GE Consumer & Industrial

Multilin - Power Quality Equipment



Service Training

Automatic
Transfer Switches

ZENITH CONTROLS, INC.

POWER PANEL REPLACEMENT PARTS LIST
40-800 AMPS
ZTG/ZTGD SERIES TRANSFER SWITCH EQUIPMENT

ISO 9001
53R-1002A
Rev 7/96

ZENITH TRANSFER SWITCH EQUIPMENT

Service and Replacement Parts

Zenith transfer switches are designed for use on emergency or standby generator systems, are 100% load applied, and rated for total system load or motor loads. These switches are designed to provide many years of trouble-free operation. In the event service is required, please call

Zenith Factory Service Hotline (24 hours every day)
PHONE: 312 247-6400 FAX: 312 247-7805

When calling Zenith Factory Service, please provide the following information (obtained from the rating nameplate):

Product Model Number: _____
Serial Number: _____
System Voltage: _____Volts ____ Phase _____ Wires _____ Hz
Date of Installation: _____

This Replacement Parts Manual provides information on the identification of all replaceable parts in your Zenith ZTG & ZTGD transfer switches. All worn or inoperative parts must be replaced using Zenith recommended replacement parts. Many Zenith replacement parts can be field installed, however several require Zenith Factory Service.

Separate manuals covering the features, operation and testing of the power panel and the control panel were supplied with each switch. Please refer to these manuals whenever servicing a switch or replacing parts.

Zenith Field Service is available to perform any service that may be required, including, but not limited to, replacement of all parts listed in this manual, diagnostic troubleshooting, and preventive maintenance. Please call us for more information.

REPLACEMENT PARTS LIST 40-260 AMPS

⚠ NOTICE

Model number and serial number of switch must be included with all orders for replacement parts. Specify line voltages, drawing numbers and date of installation. When ordering parts not shown on the parts list, refer to this part part by its legend description in the wiring diagram.

Tag	Description	Part Numbers					
		40A	80A	100A	150A	225A	260A
N1,2,3,N E1,2,3,N T1,2,3,N	Cable Connection Lug	PS-4419	PS-4423	PS-4423	27P-1128	27P-1126	27P-1127
	Wire Size	#14-2	#14-1/0	#14-1/0	#8-3/0	#6 to 250 MCM	#6 to 350 MCM
	Stationary Contact Assembly Kit	27P-1141	27P-1141	27P-1141	27P-1111	27P-1111	27P-1111
	Stationary Load Contact Assy. Kit	27P-1140	27P-1140	27P-1140	27P-1109	27P-1109	27P-1109
	Arc Grid Assembly Kit	27P-1014	27P-1014	27P-1014	27P-1014	27P-1014	27P-1014
	Moveable Contact Assembly Kit	27P-1036	27P-1036	27P-1036	27P-1037	27P-1037	27P-1037
CN/CE,CA	Note: 2S denotes two capacitors wired in series	Linear Actuator & Capacitors					
		CN/CE			CA (See Note)		
		Coil Volts	Poles		Qty	Part	mf
		120	2	K-2104PN	1	PS-4007	340-130
		240	2	K-2105PN	1	PS-4016	108-130
			3				
		208	3	K-2141PN	1	PS-4084	145-174
			4	K-2142PN	1	PS-4084	145-174
		575/600	3	K-2198PN	2S	PS-4083	36-43
			4	K-2197PN	2S	PS-4083	36-43
		480	3	K-2119PN	2S	PS-4008	72-86
			4	K-2119PN	2S	PS-4008	72-86
		416	3	K-2119PN	2S	PS-4008	72-86
SN	CN1 Cut-out Switch	L5022					
SE	CE1 Cut-out Switch	L-5022					
A3	Emergency Position Auxiliary Contact	SPDT, L-5022, DPDT, L-5021					
A4	Normal Position Auxiliary Contact	SPDT, L-5022, DPDT, L-5021					
	Limit Switch #1*	L-3067F					
	Limit Switch #2*	L-5025					
	Solenoid 4HDINT, 120VAC*	K-2204, K2204RPL					

* NOTE: On Delayed Transition Units Only

REPLACEMENT PARTS LIST 600-800 AMPS

⚠ NOTICE

Model number and serial number of switch must be included with all orders for replacement parts. Specify line voltages, drawing numbers and date of installation. When ordering parts not shown on the parts list, refer to this part part by its legend description in the wiring diagram.

Tag	Description	Part Numbers	
		600A	800A
NL 1,2,3 EL 1,2,3 T 1,2,3 NN,EN,TN	Cable Connection Lugs	S-1393F (2) 600MCM-2	2-1392F (4) 600MCM-2
	Stationary Contact Assembly Kit	Consult Factory	
	Arc Grid Assembly Kit	23P-1366	
	Movable Contact Assembly Kit	Consult Factory	
RN/RNO* RE/REO*	Coil Rectifier	23P-1473	
SN/SNO*	Limit Switch	23P-1333(Standard Transition) 23P-1397 (Delayed Transition)	
SE/SEO*	Limit Switch	23P-1327 (Standard Transition) 23P-1397 (Delayed Transition)	23P-1452 (Standard Transition) 23P-1397 (Delayed Transition
A3	Emergency Position Auxiliary Contact	Standard Transition (Qty 1)23P-1327 (Qty 2)23P-1328 (Qty.3)23P-1334 (Qty.4)23P-1336 Delayed Transition (Qty. 1) 23P-1389, (Qty. 2) 23P-1390	
A4	Normal Position Auxiliary Contact	Standard Transition (Qty 1)23P-1333 (Qty 2)23P-1334 (Qty.3)23P-1328 (Qty.4)23P-1330 Delayed Transition (Qty. 1) 23P-1393, (Qty. 2) 23P-1394	
CN/CNO* CE/CEO*	Main Operator Solenoids		
	Voltage Systems		
	Coil Volts	Poles	600A	800A
	120	2	K2090F	K2073F
	240	2	K2092F	K2070F
		3	K2078F	K2070F
		4	K2091F	K2074F
	208	3,4	K2091F	K2074F
	575/600	3,4	K2095	K2155
	480	3	K2080F	K2071F
		4	K2079F	K2071F
	416	3	K2080F	K2071F

* NOTE: CNO, CEO, SNO, SEO, RNO & REO on Delayed Transition Units Only

REPLACEMENT PARTS LIST 400 AMPS

⚠ NOTICE

Model number and serial number of switch must be included with all orders for replacement parts. Specify line voltages, drawing numbers and date of installation. When ordering parts not shown on the parts list, refer to this part part by its legend description in the wiring diagram.

Tag	Description		Part Numbers
N1,2,3,N E1,2,3,N T1,2,3,N	Cable Connection Lugs #4-600 MCM		S-1422
	Contact Assembly Kits		
NL1,2,3	Normal		46P-1100E
N	Switch Neutral Normal		46P-1101E
EL1,2,3	Emergency		46P-1102E
N	Switch Neutral Emergency		46P-1103E
	Arc Grid Assembly		46P-1140
	Main ATS Operating Coil		
	Voltage Systems		
CNE (Standard Transition) CN/O, CE/O (Delayed Transition)	Coil Volts	Poles	
	120	2	K-2178
	240	3,4	K-2189
	208	3,4	K-2177
	575/600	3,4	K-2196
	480	3,4	K-2176
	416	3,4	K-2188
	380	3,4	K-2188
SN/SNO*	CN1 Limit Switch/CNO Limit Switch		L-5021
SE/SEO*	CE1 Limit Switch/CEO Limit Switch		
A3	ATS Emergency Position Switch		
A4	ATS Normal Position Switch		
SCN/O*, SCE/O*	CNE Limit Switches		L-3079
BR (Standard Transition) RTE/RTN (Delayed Transition)	Rectifier		PS-5076

* NOTE: SNO/SEO & SCEO/SCNO on Delayed Transition Units Only



830 West 40th Street
Chicago, IL 60609
USA

Phone: 312 247-6400
FAX: 312 247-7805

© 1996 Zenith Controls, Inc.

GE ZENITH MASTER PRICE LIST
O-1153AB October, 2004
Common Replacement Parts
(serial# of switch required prior to ordering)

080BA9S120LB	LED - White 120V	46.00
080BA9S120LG	LED - Yellow/Amber 120V	46.00
080BA9S120LR	LED - Red 120V	46.00
080BA9S120LV	LED - Green 120V	46.00
080BA9S24LB	LED - White 24V	46.00
080BA9S24LG	LED - Yellow/Amber 28V	46.00
080BA9S24LR	LED - Red 28V	46.00
080BA9S24LV	LED - Green 28V	46.00
43050	Synch Light	$13.00
BA9S160	Bulb 160VAC - Incand. **min purchase 6**	4.00
BA9S24	Bulb 24VAC - Incand. **min purchase 6**	12.00
CR420NPL0224	2-Pole Control Relays, 24Vdc Coil	$31.00
CR420NPL022J	2-Pole Control Relays, 120VAC Coil	$31.00
CR420NPL0444	4-Pole Control Relays, 24Vdc Coil	$36.00
E-3009	Trip Pin (for 2410 exercisor clock on day wheel) **min purchase 6**	2.00
E-3402	Manual operating handle shaft ZBTS40 (add PS-3496 grip)	19.00
E-4099	Manual operating handle shaft ZTS/ZTSH60-120 and 40-260A (Note - Add PS1586)	25.00
E-4113	Manual operating handle shaft ZTS400-600 (horiz.type)	164.00
E-4173	Manual operating handle shaft ZTS41 & ZBTS41-121 (Note - Add PS1586)	33.00
E-5123	Manual operating handle shaft ZTS160-300 (Note - Add PS2131)	90.00
F6-25RPL	C Exerciser clock, 120V (solid state repl. assy for mechanical)	1449.00
F6-26RPL	C Exerciser clock, 208/240V (solid state repl. assy for mechanical)	1449.00
F6-27RPL	C Exerciser clock, 480V (solid state repl. assy for mechanical)	1449.00
FT-2111	Solid State Repl. Assy for TFC (120VAC)	515.00
27H-1002	Normal lug plate SZTS	55.00
27H-1003	Emergency lug plate SZTS	55.00
57H-1011	Aux. switch cam	6.00
57H-1013	Solenoid clamp	9.00
H3SAX	H Timer, replaces FT-165 & FT-167	490.00
HMICABC111	Interface cable from OIP(MIP) to PLC	$659.00
IC200CHS022	Versa Max, I/O Carrier	$286.00
IC200CPUE05	CPU, VersaMax PLC w/ Ethernet Port	$1,950.00
IC200MDD844	Mixed IO Module	$1,426.00
IC200MDL650	32 pts digital input module	$1,300.00
IC200MDL750	32 pts digital output module	$1,446.00
IC200PWR002	Power supply for Versamax	$318.00
IC693PWR331	24Vdc Power Supply	$1,171.00
IC693MDL655	32 Point Input Card	$1,500.00
IC693MDL753	32 Point Output Card	$1,459.00
IC693CPU350	CPU (To be used at the master section)	$3,054.00
IC693CMM311	Coprocessor communication module	$2,014.00
K-1028	Buzzer - 115 V	135.00
K-1049	Relay - SPDT	225.00
K-1055	PR phase relay - 120 208V	260.00
K-1056	PR phase relay - 208 V	260.00
K-1056A	PR phase relay - 240 V	260.00
K-1057	PR phase relay - 277 V	260.00

K-1058	PR phase relay - 480 V	260.00
K-1060	Relay - SPDT - 240 V	260.00
K-1061	Pneumatic timer	900.00
K-1086	Relay - DPDT - 120 V	341.00
K-1087	Relay - DPDT - 240 V	341.00
K-1088	Relay - DPDT - 480 V	341.00
K-1095	Coil control relay - 120 V	811.00
K-1099	Control relay - 4PDT - 120 V	720.00
K-1120	Coil control relay - ZTS - 120 V	350.00
K-1120B	Coil control relay - DC Solenoid	350.00
K-1121 RPL	ARS-1 phase relay - 120 V, replacement assy.	700.00
K-1122 RPL	ARS-2 phase relay - 208/240 V Specify voltage, replacement assy.	700.00
K-1123 RPL	ARS-3 phase relay - 277 V, replacement assy.	700.00
K-1156RPL	R4 Inphase monitor replacement w/labels - 120V	1556.00
K-1157RPL	R4 Inphase monitor replacement w/labels - 480V	1556.00
K-1159RPL	R4 Inphase monitor replacement w/labels - 208 - 240V	1556.00
K-1160 RPL	ARS-4 phase relay - 480 V, replacement assy.	640.00
K-1185	ARSM phase relay (plug in) - 120 V	525.00
K-1186	ARSM phase relay (plug in) - 208/240 V	525.00
K-1187	ARSM phase relay (plug in) - 277 V	640.00
K-1188	ARSM phase relay (plug in) - 480 V	490.00
K-1192 R	VFSM relay w/light	335.00
K-1192 RPL	120V VFSM field replacement assy.	397.00
K-1194	8 Pin miniature timer base	33.00
K-1196RPL	R4 Inphase monitor replacement w/labels - 120V	1500.00
K-1197RPL	R4 Inphase monitor replacement w/labels - 480V	1500.00
K-1198RPL	R4 Inphase monitor replacement w/labels - 380-416VV	1500.00
K-1199RPL	R4 Inphase monitor replacement w/labels - 208-240V	1500.00
K-1200RPL	R4 Inphase monitor replacement w/labels - 575-600V	1500.00
K-1201G	PMI 5-6 seconds, replaces K-1201	640.00
K-1204	Relay - 4 point - RT/CR	78.00
K-1208	Base	66.00
K-1212	Relay (208-240) plug in	130.00
K-1228	Relay Base	45.00
K-1232	Relay, 24VAC	45.00
K-1233	Triple purpose relay - 120V	1350.00
K-1234	Triple purpose relay - 208/240V	1350.00
K-1235	Triple purpose relay - 480V	1350.00
K-1237R	HX timer 3 sec	420.00
K-1240	Relay	420.00
K-1241	Timer cover	65.00
K-1242	Relay	65.00
K-1243	Synch check relay	1600.00
K-1246	Phase sequence relay	765.00
K-1249	Timer	510.00
K-1259	Coil control relay - ZTS - 24V	425.00
K-1260	Coil control relay - ZTS - 24V	425.00
K-1265	Relay output dual module	339.00
K-1266	Relay/Opto input, dual, 24V	225.00
K-1267	Relay/Opto input, dual, 120V	225.00
K-1268	Relay 12V E start MX200	50.00
K-1270RPL	R4 Inphase monitor replacement w/labels - 575-600V	1500.00
K-1276	C or D Clock, 120V - G Type	342.00
K-1277	C/D Clock - G type	532.00
K-1278	C/D 365 Day clock - G type	995.00
K-1285	C or D Clock 7 Day, 120V	342.00
K-1286	C or D Clock 7 Day, 208/220/240V	200.00
K-1287	Fixed 20 sec Timer, 120V	100.00
K-1288	Fixed 20 sec Timer, 208/220/240V	100.00
K-1289	C/D Clock 7 Day, 120V	811.00
K-1290	C/D Clock 7 Day, (same footprint as Z2000-2A)	811.00
K-1299	C/D Clock, 365 Day	1200.00
K-2003	Solenoid - 115 V	425.00
K-2006	Solenoid - 230 V	475.00
K-2011	Solenoid - Note use K-2149 for MT/6MT	650.00
K-2012	Solenoid	950.00
K-2013	Solenoid - 115 V	460.00

K-2014	Solenoid - 230 V		650.00
K-2015	Solenoid - 115 V		972.00
K-2016	Solenoid		1203.00
K-2017F	Solenoid		700.00
K-2018	Solenoid - 230 V		700.00
K-2019	Solenoid		1407.00
K-2020	Solenoid - 460/480 V		700.00
K-2021	Solenoid		2290.00
K-2025	Solenoid		700.00
K-2026	Solenoid		950.00
K-2030	Solenoid - 460 V		625.00
K-2032	Solenoid - 208/220 V		3100.00
K-2037	Solenoid - 440 V		3100.00
K-2051	Solenoid		950.00
K-2052	Solenoid		950.00
K-2053	Solenoid		950.00
K-2054	Solenoid		950.00
K-2055	Solenoid		950.00
K-2056	Solenoid		950.00
K-2057	Solenoid		950.00
K-2058	Solenoid		950.00
K-2063	Solenoid		950.00
K-2070F	Solenoid		1400.00
K-2071F	Solenoid		1400.00
K-2072F	Solenoid		1400.00
K-2073F	Solenoid		1400.00
K-2074F	Solenoid		1400.00
K-2078F	Solenoid	Includes both "F" suffix used on	950.00
K-2079F	Solenoid		950.00
K-2080F	Solenoid	ZTS61-121 and Non-Suffix units	950.00
K-2089	Solenoid		950.00
K-2090F	Solenoid	for ZTS60-120	950.00
K-2091F	Solenoid	(K-2070 thru K-2099)	950.00
K-2092F	Solenoid		950.00
K-2093F	Solenoid		950.00
K-2094	Solenoid		1160.00
K-2095F	Solenoid		1160.00
K-2096	Solenoid		1160.00
K-2097	Solenoid		1160.00
K-2099	Solenoid		610.00
K-2104P	Linear actuator, 120V w/plunger, Benolex subpanel		2900.00
K-2104PN	Linear actuator, 120V w/plunger, new molded subpanel		2900.00
K-2105P	Linear actuator, 240V w/plunger-Benolex subpanel		2900.00
K-2105PN	Linear actuator, 240V w/plunger, new molded subpanel		2900.00
K-2106	Linear actuator - 480 V - obsolete - use K-2119		
K-2107P	Actuator plunger (3 Pole) 40A-260A old style w/plunger		
K-2108	Actuator plunger - (4 Pole) 40A-260A old style w/plunger		1690.00
K-2109P	Linear actuator, 120V w/plunger, Benolex subpanel		1610.00
K-2109PN	Linear actuator, 120V w/plunger, new molded subpanel		1610.00
K-2110P	Linear actuator, 240 V w/plunger, Benolex subppanel		1610.00
K-2110PN	Linear actuator, 240V w/plunger, new molded subpanel		1610.00
K-2111P	Linear actuator, 480 V w/plunger, Benolex subppanel		1610.00
K-2111PN	Linear actuator, 480V w/plunger, new molded subpanel		1610.00
K-2112	Solenoid - 120 V		1610.00
K-2113	Solenoid - 208 V		1610.00
K-2114	Solenoid - 240 V		1610.00
K-2115	Solenoid - 480 V		1610.00
K-2117	Solenoid		1610.00
K-2119P	Linear actuator, 480 V w/plunger, Benolex subppanel		1610.00
K-2119PN	Linear actuator, 480V w/plunger, new molded subpanel		1610.00
K-2120	DC solenoid		2060.00
K-2123	DC solenoid		2060.00
K-2125	DC solenoid		2060.00
K-2126	DC solenoid		2060.00
K-2127	DC solenoid		2060.00
K-2128	DC solenoid		2325.00
K-2129	DC solenoid		2325.00

K-2130	DC solenoid	2325.00
K-2132P	Linear actuator - 480 V w/plunger	2100.00
K-2133P	Linear actuator - 480 V w/plunger	2100.00
K-2134P	Linear actuator - 240 V w/plunger	2100.00
K-2135P	Linear actuator - 240 V w/plunger	2100.00
K-2136P	Linear actuator - 208 V w/plunger	2100.00
K-2137P	Linear actuator - 208 V w/plunger	2100.00
K-2138P	Linear actuator - 120 V w/plunger	2100.00
K-2139P	Linear actuator - 120 V w/plunger	2100.00
K-2140	Actuator plunger 400 amp	465.00
K-2141P	Linear actuator, 208V w/plunger, Benolex subppanel	1555.00
K-2141PN	Linear actuator, 208V w/plunger, new molded subpanel	1555.00
K-2142P	Linear actuator, 208V w/plunger, Benolex subppanel	1555.00
K-2142PN	Linear actuator, 208V w/plunger, new molded subpanel	1555.00
K-2146	Solenoid ZTSD 61 AMP	2360.00
K-2147	Solenoid ZTSD 81, 101, 121	2622.00
K-2149	Solenoid - replaces K-2011 for MT/6MT	730.00
K-2151	ZTSD solenoid	2860.00
K-2157	ZTSD solenoid	2860.00
K-2158	ZTSD solenoid	2860.00
K-2159	Bypass interlock solenoid	185.00
K-2160	ZTSD solenoid	4358.00
K-2168	DC solenoid	4358.00
K-2176RPL	ZTS/D solenoid 480 V	1075.00
K-2177RPL	ZTS/D solenoid 208 or 240 V	1075.00
K-2180	Solenoid CBN/CBE/BPS/TSR	225.00
K-2182	Solenoid 120-208 V MVP	600.00
K-2183	Solenoid 240-277 V MVP	600.00
K-2184	Solenoid 480 V MVP	600.00
K-2186	Solenoid 277 V	600.00
K-2187	DC solenoid	4358.00
K-2188RPL	ZTS/D solenoid 380 V	1060.00
K-2189RPL	ZTS/D solenoid 240 V	1060.00
K-2192	Bypass interlock solenoid ZBTSH 1600-3000 Amp	170.00
K-2193	Solenoid	3120.00
K-2195	Solenoid	3120.00
K-2201	Actuator plunger (40-260A), 2/3pole new molded panel	195.00
K-2202	Actuator plunger (40-260A), 4pole new molded panel	247.00
K-2207	Solenoid 120V	200.00
K-2208	Solenoid 208V	200.00
K-2209	Solenoid 480V	200.00
K-2211	Solenoid 277V	200.00
K-2212	Solenoid 380/416 V	200.00
K-2213	Solenoid 575/600V	200.00
K-2214	Solenoid 480V	1900.00
K-2215	Solenoid 208/240V	1900.00
K-2216	Solenoid 380/416V	1900.00
K-2217	Solenoid 575/600V	1900.00
K-2228	Solenoid 240V	190.00
K-2229	Solenoid, 120V	698.00
K-2230	Solenoid, 208V	698.00
K-2231	Solenoid, 240V	698.00
K-2232	Solenoid, 277V	698.00
K-2233	Solenoid, 380/415V	698.00
K-2234	Solenoid, 480V	698.00
K-2235	Solenoid, 575/600V	698.00
K-3005	Transformer - 440/120 V - 5 VA	110.00
K-3022	Transformer - 575/120 V - 10 VA	155.00
K-3025	Transformer - 240/120 V - 10 VA	155.00
K-3026	Transformer - 480/120 V - 10 VA	155.00
K-3028	Control transformer - 480/120 V - 150 VA	444.00
K-3029	Control transformer - 600/120 V - 150 VA	470.00
K-3030	Transformer 3 phase - 480/120 V - phase relays	775.00
K-3035	Transformer 3 phase - 575/120 V - phase relays	775.00
K-3041	Transformer - 240/480/120 V - 100 VA	426.00
K-3042	Transformer - 480/120 V - 45 VA	141.00
K-3051	Transformer - 240/480-120V 25VA (CTAP)	110.00

