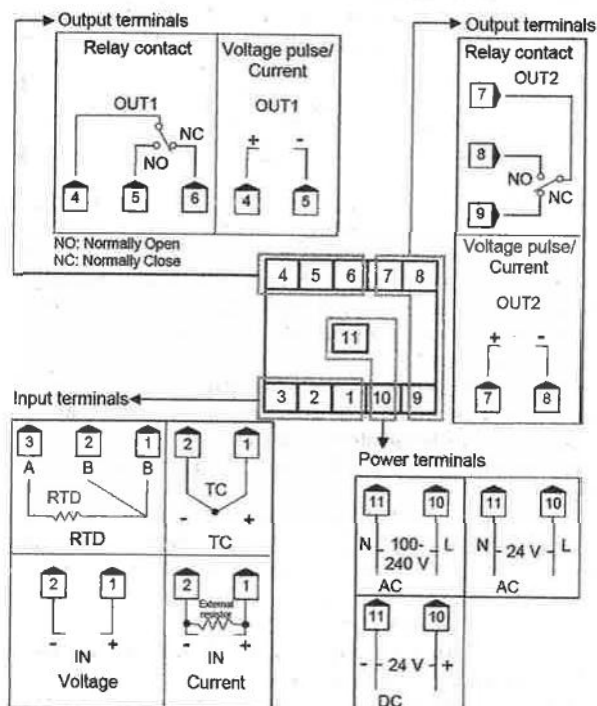


3.2 Terminal Configuration

■ Socket for DIN rail mounting (ATC180041)



■ Socket for panel mounting (AT78051)

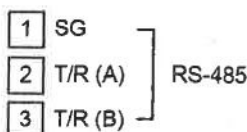


■ Option

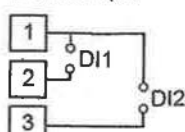
Communication function and contact input are optional. Connect connector to bottom of instrument. A connector and connector cable for connecting the input block is necessary to be prepared by the customer.

Housing: XHP-3 (J.S.T. Mfg. Co., Ltd. product)
Recommended cable size: AWG30 to 22

Communication

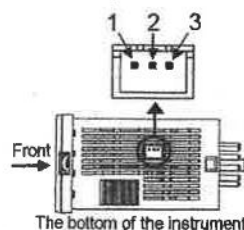


Contact input



DI1: STEP
DI2: RUN/STOP

<Connector position>



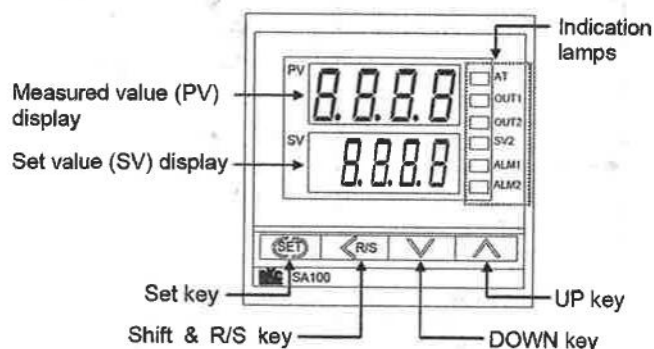
Power supply voltage:

85 to 264 V AC (Power supply voltage range), 50/60 Hz
Rating: 100 to 240 V AC
21.6 to 26.4 V AC (Power supply voltage range), 50/60 Hz
Rating: 24 V AC
21.6 to 26.4 V DC (Power supply voltage range)
Rating: 24 V DC

Power consumption:

4 VA max. (at 100 V AC) 7 VA max. (at 240 V AC)
4 VA max. (at 24 V AC) 100 mA max. (at 24 V DC)

4. PARTS DESCRIPTION



Measured value (PV) display [Green]

Displays PV or various parameter symbols.

Set value (SV) display [Orange]

Displays SV or STEP set value (SV1, SV2).
Displays various parameter set values.

Indication lamps:

Autotuning (AT) lamp [Green]

Flashes during autotuning execution.

Output lamps (OUT1, OUT2) [Green]

OUT1: Lights when output1 is turned on.
OUT2: Lights when output2 is turned on.

STEP set value (SV2) lamp [Orange]

Lights when the SV2 of STEP function is selected.

Alarm lamps (ALM1, ALM2) [Orange]

ALM1: Lights when alarm1 is turned on.
ALM2: Lights when alarm2 is turned on.

Set key

Used for parameter calling up and set value registration.

Shift & R/S key

Shift digits when settings are changed.
Selects the RUN/STOP function.

DOWN key

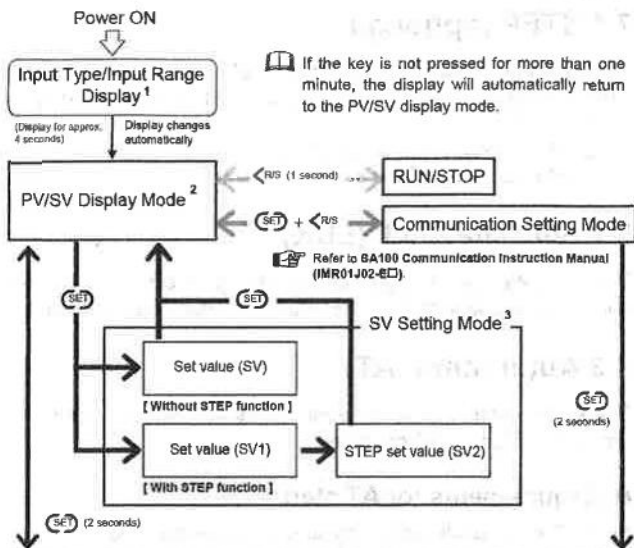
Decrease numerals.

UP key

Increase numerals.

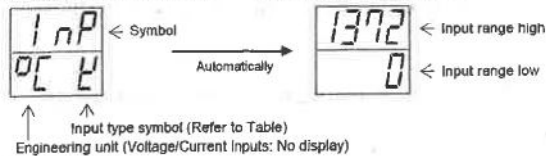
To avoid damage to the instrument, never use a sharp object to press keys.

5. SETTING



1 Input type/Input Range Display

Input type: Thermocouple K Input range: 0 to 1372 °C



Input Type Symbol Table

SYMBOL	K	J	R	S	B	E	T	N	PL II	W5Re	W26Re	U	L	JPt 100	Pt 100	Voltage (Current)
INPUT TYPE																

2 PV/SV Display Mode

The controller will display the measured value (PV) and the set value (SV).

- If the STEP function is provided, the SV display will show the set value (SV1) or STEP set value (SV2) depending on whether the contact input is opened or closed.
- The controller can be switched to RUN or STOP mode.

3 SV Setting Mode

The blinking digit on the SV display indicates which digit can be set.

- Setting range: Within input range
- Factory set value: TC/RTD inputs 0 (0.0) °C [°F], Voltage/Current inputs 0.0 %
- If the STEP function is provided, the following parameter symbols are displayed on the PV.
- Set value (SV1): 5H1 STEP set value (SV2): 5H2

Parameter Setting Mode

LbA	Control loop break alarm (LBA) Setting range: 0.0 to 200.0 minutes (0.0: OFF) Factory set value: 8.0	t	Cool-side proportioning cycle time Setting range: 1 to 100 seconds Factory set value: Relay contact output: 20 Voltage pulse output: 2
Lbd	LBA deadband (LBD) Setting range: 0 to span Factory set value: TC/RTD inputs: 0 (0.0) Voltage/Current inputs: 0.0	Pb	PV bias Setting range: -span to +span (Within -1999 to +9999 digits) Factory set value: TC/RTD inputs: 0 (0.0) Voltage/Current inputs: 0.0
AL1	Alarm 1 (ALM1) Setting range: Process alarm, SV alarm: Same as input range. Deviation alarm: -span to +span (Within -1999 to +9999 digits) Factory set value: TC/RTD inputs: 50 (50.0) Voltage/Current inputs: 5.0	dF	Digital filter Setting range: 0 to 100 seconds (0: OFF) Factory set value: 0
AL2	Alarm 2 (ALM2) Setting range: Process alarm, SV alarm: Same as input range. Deviation alarm: -span to +span (Within -1999 to +9999 digits) Factory set value: TC/RTD inputs: 50 (50.0) Voltage/Current inputs: 5.0	Ro	Analog output specification Item:
ARU	Autotuning (AT) Setting range: on: AT start or execution off: AT end or cancel Factory set value: off	AHS	Analog output scale high Setting range: Measured value (PV): Same as input range Set value (SV): Same as input range Deviation (DEV): -span to +span (Within -1999 to +9999 digits) Manipulated output value (MV): 0.0 to 100.0 % Factory set value: TC/RTD inputs: Input range (high limit) Voltage/Current inputs: 100.0
STU	Self-tuning (ST) Setting range: on: Self-tuning ON off: Self-tuning OFF Factory set value: off	ALS	Analog output scale low Setting range: Measured value (PV): Same as input range Set value (SV): Same as input range Deviation (DEV): -span to +span (Within -1999 to +9999 digits) Manipulated output value (MV): 0.0 to 100.0 % Factory set value: TC/RTD inputs: Input range (low limit) Voltage/Current inputs: 0.0
P	Heat-side proportional band (P) Setting range: 0 to span (9999 digits or less) 0 or 0.0: ON/OFF action Factory set value: TC/RTD inputs: 30 (30.0) Voltage/Current inputs: 3.0	LCU	Set data lock Setting range: 0 (Unlock) 1 (Lock) Factory set value: 0000 Refer to Lock Level Table
I	Integral time (I) Setting range: 0 to 3600 seconds (0: PD action) Factory set value: 240		
d	Derivative time (D) Setting range: 0 to 3600 seconds (0: PI action) Factory set value: 60		
Ar	Anti-reset windup (ARW) Setting range: 0 to 100 % of heat-side proportional band (0: Integral action OFF) Factory set value: 100 %		
r	Heat-side proportioning cycle time Setting range: 1 to 100 seconds Factory set value: Relay contact output: 20 Voltage pulse output: 2		
Pc	Cool-side proportional band Setting range: 1 to 1000 % of heat-side proportional band Factory set value: 100		
db	Overlap/Deadband Setting range: -span to +span (Within -1999 to +9999 digits) Factory set value: TC/RTD inputs: 0 (0.0) Voltage/Current inputs: 0.0		

Symbol	Contents of output
PV	Measured value (PV)*
SV	Set value (SV)
dEV	Deviation (DEV)
MV	Manipulated output value (MV)

* Factory set value

Setting	Lock level
0000	SV and all parameter can be set.
0001	Only SV and alarms can be set.
0010	Only setting items other than alarms can be set.
0100	Only setting items other than SV can be set.
0011	Only SV can be set.
0101	Only alarms can be set.
0110	Only setting items other than SV and alarms can be set.
0111	SV and all parameter cannot be set.

Return to first parameter setting item

Some parameter symbols may not be displayed depending on the specification.

The setting range is from -1999 to +9999 regardless of the position of the decimal point.



Press the **(SET)** key to enter the SV setting mode.



The blinking digit indicates which digit can be set.



Press the **←RS** key to shift digit to the third digit from the right and **^** key to change the numeral to 2.



Pressing the **(SET)** key stores the value settings and the display will automatically return to the PV/SV display mode.

When the set value is changed, it is not automatically stored. To store it, press the **(SET) key.**

When the set data is locked, the digits on the SV display are brightly lit and the set value cannot be changed.

6. OPERATION

6.1 Operating Precautions

All mounting and wiring must be completed before the power is turned on.

Connect the input signal wiring and turn the power on. If the input signal wiring is not complete prior to turning the power on, the instrument determines that burnout has occurred.

The settings for the SV and all parameters should be appropriate for the controlled object.

A power supply switch is not furnished with this instrument. It is ready to operate as soon as the power is turned on. [Factory set value: RUN (operation start)]

A power failure of 20 ms or less will not affect the control action. When a power failure of more than 20 ms occurs, the instrument assumes that the power has been turned off. When power returns, the controller will retain the conditions that existed prior to shut down.

The alarm hold action is activated when the power is turned on or the SV is changed, including an SV change made with the STEP function.

6.2 RUN/STOP

RUN/STOP can be selected by key operation or by open or closed contact input (optional).

■ Conditions when changed to STOP mode

Control, Alarm: Control OFF, Alarm OFF
Output: OUT1 output OFF (OPEN),
OUT2 output OFF (OPEN)

Autotuning (AT): AT canceled
(The PID constants are not updated)

■ Display when changed to STOP mode

RUN/STOP mode with Key operation	RUN/STOP Mode with Contact Input ¹	
	RUN Mode (Contact closed)	STOP Mode (Contact open)
RUN	RUN	STOP (dSFP) ²
STOP	STOP (LSFP) ²	STOP (SFOP) ²

¹ Contact input: Connector pin No.1, 3

² Characters in parentheses are those shown on the PV display:

dSFP: Only contact input is in the STOP mode

LSFP: Only key operation is in the STOP mode

SFOP: Both key operation and contact input are in the STOP mode

7. FUNCTIONS

7.1 STEP (optional)

The instrument has two set values (SV). This STEP function selects these two set values (SV) by contact input (Connector pin No.1, 2).

Contact open: Set value (SV1)
Contact closed: STEP set value (SV2)

7.2 Set Data Lock (LCK)

The set data lock function permits locking of critical parameters and prevents unauthorized personnel from changing parameters.

7.3 Autotuning (AT)

The AT function automatically measures, computes and sets the optimum PID and LBA constants.

■ Requirements for AT start

Start AT when all the following conditions are satisfied:

- Prior to starting the AT, end all the parameter settings other than PID and LBA.
- Confirm that the LCK function has not been engaged.

■ Requirements for AT cancellation

The AT is canceled if any of the following conditions exist:

- When the SV (SV1, SV2) is changed.
- When the PV becomes abnormal when burnout occurs.
- When the power is turned off.
- When a power failure longer than 20 ms occurs.
- When the PV bias value is changed.
- When the AT does not end in nine hours after autotuning started.
- When the RUN/STOP is changed to the STOP mode.

If the AT is canceled, the controller immediately changes to PID control. The PID and LBA constants will be the same as before AT was activated.

When AT is completed, the controller immediately changes to PID control. If the control system does not allow the AT cycling process, do not use AT and set each PID constant to meet the needs of the application.

7.4 Self-tuning (ST)

The ST function is used to automatically calculate and set adaptive PID constants anytime the power is turned on, the SV is changed or the controller detects unstable control conditions.

The ST function should be turned off when the controlled system is affected by rippling that occurs due to periodic external disturbances.

The power to the controlled system must be turned on before the power to the instrument is turned on or SV is changed. This is required when ST function is on.

To activate the ST function, the following parameters must not be set to zero: P≠0, I≠0, D≠0, ARW≠0.

When the Heat/Cool PID action is selected, the ST function can not be activated.

When the AT function is activated, the ST function can not be turned on.

When the ST function is activated, the PID and ARW settings cannot be changed, only monitored.

7.5 Control Loop Break Alarm (LBA)

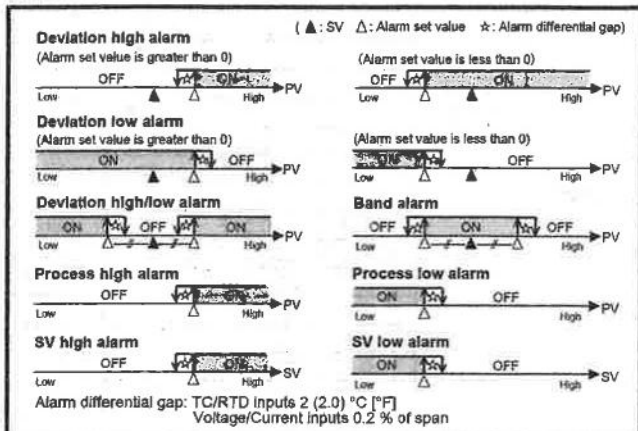
The LBA function is activated when control output reaches 0 % or 100 %. The time required for the LBA output to turn on includes both the time from the initial occurrence of loop failure and the LBA setting time. We recommend that the set value of LBA be twice the value of the integral time (I).

When AT function is turned on, the LBA function can not be activated.

If LBA setting time does not match the controlled object requirements, the LBA setting time should be lengthened. If setting time is not correct, the LBA will malfunction by turning on or off at inappropriate times or not turning on at all.

7.6 Alarms (ALM)

Each alarm action is shown below.



The alarm outputs are assigned to OUT1/OUT2.

8. ERROR DISPLAYS

Error display

Display	Description	Solution
Err Err 128	The error codes are shown in the SV display. When two or more errors occur simultaneously, the error code numbers are totaled and displayed as one number.	Turn off the power at once. If an error occurs after the power is turned on again, please contact RKC sales office or the agent.

Over-scale and Underscale

Display	Description	Solution
Measured value (PV) is flashing	PV is outside of input range.	<p>To prevent electric shock, always turn off the power before replacing the sensor.</p>
oooo flashing oooo 200	Over-scale: PV is above the high input display range limit.	
uuuu flashing uuuu 200	Underscale: PV is below the low input display range limit.	