K-3053	Transformer - 208/120 V - 100 VA	348.00
K-3055	Transformer - 416/120 V - 100 VA	450.00
K-3056	Transformer - 208/120 V - 150 VA	450.00
K-3057	Transformer - 380/120 V - 150 VA	450.00
K-3058	Transformer - 416/120 V - 150 VA	450.00
K-3061	XFR 24/120/240 25 VA	350.00
K-3062	XFR 24/240/480 25 VA	350.00
K-3063	XFR 24/208/416 25 VA	350.00
K-3064	XFR 24/220/440 25 VA	350.00
K-3065	XFR 24/575 25 VA	350.00
K-3066	XFR 24/600 25 VA	350.00
K-3067	XFR 24/380 25 VA	350.00
K-3068	XFR 100 VA - 120-120	340.00
K-3070	XFR 50 VA - 208/277 - 120	170.00
K-3071	XFR 50 VA - 240/480 - 120	170.00
K-3076	XFR 50 VA - 120-120	170.00
K-3081	XFR 5 VA - 277/120	170.00
K-3089	XFR 50 VA - 380/400-416 - 110/220	295.00
K-3092	Potential XFR	430.00
K-3095	Potential XFR	465.00
K-3096	Potential XFR	465.00
K-3102	XFR 10VA, 208/24V	206.00
K-3103	XFR 10VA, 240/24V	206.00
K-3104	XFR 10VA, 277/24V	206.00
K-3105	XFR 10VA, 480/24V	206.00
K-3107	XFR 10VA, 575/24V	300.00
K-3108	ZTC control XFR - 220/240	450.00
K-3109	ZTC control XFR - 208	450.00
K-3110	ZTC control XFR - 380	490.00
K-3111	ZTC control XFR - 277	490.00
K-3112	ZTC control XFR - 575/600	490.00
K-3113	ZTC control XFR - 415	490.00
K-3114	ZTC control XFR - 120	490.00
K-3216	XFR, 1VA, 120V	60.00
K-3217	XFR, 1VA, 208V	60.00
K-3218	XFR, 1VA, 240V	60.00
K-3224	XFR, 25VA, 120V	160.00
K-3225	XFR, 25VA, 208V	160.00
K-3226	XFR, 25VA, 240V	160.00
K-4103	ZTX 12VDC battery charger, 1.5 Amp (replaces K-4102)	248.00
L-1019	Switch block	85.00
L-1020	Switch block	55.00
L-1024	Switch block N.O. (bypass switch)	50.00
L-1025	PB operator, black, test switch (Tele)	40.00
L-1026	PB operator, green, YN (Tele)	42.00
L-1027	PB operator, red, YE (Tele)	42.00
L-1028	NO Contact Block (Tele)	56.00
L-1029	NC Contact Block (Tele)	56.00
L-2006	Toggle switch	40.00
L-2028	N/E FTO reset oper; key mom.	190.00
L-3002	Control relay switch	46.00
L-3003	Electric interlock switch	46.00
L-3019	Switch	46.00
L-3041	Switch	46.00
L-3046	Coil cutout switch - see L-3058 kit	
L-3052	Limit switch BT/TSE/BLL/ALL	180.00
L-3054	Limit switch ATS latched 1600-3000 Amp	18.00
L-3056	Cam switch	46.00
L-3057	Switch	46.00
L-3058	Coil cutout switch kit	210.00
L-3060RPL	Coil cutout switch - ZTS	180.00
L-3061RPL	Coil cutout switch - ZTS	180.00
L-3071	Limit switch AA/AE/PLS	40.00
L-3078	Limit switch	17.00
L-3079	Limit switch SCN/SCE/CNE	65.00
L-3080	Limit switch SN/SE (ZBTSDH40)	30.00

L-3081	2 Pos. Maintained Keyed (Tele)	72.00
L-3087G	Limit switch - gold	30.00
L-3089	SNO/SEO Switches for delayed transition switch (F14B)	20.00
L-4003	Test switch operator	285.00
L-4006	Voltmeter switch	285.00
L-4007	Ammeter switch	410.00
L-4008	Control switch - PC	23.00
L-4009	D3 switch operator	120.00
L-4018	2 Position operator - maintained (Tele)	60.00
L-4019	2 Position key switch - maintained (Tele)	198.00
L-4020	2 Position key switch - momentary (Tele)	198.00
L-4022	3 Pos. Spring Return Keyed	70.00
L-4023	3 Pos. Spring Return	70.00
L-4024	3 Pos. Maintained	70.00
L-4027	Limit switch 600V	45.00
L-4031	3 Pos. Maintained Keyed	70.00
L-5021	Switch DPDT A3/A4 Aux contact - new style	35.00
L-5022F	Switch SPDT A3/A4 Aux contact - new style	35.00
L-5023	Switch DPDT NA4-EA3 Aux contact (ZBTSH40)	60.00
MM-511	Touchup paint (Zenith82 grey - NEMA 1)	90.00
MM-558	Touchup paint (IEC beige) liquid	90.00
MM-554	Touchup paint (Grey) spray can	89.00
MM-555	Touchup paint (IEC beige) spray can	99.00
OSA-A-TFM	Solid state timer replacement MT 120V	910.00
OSA-C-TFM	Solid state timer replacement MT 240V	910.00
OSA-A	Solid state timer, ZTS, T, U, W	445.00
OSA-A3	Solid state timer, ZTS T, U, W	361.00
23P-1040	Coil cutout switch	445.00
23P-1085	Stationary contact 400 A - ZTS40	960.00
23P-1086	Movable contact 400 A - ZTS40	1010.00
23P-1087	Arc grid - 400 A - ZTS40	680.00
23P-1088	Solenoid hardware 400 A - ZTS40	95.00
23P-1092	Solenoid hardware 600 A - ZTS60	95.00
23P-1096	Solenoid hardware 800-1200 A - ZTS80-ZTS120	103.00
23P-1157	Movable contact kit	930.00
23P-1327	1-A4 Aux contact LZTS/ZBTS	92.00
23P-1328	2-A4 Aux contact LZTS/ZBTS	182.00
23P-1331	SE switch ZTS61-121 (replaced by L-3060RPL)	
23P-1332	SN switch ZTS61-121 (replaced by L-3061RPL)	280.00
23P-1333	1-A3 Aux contact LZTS/ZBTS	92.00
23P-1334	2-A3 Aux contact LZTS/ZBTS	182.00
23P-1344	Movable contact Assy kit ZTS301	2795.00
23P-1352	1-A3 Aux contact ZTS161/301	90.00
23P-1353	2-A3 Aux contact ZTS161/301	182.00
23P-1356	1-A4 Aux contact ZTS161/301	90.00
23P-1357	2-A4 Aux contact ZTS161/301	182.00
23P-1366	Arc grid 600-1200 AMP Replaces 23P-1091, 23P-1095, 23P-1366W (1 grid)	218.00
23P-1389	1-A3 Aux contact -ZTSD	90.00
23P-1390	2-A3 Aux contact -ZTSD	182.00
23P-1393	1-A4 Aux contact -ZTSD	90.00
23P-1394	2-A4 Aux contact -ZTSD	182.00
23P-1397	SN/SNO - SE/SEO ZTSD	90.00
23P-1400	Movable contact Assy kit ZTS161-201	2624.00
23P-1402	A4 switch ZTSD161-301	90.00
23P-1404	A3 switch ZTSD161-301	90.00
23P-1434Y	Stationary contact Assy kit ZTS161-201	884.00
23P-1434Z	Stationary contact Assy kit ZTS301	1124.00
23P-1452	SE switch ZTS81-121	182.00
23P-1461	Movable contact kit 600 AMP - ZTS60 (Horizontal) replaces 23P-1090. See Note 1 (1 contact).	925.00

23P-1462	Stationary contact kit 600 AMP - ZTS60 (Horizontal) replaces 23P-1089. See Note 1 (1 contact).	615.00
23P-1463	Movable contact kit 800-1200 AMP - ZTS80 - ZTS120 (Horizontal) replaces 23P-1094X,Y,Z. See Note 1 (1 contact).	2704.00
23P-1470	Movable contact kit 600 AMP ZTS61 For use only on units shipped after 7/1/86 consult factory for exact dates. ZBTS61 (All) N-Neutral pole only (1 contact).	1045.00
23P-1471	Stationary contact kit 600 AMP - ZTS61 For use only on units shipped after 7/1/86 consult factory for exact dates. ZBTS61 (All) (1 contact).	567.00
23P-1533	Switch assembly	182.00
23P-1534	Switch assembly	182.00
23P-1535	Switch assembly	182.00
23P-1536	Switch assembly	182.00
23P-1540	Switch assembly	110.00
23P-1541	Switch assembly	110.00
23P-1568	Switch assembly	120.00
23P-1569	Switch assembly	120.00
26P-1144	Contact assembly	460.00
26P-1299	Bypass speed wrench ZBTS41-121	207.00
26P-1303	ZBTS - 2nd generation bypass control panel	1586.00
26P-1304	Switch assembly	110.00
26P-1311	Switch assembly	110.00
26P-1312	Switch assembly	110.00
26P-1327	SN/SNO switch ZTSD81-121	110.00
26P-1328	SE/SEO switch ZTSD81-121	110.00
26P-1331	Movable contact kit 800-1200 AMP ZBTS81-121 A, B, & C Phase For use on units shipped prior to 1/1/85. Consult factory for exact dates and application prior to order - replaces 23P-1367 X, Y, Z (1 contact).	1800.00
26P-1332	Movable contact kit 800-1200 AMP ZBTS81-121 N (Neutral) phase For use on units shipped prior to 2/18/85. Consult factory for exact dates and application prior to order (1 contact).	1480.00
26P-1333	Stationary contact kit 800-1200 AMP - ZBTS81-121 For use on units shipped prior to 2/18/85. Consult factory for exact dates and application prior to order (1 contact).	712.00
26P-1334	Movable contact kit 800-1200 AMP ZTS/D, ZBTSD/ZBTS81-121, A, B & C phase. For use on units shipped after 2/18/85. Consult factory for exact dates and application prior to order (1 contact).	1800.00
26P-1335	Movable contact kit 800-1200 AMP ZBTS/D, ZTS/D, ZBTS81-121, N(neutral) phase. For use on units shipped after 2/18/85. Consult factory for exact dates and application prior to order (1 contact).	1800.00
26P-1336	Stationary contact kit, 800-1200 AMP ZBTS/D, ZTS/D, ZBTS81-121, N(neutral) phase.	712.00

	For use on units shipped after 2/18/85. Consult factory for exact dates and application prior to order (1 contact).	
27P-1004	Stationary contact - 150-260 A	133.00
27P-1014	Arc grid	110.00
27P-1015	Load carrier	65.00
27P-1016	Load carrier	65.00
27P-1017	Load carrier	85.00
27P-1018	Emergency stationary contact support block 40-260 Amp	50.00
27P-1019	Normal stationary contact support block 40-260 Amp	50.00
27P-1033	Stationary contact - 40-100 A	98.00
27P-1036	Movable contact - 40-100 A	290.00
27P-1037	Movable contact - 150-260 A	395.00
27P-1049	Stationary contact - 400 A - ZTS41	229.00
27P-1060	Arc grid - 400 A - ZTS41	140.00
27P-1063	Movable contact - 400 A - ZTS41	395.00
27P-1065Z	Capacitor replacement kit for PS-4017	272.00
27P-1142	Arc chute	25.00
NOTE:	**For correct ZTS contact replacement, see the chart at the end of this price list.**	
46P-1079	Bypass control panel "H" bypass	2250.00
	ZTSH/ZBTSH CONTACT KITS Specify Proper Suffix For All Parts	
46P-1100	ZTSH/ZBTSH Transfer Switch Contacts - Normal (A,B,C phases) (1 set of 3 movable and stationary contacts)	
	A (100 Amp)	2075.00
	B (150 Amp)	2256.00
	C (225 Amp)	2461.00
	D (260 Amp)	2708.00
	E (400 Amp)	3047.00
46P-1101	ZTSH/ZBTSH Transfer Switch Contacts - Normal neutral phase (1 set of 1 movable and stationary contact)	
	A (100 Amp)	692.00
	B (150 Amp)	748.00
	C (225 Amp)	816.00
	D (260 Amp)	888.00
	E (400 Amp)	981.00
46P-1102	ZTSH/ZBTSH Transfer Switch Contacts - Emergency (A,B,C phases) (1 set of 3 movable and stationary contacts)	
	A (100 Amp)	2075.00
	B (150 Amp)	2256.00
	C (225 Amp)	2461.00
	D (260 Amp)	2708.00
	E (400 Amp)	3047.00
46P-1103	ZTSH/ZBTSH Transfer Switch Contacts - Emergency neutral phase (1 set of 1 movable and stationary contact)	
	A (100 Amp)	692.00
	B (150 Amp)	748.00
	C (225 Amp)	816.00
	D (260 Amp)	888.00
	E (400 Amp)	982.00
46P-1104	ZBTSH Bypass Contacts - Normal (A,B,C phases) (1 set of 3 movable and stationary contacts)	

	A (100 Amp)		2075.00
	B (150 Amp)		2256.00
	C (225 Amp)		2461.00
	D (260 Amp)		2708.00
	E (400 Amp)		3047.00
46P-1105	ZBTS Bypass Contacts - Normal Neutral Phase (1 set of 1 movable and stationary contact)		
	A (100 Amp)		692.00
	B (150 Amp)		748.00
	C (225 Amp)		816.00
	D (260 Amp)		888.00
	E (400 Amp)		981.00
46P-1106	ZBTSH Bypass Contacts - Emergency (A,B,C phases) (1 set of 3 movable and stationary contacts)		
	A (100 Amp)		2075.00
	B (150 Amp)		2256.00
	C (225 Amp)		2461.00
	D (260 Amp)		2708.00
	E (400 Amp)		3047.00
46P-1107	ZBTSH Bypass Contacts - Emergency Neutral Phase (1 set of 1 movable and stationary contact)		
	A (100 Amp)		692.00
	B (150 Amp)		748.00
	C (225 Amp)		816.00
	D (260 Amp)		888.00
	E (400 Amp)		981.00
46P-1132	Switch assembly		135.00
46P-1161	Switch assembly		210.00
47P-1053	SSRCP control panel (Note: use jumpers PS-5067)		885.00
50P-1005	RT box - ZTSL, 120V	NOTE: For mini RT box	850.00
50P-1006	RT box - ZTSL, 208/220V	used with new style	850.00
50P-1007	RT box - ZTSL, 230/240V	40-150Amp standard	850.00
50P-1008	RT box - ZTSL, 277V	ATS, see 57P series	850.00
50P-1009	RT box - ZTSL, 380/400V		850.00
50P-1010	RT box - ZTSL, 416/440V		850.00
50P-1011	RT box - ZTSL, 460/480V		850.00
50P-1012	RT box - ZTSL, 575/600V		850.00
50P-1013	RT box - ZTGDK, 120V		920.00
50P-1014	RT box - ZTGDK, 208/220V		920.00
50P-1015	RT box - ZTGDK, 230/240V		920.00
50P-1016	RT box - ZTGDK, 277V		920.00
50P-1017	RT box - ZTGDK, 380/400V		920.00
50P-1018	RT box - ZTGDK, 416/440V		920.00
50P-1019	RT box - ZTDGK, 460/480V		920.00
50P-1020	RT Box - ZTGDK, 575/600V		920.00
50P-1034	RT box - ZTSDL, 120V		920.00
50P-1035	RT box - ZTSDL, 208/220V		920.00
50P-1036	RT box - ZTSDL, 230/240V		920.00
50P-1037	RT box - ZTSDL, 277V		920.00
50P-1038	RT box - ZTSDL, 380/400V		920.00
50P-1039	RT box - ZTSDL, 416/440V		920.00
50P-1040	RT box - ZTSDL, 460/480V		920.00
50P-1041	RT box - ZTSDL, 575/600V		920.00
50P-1087	Time delay board (ZTXR) 120/240V		494.00
50P-1090	Time delay board (ZTXR) 208V		
50P-1160RPL	MX100/150 Field Replacement Kit - Factory Programmed		1760.00

50P-1161RPL	MX200/250 Field Replacement Kit - Factory Programmed	2650.00
50P-1160SPR	MX100/150 Replacement Spare Controller Kit	1660.00
50P-1161SPR	MX200/250 Replacement Spare Controller Kit	2550.00
50P-2000	ZTX - MX-50 board (complete) 1 phase 208/240	494.00
50P-2003	ZTX Gen control board	120.00
50P-2005	ZTX - MX50 3 phase sensing adder board (208/240)	
50P-2006	ZTX - MX-50 board (complete) 1 phase 380/416	
50P-2008	ZTX - MX-50 board (complete) 1 phase 440/480	
50P-2009	ZTX - MX50 3 phase sensing adder board (380/415)	
50P-2010	ZTX - MX50 3 phase sensing adder board (440/480)	
50P-2012	ZTX - MX50 3 phase base board (208/240)	
50P-2013	ZTX - MX50 3 phase base board (380/416)	
50P-2014	ZTX - MX50 3 phase base board (440/480)	
50P-2019	ZTX control interface printed circuit board	
50W-1000	J5 harness	135.00
50W-1211	Configurator Accessory	60.00
57P-1015	Mini RT box - 3phase 120V	710.00
57P-1016	Mini RT box - 3phase 208/220V	710.00
57P-1017	Mini RT box - 3phase 240V	710.00
57P-1018	Mini RT box - 3phase 277V	710.00
57P-1019	Mini RT box - 3phase 380/400V	710.00
57P-1020	Mini RT box - 3phase 416/440V	710.00
57P-1021	Mini RT box - 3phase 460/480V	710.00
57P-1022	Mini RT box - 3phase 575/600V	710.00
57P-1115	Mini RT box - 1phase 120V	710.00
57P-1116	Mini RT box - 1phase 208/220V	710.00
57P-1117	Mini RT box - 1phase 240V	710.00
57P-1118	Mini RT box - 1phase 277V	710.00
57P-1119	Mini RT box - 1phase 380/400V	710.00
57P-1120	Mini RT box - 1phase 416/440V	710.00
57P-1121	Mini RT box - 1phase 460/480V	710.00
57P-1122	Mini RT box - 1phase 575/600V	710.00
57W-1021	ZTX 40-225A harness	37.00
57W-1026	ZTX Keypad connector	42.00
58P-1084	ZTX 9V battery cable assembly	
58P-1105	Cam module for delayed transition switch (F14B frame)	235.00
58P-1106	Secondary solenoid - delayed transition (F14B frame)-120	352.00
58P-1107	Secondary solenoid - delayed transition (F14B frame)-208	352.00
58P-1108	Secondary solenoid - delayed transition (F14B frame)-240	352.00
58P-1109	Secondary solenoid - delayed transition (F14B frame)-380/416	352.00
58P-1110	Secondary solenoid - delayed transition (F14B frame)-480	352.00
58P-1111	Secondary solenoid - delayed transition (F14B frame)-575/600	352.00
PS-715	Knob	21.00
PS-1231	Condenser	79.00
PS-1254	Socket (Pilot Light)	40.00
PS-1255	Red Lens (Pilot Light)	25.00
PS-1256	Green Lens (Pilot Light)	25.00
PS-1270	Bulb (ZTS Emergency Position) **min purchase 6**	15.00
PS-1271	Bulb (ZTS Normal Position) **min purchase 6**	15.00
PS-1272	Blinking light for shunt trip	32.00
PS-1362	Condenser	54.00
PS-1375	Capacitor	73.00
PS-1586	Manual operating handle knob (40-1200)	30.00
PS-1755	Terminal Block 12 point	57.00
PS-1756	Terminal Block 15 point	92.00
PS-1828	Terminal Block 13 point	60.00
PS-2131	Manual operating handle grip (1600-3000)	5.00
PS-2422	Control Panel Cover 12x29	179.00
PS-2423	Control Panel Cover 12x41	245.00
PS-2432	Control Panel Cover 22x29	245.00