9. SPECIFICATIONS

Input

TC: K, J, R, S, B, E, T, N, PLII, W5Re/W26Re, U, L
 RTD: JPt100, Pt100
 Voltage: 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC
 Current: 0 to 20 mA DC, 4 to 20 mA DC

Display accuracy

TC: ±(1 % of displayed value + 1 digit) or ±2 °C
 RTD: ±(0.3 % of displayed value + 1 digit) or ±0.8 °C
 Voltage/Current: ±(0.3 % of span + 1 digit)

Control action

PID control: Direct action/reverse action, Heat/Cool control (Water cooling, Air cooling), ON/OFF, P, PI, PD Selectable
 With Autotuning (AT) and Self-tuning (ST) functions

Output (OUT1, OUT2)

Relay contact: 240 V AC, 3 A (Resistive load) 1c contact, Electric life 300,000 times or more (Rated load)
 Voltage pulse: Input/output terminals are not isolated 0/12 V DC (load resistance 600 Ω or more)
 Current: 0 to 20 mA DC, 4 to 20 mA DC (Load resistance: 400 Ω or less, Resolution: 10 bits or more)

Communication function (Optional)

Interface: Based on RS-485, EIA standard
 Protocol: • RKC communication
 • Modbus

Contact input (Optional)

Dry contact input: At open 500 kΩ or more
 At close 10 Ω or less

Others

Dimension: 48 (W) × 48 (H) × 70 (D) mm
 Weight: Approx. 120 g

10. INPUT RANGE TABLES

Input Range Table 1

Input type	Input range	Code	
		Input	Range
Thermo-couple (TC)	K	0 to 200 °C	01
		0 to 400 °C	02
		0 to 600 °C	03
		0 to 800 °C	04
		0 to 1000 °C	05
		0 to 1200 °C	06
		0 to 1372 °C	07
		-199.9 to +300.0 °C	08
		0.0 to 400.0 °C	09
		0.0 to 800.0 °C	10
		0 to 100 °C	13
		0 to 300 °C	14
		0 to 450 °C	17
		0 to 500 °C	20
		0.0 to 200.0 °C	29
		0.0 to 600.0 °C	37
		-199.9 to +800.0 °C	38
		0 to 800 °F	A1
		0 to 1600 °F	A2
		0 to 2502 °F	A3
0.0 to 800.0 °F	A4		
20 to 70 °F	A9		
-199.9 to +999.9 °F	B2		

Continued on the next page.

Input type		Input range	Code	
			Input	Range
Thermo-couple (TC)	J	0 to 200 °C	J	01
		0 to 400 °C	J	02
		0 to 600 °C	J	03
		0 to 800 °C	J	04
		0 to 1000 °C	J	05
		0 to 1200 °C	J	06
		-199.9 to +300.0 °C	J	07
		0.0 to 400.0 °C	J	08
		0.0 to 800.0 °C	J	09
		0 to 450 °C	J	10
		0.0 to 200.0 °C	J	22
		0.0 to 600.0 °C	J	23
		-199.9 to +600.0 °C	J	30
		0 to 800 °F	J	A1
		0 to 1600 °F	J	A2
		0 to 2192 °F	J	A3
		0 to 400 °F	J	A6
		-199.9 to +999.9 °F	J	A9
		0.0 to 800.0 °F	J	B6
		0 to 1600 °C ¹	R	01
	0 to 1769 °C ¹	R	02	
	0 to 1350 °C ¹	R	04	
	0 to 3200 °F ¹	R	A1	
	0 to 3216 °F ¹	R	A2	
	0 to 1600 °C ¹	S	01	
	0 to 1769 °C ¹	S	02	
	0 to 3200 °F ¹	S	A1	
	0 to 3216 °F ¹	S	A2	
	400 to 1800 °C	B	01	
	0 to 1820 °C ¹	B	02	
	800 to 3200 °F	B	A1	
	0 to 3308 °F	B	A2	
	0 to 800 °C	E	01	
	0 to 1000 °C	E	02	
	0 to 1600 °F	E	A1	
	0 to 1832 °F	E	A2	
	0 to 1200 °C	N	01	
	0 to 1300 °C	N	02	
	0.0 to 800.0 °C	N	06	
	0 to 2300 °F	N	A1	
	0 to 2372 °F	N	A2	
	0.0 to 999.9 °F	N	A5	
	-199.9 to +400.0 °C ²	T	01	
	-199.9 to +100.0 °C ²	T	02	
	-100.0 to +200.0 °C	T	03	
	0.0 to 350.0 °C	T	04	
	-199.9 to +752.0 °F ²	T	A1	
	-100.0 to +200.0 °F	T	A2	
	-100.0 to +400.0 °F	T	A3	
	0.0 to 450.0 °F	T	A4	
	0.0 to 752.0 °F	T	A5	
	0 to 2000 °C	W	01	
	0 to 2320 °C	W	02	
	0 to 4000 °F	W	A1	
	0 to 1300 °C	A	01	
0 to 1390 °C	A	02		
0 to 1200 °C	A	03		
0 to 2400 °F	A	A1		
0 to 2534 °F	A	A2		

Input type		Input range	Code	
			Input	Range
Thermo-couple (TC)	U	-199.9 to +600.0 °C ²	U	01
		-199.9 to +100.0 °C ²	U	02
		0.0 to 400.0 °C	U	03
		-199.9 to +999.9 °F ²	U	A1
		-100.0 to +200.0 °F	U	A2
		0.0 to 999.9 °F	U	A3
	0 to 400 °C	L	01	
	0 to 800 °C	L	02	
	0 to 800 °F	L	A1	
	0 to 1600 °F	L	A2	
RTD	Pt100	-199.9 to +649.0 °C	D	01
		-199.9 to +200.0 °C	D	02
		-100.0 to +50.0 °C	D	03
		-100.0 to +100.0 °C	D	04
		-100.0 to +200.0 °C	D	05
		0.0 to 50.0 °C	D	06
		0.0 to 100.0 °C	D	07
		0.0 to 200.0 °C	D	08
		0.0 to 300.0 °C	D	09
		0.0 to 500.0 °C	D	10
		-199.9 to +999.9 °F	D	A1
		-199.9 to +400.0 °F	D	A2
		-199.9 to +200.0 °F	D	A3
		-100.0 to +100.0 °F	D	A4
		-100.0 to +300.0 °F	D	A5
		0.0 to 100.0 °F	D	A6
		0.0 to 200.0 °F	D	A7
		0.0 to 400.0 °F	D	A8
	0.0 to 500.0 °F	D	A9	
	JPt100	-199.9 to +649.0 °C	P	01
		-199.9 to +200.0 °C	P	02
		-100.0 to +50.0 °C	P	03
		-100.0 to +100.0 °C	P	04
		-100.0 to +200.0 °C	P	05
		0.0 to 50.0 °C	P	06
		0.0 to 100.0 °C	P	07
		0.0 to 200.0 °C	P	08
		0.0 to 300.0 °C	P	09
		0.0 to 500.0 °C	P	10

¹ Accuracy is not guaranteed between 0 to 399 °C (0 to 751 °F) for type R, S and B.

² Accuracy is not guaranteed less than -100.0 °C (-148.0 °F) for type T and U.

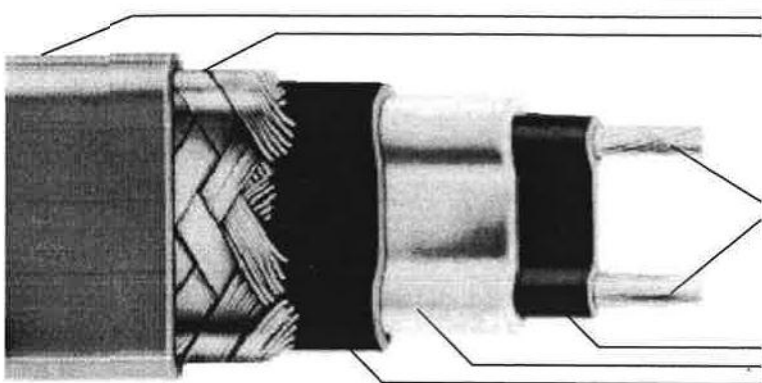
Input Range Table 2

Input type		Input range	Code	
			Input	Range
Voltage	0 to 5 V DC	0.0 to 100.0 %	4	01
	0 to 10 V DC		5	01
	1 to 5 V DC		6	01
Current	0 to 20 mA DC		7	01
	4 to 20 mA DC		8	01

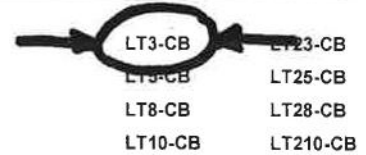
Part number 3-FAUCU-0027

SPECIFICATION/APPLICATION INFORMATION

SELF-REGULATING HEATER CABLE



- Optional Overjacket
- Standard Metal Braid



- Stranded Plated Copper Conductors
- Self-Regulating Conductive
- Bonded Inner Thermoplastic Jacket
- Outer Thermoplastic Elastomer Jacket

Description:

A self-regulating heater cable is a parallel circuit electric heater strip. An irradiation cross-linked conductive polymer core material is extruded over the multi-stranded, tin-plated, 18-gauge copper bus wires. The conductive core material increases or decreases its heat output in response

to temperature changes. Two jackets provide extra dielectric strength, moisture resistance, and protection from impact and abrasion damage. The inner thermoplastic jacket is extruded over and bonded to the core material. A thermoplastic elastomer outer jacket is then extruded over the inner jacket.

A stranded tinned copper metal braid is supplied on all heaters. An optional overjacket (fluoropolymer or modified polyolefin) can be specified when the heater cable is to be installed in wet or corrosive environments.

Principle of Operation:

The parallel bus wires apply voltage along the entire length of the heater cable. The conductive core provides an infinite number of parallel conductive paths permitting the cable to be cut to any length in the field with no dead or cold zones developing. The heater cable derives its self-regulating characteristic from the inherent properties of the conductive core material. As the core

material temperature increases, the number of conductive paths in the core material decrease, automatically decreasing the heat output. As the temperature decreases, the number of conductive paths increase, causing the heat output to increase. This occurs at every point along the length of the cable, adjusting the power output to the varying conditions along the pipe.

The self-regulating effect allows the cable to be overlapped without creating hot spots or burnout. As the cable self-regulates its heat output, it provides for the efficient use of electric power, producing heat only when and where it is needed, and also limiting the maximum sheath temperature.

Application:

A self-regulating heater cable is ideal for use in maintaining fluid flow under low ambient conditions. Freeze protection and low watt density process temperature systems such as product pipelines, fire protection, process water, dust suppression systems, lube oil, condensate return, hot water and structure anti-icing are typical applications for this product.

The base product is supplied with a tinned copper metal braid that may be used in both general applications and in dry, non-corrosive hazardous (classified) areas. It is also used to provide a conductive ground path when cable is installed on non-conductive surfaces, such as plastic or painted pipe.

Options: (Delete -CB and add)

- JT A tinned copper metal braid with a modified polyolefin overjacket is available for use when the heater cable is exposed to aqueous solutions of inorganic chemicals (phosphate, dilute acids, chlorides, bases and carbonites). It is also recommended where mechanical abuse is a problem.
- J A tinned copper metal braid with a fluoropolymer overjacket is available for use when the heater is available for use when the heater cable is exposed to excessive moisture, organic chemicals, solvents, etc. in hazardous (classified) areas and ordinary areas.

D1- Approved for use in Class I, Division 1, Groups B, C, and D, Class II, Division 1, Groups E, F and G, Class III hazardous areas. D1 heating cable requires the use of HASK series connection kits.

SELF-REGULATING HEATER CABLE

Performance and Rating Data:

Catalog Number	Service Voltage	Maximum Length	Maximum Maintenance Temperature	Maximum Intermittent Exposure	T-Rating*
LT3	120	325	150°F (65°C)	185°F (85°C)	T6
LT23	240	650	150°F (65°C)	185°F (85°C)	T6
LT5	120	270	150°F (65°C)	185°F (85°C)	T6
LT25	240	540	150°F (65°C)	185°F (85°C)	T6
LT8	120	210	150°F (65°C)	185°F (85°C)	T5
LT28	240	420	150°F (65°C)	185°F (85°C)	T5
LT10	120	180	150°F (65°C)	185°F (85°C)	T5
LT210	240	360	150°F (65°C)	185°F (85°C)	T5

*Electrical equipment T-rating codes define the maximum surface temperature that equipment will reach. It is used in hazardous (classified) area applications.

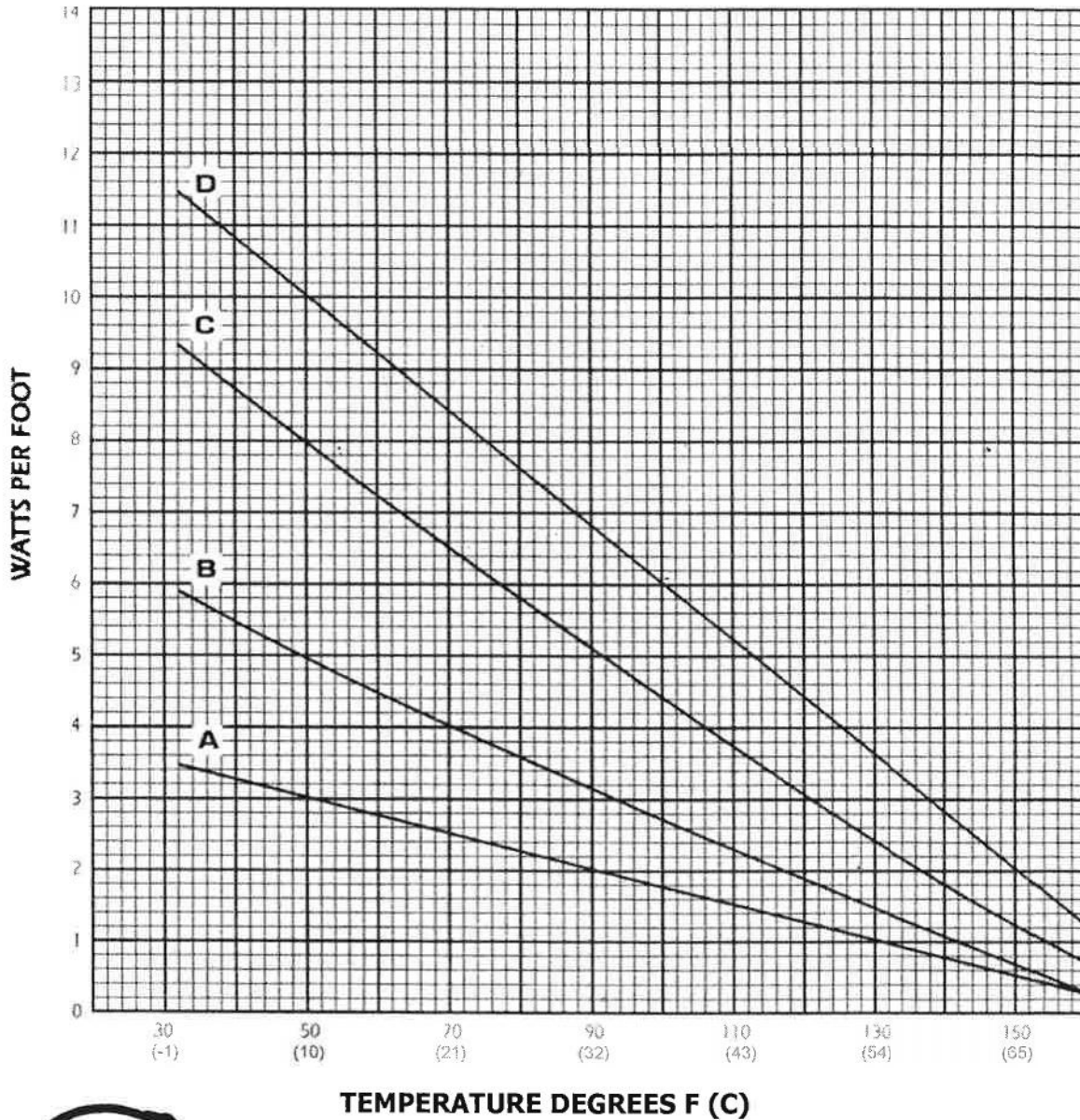
Circuit Breaker Selection:

Watts/Ft.	Start-Up Temp.	Max. Length (Feet) Vs. Circuit Breaker Size							
		120 Volt				240 Volt			
		15A	20A	30A	40A	15A	20A	30A	40A
3	50°F (10°C)	325				650			
	0°F (-18°C)	230	305	325		460	620	650	
	-20°F (-29°C)	205	275	325		410	550	650	
5	50°F (10°C)	225	270			460	540		
	0°F (-18°C)	155	205	270		310	415	540	
	-20°F (-29°C)	135	180	270		275	370	540	
8	50°F (10°C)	145	195	210		295	390	420	
	0°F (-18°C)	100	130	195	210	200	265	395	420
	-20°F (-29°C)	90	115	175	210	175	235	350	420
10	50°F (10°C)	115	150	180		230	305	360	
	0°F (-18°C)	85	110	155	180	165	220	325	360
	-20°F (-29°C)	75	100	145	180	150	195	290	360

- NOTES:
1. Circuit breakers are sized per national electrical codes.
 2. When using 240 volt product at 208, 220 or 277 volts, use the circuit adjustment factors shown in the Voltage Adjustment Table.
 3. When using 2 or more heater cables of different wattage ratings in parallel on a single circuit breaker, use the 15A column amperage of 15 amps, divide it by the maximum footage to arrive at an amps/foot figure for each cable. You can then calculate circuit breaker sizes for these combination loads. These amps/foot factors include the 125% sizing factor.
 4. National electrical codes require ground-fault equipment protection for each branch circuit supplying electric heating equipment. Exceptions to this requirement can be found in the 2002 N.E.C.
 5. Heater cables with D1 optional construction require the use of ground fault interrupter/ground leakage device with a trip setting no greater than 30mA.

SELF-REGULATING HEATER CABLE

Power Output Rating:



B LT5
LT25

C LT8
LT28

D LT10
LT210

WATTS PER FOOT x 3.28 = WATTS PER METER
PIPE TEMPERATURE °F CONVERSION TO °C = 5/9 (°F - 32)

Part number 3-FAUCU-0027

SPECIFICATION/APPLICATION INFORMATION

SELF-REGULATING HEATER CABLE

Catalog Numbers:

BASIC CATALOG NUMBERS				
Voltage	Watts Per Foot			
	3	5	8	10
120 VAC	LT3	LT5	LT8	LT10
240 VAC	LT23	LT25	LT28	LT210

Standard Feature Suffix:

-CB Tinned Copper Braid

Optional Features Suffix:

- J Tinned Copper Braid and Fluoropolymer Overjacket
- JT Tinned Copper Braid and Modified Polyolefin Overjacket
- D1- Division 1 approved

Voltage Adjustment:

Use of Self-Regulating heater products at other than rated voltages require minor adjustments in power and maximum circuit lengths.