PS-3013	Stationary contact screw **min purchase 6**	4.00
PS-3080	OSA Timer clip (2 required) **min purchase 2**	4.00
PS-3156	Clip **min purchase 2**	4.00
PS-3472	Adapter ring kit for reduction of 1 3/16 to 7/8 hole	15.00
PS-3473	Contact block mounting base. Required for all Tele.	10.00
PS-3496	Handle grip	5.00
PS-3504	Roller	30.00
PS-3549	Lock assembly	95.00
PS-3550	Cam assembly	13.00
PS-3594	Quarter turn fasteners	110.00
PS-3595	Door latch	145.00
PS-3599	Door latch	203.00
PS-3604	Replacement keys for PS-3599/PS-3595	28.00
PS-4007	Capacitor	99.00
PS-4008	Capacitor	104.00
PS-4015	Capacitor	122.00
PS-4016	Capacitor	145.00
PS-4045	Capacitor	120.00
PS-4046	Capacitor	146.00
PS-4047	Capacitor	165.00
PS-4048	Capacitor	165.00
PS-4053	Capacitor	165.00
PS-4056	Resistor RNH, 30 ohm	12.00
PS-4057	Resistor LDS, 120 ohm	22.00
PS-4058	Capacitor	45.00
PS-4082	Capacitor	25.00
PS-4084	Capacitor	80.00
PS-4642	Modular terminal block	92.00
PS-4648	Control panel cover 18 x 29 SSRCP	245.00
PS-4086	Resistor, 1Kohm, 3W, axial led	
PS-4087	Capacitor, 2.2mf 400VDC Radial Lead	
PS-4812	Diodes	4.00
PS-5046	Incandescent light sockets	46.00
PS-5047	Red lens	10.00
PS-5048	Green lens	10.00
PS-5049	Amber lens	10.00
PS-5051	White lens	10.00
PS-5053	Clear lens (L1, L2)	10.00
PS-5054	Neon light base	57.00
PS-5055	Neon lamp - orange (L1, L3, L4)	19.00
PS-5056	Neon lamp - green (L2)	19.00
PS-5067	SSRCP jumpers **min purchase 6**	2.00
PS-5076	Rectifier	135.00
PS-5110	Base & Red LED 24V Flashing	60.00
PS-5111	LED - Red 28V	40.00
PS-5112	LED - Green 28V	40.00
PS-5113	LED - Yellow/Amber 28V	40.00
PS-5114	LED - Green 120V	40.00
PS-5115	LED - Red 120V	40.00
PS-5116	LED - White 120V	40.00
PS-5128	Red LED unit 28V	41.00
PS-5129	Green Bypass LED unit 28V	41.00
PS-5130	Yellow Bypass LED unit 28V	41.00
PS-5131	Red blinking Bypass LED 28V	46.00
PS-5132	Connector - 14 position	52.00
PS-5133	Connector - 16 position	56.00
PS-5151	Dual rectifier replaces 23P-1473, 23P-1582 & PS-4870	239.00
PS-6161	DIN Rail	21.00
PS-7345	Din Rail MX200	14.00
PS-8706	Black cover for MX50/90 processor board	18.00
P9ACFS5	Opt. Flange for 5 Contact Blocks	12.00
P9B01VN	Normally Closed Contact	20.00
P9B10VN	Normally Open Contact	20.00
P9B11VN	N. Open, N. Closed Contacts	30.00

P9PDMVD	Base & Bulb 24V Flashing			98.00
P9PDMVDLR	Base & Red LED 24V Flashing			98.00
P9PDNVO	Base (full voltage)			34.00
P9XLAD	Housing w/ Amber Lens			12.00
P9XLBD	Housing w/ White Lens			12.00
P9XLID	Housing w/ Clear Lens			12.00
P9XLRD	Housing w/ Red Lend			12.00
P9XLVD	Housing w/ Green Lens			12.00
P9XPGD	Housing w/ Yellow Lens			12.00
P9XPNNG	Black Flush Pushbutton			30.00
P9XSCD0A95	2 Pos. Maintained Keyed			133.00
P9XSCD0K95	2 Pos. Maintained Keyed			133.00
P9XSCD3C95	3 Pos. Spring Return Keyed			110.00
P9XSCD5A95	2 Pos. Spring Return Keyed			110.00
P9XSCZ0C95	3 Pos. Maintained Keyed			85.00
P9XSMD0N	2 Pos. Maintained			44.00
P9XSMZ0N	3 Pos. Maintained			44.00
P9XSMZ3N	3 Pos. Spring Return			40.00
Y110012	Voltmeter, 0-600V Scale			$231.00
Y120006	Frequency Meter, 55-65Hz Scale			$1,025.00
Y260099	3-Pole Control Relays, 24Vdc Coil			$33.00
Y500065	Incandescent Lamp, 30Vdc, Use on IDEC SLC40 type			$10.00
Y500066	Green, LED Lamp, 24Vdc, Use on IDEC SLC40 type			$56.00
Y500067	Red, LED Lamp, 24Vdc, Use on IDEC SLC40 type			$32.00
Y500068	Amber, LED Lamp, 24Vdc, Use on IDEC SLC40 type			$32.00
Y600105	10A DC Fuse, Fast acting type			$6.00
Y600152	10A AC Fuse for Breaker trip coil, Slow Blow			$12.00
Y600169	15A AC Fuse for Breaker close coil, Slow Blow			$10.00
Y600172	PT's secondary fuse, 2A (250Vac Rated)		Min purchase 5	$5.00
Y600010	PT's secondary fuse, 6A (250Vac Rated)		Min purchase 5	$5.00
Z-4009	Coil - Sold as assembly	Consult factory		
Z-4010	Coil - Sold as assembly			
Z-4011	Coil - Sold as assembly	for replacement		
Z-4012	Coil - Sold as assembly			
Z-4014	Coil - Sold as assembly	information		
Z-4018	Coil - 120 V			325.00
Z-4019	Coil - 240 V			325.00
Z-4022	Coil - 277 V			325.00
Z-4023	Coil - 480 V			325.00
Z-5003	Coil - 120 V			145.00
Z-5005	Coil - 480 V			165.00
Z-5011	Coil - 24 V			165.00
Z-5013	Coil - 277 V			230.00
Z-5014	Coil - 208/240 V			176.00
	IN-PHASE MONITOR			
R4	In phase monitor - electronic governor (1%) Field add.to existing ATS's			2425.00
R43	In phase monitor - mechanical governor (3-5%) Field add.to existing ATS's			2425.00
	Adder module for "H" and older style control panels (non-microprocessor)			
A6	**MOTOR CONTROL DISCONNECT**			1950.00
	Field addition to existing transfer switches			
	Adder components for ZTS series products (any type) ONLY - specify			
	model and serial number at time of order. A6 may NOT be added to			
	ZTG series products without a microprocessor change			

T3/W3	**ELEVATOR PRE-SIGNAL** Field Addition to existing transfer switches Adder components for ZTS series products (any type) ONLY - specify model and serial number at time of order. T3W3 may NOT be added to ZTG series products without a microprocessor change	2055.00
C/D	**PLANT EXERCISER - LOAD/NO LOAD, 7 DAY TYPE** Field Addition to existing transfer switches Adder components for ZTS (non-microprocessor type)	990.00
C/D365	**PLANT EXERCISER - LOAD/NO LOAD, 365 DAY TYPE** Field Addition to existing transfer switches Adder components for ZTS (non-microprocessor type)	1690.00
	PRODUCT DRAWINGS AND MANUALS	
ATSOM	Automatic Transfer Switch O&M Manual	96.00
ATSDS	Automatic Transfer Switch Drawing Set	192.00
PSGOM	Paralleling Switchgear O&M Manual	962.00
	OPTION ADVANTAGE (parts sold separately) **Available in MX-150**	
A62-OA	Sequential Motor Disconnect & Staged Restart	105.00
VI-OA	Voltage imbalance between phases (3 phase units only)	100.00
6A/P-OA	Test switch (maintained)	90.00
CDP-OA	Programmable exerciser daily, 7-14-28-365 w/wo load	390.00
CTAP-OA	Chicago transfer alarm panel (configuration only)	595.00
T3/W3-OA	Elevator Pre-Signal	105.00
UMD-OA	Adj Pre and post transfer output. Functions in both directions	105.00
	Available in MX-250	
	Those listed above in MX-150 plus:	
R1-1-OA	Over voltage sensing (source 1) single phase	100.00
R1-3-OA	Over voltage sensing (source 1) three phase	300.00
S5/P-OA	Auto/manual (source 1) retransfer selector soft switch	420.00
S12/P-OA	Auto/manual (source 1 & 2) retransfer selector soft switch	500.00
	COMMUNICATION ACCESSORIES	
MNET000	Multinet Modbus to Ethernet Covertor	2778.00
50P-1105	Modbus Communications Card	1738.00
50P-1124	Modbus Configuration Kit	560.00
50P-1054	Lon Works Card (MX-100)	1160.00
50P-1055	Lon Works Card (MX-150/200/250)	1280.00
50P-1049	Lon Works Annunciator Module	1920.00
50P-1057	Lon Works Annunicator (1-8 position)	1993.00
ZNET10PS	Lon Works Power Supply (8-24 VAC/VDC)	1012.00

TITLE: Field Service Report Form	New# 5F-503	Responsible: Tech. Svc Mgr.	Approved By:	Page 1 of 2
	Old# ISO-2-1-03-3-0007	ISO Section X	Rev. Date 12/16/96	

Purpose: To be filled out for every service visit on a daily basis

Scope: Any field service employee

1) * Date of Service
2) * Name of Engineer performing service
3) * Name of facility or building
4) Zenith Y# assignment if applicable
5) * Zenith Service Authorization number
6) * Circle applicable work description
7) * Provide a summary of work performed
8) * Provide a list of parts installed
9) * Fill in arrival and departure to job site
10) * Fill in travel time if applicable
11) Total miles traveled if ground transportation used
12) Show remaining start-up time allowed
13) Customer purchase order number for work beyond allotment
14) * Signature of customer receiving service
15) * Customer phone number
16) * Customer name (PRINT)
17) * Company name of customer

* Required field

ZENITH CONTROLS, INC.

830 West 40th Street • Chicago, Illinois 60609 USA
PHONE: 773 247-6400 • FAX: 773 247-7805
E-Mail: zenith@zenithcontrols.com

SERVICE REPORT

Customer: _____ Date: _____

Job Site: _____ ZSA #: _____

Address: _____ Job #: _____

_____

Site Phone # _____ Site contact # _____

Nature of Complaint: _____

_____

_____

Service Performed: _____

_____

_____

_____

_____

_____

_____

_____

Recommendations: _____

_____

_____

Is Job Complete? ☐ Yes ☐ No

PARTS USED:	QUANTITY	PART #	DESCRIPTION	INVENTORY (S=Stock V=Van)

Type of Work: ☐ Start-Up ☐ Warranty Repair ☐ Preventive Maintenance ☐ Training ☐ Non Warranty Repair ☐ Other (Specify) _____

Arrival: _____ A.M. P.M. Departure: _____ A.M. P.M. Travel: _____ Hours Total Time: _____ Hours

Company: _____

Name: _____ Field Engineer

Title: _____ Name: _____

Signature: _____ Date: _____ Signature: _____ Date: _____

By signing I agree to the service procedures and policies as outlined on the reverse side

Leader in Power Switching Since 1923 ISO 9001

5F-503

SERVICE FILE COPY

ZENITH CONTROLS, INC.

PREVENTIVE MAINTENANCE

CUSTOMER:		SERVICE DATE:	
LOCATION:		ZSA:	
CONTACT:		SN:	
PHONE:	SYSTEM VOLTAGE:		FREQUENCY:
FIELD DESIGNATION OF THE UNIT:			
CHECK POINT	ACCEPTABLE	NEEDS REPAIR	CORRECTED
ATS INSPECTION:			
LUBRICATION			
STATIONARY CONTACTS			
MOVABLE CONTACTS			
LIMIT SWITCHES			
MAIN OPERATOR (Mechanical Checks)			
BYPASS INSPECTION:			
LUBRICATION			
STATIONARY CONTACTS			
MOVABLE CONTACTS			
LIMIT SWITCHES			
MAIN OPERATOR (Mechanical Checks)			
INSPECTION CONTROL PANEL			
CHECK TORQUE ON ALL SCREWS			
CONTROL RELAYS			
TIMERS			
TRANSFORMERS			

	ELECTRICAL CHECKS AND ADJUSTMENTS			
	BEFORE		AFTER	
RELAY:	PICK UP	DROP OUT	PICK UP	DROP OUT
B1				
B2				
B3				
ER1				
ER2				
ER3				
VFSM				
Timers	T	U	W	P
	T3	W3	DT	DW

Notes:_____

Engineer:_____ Date:_____

5F-504-C 830 W. 40TH St. - Chicago, IL 60609 PH:773/247-6400 FAX:773/247-7805

TITLE: ZTS PREVENTIVE MAINTENANCE REPORT FORM	New# 5F-504-C	Responsible: TECH. SERVICE MGR.	Approved By:	Page 1 of 2
	Old# 2-1-03-3-0008-C	ISO Section X	Rev. Date 6/3/98	

Purpose: To be filled out for most transfer switch during preventive maintenance visits
Scope: Any servicing technician

1) * Purchaser of service
2) * Date service is performed
3) * Building name and/or address
4) * Zenith Service Authorization number
5) * Name of contact on job site
6) * Factory serial number of switch
7) * Phone number of job site contact
8) * System voltage of switch
9) * Frequency of installation in Hertz
10) * End users transfer switch identification
11) * Inspection power panel - fill in every box of matrix with a Yes or No; if any changes are made explain on Service Report
12) * Bypass inspection - fill in every box with a Yes or No; if any changes are made explain on Service Report
13) * Inspection control panel - fill in every box with a Yes or No; if any changes are made explain on Service Report
14) * Control panel settings - fill in every box with value of settings of inspective relays
15) * Note - make comments not addressed on form
16) * Name of Engineer performing service
17) * Date of service

* Required field

TITLE: Millivolt Drop Test Form	New# 5F-506-B	Responsible: Tech. Svc. Mgr	Approved By:	Page 1 of 2
	Old# ISO-2-1-03-3-0013	ISO Section 4.19	Rev. Date 3/22/99	

Purpose: To be filled out for every service ZTS switch during preventive maintenance visits

Scope: Any field service technician

1) *With the transfer switch in the Normal position, record millivolt and amperage values –fill in respective spaces

2) *With the transfer switch in the Normal position, record voltage and frequency values –fill in respective spaces

3) With the transfer switch in the Emergency position, record millivolt and amperage values –fill in respective spaces

4) With the transfer switch in the Emergency position, record voltage and frequency values –fill in respective spaces

5) With the Bypass in the Normal position and the transfer switch isolated, record millivolt and amperage value –fill in respective spaces

6) With the Bypass in the Emergency position and the transfer switch isolated, record millivolt and amperage value –fill in respective spaces

7) Notes

8) End users transfer switch identification

9) * Name of Engineer performing test

10) * Factory serial number of switch

11) * Factory model number of switch

12) * Date of service

13) * Over all test results

***Required field**

ITEM #7 [NOTES] ADDED THIS REVISION

MilliVolt Drop Test
(millivolt drop measurements taken from lug to lug)

WITH ATS IN NORMAL A phase _____mV_____Amps B phase _____mV_____Amps C phase _____mV_____Amps	**VOLTAGE** A to B _____Volts B to C _____Volts A to C _____Volts Frequency _____Hz
WITH ATS IN EMERGENCY A phase _____mV _____Amps B phase _____mV _____Amps C phase _____mV _____Amps	**VOLTAGE** A to B _____Volts B to C _____Volts A to C _____Volts Frequency _____Hz
ATS ISOLATED AND BYPASS CLOSED TO NORMAL A phase _____mV _____Amps B phase _____mV _____Amps C phase _____mV _____Amps	**ATS ISOLATED AND BYPASS CLOSED TO EMERGENCY** A phase _____Volts B phase _____Volts C phase _____Volts

Notes:

_____

_____

_____

_____

_____

Field Designation _____ Date _____

Test Performed By _____

Passed _____

Serial # of Switch _____ Failed _____

Model # _____ Questionable _____

GE Zenith Controls



52R-1000H
5/02

Operation and Maintenance Manual

Safety / Installation

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

The safe operation of your switch is GE Zenith's focus. The proper storage, installation, operation and maintenance will help increase the life of the switch.

⚠ CAUTION ⚠

Due to hazardous voltage and current, GE Zenith recommends that a GE Zenith Certified technician or a qualified electrician must perform the installation and maintenance of the switch.

Equipment Inspection and Storage

Once you have received the transfer switch, inspect it for any damage. This includes damage to the enclosure, power panel, control panel and wiring harness. If any damage is found or suspected, file a claim as soon as possible with the carrier and notify the nearest GE Zenith representative.

Before installation, it is necessary to store the transfer switch in a clean dry place, protected from dirt and water. Provide ample air circulation and heat, if necessary, to prevent condensation.

Storage Temperature	Operating Temperature (Ambient):	Humidity
-30°C to +75°C (-22°F to +167°F)	**40-400 AMP** *(molded shell)* -20°C to +65°C (-4°F to +149°F) **40-4000 AMP** *(all other frame and panel types)* -20°C to +60°C (-4°F to +140°F)	5% to 95% (non-condensing)

Final Equipment Inspection

Prior to energizing the transfer switch:

1. Remove any debris incurred, with a vacuum, due to shipment or installation.

⚠ WARNING ⚠

Do not use a blower since debris may become lodged in the electrical and mechanical components and cause damage.

2. Verify that all cabled connections are correct and that phase rotation of both sources match.
3. Check engine start connections.
4. Verify the correct connection of all control wires.
5. Check settings of all timers and adjust as necessary.
6. Adjust any optional accessories as required.
7. Check the lug torque values of the power connections.

   NOTE: Lug torque values are specified in the power panel manual.

8. Make sure that all covers and barriers are installed and properly fastened.

   NOTE: Power panels ship from GE Zenith in the Normal Position.

Each GE Zenith transfer switch is factory wired and tested. A complete information package is furnished with each switch which includes:

a. Sequence of operation.
b. Description and operation of all accessories supplied.
c. Power panel connection diagram and schematic.
d. Description and identification of all customer field connections.

Installation of GE Zenith transfer switches includes:

a. Mounting the transfer switch cabinet.
b. Connection of all Normal, Emergency, and Load cables or bus bars.
c. Connection of external control circuits as required.

Mounting

Adequate lifting means must be used to mount the transfer switch into place. The recommended method for moving the transfer switch using the lifting eyes, where supplied, and a spreader bar is illustrated in *Figure 1*. Enough room should be allowed to open the cabinet doors fully for inspection and servicing of the switch per NEC and local codes.

⚠ CAUTION ⚠

Before drilling conduit entry holes or any accessory mounting holes, cover and protect the switch and control panel to prevent dirt and metal fragments from entering the mechanical and electrical components.

Failure to do so may result in damage and malfunction of the switch.

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Power Connections

GE Zenith transfer switches are supplied with UL listed solderless screw type terminals as standard for the Normal, Emergency and Load power connections. *Table 1* lists the number and sizes of cable lugs supplied as standard for each switch amp rating.

Connect the Normal, Emergency, and Load conductors to the clearly marked terminals on the transfer switch. Remove surface oxides from cables by cleaning with a wire brush. Verify that all connections are correct before tightening the lugs. All cable lug connections must be tightened to the proper torque values as shown in *Table 2*.

NOTE: Do not run cables or wiring behind front-connected transfer switches.

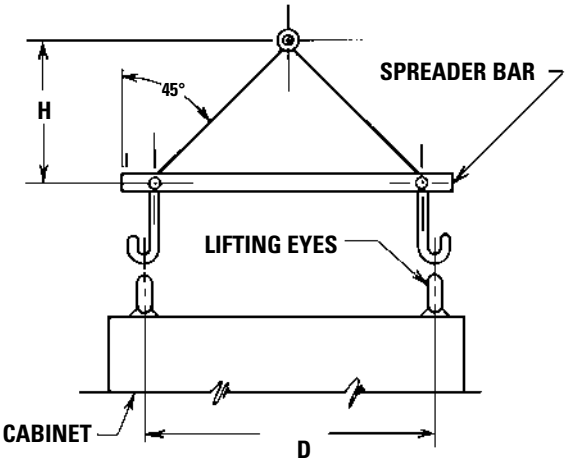


Figure 1

NOTE: When lifting the switch using a spreader bar, height H must be equal to half of distance D.

Screw Type Terminals for External Power Connections

Switch Size (Amps)	Normal, Emergency & Load Terminals		Neutral Bar (When Required)	
	Cable Per Pole	Range of Wire Sizes	No. of Cables	Range of Wire Sizes
40	1	#8 to 1/0 AWG	3	#8 to 1/0 AWG
80	1	#8 to 1/0 AWG	3	#8 to 1/0 AWG
100	1	#8 to 1/0 AWG	3	#8 to 1/0 AWG
150	1	#8 to 3/0 AWG	3	#8 AWG to 300 MCM
200, 225, 250*(1)	1	#6 AWG to 250 MCM	3	#6 AWG to 300 MCM
260, 300*, 400	1	#4 AWG to 600 MCM	3	#4 AWG to 300 MCM
600	2	#2 AWG to 600 MCM	8	#2 AWG to 600 MCM
800, 1000, 1200	4	#2 AWG to 600 MCM	12	#2 AWG to 600 MCM
1600, 2000 2600, 3000	8	#2 AWG to 600 MCM	12	#2 AWG to 600 MCM

Table 1 (1) 200 amp unit utilizes #6 ō 250 MCM wire effective approximately 11/1/00.
* IEC Ratings Only

Engine Start Control Connections

Engine-start control wires connect to control terminals below of the MX100. Engine start terminals are indicated by a schematic symbol (the symbol indicates the contact state for a de-energized Normal source). *Figure 2* shows the engine-start contacts.

Make all other necessary control connections to the control panel terminal blocks per the schematics supplied with the ATS.

NOTE: All control wires (18-12 AWG) must be torqued to 19 in/lbs.

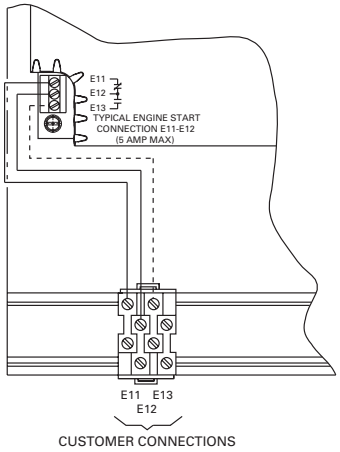


Figure 2 – Din Rail

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

The engine-start terminals are clearly identified by a label on the microcontroller backplate. In the case of manual transfer switches, or in other applications not requiring the microprocessor, clearly marked terminal blocks are provided in the upper left corner of the control panel for the engine start control wires.

Terminals for field connections to the A3 Emergency auxiliary contacts and the A4 Normal auxiliary contacts are also provided. These terminals are clearly marked and appear on the side of the power panel. On 400 amp metal frame units these terminals appear on the bracket above the operator handle.

Tightening Torque for Lugs

Socket Size Across Flats	Torque	
	Lb. - In.	Lb. - Ft.
1/8	45	4
5/32	100	8
3/16	120	10
7/32	150	12
1/4	200	17
5/16	275	23
3/8	375	31
1/2	500	42
9/16	600	50

Table 2

Functional Test

Functional testing of the ATS consists of electrical tests described in this section. Before proceeding, refer to the information package supplied with the ATS and read and understand the information on all accessories provided.

⚠ CAUTION ⚠

Certain accessories, per specific schematics, can inhibit automatic transfer.

1. Unlock the enclosure.
2. Open the enclosure.
3. Verify the correct system voltage.

   NOTE: The equipment rating nameplate on the transfer switch lists the voltage. See *Figure 3*.

4. Close the Normal source circuit. breaker.

   NOTE: The controller will illuminate the Normal Available LED if proper voltage is sensed.

5. Verify the phase to phase voltages at the Normal line terminals.
6. Close the Emergency source circuit breaker.
7. Start the generator's engine.

   NOTE: The controller will illuminate the Emergency Available LED when preset voltage and frequency levels are reached.

8. Verify the phase to phase voltages at the Emergency line terminals.
9. Verify that the phase rotation of the Emergency source is the same as the phase rotation of the Normal source.



10. Shut down the generator's engine.
11. Place the starting control in the Automatic position.
12. Complete the visual inspection of the transfer switch.
13. Close the enclosure.
14. Lock the enclosure.

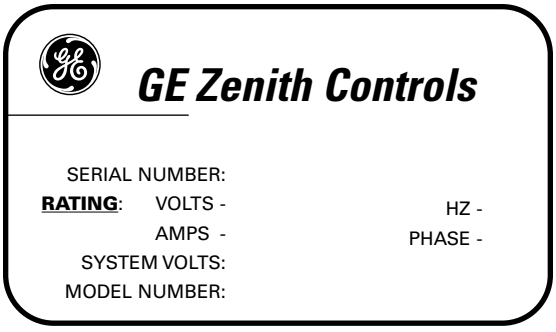


Figure 3

⚠ CAUTION ⚠

Engine Gen-Set could start when engine control wires are attached.

Initial Energization

After all options and accessories are checked and verified, follow these steps to set up the ATS. Refer to MX100 display *Figure 4*. The annunciation LEDs illuminate to indicate (1) source availability, (2) ATS position, and (3) MX100 control function (timing).

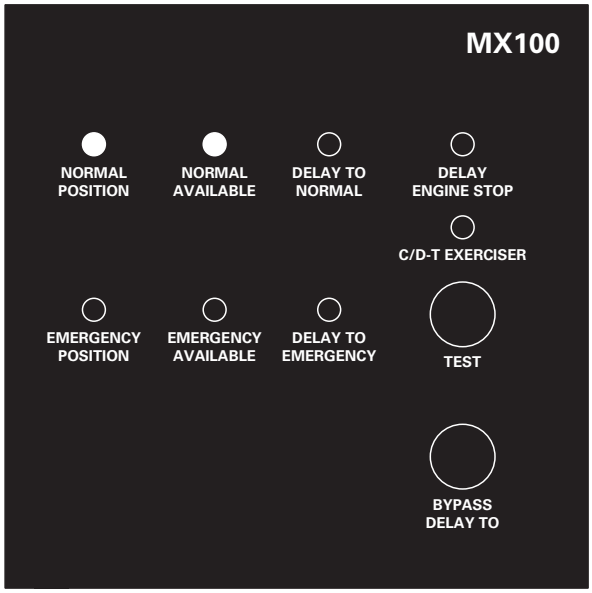


Figure 4 – Standard Transition Annunciation LEDs and Test Switch

NOTE: If LEDs are flashing, refer to Troubleshooting and Diagnostics.

1. Unlock the enclosure.
2. Open the enclosure.
3. Place the Disconnect Switch in the Inhibit.

   NOTE: This step is only performed if the "DS" Option was purchased.

4. Close the external (up-stream) Normal circuit breaker.

   NOTE: The normal Available and Normal Position LED's will illuminate.

   NOTE: If the Normal Available LED does not illuminate, verify that the Normal Source Voltage is above the preset pick-up value.

   NOTE: On the initial start-up, the Delay to Engine Stop Timing LED will illuminate for the duration of its setting.

   NOTE: The Gen-Set will start and run while Delay to Engine Stop is timing.

5. Close the External (up-stream) Emergency line circuit breaker.
6. Start the engine generator in MANUAL mode.

   NOTE: When the voltage and frequency reach preset values, the Emergency Available LED will illuminate.

7. Verify the phase to phase voltages at the Emergency line terminals.
8. Verify that the phase rotation of the Emergency source is the same as the phase rotation of the Normal source.



9. Shut down the generator's engine. (Place in Automatic Mode.)

   NOTE: The Emergency Available LED will turn off.

   NOTE: The engine generator will continue to run if the Delay to Engine Stop LED is illuminated.

10. Place the disconnect switch to ENABLE.
11. Complete the visual inspection of the transfer switch.
12. Close the enclosure.
13. Lock the enclosure.

⚠ WARNING ⚠

When performing a hi-pot or dielectric test on the power section, DISCONNECT the control panel plugs from the microprocessor to avoid potential damage.

Operation and Testing

Standard Transition ATS Testing (w/o A6 or T3/W3)

For this test description, please refer to MX100 standard transition display *Figure 4*.

Initiate testing with the ATS in Normal position and Normal power available (Normal Position and Normal Available LEDs illuminated).

Step 1: Press and hold the test switch until transfer.

NOTE: Releasing the test switch prematurely will abort the test.

The delay to engine start timer (P) begins its timing cycle. After the P timer has completed its timing cycle, the engine start contacts close to start the generator.

When Emergency voltage and frequency reach preset pickup points the Emergency Available LED illuminates. Simultaneously, the delay to emergency timer (W) begins its timing cycle and the Delay to Emergency LED illuminates. When the W time delay is completed the switch will transfer to emergency. The Delay to Emergency and Normal Position LEDs go off, and the Emergency Position LED illuminates.

Step 2: Release the test switch to start retransfer to Normal.

The delay to normal timer (T) begins its timing cycle illuminating the Delay to Normal LED. When the T timer has completed its timing cycle the switch will transfer into Normal. The Delay to Normal and Emergency Position LEDs go off, and the Normal Position LED illuminates. The delay engine stop timer (U) begins its timing cycle and the Delay Engine Stop LED illuminates. The generator runs unloaded for the duration of the U timing cycle. When the timer completes its timing cycle, the generator will stop. The Delay Engine Stop and the Emergency Available LEDs go off.

NOTE: A periodic test of the transfer switch under load conditions is recommended to insure proper operation. (See National Electric Code articles 700 and 701).

Delayed Transition ATS Testing

Refer to Delayed Transition display Figure 5. Initiate testing with the ATS in Normal position and Normal power available (Normal Position and Normal Available LEDs illuminated).

Step 1: Press and hold the test switch until transfer (releasing the test switch prematurely will abort the test).

The delay to engine start timer (P) begins its timing cycle. After the P time delay the engine start contacts close to start the generator.
When Emergency voltage and frequency reach the preset pickup points the Emergency Available LED illuminates. Simultaneously, the delay to open normal timer (W) begins its timing cycle and the Delay to Open Normal LED illuminates. After the W time delay the ATS transfers out of Normal position into the Open position. The Delay to Open Normal and Normal Position LEDs go off, and the Open Position and Delay to Emergency LEDs illuminate.

Step 2: Release the test switch.

Time delay to emergency (DW) then begins. When the DW time delay is completed the switch will transfer to Emergency. The Delay to Emergency and Open Position LEDs go off, and the Emergency Position LED illuminates.

The MX100 microcontroller will automatically begin the retransfer sequence to Normal. The delay to open emergency (T) timer begins its timing cycle and the Delay to Open Emergency LED illuminates. When the T timer has completed its timing cycle, the ATS transfers to the open position. The Delay to Open Emergency and the Emergency Position LEDs turn off, and the Open Position and the Delay to Normal LEDs illuminate. The delay to normal timer (DT) then begins its timing cycle illuminating the Delay to Normal LED. When the DT timer has completed its timing cycle the ATS will transfer out of the open position into the Normal position. Delay to Normal and the Open Position LEDs turn off, and the Normal Position LED illuminates.

The delay engine stop timer (U) begins its timing cycle and the Delay Engine Stop LED illuminates. The generator runs unloaded for the duration of the U timing cycle. Upon completion of the U time delay, the generator will stop. The Delay Engine Stop and the Emergency Available LEDs go off.

Operation and Testing *(cont'd)*

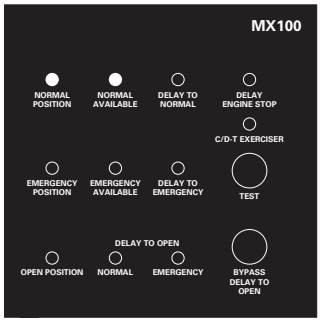


Figure 5 – Delayed Transition Annunciation LEDs and Test Switch

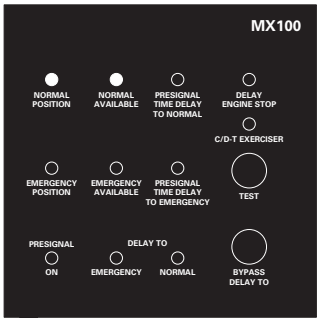


Figure 6 – Standard Transition w/A6 Annunciation LEDs and Test Switch

Standard Transition Transfer Sequence (w/o A6 or T3/W3)	LED Annunciation Status						
	Normal Position	Normal Available	Emergency Position	Emergency Available	Delay to Normal	Delay to Emergency	Delay Engine Stop
Normal Position	●	●					
W Time Delay	●	○		●		●	
Emergency Position		○	●	●			
T Time Delay		●	●	●	●		
Normal Position/ Engine Overrun Timer	●	●		●			●

○ Illuminated only when running TEST, not on Normal power failure

Delay Transition Transfer Sequence	LED Annunciation Status									
	Normal Position	Normal Available	Emergency Position	Emergency Available	Delay to Normal	Delay to Emergency	Delay Engine Stop	Open Position	Delay to Open Normal	Delay to Open Emergency
Normal Position	●	●								
W Time Delay	●	○		●					●	
Open Position/DW Time Delay		○		●		●		●		
Emergency Position		○	●	●						
T Time Delay		●	●	●						●
Open Position/DT Time Delay		●		●	●			●		
Normal Position/ Engine Overrun Timer	●	●		●			●			

○ Illuminated only when running TEST, not on Normal power failure

Standard Transition Transfer w/A6 or T3/W3 Sequence	LED Annunciation Status									
	Normal Position	Normal Available	Emergency Position	Emergency Available	Presignal Time Delay to Normal	Presignal Time Delay to Emergency	Delay Engine Stop	Presignal On	Delay to Emergency	Delay to Normal
Normal Position	●	●								
W Time Delay	●	○		●					●	
Open Position/TA6 Time Delay		○		●		●		●		
Emergency Position		○	●	●						
T Time Delay		●	●	●						●
Open Position/TA5 Time Delay		●		●	●			●		
Normal Position/ Engine Overrun Timer	●	●		●			●			

○ Illuminated only when running TEST, not on Normal power failure

Operation and Testing *(cont'd)*

Standard Transition ATS Testing (w/A6 or T3/W3)

Refer to Standard Transition w/A6 or T3/W3 display Figure 6. Initiate testing with the ATS in Normal position and Normal power available (Normal Position and Normal Available LEDs illuminated).

Press and hold the test switch until transfer (releasing the test switch prematurely will abort the test).

The delay to engine start timer (P) begins its timing cycle. After the P time delay the engine start contacts close to start the generator.

When Emergency voltage and frequency reach the preset pickup points the Emergency Available LED illuminates. Simultaneously, the delay to emergency timer (W) begins its timing cycle and the Delay to Emergency LED illuminates. After the W time delay the ATS presignal is initiated. The Delay to Emergency and Normal Position LEDs go off, and the Presignal On and Presignal Time Delay to Emergency LEDs illuminate.

Release the test switch.

Presignal Time Delay to emergency (TA6) then begins. When the TA6 time delay is completed, the switch will transfer to Emergency. The Presignal Time Delay to Emergency and Presignal On LEDs go off, and the Emergency Position LED illuminates.

The MX100 microcontroller will automatically begin the retransfer sequence to Normal. The delay to normal (T) timer begins its timing cycle and the Delay to Normal LED illuminates. When the T timer has completed its timing cycle, the ATS presignal is initiated. The Delay to Normal and the Emergency Position LEDs turn off, and the Presignal On and the Presignal Time Delay to Normal LEDs illuminate. The Presignal Time Delay to normal (TA5) then begins. When the TA5 timer has completed its timing cycle, the ATS will transfer to the Normal position. Presignal Time Delay to Normal and Presignal On LEDs turn off, and the Normal Position LED illuminates.

The delay engine stop timer (U) begins its timing cycle and the Delay Engine Stop LED illuminates. The generator runs unloaded for the duration of the U timing cycle. Upon completion of the U time delay, the generator will stop. The Delay Engine Stop and the Emergency Available LEDs go off.

The MX100 continuously monitors source voltage. In the event that Normal voltage falls below a preset drop-out value, the unit will perform in exactly the same way as noted in the test procedure (either standard transition or delayed transition).

NOTE: A periodic test of the transfer switch under load conditions is recommended to insure proper operation. (See National Electric Code articles 700 and 701).

Sequence of Operation - Standard Transition

Operation Sequence

Normal Power Failure. When Normal voltage has fallen below the preset dropout value, the engine start (P) timer begins its timing cycle (factory set 3 seconds). The P timer allows for momentary under-voltage conditions in the Normal source without triggering the generator to start. If the Normal voltage remains below the dropout point throughout the P timing cycle, a generator start signal will be sent. The MX100 then monitors generator voltage and frequency to determine if they are within preset parameters. When the generator voltage and frequency reach acceptable limits the W timer begins its timing cycle. The W timer governs either the time delay for transfer to Emergency or to the open position (standard or delayed transition, respectively). The W timer (typically 1 second) assures that the generator voltage and frequency are stable before transfer. The transfer to Emergency sequence is then completed as follows:

Standard Transition—after the W time delay, the ATS transfers to Emergency position and load power is supplied by the generator.

Delayed Transition—following the W time delay, the switch opens out of Normal to the Open position. The DW timer is activated. The DW time delay is typically set to 5 seconds. After the DW time delay, the switch completes transfer to Emergency.

Standard Transition w/A6 or T3/W3—following the W time delay, the presignal is initiated. The TA6 timer is started. The TA6 time delay is typically set to 5 seconds. After the TA6, the ATS transfers to Emergency.

When the W time is completed, the CCE relay energizes the CE solenoid to close the transfer switch into the emergency source. The SE limit switch activates to de-energize the CCE relay.

Restoration of Normal Power. When Normal power reaches the preset pickup value, the T timer begins its timing cycle (factory set 30 minutes). The T timer is used to ensure that the Normal source has fully restored before retransfer. If Normal voltage remains above the pickup values for the duration of the T timer, transfer to Normal position is performed. Retransfer is accomplished as follows:

Standard Transition—ATS transfers to the Normal position and the load power is supplied by utility.

Delayed Transition—the switch opens out of Emergency to the Open position. The DT timer activates, typically set to 5 seconds. After the DT time delay, the switch completes transfer to Normal.

Standard Transition w/A6 or T3/W3—following the T time delay, the presignal is initiated. The TA5 timer is started. The TA5 time delay is typically set to 5 seconds. After the TA5, the ATS transfers to Normal.

When the T time delay is completed, the CCN relay energizes the CN solenoid to retransfer the switch into the normal source. The SN limit switch activates to de-energize the CCN relay. Simultaneously, the engine over-run timer U begins its timing cycle. This timer provides a period of time for the engine generator to run without load and cool down before shutdown.

Control Features

A6. Motor load disconnect capability (standard transition only). Ensures that closing into the oncoming source does not create a large disturbance due to phase angle difference between the load and the oncoming source. Motor loads can be disconnected for an adjustable period of 0-60 seconds prior to transfer of the main contacts. This feature includes LEDs to indicate when the motor load is disconnected.

CDT Exerciser. A built in 7 day exerciser timer is incorporated into the MX100, (standard feature, all models). Pressing the initiate switch will start a timer that will continue for 167 hours and 40 minutes. Along with initiating the timer, an LED will illuminate to indicate that the timer has been started. After 167 hours and 40 minutes, a load test (ATS transfers to Emergency) or a no load test (ATS signals the genset to start but does not transfer) occurs. The exercise mode is determined by the MX100 PCboard jumper location (TSL = load, TSNL = no load). The test lasts for 20 minutes. The CDT Exerciser LED will flash when the exercising is in progress. This 20 minute exercise does not include the time delay to retransfer to normal (T timer) when the ATS is transferred (load test) or the time delay engine stop (U timer) for either load or no load tests. Disabling the exercise event is done by pressing the disable/enable switch. When this is done the exercise event will not occur, although the timer will not be affected. The CDT Exerciser LED will turn off when the disable/enable switch is pressed for the first time after initiating the timer. Pressing the disable/enable switch again will re-enable the exercise event while turning the CDT Exerciser LED back on. The time of the exercise event can be changed by re-initiating the event. The time that the button is pressed will be the end of the exercise event one week later.

CDT Exerciser Notes

1. To avoid unintentional intiating/disabling the button should be held down for 3 seconds when pressed.
2. A 9V battery is supplied to prevent CDT exercise timer from losing it's "set exercise time" in the event of an extended power outage. The battery can back up the processor for up to 8 hours. The battery should be replaced if it has supplied power to the microprocessor for an extended outage.
3. The 9V battery cannot be plugged into a PC board that is deenergized. The PCboard includes large capacitors that the battery will not be able to charge. If the capacitors are charged, the battery will still discharge eventually due to the load of the PCboard. Therefore, do not install a battery until the PCboard is energized. The battery will then be able to maintain the CDT "set exercise time" in the event of an extended outage.

R50. In-phase monitor (standard transition w/o A6 only). R50 ensures that the phase angle difference between the load voltage and the oncoming source voltage is minimal (live source-to source transfers). The feature requires a fast acting transfer switch, therefore is only available with a standard transition ATS. The in-phase monitor is suitable for isochronous through 3% droop governors. The microprocessor anticipates the synchronized condition by monitoring the phase angle and frequency differential between the sources. Then it signals a transfer at the precise moment to ensure minimal phase difference between the sources at the completion of transfer. R50 also includes a PCboard-mounted switch to override the in-phase monitor function if necessary. The override toggle switch is located below the MX100 cover, but the toggle position to enable or disable the function is clearly indicated on the cover.