Product	ADJUSTMENT MULTIPLIER						
	208 VAC		220 VAC		277 VAC		Absolute Max Length
	Power	Length	Power	Length	Power	Length	
LT23	.76	.93	.85	.96	1.27	1.07	650 ft.
LT25	.79	.93	.87	.96	1.24	1.07	540 ft.
LT28	.84	.93	.90	.96	1.19	1.08	420 ft.
LT210	.86	.93	.92	.96	1.16	1.09	360 ft.

Approvals:

FM

Ordinary Locations -
(-CB, -J or -JT options)
Hazardous (Classified) Locations
(-CB, -J or -JT options)
Class I, Division 2;
Groups B, C, D
Class II, Division 2
Groups G
Class III, Division 2
(-J option)
Class I, Zone 1
Group IIC



CSA

Ordinary Locations -
(-CB, -J or -JT options)
Hazardous (Classified) Locations
(-CB, -J or -JT options)
Class I, Division 2
Groups B, C, D
Class II, Division 2
Groups E, F, G
Class III, Division 2
(-J option)
Class 1, Division 1
Groups B, C, D
Class II, Division 1
Groups E, F, G
Class I, Zone 1
Group IIB + H2
Zone 1, Ex e II T6 (T5)



UL

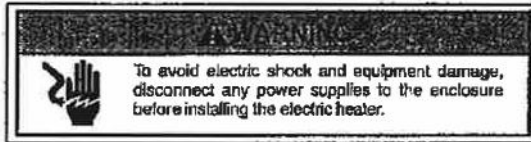
Ordinary Locations -
(-CB, -J or -JT options)
Hazardous (Classified) Locations
(-CB, -J or -JT options)
Class I, Division 2;
Groups A, B, C, D
Class II, Division 2
Groups F, G
Class III, Division 2
(-J option)
Class I, Zone 1 and 2
Group IIC
(D1 option)
Class I, Division 1
Groups B, C, D
Class II, Division 1
Groups E, F, G
Class III



English

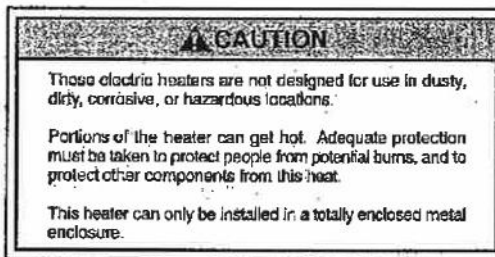
INTRODUCTION

1. Before installing the electric heater, read these instructions carefully. Failure to follow these instructions could damage the product or cause a hazardous condition.
2. Check the ratings on the heater label to assure the product is suitable for your application.



GENERAL SAFETY INFORMATION

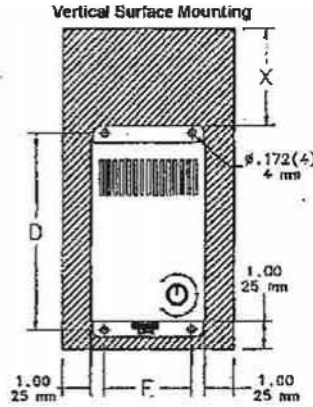
1. Protect the lead wires from coming in contact with sharp objects, hot surfaces, and/or chemicals.
2. If continuous operation of the heater is essential to the safe functioning of any other equipment, adequate warning devices must be installed to assure safe operation at all times.



English

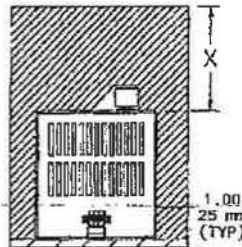
LOCATION AND MOUNTING

1. Electric heaters should be centered as low as possible in the enclosure for optimum heat distribution.
2. It is recommended that the heater be installed on a panel for optimum performance. It may, however, be mounted on any metal surface.
3. The heater should be mounted in a vertical position with the terminal block at the bottom and the air outlet openings at the top as shown.
4. Heaters should not be installed on wood or other combustible surfaces.
5. Heat sensitive components should not be placed above the heater discharge area.
6. The recommended clearances shown by the shadowed area indicate the space that should be kept free of components for safe operation of the heater.
7. Four 10-32 UNF, self-tapping screws are included for installation.



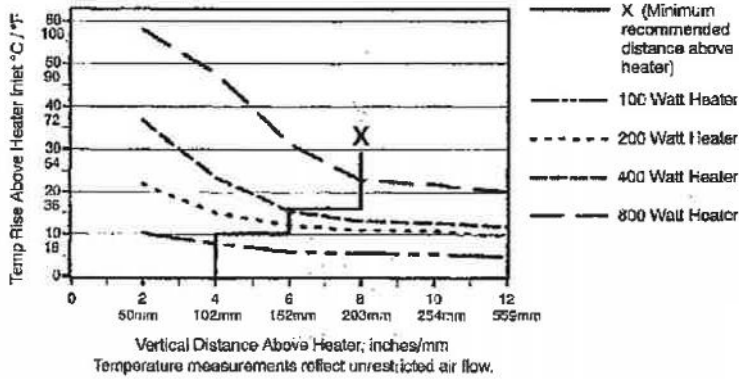
CAUTION
Thermal sensitive devices or materials may need to be located further from the heater than the minimum recommended distance.

Optional Horizontal Surface Mounting



	Watts	X	D	E
DAH1001A/DAH1002A	100	4	5.00 127 mm	3.25 83 mm
DAH2001A/DAH2002A	200	8	7.00 178 mm	3.90 99 mm
DAH4001B/DAH4002B	400	6	7.00 178 mm	3.90 99 mm
DAH8001B/DAH8002B	800	8	7.00 178 mm	3.90 99 mm

Temperature Rise Vs Distance Above Heater



English

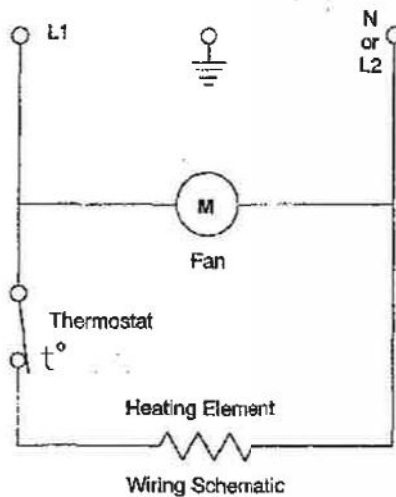
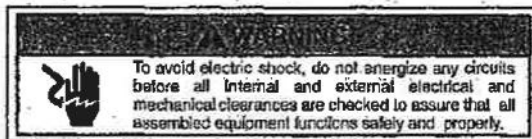
WIRING

1. All wiring must comply with applicable local codes and ordinances.
2. Connect the heater leadwires to the proper A.C. power source. Power source for 800 watt heaters should be continuous.
3. The heater must be properly grounded.

NOTE: Exposed wires should not come in contact with the heater housing.

MAINTENANCE

1. Always disconnect power supply before inspecting or working on the heater.
2. Generally the unit requires no maintenance since the fan bearings are permanently lubricated and sealed.



SUBMITTAL REVIEW COMMENTS



DATE: 07/28/2016 PROJECT: Sudbury Landfill Remedial Action

SUBMITTAL NO.: 21-1A PROJECT NO.: 30-11-012

SPEC SECTION: 15700 REVIEWER'S NAME: Lisa Reich, E.I.T.

DESCRIPTION: Pipe Insulation PAGES: 12

SUBMITTAL TYPE: SHOP DRAWING SAMPLE INFORMATION

X	1. REVIEWED	4. FURNISH AS CORRECTED
	2. REJECTED	5. REVISE AND RESUBMIT
	3. SUBMIT SPECIFIC ITEM	

NO.	COMMENT	RELATED SPEC PARA. DRAWING #
1	Reviewed.	

This review is only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Corrections or comments made on the shop drawings during this review do not relieve contractor from compliance with the requirements of the plans and specifications. Approval of a specific item shall not include approval of an assembly of which the item is a component. Contractor is responsible for: dimensions to be confirmed and correlated at the jobsite; information that pertains solely to the fabrication processes or to the means, methods, techniques, sequences and the procedures of construction; coordination of his or her work with that of all other trades; and for performing all work in a safe and satisfactory manner.

J-U-B ENGINEERS, INC.

Date: 07/28/2016

By: LLR



SUBMITTAL(s) # 21-1A

PROJECT: Sudbury Road Landfill Remedial Action
TO: Alex Fazarri, P.E., JUB Engineers, Inc.
SUBMITTAL NO.(s): 21-1A
SUBJECT: Pipe Insulation
PLAN SHEET: N/A
SPEC. REFERENCE: 15700
DATE: 7/27/16
RESPOND BY: **7/29/16**

Description:

We appreciate your review and acceptance of the attached submittals for the ***Pipe Insulation Submittals, Section 15700***. This information has been reviewed by Culbert Construction, Inc. and appears to be in compliance with the applicable specification.