YEN. Pushbutton time delay transfer/retransfer bypass.

Control Options

Six control input options can be used with the MX100:

- 6A
- C
- C/D
- D
- Q2
- ZNET100

Note: Consult the factory when field adding Q2 option.

6A. Maintained test switch. An auxiliary two position maintained test switch is located on the cabinet door. This is in addition to the standard test switch found on all MX100 models. When the auxiliary test switch is activated in the TEST position, it will simulate a Normal line failure. The transfer switch will automatically transfer the load to the Emergency position. When the test switch is returned to the AUTOMATIC position the transfer switch will restore the load to the Normal position. Should Emergency fail while ATS is in Emergency position the ATS will transfer back to Normal immediately, if Normal is available.

C. *Plant Exerciser.* Automatically starts generator for selected time intervals. Runs generator unloaded.

C/D. *Plant Exerciser.* Automatically starts generator to run unloaded, or simulate a power failure and starts generator to run under load.

D. *Plant Exerciser.* Automatically starts generator for select time intervals. Simulates a power failure and runs generator under load.

Q2. *Connections for remote peak shave or area protection.* Includes bypass for immediate return to Normal if Emergency line fails and Normal is available.

ZNET100. *Communication Capability.* The MX100 can be equipped with an optional network card that allows digital communication of ATS position, source availability, control timers and test mode. A test signal can also be initiated from a remote PC or annunciator panel. Communication is via one twisted pair of wires.

Sequence of Operation - Delayed Transition

Transfer of the load to the Emergency source begins automatically when any phase of the Normal source falls below the preset dropout point and this undervoltage failure condition is detected by the MX100 microcontroller. The engine start timer P begins its timing cycle. The P time delay is provided to override momentary outages and to prevent nuisance starting of the engine generator. If the Normal source voltage returns above the pickup setting, the P timing cycle is reset, and the transfer sequence is stopped.

If the normal source voltage does not return before the P time delay is completed, the P timer drops out and sends a starting signal to the engine generator. The microcontroller senses the voltage and frequency of the Emergency source. When both the voltage and the frequency of the Emergency source reach the preset values timer W begins its timing cycle. The W timer provides an adjustable transfer delay to the Emergency source as required.

When the W time is completed, the CCNO relay energizes the CNO solenoid to open the transfer switch out of the Normal source. The switch is now in a neutral (both sources open) position. The switch remains in a neutral position for the duration of the DW time delay. DW is an adjustable time delay between the opening of the Normal source and closing into the Emergency source.

After the DW time delay has elapsed, the CCE relay energizes. The switch then completes transfer to the Emergency source by energizing the CE solenoid. The SE limit switch activates to de-energize the CCE relay.

The sequence for retransfer to the Normal source begins automatically when the microcontroller detects that the voltage on all phases of the Normal source has been restored.

When the Normal source restores, switching to the Normal source is initiated by energizing timer T, beginning its timer cycle. The T timer provides an adjustable delay to insure that the Normal source has stabilized before reconnection to the load. If the Normal source fails before the T time delay completes, the retransfer sequence is stopped.

When the T time delay is completed, the CCEO relay energizes the CEO solenoid to open the switch out of Emergency and into a neutral position. The switch remains in neutral for the DT time delay. When the DT time delay has elapsed, the CCN relay energizes the CN solenoid to complete retransfer of the switch into the normal source. The SN limit switch activates to de-energize the CCN relay. Simultaneously, the engine overrun timer U begins its timing cycle. This timer provides a period of time for the engine generator to run without load and cool down before shutdown.

User Settings

All user settings are adjustable on the back of the MX100 display. *Figure 6* shows the MX100 user adjustments.

Voltage and Frequency Pickup/Dropout Adjustments

Normal Pickup Voltage %: Pickup voltage is adjustable from 85 to 100% of nominal line voltage. Standard factory setting is 90%.

Normal Dropout Voltage %: The dropout voltage is adjustable from 75 to 98% of nominal line voltage. Standard factory setting is 80%. Dropout must be a minimum of 2% below Normal pickup voltage under all conditions. Note: The microprocessor will automatically set the Normal dropout voltage 2% below the Normal pickup voltage if it is not properly set by the user.

Normal Pickup Frequency %: The pickup frequency is adjustable from 90 to 100% of nominal line frequency. Standard factory setting is 90%.

Emergency Pickup Voltage %: The pickup voltage is adjustable 85 to 100% of nominal line voltage. The standard factory setting is 90%.

Emergency Dropout Voltage %: The dropout voltage is adjustable from 75 to 98% of nominal line voltage. Standard factory setting is 80%. Emergency dropout voltage must be a minimum of 2% below emergency pickup voltage under all conditions. ***Note:*** The microprocessor will automatically set the Emergency dropout voltage 2% below the Emergency pickup voltage if it is not properly set by the user.

Emergency Pickup Frequency %: The pickup frequency is adjustable from 90 to 100% of nominal line frequency. Dropout is fixed at 2 Hz below pickup. Dropout has a 5 second delay. Standard factory setting is 95%.

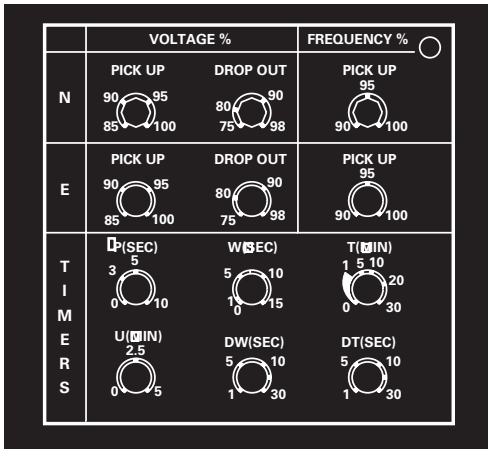


Figure 7 – Delayed Transition User Adjustments

Timer Adjustments

P Timer (delay to engine start). Time delay before engine start after Normal voltage failure: adjustable 0 to 10 seconds. P timer is designed to avoid engine starts on momentary Normal source failures. Standard factory setting is 3 seconds.

W Timer (delay to Emergency or delay to open Normal timer). Time delay before initiating transfer to Emergency: adjustable 0 to 15 seconds. Standard factory setting is 1 second. After the successful acquisition of correct Emergency voltage and frequency, the W timer function provides a time delay before initiating transfer to Emergency. This permits the Emergency source to stabilize. On completion of the time out, transfer to Emergency is initiated.

Transfer to Emergency is non-commit. This means that should the Normal voltage be restored before the time-out of the W timer, the ATS will remain in the Normal position and initiate the delay to engine stop timer.

T Timer (delay to Normal or delay to open Emergency). Time delay before initiating retransfer to Normal: adjustable 0 to 30 minutes. Standard factory setting is 30 minutes. On return of acceptable Normal voltage the time delay is initiated. T time delay ensures Normal source has stabilized before transferring to Normal position. On completion of the time out, transfer to Normal is initiated. Should Emergency power fail when the ATS is in the Emergency position, the T timer function will be bypassed when normal power is restored.

U Timer (delay engine stop). Time delay to engine stop, after retransfer to Normal, for purpose of cooling the engine after the load is removed: adjustable 0 to 5 minutes. Standard factory setting is 5 minutes.

DW Timer (time delay from Open position to Emergency position). Delayed Transition Transfer only: adjustable 0 to 30 seconds. Standard factory setting is 5 seconds. DW timer activates when the switch enters open position on a transfer from Normal to Emergency. After time out, the transfer to Emergency is complete.

DT Timer (time delay from Open position to Normal position). Delayed Transition Transfer only: adjustable 0 to 30 seconds. Standard factory setting is 5 seconds. DT timer activates when the switch enters the open position on transfer from Emergency to Normal. After time out, the transfer to Normal is complete.

MX100, Standard Transition w/A6 or T3/W3 (A6 = motor load disconnect circuit) (T3/W3 = elevator presignal circuit)

TA5 (presignal time delay to normal). Time delay is available only on standard transition ATSs specifically configured with the presignal circuit. Adjustable 0 to 30 seconds. Standard factory setting is 5 seconds.

TA6 (presignal time delay to emergency). Time delay is available only on standard transition ATSs specifically configured with the presignal circuit. Adjustable 0 to 30 seconds. Standard factory setting is 5 seconds.

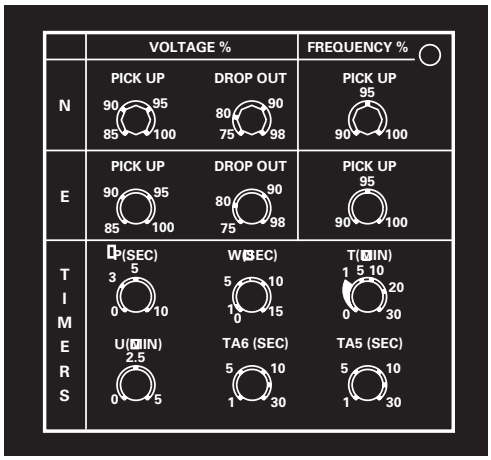


Figure 8 - Standard Transition w/A6 or T3/W3 User Adjustments

Factory Settings of Voltage, Frequency and Timer Adjustments	
Normal Pickup Voltage	90% Nominal V
Normal Dropout Voltage	80% Nominal V
Normal Pickup Frequency	90% Nominal F
Emergency Pickup Voltage	90% Nominal V
Emergency Dropout Voltage	80% Nominal V
Emergency Pickup Frequency	95% Nominal F
P Timer	3 seconds
W Timer	1 second
T Timer	30 minutes
U Timer	5 minutes
DW Timer *	5 seconds
DT Timer *	5 seconds
TA5 **	5 seconds
TA6 **	5 seconds

* Delayed
** Standard w/A6 or T3/W3
V = Line Voltage
F = Line Frequency

NOTE: All adjustments are factory preset to values in the table above, unless otherwise specified by the user.

Maintenance and Testing

⚠ CAUTION ⚠

Due to hazardous voltage and current, GE Zenith recommends that a GE Zenith Certified technician or a qualified electrician must perform the installation and maintenance of the switch.

⚠ WARNING ⚠

Both power sources must be disconnected before manual operation of the switch.

A preventive maintenance program will insure high reliability and long life for the transfer switch. The preventive maintenance program for the transfer switch should include the following items:

Inspection and Cleaning

The switch should be inspected for any accumulation of dust, dirt, or moisture, and should be cleaned by vacuuming or wiping with a dry cloth or soft brush. do not use a blower since debris may become lodged in the electrical and mechanical components and cause damage.

Remove the transfer switch barriers and check the condition of the contacts. Any surface deposits must be removed with a clean cloth (do not use emery cloth or a file). If the contacts are pitted or worn excessively, they should be replaced. A general inspection of mechanical integrity should be made to include loose, broken or badly worn parts.

Servicing

All worn or inoperative parts must be replaced using GE Zenith recommended replacement parts. Please refer to the Replacement Parts manual for specific part information and ordering procedures. Please contact the GE Zenith Technical Services Department for the Replacement Parts manual.

The operating mechanism of the transfer switch is lubricated with Lubriplate 105. The lubricant applied at the factory provides adequate lubrication for the lifetime of the switch. Should debris contaminate the mechanism, clean and apply additional Lubriplate.

GE Zenith can provide complete preventative maintenance services. Please contact the GE Zenith Technical Services Department for additional information.

CDT battery replacement - lithium batteries may last up to 10 years, however it is recommended that battery replacement be included in a 3-5 year service cycle. The battery maintains the exerceser memory only and does not otherwise affect the operation.

Testing

A manual operator handle is provided with the transfer switch for maintenance purposes only. Manual operation of the switch must be checked before it is operated electrically. **Both power sources must be disconnected before manual operation of the switch.** Insert the handle and operate the transfer switch between the Normal and Emergency positions. The transfer switch should operate smoothly without binding. Return the switch to the Normal position, remove the handle, and return it to the holder provided.

After completing the inspection, cleaning and servicing of the transfer switch, reinstall the switch cover, and close and lock the cabinet door. Reclose the circuit breakers feeding the utility and generator sources to the switch.

Initiate the electrical transfer test by activating the TS test switch. P timer will time out and the microcontroller will send an engine start signal. When the W time has elapsed, the switch will complete its transfer by closing into the Emergency source.

Deactivating the test switch will start retransfer to the Normal source. The switch will complete its retransfer to Normal after the time delay of the T timer. The U engine overrun timer allows the engine generator to run unloaded for a preset cool down period.

NOTE: A periodic test of the transfer switch under load conditions is recommended to insure proper operation. (See National Electric Code articles 700 and 701).

⚠ WARNING ⚠

When performing a hi-pot or dielectric test on the power section, DISCONNECT the control panel plugs from the microprocessor to avoid potential damage.

Troubleshooting and Diagnostics

⚠ DANGER ⚠

HAZARDOUS VOLTAGES CAN CAUSE SEVERE INJURY OR DEATH.
These charts may indicate problems that require authorized GE Zenith service personnel.
Hazardous voltages may exist on termination plugs other than those that go into the MX100.

General Troubleshooting - All ZTG Units

The following troubleshooting guide is used to recognize, and determine basic faults. When using this guide, it will ask several questions about the condition of the switch. This guide will then list an order of the possible faults. You will then look at the first suspected fault to determine if it is the problem. If it is not a fault, you go to the second suspected fault. If you go through all of the suspected faults, or the chart instructs you to, call a GE Zenith Representative for further assistance.

NOTE: When you use the troubleshooting charts, the Annunciation column refers to the LED's on the control panel.

Symptom	Annunciation	Possible Cause(s)	Corrective Action
No engine start	EMERGENCY AVAILABLE LED off	Engine start wires not properly connected	Check engine start connections (Figure 2).
		Generator is in OFF position	Place Engine Control Switch in AUTO.
No engine stop	DELAY TO ENGINE STOP LED on	U timing cycle not complete	Check U timer setting.
	NORMAL AVAILABLE, NORMAL POSITION, and EMERGENCY AVAILABLE LEDs on	Engine start wires not properly connected	Check engine start connections (Figure 2).
		Generator in MANUAL	Place Engine Control Switch in AUTO.
ATS will not transfer to EMERGENCY	EMERGENCY AVAILABLE LED off	Emergency voltage or frequency not within settings	Check: engine start connections, generator breaker closed, generator output (compare to MX100 settings) and place engine control switch in AUTO.
	All LEDs off	Power supply harness unplugged (18 pin connector on MX100)	Plug in harness.
	NORMAL POSITION and EMERGENCY POSITION flashing	Limit switch harness unplugged	Plug in harness.
	DELAY TO OPEN NORMAL LED on	**W** timing cycle not complete	Check **W** Timer setting.
ATS will not transfer to NORMAL	NORMAL AVAILABLE LED off	Normal voltage or frequency not within acceptable parameters	Check: normal voltage within MX100 settings; verify Normal breaker source breaker is closed.
	All LEDs off	Power supply harness unplugged (18 pin connector on MX100)	Plug in harness.
	NORMAL POSITION and EMERGENCY POSITION LEDs flashing	Limit switch harness unplugged	Plug in harness.
	DELAY TO OPEN EMERGENCY LED on	**T** timing cycle not complete	Check **T** Timer setting.
Improper LED annunciation	Neither source available LEDs illuminate, position LED only	MX100 PC board may be configured for wrong frequency (60 Hz vs. 50 Hz)	1. Verify source voltage and frequency. 2. Consult GE Zenith Controls for information to reconfigure hardware.
	NORMAL and/or EMERGENCY AVAILABLE LEDs on when frequency is below the present pick up value	MX100 PC board may be configured for wrong frequency (60 Hz vs. 50 Hz)	1. Verify source voltage and frequency. 2. Consult GE Zenith Controls for information to reconfigure hardware.

Diagnostic Annunciation - Standard Transition ATS

The MX100 controller incorporates diagnostics that allows ease of troubleshooting. Diagnostic annunciations are flashing position LEDs. The symptoms that the diagnostic annunciation indicate include inhibiting transfer or incorrect transfer sequence. A more general troubleshooting chart that addresses system problems precedes these charts.

⚠ DANGER ⚠

HAZARDOUS VOLTAGES CAN CAUSE SEVERE INJURY OR DEATH.
These charts may indicate problems that require authorized GE Zenith service personnel.
Hazardous voltages may exist on termination plugs other than those that go into the MX100.

(Two Position ATS—Normal and Emergency) **(Not for Standard Transition w/A6)**

⚠ WARNING ⚠

If limit switch plug is disconnected or reconnected and power is available, the switch may transfer.
Use caution when servicing.

Symptom	Annunciation	Possible Cause(s)	Corrective Action
ATS will not transfer out of Normal	Flashing NORMAL POSITION LED	Solenoid circuit	Contact authorized GE Zenith service representative.
ATS will not transfer out of Emergency	Flashing EMERGENCY POSITION LED	Solenoid circuit	Contact authorized GE Zenith service representative.
ATS will not transfer; ATS is not in a defined position as indicated by the limit switch contact (no SN or SE limit switch input)	Flashing NORMAL POSITION and EMERGENCY POSITION LEDs	1. Limit switch plugs not connected 2. Limit switches not within adjustment	1. Connect all plugs to the MX100. 2. Contact authorized GE Zenith service representative.

Troubleshooting and Diagnostics *(cont'd)*

Diagnostic Annuncation - Delayed Transition ATS
(Three Position ATS—Normal, Open and Emergency)

⚠ WARNING ⚠

If limit switch plug is disconnected or reconnected and power is available, the switch may transfer. Use caution when servicing.

Symptom	Annunciation	Possible Cause(s)	Corrective Action
ATS will not transfer out of Normal	Flashing NORMAL POSITION LED	Solenoid circuit	Put ZTG in AUTO. Disconnect and reconnect MX100 18 pin plug. Contact authorized GE Zenith service representative.
ATS will not transfer out of Emergency	Flashing EMERGENCY POSITION LED	Solenoid circuit	Put ZTG in AUTO. Disconnect and reconnect MX100 18 pin plug. Contact authorized GE Zenith service representative.
ATS will not transfer out of Open position	Flashing OPEN POSITION LED	Solenoid circuit	Put ZTG in AUTO. Disconnect and reconnect MX100 18 pin plug. Contact authorized GE Zenith service representative.
ATS is not in a defined position as indicated by the limit switch contacts (no SN or SNO limit switch	Flashing NORMAL POSITION and OPEN POSITION LEDs	Limit switches not registered as opened or closed	Contact authorized GE Zenith service representative.
ATS is not in a defined position as indicated by the limit switch contacts (no SN or SEO limit switch inputs)	Flashing EMERGENCY POSITION and OPEN POSITION LEDs	Limit switches not registered as opened or closed	Contact authorized GE Zenith service representative.
ATS is not in a defined position as indicated by the limit switch contacts (no SN, SE, SNO, or SEO limit switch inputs)	Flashing NORMAL POSITION, OPEN POSITION and EMERGENCY POSITION LEDs	1. Limit switch plugs not connected 2. Limit switches not registered as opened or closed	Connect all plugs to the MX100.

Diagnostic Annuncation - Standard Transition ATS
(with A6 or T3/W3)

Symptom	Annunciation	Possible Cause(s)	Corrective Action
ATS will not transfer out of Normal; motor load still connect-	Flashing NORMAL POSITION LED	Motor load disconnect relay is not latching	Check connections to RA6 relay.
ATS will not transfer out of Emergency; motor load still connected	Flashing EMERGENCY POSITION LED	Motor load disconnect relay is latched	Check connections to RA6 relay.
ATS will not transfer after motor load disconnect operated	Flashing MOTOR CONTROL OFF LED	Solenoid circuit	Contact authorized GE Zenith service representative.
ATS is not in a defined position as indicated by the limit switch contacts (no SN or RA6 limit switch inputs)	Flashing NORMAL POSITION and MOTOR CONTROL OFF LEDs	Limit switches not registered as closed or RA6 contact is not registered	Contact authorized GE Zenith service representative.
ATS is not in a defined position as indicated by the limit switch contacts (no SE or RA6 limit switch inputs)	Flashing EMERGENCY POSITION and MOTOR CONTROL OFF LEDs	Limit switches not registered as closed or RA6 contact is not registered	Contact authorized GE Zenith service representative.
ATS is not in a defined position as indicated by the limit switch contacts (no SN, SE, SNO, or SEO limit switch inputs)	Flashing NORMAL POSITION, OPEN POSITION and EMERGENCY POSITION LEDs	1. Limit switch plugs not connected 2. Limit switches not registered as opened or closed	Connect all plugs to the MX100.

Standard Drawings *(cont'd)*

ZTS product line model numbers are modular in nature. To obtain a complete number:

A. Select the basic model number desired.
B. Add switch type.
C. Add control panel type.
D. Add the ampere size.
E. Add the suffix indicating the number of switched poles.
F. Add the proper suffix for enclosure type (see note 2).
G. To the basic model number, add the voltage system designator.
H. Indicate option module and any additional accessories required.

Example:

A customer desires to order a delayed transition switch rated 400 amps, 4 poles, NEMA 1 enclosed for use in a 277/480V 3⌀, 4W, 60 Hz system with Module 25 as an option. See example below.