We appreciate your timely review of this Submittal. Please do not hesitate to call or email, should you have any questions.

Proposed Changes:

None

Clarifications:

None

Sincerely,

A handwritten signature in blue ink, appearing to read "D. P. DeRousie".

Dan DeRousie
Project Leader



Project Submittals For

Mechanical Insulation Divisions

DKB, Inc.
702 N California
Pasco WA 99301
www.dkbinc.net

Pipe Systems

Pipe System Descriptions	Specification Material Descriptions	Insulation Thickness
Heat-Traced Pipe All Pipe Sizes	Fiberglass/.016 Embossed Aluminum	1" Thick - for All Pipe Sizes
Knock-Out Pot All Pipe Sizes	Crimp Wrap/.016 Embossed Aluminum	1" Thick - for All Pipe Sizes

Micro-Flex® Large-Diameter Pipe and Tank Wrap

Description

Micro-Flex large-diameter pipe and tank wrap is a 2.5 pcf (40.1 kg/m³) density product made from high-temperature, semi-rigid fiber glass blanket bonded to a flexible facing. Shipped in roll form, Micro-Flex's unique fiber orientation gives it increased compressive strength and permits close installation on round surfaces without reducing the thickness of insulation resulting in a loss of insulating efficiency. Both All Purpose (AP) and FSK facings are intended for indoor use, and AP facing may be painted with latex paint after installation. The ease of fit is particularly helpful on retrofit installations where existing insulation may result in nonstandard outside diameters.

Uses

Micro-Flex large-diameter pipe and tank wrap is ideally suited for application on rounded shapes such as pipes, tanks, ducts, vessels and other similar round and irregular shapes. For applications requiring a vapor seal, all joints and facing penetrations must be sealed.

Available Types and Sizes of Rolls

Micro-Flex is available in 3-foot (0.92 m) or 4-foot (1.22 m) wide rolls in either AP or FSK facings. For roll lengths, thicknesses and the amount of material per roll, please see List Price Schedule MFX-MI-1.

Advantages

Easy to Apply. For most applications, only a ruler, knife, 3- or 4-inch (76 mm or 102 mm) wide AP or FSK pressure-sensitive tape and stapler are required.

Solid Glass Substrate. The unique fiber manufacturing process results in a continuous monolithic mass of interconnected fibers. There are no segments that are prone to delaminate and fall out during handling and fabrication.

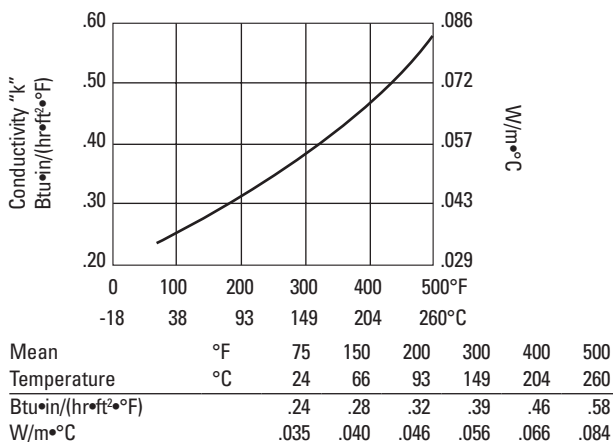
Conforms Around Various Diameters and Shapes. Due to the solid mass of fibers rather than cut-and-glued segments, even small diameter vessels can be wrapped without the worry of the "stop-sign effect."

Low Thermal Conductivity. The unique, uniform fiber orientation and a variety of thicknesses provide a dependable thermal conductivity ("k") of .24 Btu•in/(hr•ft²•°F) at 75°F mean temperature (.035 W/m•°C at 24°C).

Superior Strength. The unique fiber manufacturing process results in a highly durable product that exhibits excellent handling properties during shipping and installation.

Operating Temperature Limits: 0°F to 850°F (-18°C to 454°C)*

Thermal Conductivity "k" (ASTM C 518)



Shot-Free Glass Fibers. Due to the advanced fiber-manufacturing process and latest advances in binder technology, Micro-Flex can stand up to the rigors of heavy vibration.

Long Lasting. The continuous fiber blanket remains intact compared to the 4-inch (102 mm) wide strips of conventional pipe and tank insulation, which tend to loosen or fall out over time when the adhesive dries out.

Specification Compliance

ASTM C 1393, Type III
ASTM E 84
New York City MEA #360-03-E

Installation

When applying, simply determine the circumference of the piece being insulated (remember to add twice the thickness of insulation being used to the diameter). Add 2 to 4 inches (51 mm to 102 mm) for lap seam and cut to length. Remove 2 to 4 inches (51 mm to 102 mm) of glass to provide for the lap. Care should be taken to not cut through the facing. Lap seams should be stapled with outward-clinching staples placed on maximum 4-inch (102 mm) centers. For vapor retarder applications, the staples must be coated with a vapor retarder mastic for a complete vapor seal. All longitudinal and circumferential joints should be sealed with a 3- or 4-inch (76 mm or 102 mm) wide pressure-sensitive tape. For some applications, banding may be required for additional securement.

**A sufficient thickness of properly installed insulation must be used to prevent insulation surface temperature from exceeding 150°F (66°C). A minimum 1½-inch (38 mm) thickness of insulation is required for operating temperatures above 350°F (177°C).*

Note: For additional application or installation recommendations, please consult Johns Manville.

Physical Properties

Property	Value	ASTM Test Method
Maximum Use Temperature	850°F (454°C)	C 411
Density	2.5 pcf (40.1 kg/m ³)	C 303
Compressive Resistance	25 psf (1,197 Pa)	C 165
Composite Surface		E 84
Burning Characteristics		
Flame Spread	25 or Less	
Smoke Developed	50 or Less	
Facing Temperature Limit	150°F (66°C)	C 1136
Water Vapor Permeance	0.02 Perms	E 96

Micro-Flex®

Large-Diameter Pipe and Tank Wrap

Micro-Flex Stretch-Out Chart (I-P Units)

Approximate length in inches to cut rolls to fit large pipes and ducts.

Nominal Pipe Size (in.*)	Pipe Outside Diameter (in.*)	Thickness (in.)						
		1	1½	2	2½	3	3½	4
10	10¾	40%	44%	47%	50%	53%	56½	59%
12	12¾	47	50½	53¾	56½	59%	62%	66
14	14	50%	53¾	56%	59%	62%	66	69¾
16	16	57¾	60%	63¾	66	69¾	72%	75¾
18	18	63%	66½	69%	72%	75¾	78%	81½
20	20	70	72½	75%	78%	81½	84%	87%
22	22	76	78¾	82	84¾	87%	91%	94¾
24	24	82%	85%	88¾	91%	94¾	97¾	100%
26	26	88¾	91%	94%	97%	100%	103½	106%
28	28	95	97¾	101	103½	106%	109¾	113
30	30	101%	103%	107	109¾	113	116%	119¾

*These dimensions do not include a lap. You must ADD 2 to 4 inches for lap.

Micro-Flex Stretch-Out Chart (SI Units)

Approximate length in mm to cut rolls to fit large pipes and ducts.

Nominal Pipe Size (mm*)	Pipe Outside Diameter (mm*)	Thickness (mm)							
		25	38	51	64	76	89	102	
250	273	1014	1104	1184	1253	1333	1412	1492	
300	324	1174	1263	1343	1412	1490	1572	1651	
350	356	1273	1343	1422	1492	1571	1651	1731	
400	406	1432	1502	1581	1651	1731	1802	1881	
450	457	1591	1661	1740	1802	1881	1960	2039	
500	508	1751	1812	1891	1960	2039	2118	2198	
550	559	1901	1970	2049	2118	2198	2277	2356	
600	610	2059	2128	2208	2277	2356	2435	2514	
650	660	2217	2287	2366	2435	2514	2587	2666	
700	711	2376	2445	2524	2587	2666	2745	2824	
750	762	2534	2597	2676	2745	2824	2903	2982	

*These dimensions do not include a lap. You must ADD 51 mm to 102 mm for lap.

EXAMPLE:

To use Micro-Flex large-diameter pipe and tank wrap instead of 20-inch x 2-inch (500 mm x 51 mm) pipe covering:

1. Cut piece 78¾ inches (1991 mm) long (75¾ inches [1915 mm] plus 3 inches [76 mm] for lap).
2. Strip off 3 inches (76 mm) of the fiber glass leaving the jacket intact.
3. Physically apply to the pipe the first section cut of any size to verify dimensional fit.
4. You now have a section that will cover a 3-foot (0.92 m) section of 20-inch (500 mm) pipe.

In order to determine the length for pipe sizes not in the table:

1. Add twice the thickness of the insulation to the outside diameter of the pipe.
2. Multiply this value by 3.14.
3. Add 2 to 4 inches (51 mm to 102 mm) for a lap.