Z T S	D	L	4 0	F	C	-	7	M 2 5
Block A Base Model	*Block B* Type	*Block C* Control Panel	*Block D* Ampere Size	*Block E* Switched Poles	*Block F* Enclosure Type		*Block G* Operational Voltage	*Block H* Accessories

Block A - Base Model

Z T S = Transfer Switch
Z B T S = Transfer/Bypass Isolation Switch

Block B - Type

= Blank for Standard ATS
D = Delayed Transition
C T = Closed Transition
G = Generator to Generator
M = Manual Operation
U = Utility to Utility

Block C - Control Panel

L = MX200 Microprocessor Control
H = SSRCP. Control System special orders/manual switches
= Blank for special wire panel (special orders only)

Block D - Ampere Size

4 = 40 amps
8 = 80 amps
1 0 = 100 amps
1 5 = 150 amps
2 2 = 225 amps
2 6 = 260 amps
4 0 = 400 amps
6 0 = 600 amps
8 0 = 800 amps
1 0 0 = 1000 amps
1 2 0 = 1200 amps
1 6 0 = 1600 amps
2 0 0 = 2000 amps
3 0 0 = 3000 amps
4 0 0 = 4000 amps

Block E - Switched Poles

B = 2 Pole
E = 3 Pole
F = 4 Pole

Block F - Enclosure Type

C = NEMA 1 Enclosed
S = Special Enclosure
X = Open Style Unit

Block G - Operational Voltage

1 = 120V 1⌀, 2 wire, 60Hz
2 = 120/240V 1⌀, 3 wire, 60Hz
2 1 = 120/208V 1⌀, 3 wire, 60Hz
3 = 240V 3⌀, 3 wire, 60Hz
3 1 = 208V 3⌀, 3 wire, 60Hz
3 2 = 220V 3⌀, 3 wire, 50Hz
3 8 = 120/240V 3⌀, 4 wire, 60Hz
4 = 120/208V 3⌀, 4 wire, 60Hz
4 1 = 127/220V 3⌀, 4 wire, 60Hz
5 = 480V 3⌀, 3 wire, 60Hz
5 1 = 440V 3⌀, 3 wire, 60Hz
5 2 = 440V 3⌀, 3 wire, 50Hz
5 3 = 440V 1⌀, 2 wire, 60Hz
6 = 575V 3⌀, 3 wire, 60Hz
6 1 = 347/600V 3⌀, 4 wire, 60Hz
7 = 277/480V 3⌀, 4 wire, 60Hz
9 = 240/416V 3⌀, 4 wire, 60Hz
9 1 = 220/380V 3⌀, 4 wire, 60Hz
9 2 = 220/380V 3⌀, 4 wire, 50Hz
9 3 = 240/416V 3⌀, 4 wire, 50Hz

Block H - Accessories

M 9 = Module 9
M 1 2 = Module 12
M 2 5 = Module 25

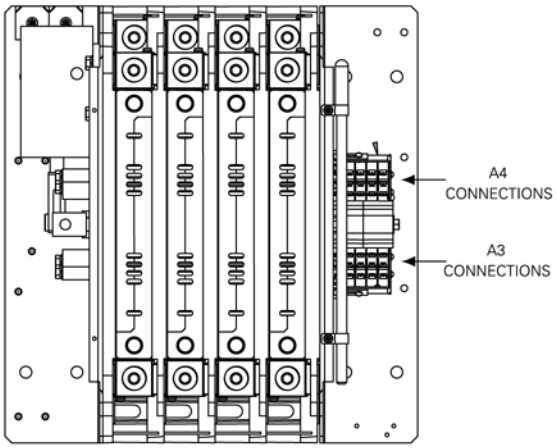
Then add the appropriate accessory codes in alpha/numeric order for additional accessories.
Reference page 14 for specific items.

NOTES:

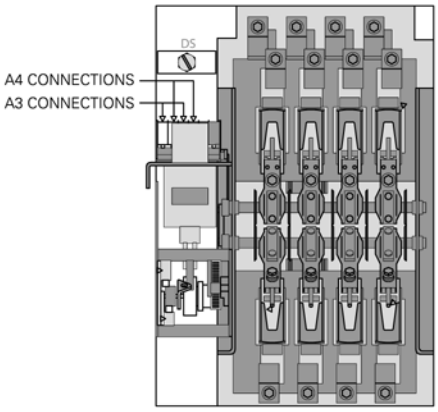
1. Some operational designators may be combined to indicate a special adaptation such as "DM" for a manual (pushbutton) delayed transition unit.
2. Many types of special enclosures are available including NEMA 1A, 3R, 4, 4X and 12.
3. The voltage systems shown are those commonly specified. Other voltage configurations are available upon request.

Standard Drawings *(cont'd)*

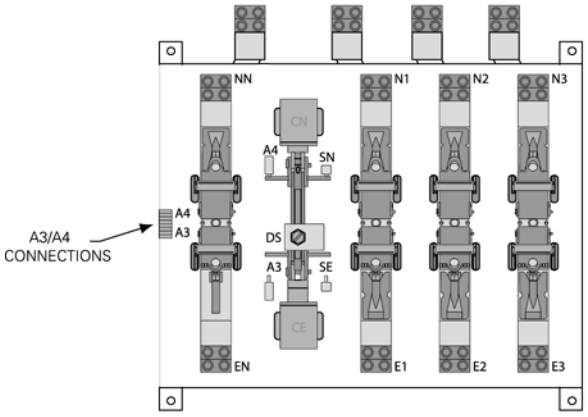
A3 AND A4 CONNECTIONS CONTINUED



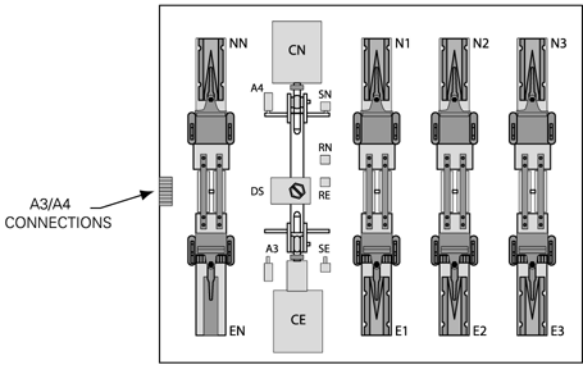
POWER PANEL 225-400 AMPS MOLDED TYPE



POWER PANEL 400 AMPS METAL FRAME TYPE



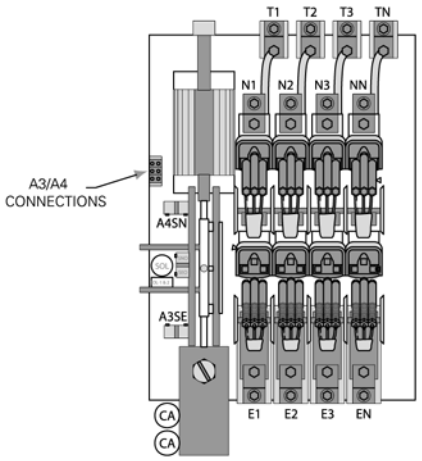
POWER PANEL 600-1200 AMPS



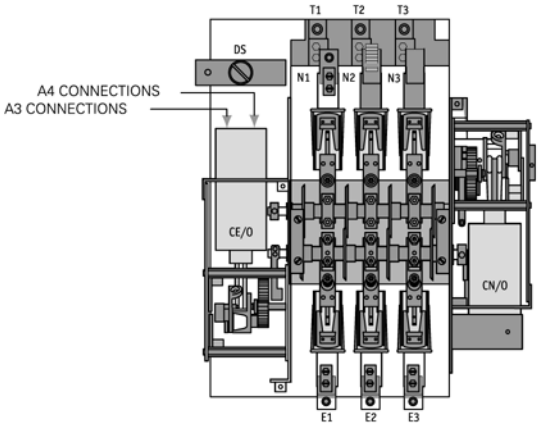
POWER PANEL 1600-3000 AMPS

Standard Drawings *(cont'd)*

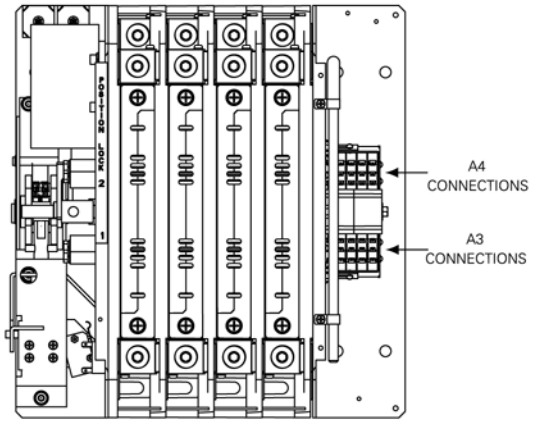
A3 AND A4 CONNECTIONS CONTINUED



DELAYED TRANSITION 40 TO 260 AMPS

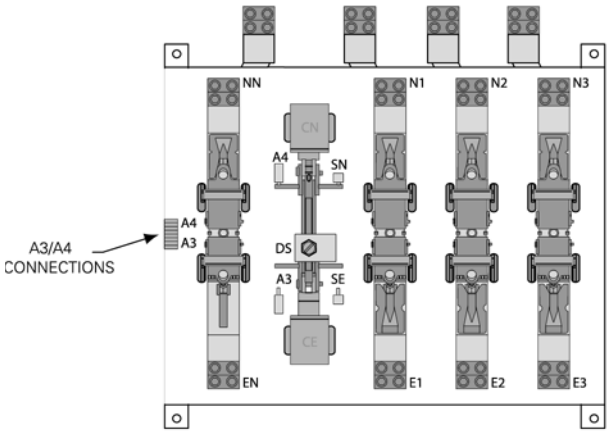


DELAYED TRANSITION 400 AMPS METAL FRAME TYPE

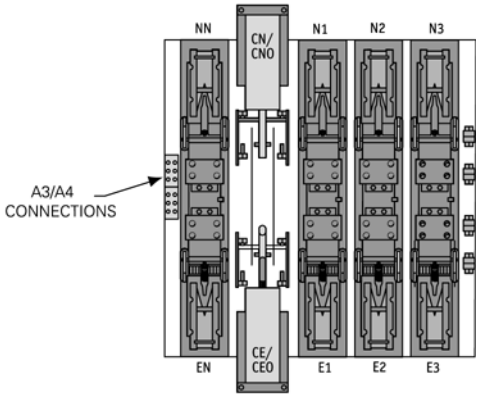


DELAYED TRANSITION 400 AMPS MOLDED TYPE

A3 AND A4 CONNECTIONS CONTINUED



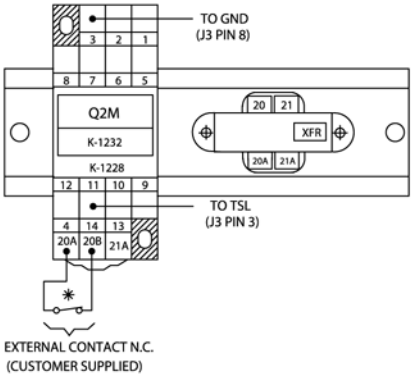
DELAYED TRANSITION 600-1200 AMPS



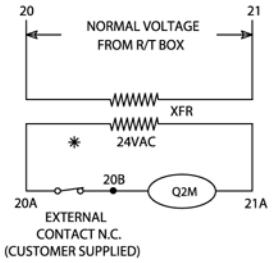
DELAYED TRANSITION 1600-3000 AMPS

Standard Drawings *(cont'd)*

Q2M ACCESSORY



CONNECTION DIAGRAM



SCHEMATIC

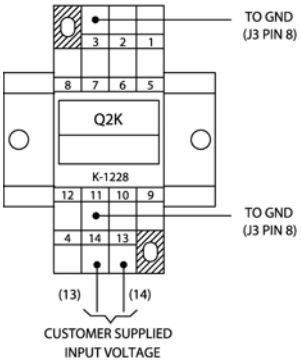
✳ NOTE -MAX DISTANCE EXTERNAL CONTACT CAN BE LOCATED FROM CONTROLLER

AWG	MAX FT
18	400
16	650
14	1000

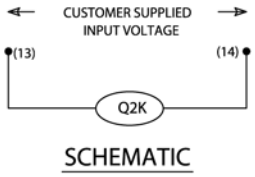
OPERATION

Q2M - **Remote Peak Shave or Area Protection Circuit**
Open external N.C. contact to simulate a normal line failure causing the Generator to start and transfer the load to Emergency. Should Emergency fail during this operatior the transfer switch will retransfer back to Normal.

Q2K ACCESSORY



CONNECTION DIAGRAM

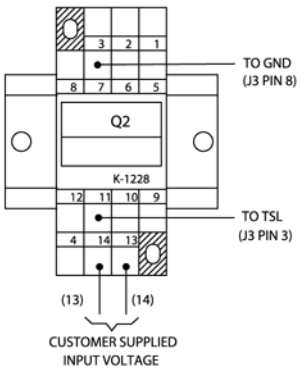


SCHEMATIC

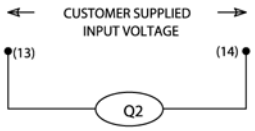
OPERATION

Q2K - De-energize Q2K Relay to simulate a normal line failure causing the Generator to start and transfer the load to Emergency. Should Emergency fail during this operation, the transfer switch will retransfer back to Normal.

Q2 ACCESSORY



CONNECTION DIAGRAM

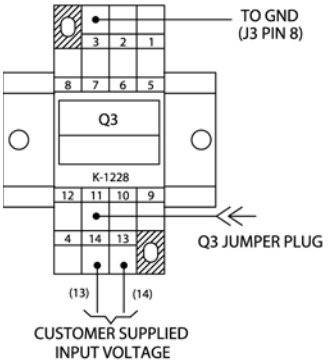


SCHEMATIC

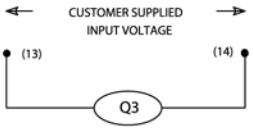
OPERATION

Q2 - **Remote Peak Shave or Area Protection Circuit**
Energize Q2 Relay to simulate a normal line failure causing the Generator to start and transfer the load to Emergency. Should Emergency fail during this operation, the transfer switch will retransfer back to Normal.

Q3 ACCESSORY



CONNECTION DIAGRAM

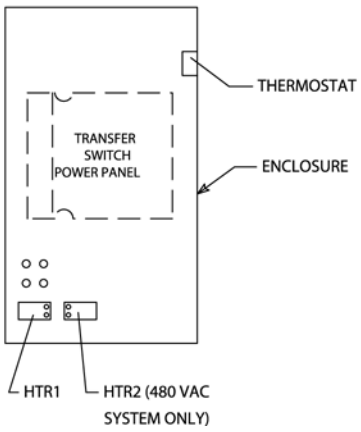


SCHEMATIC

OPERATION:

Q3 - **Remote Inhibit Transfer to Emergency Circuit.** Voltage applied to Q3 input will allow transfer to Emergency, conversely, no input on Q3 will result in no transfer to Emergency. To enable Q3 option engage Q3 jumper.

HEATER AND THERMOSTAT ACCESSORY

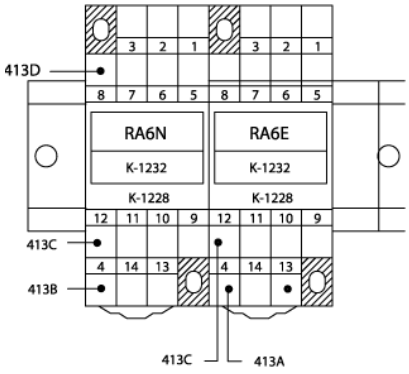


OPERATION:

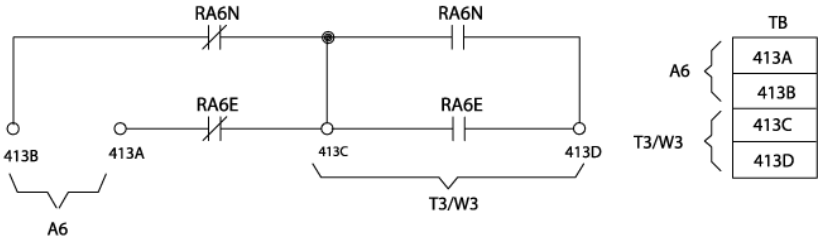
When temperature in cabinet drops below thermostat set point, (50∞ F unless othewise specified) heater is turned "ON". Above set point, heater turns "OFF".

A6 OR T3/W3 PRE-SIGNAL ACCESSORY

MX100 DIN RAIL



CUSTOMER CONNECTIONS



CONTACT RATING: 5A @ 240 VAC OR 28 VDC

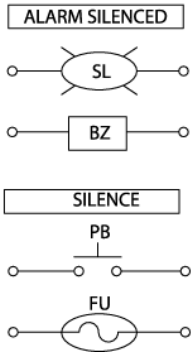
OPERATION

When Normal restores, A6 circuit opens (or T3/W3 circuit closes) until MX100 TA5 timer times out. (Adjustable 0-30 seconds) The Normal transfer relay(s) picks up and closes its contacts to transfer the switch to Normal. A6 recloses (or T3/W3 circuit reopens).

When Normal fails, A6 circuit is open (or T3/W3 circuit closes) until MX100 TA6 timer times out. (Adjustable 0-30 seconds) The Emergency transfer relay(s) picks up and closes its contacts to transfer the switch to Emergency. A6 recloses (or T3/W3 circuit reopens).

CTAP ACCESSORY

CABINET FRONT



OPERATION

If Normal voltage fails and if emergency voltage is present, the transfer switch will transfer to the emergency position

The alarm buzzer (BZ) is now energized to indicate the ATS is in Emergency. To silence the alarm buzzer, press "PB". This will illuminate the silence alarm (SL) light. When the transfer switch restores to Normal, the CTAP is de-energized.

C OR D CLOCK ACCESSORIES

OPERATION The "C" plant exercisor starts the engine (No Load Test) by closing the engine start circuit. The "D" plant exercisor simulates normal line failure, starts the generator, and transfers the load to emergency at selected time intervals.

NOTE Total GENERATOR running time = clock ON time + "U" timer ON time (if U is used)

CAUTION ⚠ Before changing the time setting, turn Disconnect Switch (DS) to "OFF" position; after desired selection has been made, return DS to "ON" position.

Digi 20 PROGRAMMING INSTRUCTIONS

The circular keypads are positioned to provide a sequential path for programming. Starting with Prog. to select a program, clockwise to to select ON or OFF. Then h for hour, m for minute, and finally Day to select day or days of the week. If an input is missing or incomplete, the missing segments will flash when the or program key is depressed. (For example, if no ON or OFF is selected, the ON symbol will flash). The missing entry must be completed before programming can resume. While programming, pressing the h, m or Day key longer then 2 seconds will cause a rapid roll of the parameter. A program consists of: 1. ON or OFF command, 2. Hour and minute, and 3. Day or multiple days on which it is to occur.
Note: A flashing display indicates either incomplete data entry or the battery is low. Check to see if days and ON or OFF times are entered, and check the power supply to the time control.

IMPORTANT: Depress reset key (Res.) before beginning to set time and program

SETTING TIME AND DAY OF CLOCK

1. Select military (24:00 hr.) or AMPM (12:00 hr.) time mode by depressing and holding h key while pressing ±1h key to toggle between military and AM/PM. (AM appears in display when in AM/PM mode).
2. Press and hold down key.
3. If setting the time when daylight savings time is in effect, press ±1h key once (±1h will appear in display).
4. Set hour with h key. If AM or PM does not appear in display, the unit is in Military time see note above to change display.
5. Set minutes with m key.
6. Press Day key repeatedly to the day of the week (1 is Monday, 7 is Sunday).
7. Release key, colon will begin flashing. If the days are flashing, the day of the week was not entered. (See step 6).

PROGRAMMING

1. Press Prog.key will appear in display. (Pressing Prog. key again, display will show the number of free programs: Fr 20). Press again to advance to 1st program.
2. Press key, ⦿ ON symbol will appear. Pressing the key again will toggle to OFF ◠ . Select ON or OFF for the program with the key.
3. Press h to select hour for switching time.
4. Press m to select minute for switching time.
5. If the program is to occur every day of the week, (24 hour time control) ignore Day key and press Prog. key to advance to next program.
6. If 7 day time control is desired, press Day key. 1 2 3 4 5 6 (Mon. thru Sat.) block of days appears in Day key again, 1 2 3 4 5 (Mon. thru Fri.) appears in display. Pressing Day key again, 6, 7 (Sat. & Sun.) appears in display. Pressing Day key again, 1 (Mon.) appears in display. Repeated presses will cycle through all days of the week and back to 1 thru 7 (Mon. thru Sun.). Select day or block of days desired with the Day key.

7. Press Prog. key and repeat steps 2 thru 6 to enter additional programs of ON and OFF times. Note that more than and Prog. Press OFF times. Note that more than one OFF time program may be entered, enabling automatic control of manual overrides.