5% Pre-consumer
20% Post-consumer
SCIENTIFIC CERTIFICATION SYSTEMS
SCS-MC-01073

North American Sales Offices, Insulation Systems

Eastern Region
P.O. Box 158
Defiance, OH 43512
(800) 334-2399
Fax: (419) 784-7866

Western Region and Canada
P.O. Box 5108
Denver, CO 80217
(800) 368-4431
Fax: (303) 978-4661



717 17th St.
Denver, CO 80202
(800) 654-3103
specJM.com

CI-187 03/10 (Replaces 09/09)

The physical and chemical properties of the Micro-Flex® large-diameter pipe and tank wrap listed herein represent typical, average values obtained in accordance with accepted test methods and are subject to normal manufacturing variations. They are supplied as a technical service and are subject to change without notice. Numerical flame spread and smoke developed ratings are not intended to reflect hazards presented by these or any other materials under actual fire conditions. Check with the Regional Sales Office nearest you to assure current information. **All Johns Manville products are sold subject to Johns Manville's standard Terms and Conditions, including Limited Warranty and Limitation of Remedy. For a copy of the Johns Manville standard Terms and Conditions, Limited Warranty and Limitation of Remedy and information on other Johns Manville thermal insulation and systems, call (800) 654-3103.**

♻️ Printed on recycled paper.

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Micro-Lok®
Fiber Glass Pipe Insulation

Description

Micro-Lok fiber glass pipe insulation is made from glass fibers bonded with a thermosetting resin and produced in 36" (0.92 m) lengths. Jacketed with a reinforced vapor retarder facing and a factory-applied, longitudinal acrylic adhesive closure system, Micro-Lok insulation is designed for application temperatures from 0°F to 850°F (-18°C to 454°C). Section joints are sealed with butt strips, which are supplied from the factory. Micro-Lok insulation may be painted with a latex paint after installation.

The factory-installed tape system permits installation at ambient temperatures down to 20°F (-7°C) and will not soften or separate when exposed to high ambient temperatures and humidity.

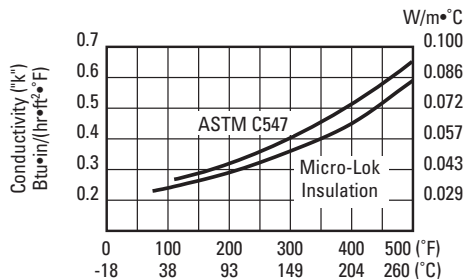
Uses

Micro-Lok fiber glass pipe insulation is suitable for installation over hot, cold, concealed and exposed piping systems with operating temperatures up to 850°F (454°C). Weather-protective jacketing is required for outdoor applications. Pipes operating below ambient temperatures require all joints to be sealed with the factory-applied, self-seal lap and butt strips.

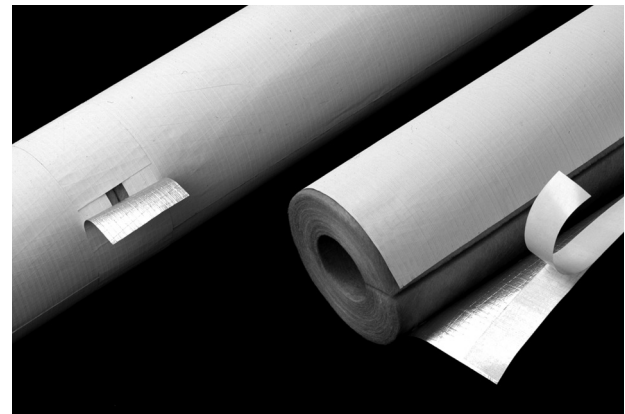
Physical Properties

Service Temp. Range	0°F to 850°F (-18°C to 454°C)
Moisture Sorption	<5% by weight
Alkalinity	<0.6% expressed as Na ₂ O
Corrosivity	Does not accelerate
Capillarity	Negligible (after 24 hours)
Shrinkage	None
Fungi & Bacteria Resistance	Does not breed or promote
Surface Burning Characteristics	Composite FHC 25/50 per ASTM E84, UL 723, NFPA 255, CAN/ULC S102-M88
Limited Combustibility	NFPA 259
Jacketing	ASTM C1136 (Type I)
Water Vapor Permeance (ASTM E96 – Procedure A)	0.02 perms max.
Burst Strength (ASTM D774)	50 Beach Units (1.5 Joules min.)
Tensile Strength (ASTM D828)	45 lbs./in. (7.9N/mm) width min. (MD) 30 lbs./in. (5.23N/mm) width min. (CD)

Thermal Conductivity ("k")



Mean Temperature	°F	75	100	200	300	400	500
	°C	24	38	93	149	204	260
Btu•in/(hr•ft²•°F)		0.23	0.24	0.29	0.36	0.45	0.59
W/m•°C		0.033	0.035	0.042	0.052	0.065	0.085



Operating Temperature Limits: 0°F to 850°F (-18°C to 454°C)

Specification Compliance

- ASTM C1136 (Jacketing) (Replaces HH-B-100B, Type I & II)
- ASTM C547 Type I (Replaces HH-I-558B, Form D, Type III, Class 12, Class 13 up to 850°F [454°C])
- ASTM C585 Dimensional Standard
- MIL-I-22344D
- NRC 1.36, ASTM C795, MIL-I-24244C
- New York City MEA # 330-85-M
- NFPA 90A & 90B, FHC 25/50

GREEN BUILDING ATTRIBUTES

Manufacturing Location	Defiance, Ohio (43512)	
Recycled Content	10%	
Volatile Organic Compounds (ASTM D5116)	Total	0.15 g/l
(Analysis ASTM D6196 & ASTM D5197)		
Fiber Glass Pipe Insulation	Formaldehyde	0.009 ppm
	Aldehydes	0.009 ppm
Volatile Organic Compounds (Calculated)	Total	<49 g/l
Self-Sealing Lap & Butt Strips		

GREEN BUILDING CERTIFICATIONS

GREENGUARD®		
• Indoor Air Quality	Certified	
• Children and Schools	Certified	
LEED® Credits		
LEED-NC	See JM.com/buildgreen JM LEED Credit Guide (HIG-1231)	

GREENGUARD® Certified products have been screened for more than 10,000 volatile organic compounds (VOCs) and meet stringent standards for low chemical emissions based on established criteria from key public health agencies.



Micro-Lok®

Fiber Glass Pipe Insulation

Size Availability

Insulation Thickness		Iron Pipe Size Range		Copper Tubing Size Range	
in	mm	in	mm	in	mm
1/2	13	1/2 – 6	13 – 152	5/8 – 4 1/8 [‡]	16 – 105
1	25	1/2 – 24	13 – 610	5/8 – 6 1/8	16 – 156
1 1/2	38	1/2 – 24	13 – 610	5/8 – 6 1/8	16 – 156
2	51	1/2 – 24	13 – 610	1 1/8 – 6 1/8	29 – 156
2 1/2	64	1 – 24	25 – 610	1 3/8 – 6 1/8	35 – 156
3	76	1 – 24	25 – 610	1 3/8 – 6 1/8	35 – 156
3 1/2	89	1 1/2 – 24*	38 – 610	–	–
4	102	3 – 24**	76 – 610	–	–
4 1/2	114	3 – 24 [†]	76 – 610	–	–
5	127	3 – 20 [†]	76 – 508	–	–

Notes:

*2 1/2" and 23" IPS not available in this insulation thickness.

**22" and 23" IPS not available in this insulation thickness.

†21", 22" and 23" IPS not available in this insulation thickness.

‡19" IPS not available in this insulation thickness.

§3 5/8" CTS not available in this insulation thickness.

Qualifications for Use

A sufficient thickness of insulation must be used to keep the maximum surface temperature of Micro-Lok insulation below 150°F (66°C). In addition, at operating temperatures above 500°F (260°C), Micro-Lok pipe insulation must be applied in a thickness ranging from 2" (51 mm) minimum to 6" (152 mm) maximum.

During initial heat-up to operating temperatures above 350°F (177°C), an acrid odor and some smoke may be given off as the organic binders used in the fiber glass pipe insulation begin to decompose. When this occurs, caution should be exercised to ventilate the area well. This loss of binder does not directly affect the thermal performance of the pipe insulation, but the compressive strength and resiliency of the product are reduced. For applications with excessive physical abuse or vibration at high temperatures, consult your local Performance Materials Division Market Development Manager for alternate material recommendations.

Application Recommendations*

Micro-Lok Pipe Insulation and Butt Strips.

1. Do not apply Micro-Lok insulation if air temperature is below 20°F (-7°C) or above 130°F (54°C) due to the effect of temperature on tape performance. We recommend stapling when application falls outside this temperature range.

When stapling, we recommend mastic be applied over staples to prevent moisture penetration.

2. If stored below 20°F (-7°C) or above 130°F (54°C), insulation cartons should stand within the recommended temperature range for 24 hours prior to application.

3. Once release paper is removed, both adhesive and lap must be kept free of dirt and water, and the lap sealed immediately.

4. When adhered, the lap and butt strips must be pressurized by rubbing firmly with a plastic squeegee or the back of a knife blade to ensure positive closure.

*For complete application recommendations and installation instructions, see Micro-Lok insulation brochure, CI-32.