8. Press ◷ key to enter run mode.

IMPORTANT: THE OUTPUT RELAYS WILL SWITCH ON (OR OFF) ONLY AT THE PROGRAMMED TIMES, AFTER PROGRAMMING IS COMPLETED. IF A CHANNEL SHOULD BE ON, IT MUST BE MANUALLY TURNED ON WITH THE KEY. FOR EXAMPLE: PROGRAMMING IS COMPLETED AT 2PM AND CH1 WAS PROGRAMMED TO BE ON AT 8AM AND OFF AT 5PM. AFTER PRESSING THE ◷ KEY, CH1 WILL BE OFF; PRESS TO TURN IT ON. IT WILL ASSUME AUTOMATIC OPERATION AT THE 5PM OFF TIME.

REVIEW AND CHANGE OF PROGRAMS

1. To review a program at any time press Prog. key. Programs will be displayed in the sequence they were entered with repeated presses of Prog. key.
2. To change a program, select the program to be changed with Prog. key and enter the new time of day and/or days of week just as in the programming steps shown above. The old program is overwritten with the new selections. Press Prog. to store the new program.
3. To delete on individual program, select the program as in step 1 and press the m key and then the h key until "--:--" appears in display. Press either Prog. or ◷ key until "--:--" flashes. The program is deleted after a few seconds.

MANUAL OVERRIDE

While in Run mode, (◷ symbol is in display), pressing the key will reverse the load status (switch load OFF if it is ON, or switch ON if it is OFF) a symbol appears in display to indicate the override is active. At the next scheduled time, automatic time control will resume, eliminating the override.

Pressing the key a second time ⦿ appears in the display indicating the load is switched permanently ON
Pressing the key a third time ◯ appears in the display indicating the load is switched permanently OFF.
Pressing the key a fourth time returns to automatic, ◷ appears in the display.

C/D ACCESSORY

OPERATION — The "C" plant exerciser starts the engine (No Load Test) by closing the engine start circuit. The "D" plant exerciser simulates normal line failure, starts the generator, and transfers the load to emergency at selected time intervals.

NOTE — Total GENERATOR running time = clock ON time + "U" timer ON time (if U is used)

CAUTION — ⚠ Before changing the time setting, turn Disconnect Switch (DS) to "OFF" position; after desired selection has been made, return DS to "ON" position.

Digi 42/2 PROGRAMMING INSTRUCTIONS

The circular keypads are positioned to provide a sequential path for programming. Starting with Prog. to select a program, clockwise to to select ON or OFF. Then h for hour, m for minute, and finally Day to select day or days of the week. If an input is missing or incomplete, the missing segments will flash when the ◷ or program key is depressed. (For example, if no ON or OFF is selected, the ON symbol will flash). The missing entry must be completed before programming can resume. While programming, pressing the h, m or Day key longer then 2 seconds will cause a rapid roll of the parameter. A program consists of: 1. ON or OFF command, 2. Hour and minute, and 3. Day or multiple days on which it is to occur.
Note: A flashing display indicates either incomplete data entry or the battery is low. Check to see if days and ON or OFF times are entered, and check the power supply to the time control.

IMPORTANT: Depress reset key (Res.) before beginning to set time and program

MANUAL OR AUTOMATIC DAYLIGHT TIME CHANGEOVER

For areas where Daylight Savings time is not observed, please ignore this section. The Digi 42/2 offers the option of manual or completely automatic Daylight Savings time chageover in the spring and fall. For manual changeover, depressing the ±1h key sets clock time up or down 1 hour to change the time twice a year. For automatic changeover, perform the following programming, which only needs to be done during initial installation, or if the reset key is depressed at any time. When programmed for auto changeover, the time switch will automatically change the time at 2 AM on the first Sunday of April and the last Sunday of October until the year 2079.

1. Select military (24:00 hr.) or AM/PM (12:00 hr.) time mode by simultaneously depressing the ±1h key and h keys. (AM appears in display when in AM/PM mode).
2. Enter the Daylight Savings Time Program by pressing the ±1h and Day once simultaneously. A "1" will appear uner "Mo" in display. Then set the current (today's) date with the m key and the month with the h key. (If military time, set the date with h key and month with m key). For example: Feb 15 would appear as 02:15 if in AM/PM or as 15:02 if military time.
3. Press ±1h key once. A "12" will appear under "Tu" in display. Then enter the current year with the m key. If you overshoot the current year, hold down the m key and the years will scroll to 2079 and back to 1995, 1996, 1997, etc.
4. Press ±1h key once. A "3" will appear under "We" in display, and "AU" (for preset European dates). If European dates are desired, press key to enter the data and exit Daylight Time programming mode.
5. Press m key onc. "cHA" will appear in display (for entering North American dates).

   NOTE: If the m key is inadvertantly pressed two times and "HA" appears in display, press the m key two more times, until display shows "cHA". ("HA" for specific dates is not used at present).
6. Press ±1h key once. A "4" will appear under "Th" in display. Enter the date for changeover to Summer Daylight Savings Time for the current year (see chart below for dates) by entering the date with the m key and the month with the h key) (If in Military Time, set date with h month with m key). For example: April 7 would appear as 04:07 if in AM/PM time, 07:04 if in military time.
7. Press ±1h key once. A "5" will appear under "Fr" in display. Enter the date changeover to Winter Time for the current year (see chart below for dates) by entering date with the m key and the month with the h key. (If in Military Time, set date with h key and the month with m key).
8. Press key to enter the data and exit the Daylight Savings Time programming mode.

Daylight Savings Time Changeover Dates

2002.....April 07.....October 27	2005.....April 03.....October 30
2003.....April 06.....October 26	2006.....April 02.....October 29
2004.....April 04.....October 31	2007.....April 01.....October 28

SETTING TIME AND DAY OF CLOCK

1. Select military (24:00 hr.) or AM/PM (12:00 hr.) time mode by depressing and holding h key while pressing ±1h key to toggle between military and AM/PM. (AM appears in display when in AM/PM mode).
2. Press and hold down ◷ key.
3. If Automatic Daylight Savings Time Changeover is not programmed, press ±1h key once if setting the timer when Daylight Savings time is in effect (±1h appears in display).
4. Set hour with h key. If AM or PM does not appear in display, the unit is in Military Time (see note above to change display).
5. Set minutes with m key.
6. Press Day key repeatedly until the day of the week is displayed (1 is Monday, 7 is Sunday).
7. Release key, colon will begin flashing. If the days are flashing, the day of the week was not entered. (See step 6).

PROGRAMMING

1. Press Prog. key 1234567 AM will appear in display. (Pressing Prog. key again, display will show the number of free programs: Fr 42) press again to advance to 1st program.

2. Press 1 key or 2 key. ON symbol will appear below CH 1 or CH2. Pressing the key again will toggle to OFF . Pressing a third time clears the ON/OFF for the channel from the program. Pressing again returns to ON. Select ON or OFF for the program with the key. Note: ON or OFF con be selected for BOTH CHANNELS. (Both channels con switch ON at the some time, or one con switch ON and the other OFF from the some program).
3. Press h to select hour for switching time.
4. Press m to select minute for switching time.
5. If the program is to occur every day of the week. (24 hour time control) ignore Day key and press Prog. key to advance to next program.
6. If 7 day time control is desired, press Day key, a flashing underline appears below day 1. Pressing the Day key a second time advances the underline to day 2, etc. Use the Day key to advance to a day of the week to be omitted from the program and press the Sel. (select) key, the day will flash. Continue pressing Day and Sel. keys to omit days until only the desired days remain and ore not flashing.
7. Press Prog. key and repeat steps 2 thru 6 to enter additional programs of ON and OFF times. Note that more than one OFF time program may be entered, enabling automatic control of manual overrides.
8. Press key to enter run mode.

8th DAY (HOLIDAY OR VACATION) PROGRAM
Multiple programs (more than one ON and OFF time) may be entered to be implemented on holidays or vacation periods. (A typical program is: OFF, 12:01Am to hove the loads) OFF during the holiday).

1. Press Prog. key, select ON or OFF, h and m as with normal programming. but do not select or omit any days.
2. Press key. will appear in the display, indicating 8th day holiday/vacation program.
3. Press key to enter run mode. Time switch is now permanently preset for the ON/OFF schedule to be implemented on holiday or extended vacation period in the Future as described below.
   HOLIDAY PROGRAM: Pre-select Day or Series of Days for 8th day Program to Occur.
   The holiday program may be implemented at any time up to 6 days in advance of the holiday(s) or vacation period. It may also be activated on the holiday or first day of the vacation period.
1. While in Run mode, press key. "--Ho" appears in display.
2. Press Day key to select the day of week Holiday program is to begin.
3. Press Sel. key to select the number of days Holiday program is to run. Up to 99 days. If Sel. key is held down. numbers roll up rapidly to 99 then to 01)
4. Press key to store, holiday symbol appears in display.
5. To review or change the Holiday Program, press key. To cancel Holiday Program, press key.

   On the day that the Holiday Program is selected to begin, the 8th day program will be implemented at 1 2:00AU Midnight and hove priority over the regular doily programs. The display will show the holiday symbol and the number of days the program is to run, which will count down each day and revert to the normal display, when all days of the holiday/vacation period hove expired. To cancel holiday program, press key.

IMPORTANT: THE OUTPUT RELAYS WILL SWITCH ON (OR OFF) ONLY AT THE PROGRAMMED TIMES, AFTER PROGRAMMING IS COMPLETE. If A CHANNEL SHOULD BE ON, It MUST BE MANUALLY TURNED ON WITH THE KEY. FOR EXAMPLE: PROGRAMMING IS COMPLETE AT 2PM AND CH1 WAS PROGRAMMED TO BE ON AT 8AM AND OFF AT 5PM. AFTER PRESSING THE KEY, CH1 WILL BE OFF; PRESS TO TURN IT ON. IT WILL ASSUME AUTOMATIC OPERATION AT THE 5PM OFF TIME.

REVIEW AND CHANGE OF PROGRAMS

1. To review a program at any time press Prog. key. Programs will be displayed in the sequence they were entered with repeated presses of Prog. key.

2. To change a program, select the program to be changed with Prog. key and enter the new time of day and/or days of week just as in the programming steps shown above. The old program is overwritten with the new selections. Press Prog. to store the new program.
3. To delete on individual program, select the program as in step 1 and press the m key and then the h key until "--:--" appears in display. Press either Prog. or ◷ key until "--:--" flashes. The program is deleted after a few seconds.

MANUAL OVERRIDE

While in Run mode, (◷ symbol is in display), pressing the ✋ key will reverse the load status (switch load OFF if it is ON, or switch ON if it is OFF) a ✋ symbol appears in display to indicate the override is active. At the next scheduled time, automatic time control will resume, eliminating the override.

Pressing the ✋ key a second time ⦿ appears in the display indicating the load is switched permanently ON
Pressing the ✋ key a third time ◠ appears in the display indicating the load is switched permanently OFF.
Pressing the ✋ key a fourth time returns to automatic, ◷ appears in the display.

C/D WITH 365 DAY CLOCK

LEGEND

C/D.... Exercise clock, 365 day pogrom.
See sheets 2, 3 & 4 for programming instructions.

OPERATION

C-MODE: The "C" plant exercisor starts the engine (No Load Test) by closing the Engine Start circuit.
D-MODE: The "D" plant execisor simulates normal line failure, starts generator, and transfers load to emergency at the selected time intervals.

NOTES

1. Total GENERATOR running time = "C" ON time + "U" timer ON time (if U is used).

CAUTION

⚠ Before changing the time setting, turn Disconnect Switch (DS) to "INHIBIT" position; after desired selection has been mode, return DS to AUTO position

DIGI 322 - 45/2 Y—24

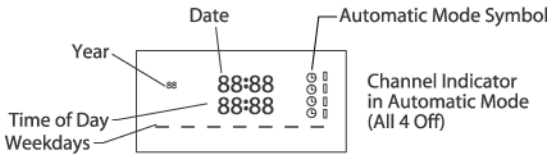
KEYPAD DESCRIPTION

Mo-Su - Day selector
✱Reset - Clears all programs and actual time
✱S/W - Switch for daylight savings time functions
Prior - Sets priorities
Year - Sets year when setting actual time
CL - To cancel on individual pogrom step
R - Used to review the pogrom
1X - Used to enter a one time schedule
N - Used to enter on intermediate step in a pogrom block
◷ - Recalls actual time (Time of Day)
S - Used to store the final step in a pogrom block
⎍ - Sets the momentary contact (IMP)
→|← - Used to set the end of a multiday holiday period
Day - Used to set the day of the month
Month - Used to set the month
h+ - Hour advance
h- - Hour reverse
m+ - Minute advance
m- - Minute reverse
I/O - Sets ON(1), OFF(0) command for each channel
✋ - Manual override for each channel
✱ - Recessed buttons - use a long pen point

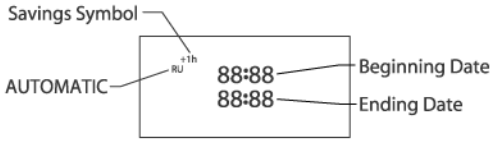
LCD DISPLAY ELEMENTS

The LCD incorporates a number of different elements to display various data and information.

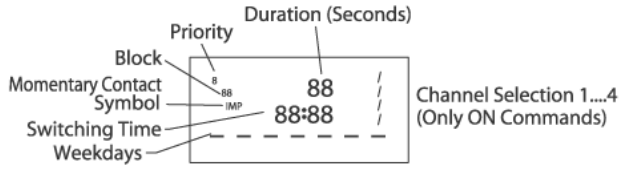
1. Example: Actual dote and time of day



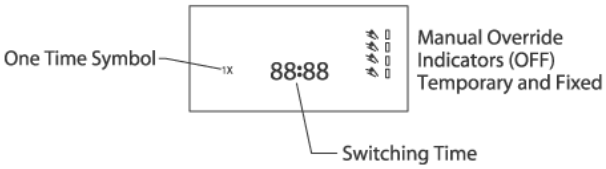
2. Example: Daylight savings time



3. Example: Momentary Contact



4. Example: Other displays



BLOCK FORMATION

The purpose of the blocks is to simplify the programming, i.e. switching times that are repeated for different holidays or periods need not be repeated. Likewise, when programming ON and OFF times the date need only be entered once.

The time switch assigns a block number to each program or date block entered from 00 to 99. All programs withour a date (7-day prograns) automatically receive the block number 00.

Programs with dates - individual days or period of days - are assigned an ascending block number (01, 02.....99). All programs within a block are stored by pressing "N". The last program or portion of a program within a block is entered by pressing "S", thus closing the block.

EXECUTION OF PROGRAMS

At beginning of each day the microprocessor determines which of the stored programs for that day have the highest priority. Only the highest priority program(s) will be

Once the digi 322 is programmed, it will automatically "look back" and assume the correct ON or OFF switch position.

PRIORITY

The microprosessor automatically assigns the lowest priority - "0" - to standard 7-day programs. Holiday programs with a duration of more than one day automatically receive priority "1". Holiday programs for one day only automatically receive priority "2". A higher priority can be manually assigned to any holiday program by using the "Prior." key.

PROGRAM STORAGE CAPACITY

The digi 322 can store up to 322 programs. These 322 programs can be freely assigned to different dates or periods, switching times or channels.

A storage position is used each time the button "N" or "S" is pressed. If all storage positions are used up, four 8's will be shown in the display.

If a program step is not complete and storage is attempted with the "N" or "S" button, the missing components will blink in the LCD.

SETTING THE TIME

[Example: 8:15 AM, July 10, 1991]
Press "Reset" to clear the time and all programs.
While holding ◷ :

Press "Year"	to 91
Press "Month"	to 7 (July)
Press "Day"	to 10
Press "h+"	to 8 (AM)
Press "m+"	to 15

Release the ◷. The current date and time will be displayed, as will the day of the week; the time colon will blink. Channel setting and override status will be indicated on the right and the +1h indicates that Daylight Saving Time is in effect, if appropriate.

DAYLIGHT SAVINGS TIME (DST) FUNCTIONS

The digi 322 is pre-programmed for DST to begin on the last Sunday in March and to end on the last Sunday in September every year. You can program a different DST as follows:

To cancel pre-programmed DST:

Press "S/W"	(dates will appear)
Press "CL"	to cancel - (zeros will appear)
Press "S"	to store
Press ◷	to display the time of day

To program different dates for DST:

[Example: For 1991, April until October 27]

Press "S/W"	the dates 03:31 to 09:29 are displayed
Press "CL"	the display shows zeros

Press "Month"	to 4 (April)
Press "Day"	to 7
Press →|	to set the ending date
Press "Mounth"	to 10 (Ocober)
Press "Day"	to 27
Press "S"	to store
Press ◷	to display the time of day

PROGRAMMING 7-DAY SCHEDULES

NOTE: The actual time of day must be set prior to programming. Check DST. We recommend that all programs be first written out on the enclosed program worksheets.

[Example: Channel 1 on at 7 AM and off at 6 PM, Monday thru Friday]

Press "h+"	to 7 AM (press 9 times)
Press "m+"	to 00 (once)
Press "Sa"	to omit Saturday
Press "Su"	to omit Sunday
Press "I/O"	(for channel 1) to 1 (ON)
Press "N"	to store
Press "h+"	to 6 PM
Press "m+"	to 00 (once)
Press "Sa"	to omit Saturday
Press "Su"	to omit Sunday
Press "I/O"	(for channel 1) twice to 0 (OFF)
Press "S"	to store

Weekly program steps are automatically assigned to block "00" and priority "0".

PROGRAMMING INDIVIDUAL HOLIDAYS

[Example: July 4th - fixed date holiday; Labor Day (September 2, 1991) - 1-time schedule; Channel 1 off at 12:01 AM]

NOTE: Fixed day holidays will stay in the program until the year 2079 when the internal clock stops. As one time holiday commands are executed the month and day go to zero (visible if you review the program). The month and day for the next year can be substituted for the zeros. For example: If you have a holiday program for Thanksgiving 1991 it is executed on November 28. If you review the program on November 29th you will see 00.00 not 11.28; you can enter 11.26, and press the "N" key to program Thanksgiving for 1992.

Press "Month"	to 07 (July)
Press "Day"	to 04
Press "N"	to store
Press "Month"	to 09 (September)
Press "Day"	to 02
Press "1X"	1-time schedule only
Press "N"	to store
Press "h+"	to 12 AM
Press "m+"	to 01
Press "I/O"	(for channel 1) twice to 0 (OFF)
Press "S"	to store this and close the block

Individual Holiday programs are automatically assigned priority 2.

NOTE: Ignore the days of the week indicator.

PROGRAMMING MULTIDAY HOLIDAY PERIODS

[Example: Channel 1 off (we will use an OFF command at 12:01 AM) each day from June 22, 1991 until September 3, 1991 inclusive]. The daily program will resume September 4. As this "School Summer Vacation" will be different in 1992 this becomes a 1X (one time) schedule.

Press "Month"	to 06 (June)
Press "Day"	to 22
Press →|	to set the end date
Press "Month"	to 09 (September)
Press "Day"	to 03
Press "1X"	to set one time
Press "N"	to store
Press "h+"	to 12 AM
Press "m+"	to 01
Press I/O"	(for channel 1) twice to 0 (OFF)
Press "S"	to store this and close the block

Multiday holiday program are automatically assigned priority 1. These periods can be programmed with a 7-day schedule that is different than the standard 7-day schedule. Simply follow the above procedure and add the respective Monday thru Sunday keys for the desired days of the week before selecting the hours.

If no ON or OFF times are programmed for some or all days of the week during a multiday holiday period, the standard 7-day schedule will be executed.

REPEAT CHANNEL SELECTION

The control of loads is not restricted to a single channel. All loads can be turned on or off at the same time. For example, load 1 can be turned OFF simultaneous to load 2 being turned ON.

SPECIAL PROGRAM FUNCTIONS

MOMENTARY CONTACT PROGRAM

Short duration programs in 1-second intervals up to 59 seconds can be programmed for loads such as bells.

[Example: A noon whistle (channel 2) for six seconds Monday through Friday]

Press "h+"	to 12 PM - noon
Press "m+"	once to 00
Press "I/O"	(channel 2) once to 1
Press "Pulse"	to 6 (seconds)
Press "Sa, Su"	to eliminate Saturday & Sunday
Press "S"	to store

NOTE: This can only be used for ON commands.

PRIORITIES

Pressing the "Prior." key after entering the date for a holiday program permits the assignment of a higher priority (the highest is 9). This allows that standard holiday programs with priority 1 or 2 are overridden with special programs.

MANUAL OVERRIDE

The digi 322 provides temporary and fixed overrides. Each channel has an elongated button below the . Pressing this button will change the status of a channel, i.e. ON to OFF or OFF to ON. The small in the display will change to indicating an override condition. This is a temporary override which will in turn be overridden by the next program change.
For example, if lights are programmed to turn off at 4 PM and they are turned on manually at 2 PM, they will turn off at 4 PM.
Pushing the button again will give a FIX 1 (ON) and pushing it another time will give a FIX 0 (OFF). These are permanent ON or OFF commands which will not be overridden by the program. Pushing the elongated button one more time will return to automatic operation.

PROGRAM REVIEW

The program can be reviewed by pushing the "R" key successively. Block 00 is reviewed first and each weekly ON/OFF command will be displayed on successive screens. A blank screen indicates the end of block 00. Block 01 is reviewed next. The first screens show the holidays followed by a blank screen. The ON/OFF commands for those days are next followed by another blank screen which indicates the end of block 01. Block 02 and any additional blocks are reviewed in the same manner. Press the turn to the TOD display anytime.