North American Sales Offices, Insulation Systems

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P.O. Box 158
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Denver, CO 80217
(800) 368-4431
Fax: (303) 978-4661



717 17th St.
Denver, CO 80202
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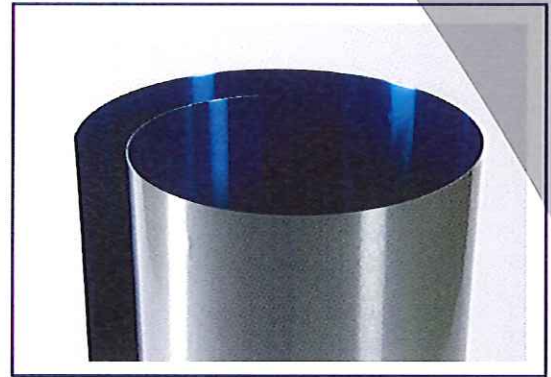
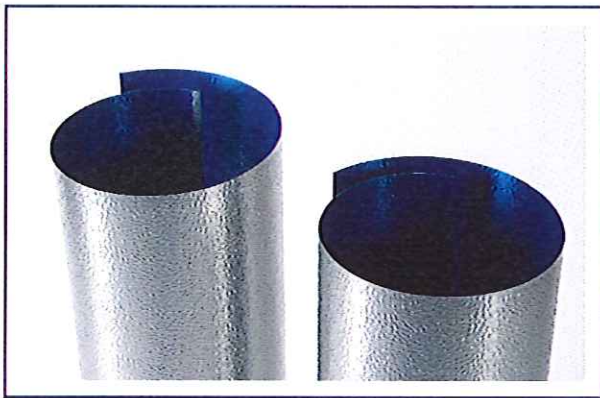
The physical and chemical properties of Micro-Lok® Fiber Glass Pipe Insulation listed herein represent typical, average values obtained in accordance with accepted test methods and are subject to normal manufacturing variations. They are supplied as a technical service and are subject to change without notice. Numerical flame spread and smoke developed ratings are not intended to reflect hazards presented by these or any other materials under actual fire conditions. Check with the Regional Sales Office nearest you to ensure current information. **All Johns Manville products are sold subject to Johns Manville's standard Terms and Conditions including Limited Warranty and Limitation of Remedy. For a copy of the Johns Manville standard Terms and Conditions, Limited Warranty and Limitation of Remedy, and information on other Johns Manville thermal insulations and systems, call (800) 654-3103.**



Product Information Aluminum Roll Jacketing With Painted Moisture Retarder

Product Description

Ideal Products' Aluminum Roll Jacketing is produced from 3003 and 3105 series aluminum, meeting ASTM B-209 standards. Both the interior and exterior of this product has a hard film of heat cured acrylic enamel for durable corrosion protection of pipes, tanks and vessels. The exterior clear finish helps in the prevention of oxidation and resists the dulling of the aluminum, while the interior finish provides a highly effective moisture retarder.



Painted Moisture Retarder Aluminum Jacketing is available in smooth, stucco embossed or 3/16" corrugation (cross crimped) finishes, and in 0.016", 0.020", 0.024" and 0.032" thicknesses.

Product Application

- | | |
|----------------|--|
| 0.016" (0.4mm) | Recommended on pipelines up to 24" O.D., including insulation. Used to protect piping, vessels, and tanks which are less than 8 feet in diameter. |
| 0.020" (0.5mm) | Recommended on pipelines up 36" O.D., including insulation. Used to protect towers, vessels, and tanks with a diameter greater than 8 feet. |
| 0.024" (0.6mm) | This heavier gauge is used where extra strength and protection is required. Used to protect larger diameter pipelines, towers, vessels, tanks and equipment. |
| 0.032" (0.8mm) | For areas where extra heavy protection is required, or in custom fabrication of box covers, tank heads, or heavy wear areas. |



Product Information Aluminum Numbered WeatherJacs®

Product Description

Ideal Products' Aluminum Numbered WeatherJacs® are produced from 1100 series aluminum, .024" in thickness, meeting ASTM C-585 standards. All of our aluminum numbered WeatherJacs® are coated on the interior and exterior with a heat cured acrylic enamel moisture barrier. The interior covering helps provide moisture and corrosion resistance to the alloy, while the exterior clear coat helps provide protection against oxidation and corrosion, to maintain protection and finish.

Our Aluminum Numbered WeatherJacs® are made from two matching halves, and when fastened together they form a precise fit every time. Each half has a plastic weather proof label attached on the inside, identifying the size number of the elbow for easy identification.

Ideal offers a selection of Aluminum Numbered WeatherJacs® in both 90° and 45° angles, in sizes from #2 - #61 (for 90°) and #1 - #16 (for 45°). We also offer a selection of Large Bore WeatherJacs® and Gore Elbow Covers for your larger pipe or custom needs.



Product Application

Aluminum Numbered WeatherJacs® should be installed at any angle or bends in a pipe line, over the Aluminum Roll Jacketing. When used along with Ideal Products' Roll Jacket covering it provides complete protection to any work project.

WeatherJacs® can be secured by strapping, stainless steel screws or rivets. The amount of straps, screws or rivets, is dependant on the size of the elbow. When fastening with screws or rivets, the exterior and interior center points should be started first, then working outwards towards the two ends. It is recommended that a joint sealant be used on all overlaps when installing WeatherJacs®.

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Product Information Strapping & Seals

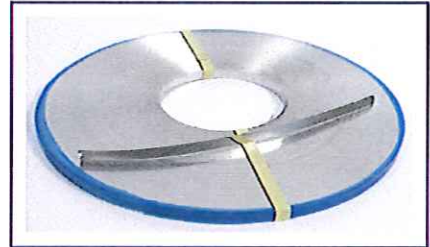
Strapping

Ideal Products' strapping is made from T-304 Series Stainless Steel, which meets ASTM A-240 standards, and Aluminum Alloy 3003, 3105 meeting ATSM B209 standards. Ideal Products' strapping is manufactured from a soft annealing, making it easy to handle. Stainless Steel is available in both 1/2" and 3/4" widths and in 0.015" and 0.020" thicknesses, while Aluminum is available in both 1/2" and 3/4" widths and 0.020" thickness. Ideal Products has "No Asbestos" engraved strapping to help identify asbestos free insulation areas. Asbestos free banding is available by custom order in 1/2" width by 0.020" thickness.

1/2" Strapping 0.015" -Bright Annealed
-Mill Finish

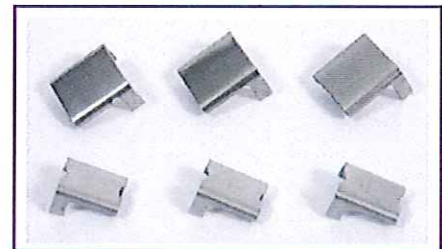
1/2" Strapping 0.020" -Bright Annealed
-Mill Finish
-No Asbestos

3/4" Strapping 0.020" -Bright Annealed



Wing Seal

Ideal Products' Wing Seals are available in 1/2" and 3/4" widths in Aluminum and Stainless Steel. Ideals' wing seals are made from 0.025" thick, heavy duty 300 Series Stainless Steel and 0.024", 0.032" Aluminum.



Stainless Steel Closed Seals

Stainless Steel closed seals are available in 1/2" and 3/4" widths. They are made from 0.025" thick heavy duty 300 Series Stainless Steel. Closed Seals are designed to be used for diameters of 8' and over. A standard seal tool is required for use with this particular seal. Closed seals ensure a stronger closure over wing seals on high tension or expansion spring applications.

Stainless Steel Tie Wire

Ideal Products' Tie Wire is manufactured from T-304 Stainless Steel, and is available in both 16 and 18 gauge on 25lb or 5lb spools.



Removable Insulation Covers

DKB, Inc. Removable Insulation Covers are fabricated to the highest standards and installed by professional craftsmen.

DKB, Inc. Removable Insulation Covers can be custom fabricated to be utilized any item requiring sound absorption, energy conservation, personnel protection, condensation control, or freeze protection.

DKB, INC.

**702 N California
Pasco, WA
99301**

Phone: 509-545-3885

Fax: 509-545-3880

E-mail:

customerservice@dkbinc.net



DKB, Inc. Removable insulation covers may be fabricated utilizing ceramic fiber, micro porous, high temperature fiberglass, or rigid fiberglass board insulation with thicknesses ranging from 1/2" to 4". Each removable cover is fabricated with silicone-impregnated fiberglass fabric, Teflon coated fiberglass fabric, high temperature silica fabric, light, medium, and heat treated fiberglass fabric. Each removable insulation cover can be constructed with the use of seam threads, hog rings, or staples and secured with the use of "D" rings, Velcro, or lacing hooks with 18 GA stainless steel tie wire.

DKB, Inc. Removable insulation covers conform to these standards based on component materials: ASTM E-84, ASTM E-136, ASTM C-167, ASTM C-177, ASTM C-201, ASTM C-411, ASTM C-423, ASTM C-522, ASTM C-553, ASTM C-612, ASTM C-795, ASTM C-1104, ASTM C-1139, ASTM C-1335, UL-214, UL-723, NFPA 255, NFPA 701-1999, UBC 42-1, MiH-24244, NRC 1.36.