CANCELLING PROGRAMS

Use the "R" key to find the program step to be cancelled. Pressing the "CL" key will cancel that step and it is deleted from memory. To delete holidays from the program you must clear both the date and the time/on/off positions. The reset key will cancel all program steps and also the current time of day, date etc.

EDITING PROGRAMS

Use the "R" key to find the program step to be corrected. Make the changes as in normal programming and then use the "N" key to store the change.

BATTERY-POWERED RESERVE

In case of power failure, the built-in nickel-cadmium battery maintains the time of day, program storage and the LCD display of 150 hours (6+ days). During this time, all programmed switching events will be carried out but the relays will not operate. The battery reserve operates to its full capacity only if the digi 322 has been connected to electrical power for at least 140 hours.

NOTES:

1. When power is restored after a power failure, the digi 322 "looks back" and assumes the correct ON or OFF switch position.

2. After entering a time of day and pressing N or S, the display may still show the hour that was entered.

   For example: if 2:00 PM had been enterned, the display may show "PM 02:--" after pressing N or S.

   To enter the next time of day program, it is necessary to change the hour with the h+ or h- key even if the next time of day program is to be the same hour as previously entered. If the hour is not changed, the Digi322 will not accept the next program.

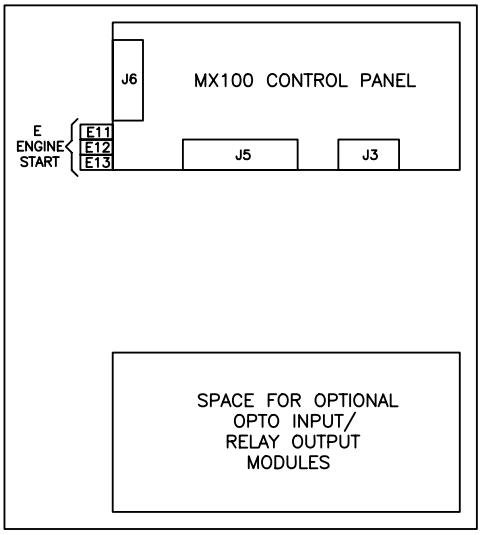
   For example: After entering a 2:00 PM program, if the next time of day program is to be 2:30 PM, press the h+ key to 3 PM, and then the h-key back to 2 PM, and then press the m+ key to :30.



GE Zenith Controls

GE Industrial Systems – Power Equipment Business
General Electric Company
830 West 40th Street, Chicago, IL 60609 USA
773 299-6600, Fax: 773 247-7805
www.zenithcontrols.com

INSIDE VIEW OF CABINET DOOR

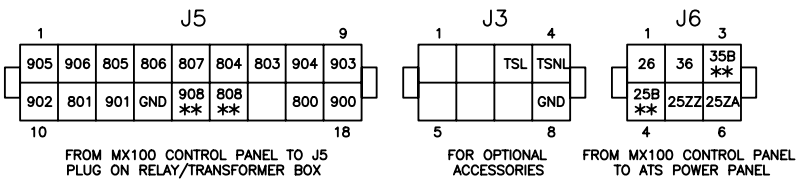


AUXILIARY CONTROL PANEL *

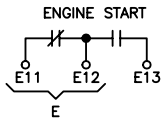
(12" X 18")
(305mm X 457mm)

PILOT DEVICES

INTERCONNECT PLUGS



CUSTOMER CONNECTIONS



CONTACT	RATING
E	5 AMP @ 250 VAC 5 AMP @ 30 VDC
A3, A4	20 AMP @ 125, 250 VAC

LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION		
—○— WIRE ON TERMINAL BLOCK		
* OPTIONAL		
** DELAY UNIT ONLY		

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
A	S-5757-B	ESTABLISH	DWG.	

ZENITH CONTROLS, INC.

TITLE: MX100 INSIDE DOOR VIEW
MODEL: ZTGK,ZTGDK SERIES TRANSFER SWITCHES

DRFT: SDW	DATE:	SCALE:	CHK:	APPD:
ENGR: JC	11/27/95	N/A		

DWG NO.: 50A-1000 REV A
CADD: S5K SHT. 1 OF1

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
R	S-7866 REVISED DWG	07/16/02	GG MAC

ZTG(2/3/4)K SERIES WITH MX100 MICROPROCESSOR-BASED CONTROL PANEL AUTOMATIC TRANSFER SWITCH (ATS) 30-3000 AMP

FOR USE ON EMERGENCY OR STANDBY SYSTEMS - RATED FOR TOTAL SYSTEM & MOTOR LOAD

A. LEGEND

MX Series Microprocessor-Based Control Panel

Standard Features:
- DS..... Disconnect Switch
- TS..... Test Switch

Relay/Transformer Box
- CCE..... Control Relay, Close Emergency
- CCN..... Control Relay, Close Normal
- XE1..... Control Transformer, Emergency
- XN1,XN2..... Control Transformer, Normal

Power Panel
- N1,2,3,(N)..... Normal Line _____
- E1,2,3,(N)..... Emergency Line _____
- T1,2,3,(N)..... Load Connections
- BR..... Bridge Rectifier (ZTG(2/3)K30-400A)
- CA..... CN/CE Capacitor (ZTGK40-260A)
- CE..... Emergency Transfer Operator (ZTG4K 225-400A, 600-3000 Amp)
- CN..... Normal Transfer Operator (ZTG4K 225-400A, 600-3000 Amp)
- CNE..... Main Transfer Operator (ZTG(2/3)K30-400A)
- CN/CE..... Main Transfer Operator (ZTGK40-260A)
- GND..... Ground
- NB..... Neutral Bar (if required)
- RE..... Bridge Rectifier, CE (ZTG4K 225-400A, 1600-3000 Amp)
- RN..... Bridge Rectifier, CN (ZTG4K 225-400A, 1600-3000 Amp)
- SCE,SCN..... CNE Limit Switches (ZTG(2/3)K30-400A)
- SE..... Emergency Position Limit Switch
- SN..... Normal Position Limit Switch

B. OPERATION

When Normal line voltage drops below the preset dropout point, the Normal voltage sensing circuit initiates the engine start circuit.

When Emergency line voltage and frequency reach the preset pickup point, the MX control panel energizes the CCE control relay to operate the main transfer operator. The load is now transferred to the Emergency line. The transfer switch is mechanically locked. The SN limit switch awaits the next operation to Normal.

When the Normal line voltage reaches the preset pickup point, the MX control panel energizes the CCN control relay to operate the main transfer operator. The load the load is now re-transferred back to the Normal line. The transfer switch is mechanically locked. The SE limit switch awaits the next operation to Emergency.

Test Switch

The Test Switch simulates a normal line failure when activated.

To test, activate the Test Switch, thus allowing the transfer switch to transfer to the Emergency position. De-activate the Test Switch. The transfer switch will reset to the Normal position.

Testing at least once a month is recommended. For hospital emergency systems, test once a week.

Disconnect Switch

When the Disconnect Switch is placed in the INHIBIT position, the MX control panel is disengaged and transfer cannot take place.

C. STANDARD ACCESSORIES

Zenith Transfer Switch with MX100 microprocessor-based control panel contains the following standard accessories:

- A3..... Auxiliary Contacts - Emegency Position
- A4..... Auxiliary Contact - Normal Position
- C/DT..... Plant Exercise Timer
- E..... Engine Start Contact
- L1..... Emergency Position Light
- L2..... Normal Position Light
- L3..... Normal Available Light
- L4..... Emergency Available Light
- P..... Time Delay to Engine Start
- R50..... In-Phase Monitor
- T..... Time Delay to Normal
- U..... Time Delay to Engine Cool Down
- W..... Time Delay to Emergency
- YEN..... Pushbutton to Bypass T/W Time Delays

D. OPTIONAL ACCESSORIES

Zenith Transfer Switch with MX100 microprocessor-based control panel has the capability for additional accessories. The following is a description of the optional accessories. Those options checked are supplied on this unit. See additional pages for complete legend and operation.

- ☐ A6 Motor Disconnect. To de-energize external motor control circuit prior to transfer in either direction.
- ☐ C/D Plant Exercise Clock.
- ☐ CTAP Chicago Transfer Alarm Panel.
- ☐ HT Heater with Thermostat.
- ☐ Q2 Remote peak shave or area protection circuit. Includes bypass for automatic return to Normal if Emergency line fails and Normal is present.
- ☐ Q3 Remote Inhibit transfer to Emergency Circuit. Energizing QR3 input allows transfer to Emergency.
- ☐ T3/W3 Pre-Signal Contact. Closes a dry contact prior to transfer in either direction.
- ☐ ZNET Communications provisions.
- ☐ 6A Maintained Test Switch.

NOTES:

1. ⚠ CAUTION: In using a 3 phase, 4 wire delta or open delta power supply (usually 120/240 volts, sometimes listed as 120/208 volts) with one leg having a grounded center tap, one line will be 160 to 208 volts to ground. When such a system is used it is necessary to connect the high leg to N2. DO NOT CONNECT 120 VOLT LOAD CIRCUIT TO THE HIGH LEG.
2. GROUNDING TERMINAL: A grounding terminal (GND) is provided. When installing open type switches connect this terminal to the metal enclosure or an equivalent earth ground.
3. ⚠ WARNING - TO ENSURE AGAINST SHOCK OR ACCIDENT HAZARD, DISCONNECT ALL SOURCES OF SUPPLY BEFORE SERVICING.
4. ON SINGLE PHASE UNITS WHERE THE EMERGENCY SOURCE IS A UTILITY LINE, CONNECT EMERGENCY LINE SO THAT MINIMUM VOLTAGE IS MEASURED FROM N1 TO E1.
5. ON SINGLE PHASE (2 POLE) UNITS, THE CENTER POLE IS NOT SUPPLIED. RIGHT HAND POLE IS NOT SUPPLIED ON 400 AMP UNITS.
6. FOR F14 AND F17 UNITS, THE DISCONNECT SWITCH (DS) IS AN OPTIONAL ACCESSORY, NOT A STANDARD FEATURE.

GE PROPRIETARY AND CONFIDENTIAL INFORMATION
This document is the property of General Electric ("GE") and contains proprietary information of GE. This document is loaned on the express condition that neither it nor the information contained therein shall be disclosed to others without the express, written consent of GE Industrial Systems, and that the information shall be used by the recipient only as approved expressly by GE Industrial Systems. This document shall be returned to GE upon its request. This document may be subject to certain restrictions under U.S. export controls laws and regulations.

THIRD ANGLE PROJECTION

FOR ADDITIONAL INFO REFER TO
APPLIED PRACTICES
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
2 PL. DECIMALS ± .020
3 PL. DECIMALS ± .005
ANGLES ± 1°
FRACTIONS ± 1/64
FINISH

SIGNATURES		DATE
MODEL	SB	12/21/95
DETAIL		
CHECKED		
ENGRG		
MFG		
QUALITY		
ISSUED		

DRAWING FILE:
MODEL / ASSEMBLY FILE: ZTG(2/3/4)K3-300 (30-3000A)
CTQs ⊖ CRITICAL TO QUALITY CHARACTERISTIC
AutoCad Generated

GE Zenith Controls

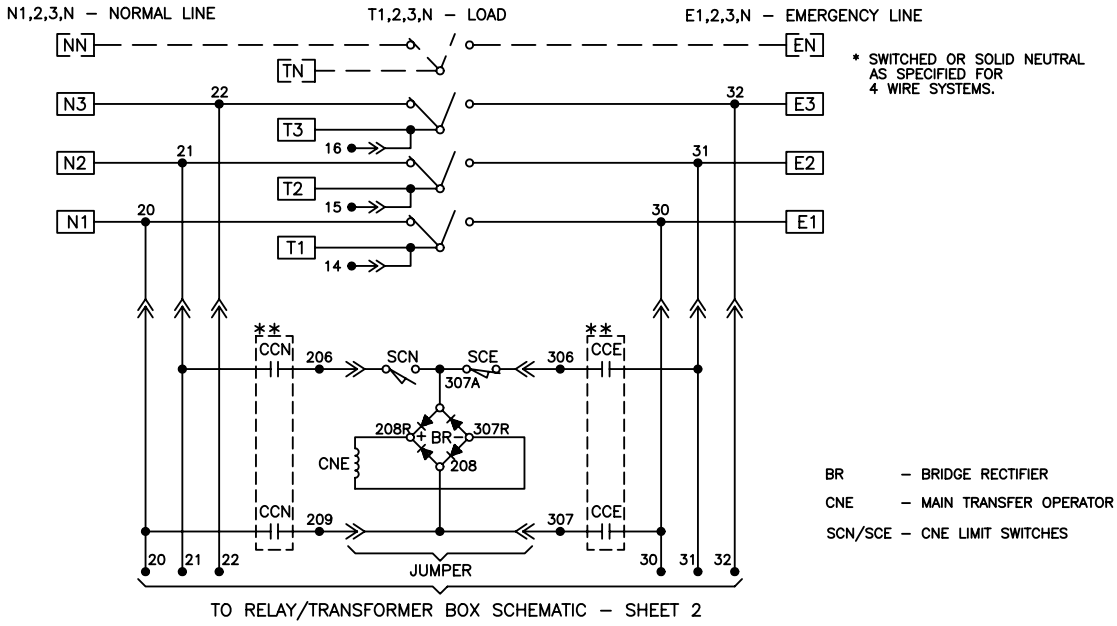
TITLE
LEGEND, OPERATION & ACCESSORIES

FIRST MADE FOR: -

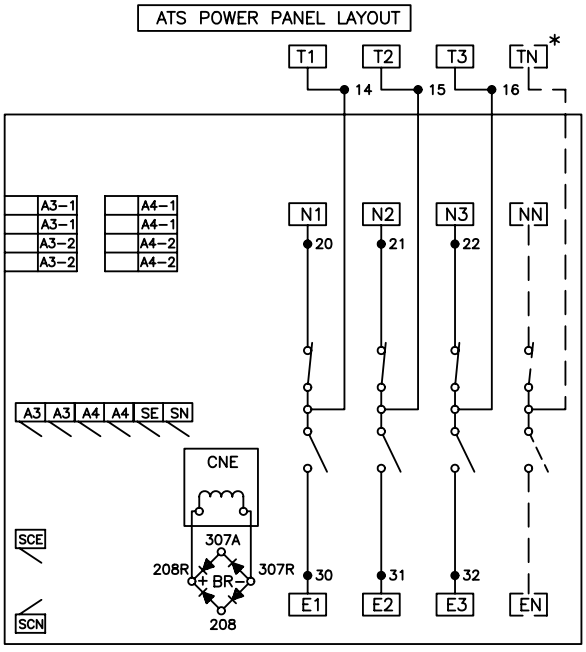
SIZE	CAGE CODE	DWG NO
B		52A-0900

SCALE: - SHEET 1 OF 1

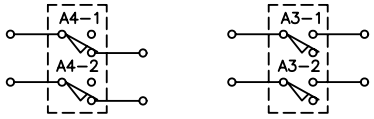
ATS POWER CIRCUIT SCHEMATIC



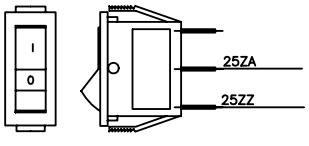
ATS POWER PANEL LAYOUT



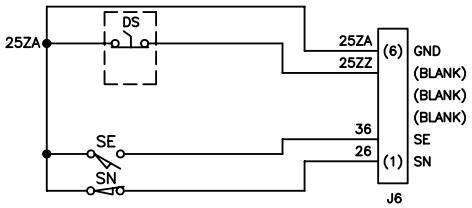
AUXILIARY CONTACTS



LIMIT SWITCH SCHEMATIC



DETAIL L–4030



TO MX SERIES CONTROL PANEL

SE – EMERGENCY POSITION LIMIT SWITCH
SN – NORMAL POSITION LIMIT SWITCH
DS – DISCONNECT SWITCH ON MX100

LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —○— WIRE ON TERMINAL BLOCK —≫— WIRE IN INTERCONNECT PLUG * OPTIONAL ** LOCATED ON RELAY/ TRANSFORMER BOX	LEGEND, OPERATION, AND ACCESSORIES: 52A–0900 FOR PRODUCTION ONLY: R/T BOX AND PLUGS – SHEET 2 OF 2 MX100 CONTROLLER – 50A–1000	ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS				
REV	ECN NO.	DATE	DWN	ENG
A	S–5757–B	ESTABLISH DWG.		
B	S–5757–D	01/09/96	SDW	SB
C	S–6849	01/28/98	RMC	SB
D	S–6924	05/08/98	EC	SB
E	S–7028	11/02/98	SG	VZ
F	S–7254	10/28/99	EC	MES
G	S–7377	05/19/00	SG	MES

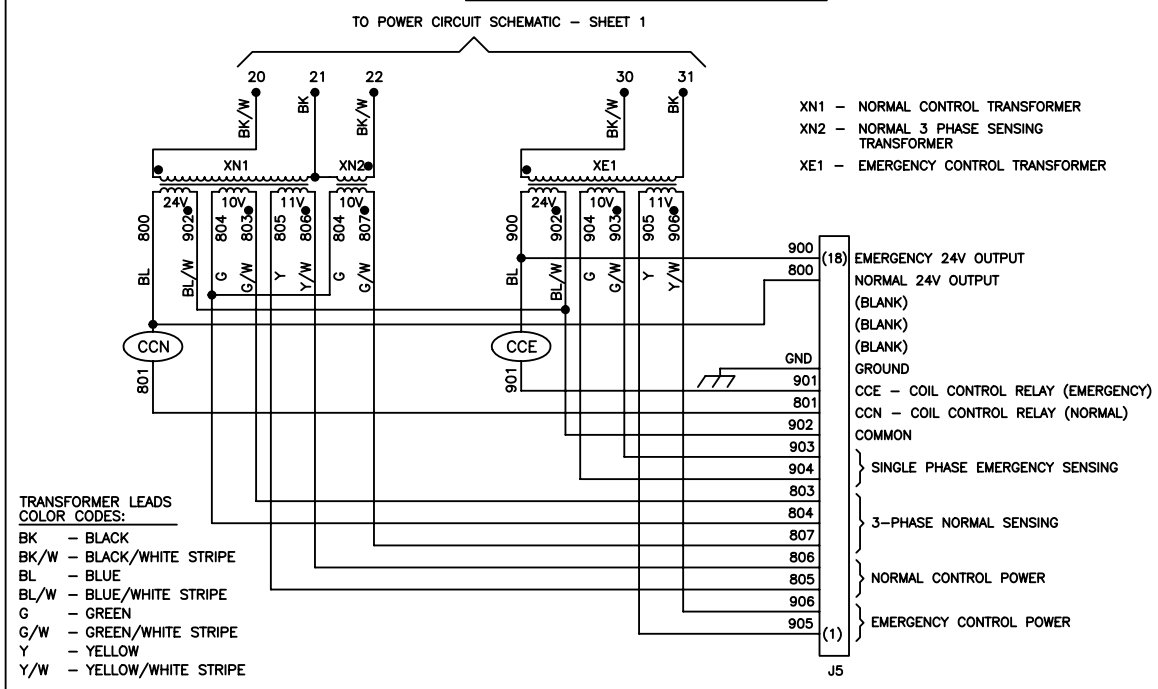
ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

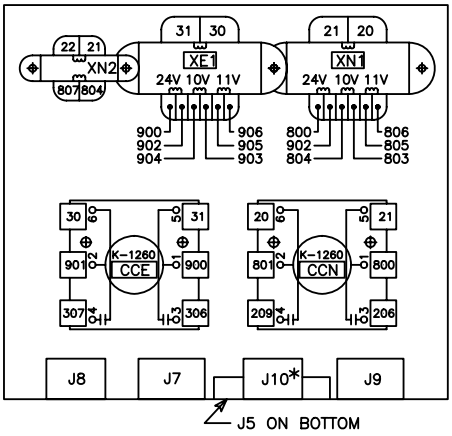
DWG TITLE: ATS POWER CIRCUIT & LIMIT SWITCHES
JOB/MODEL: ZTGK40 (400 AMP) (3/4P)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:		
		ACAD	N/A	52A–2000		
DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:	
SDW	SB	11/28/95	–	1 OF 2	G	

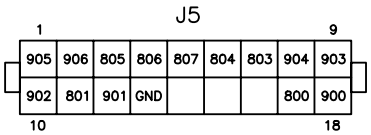
RELAY/TRANSFORMER BOX SCHEMATIC

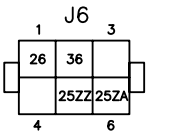


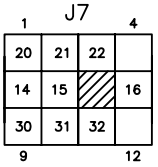
RELAY/TRANSFORMER BOX

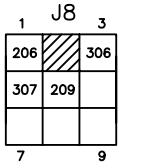


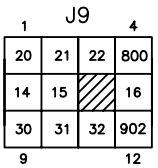
INTERCONNECT PLUGS

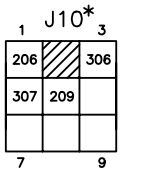




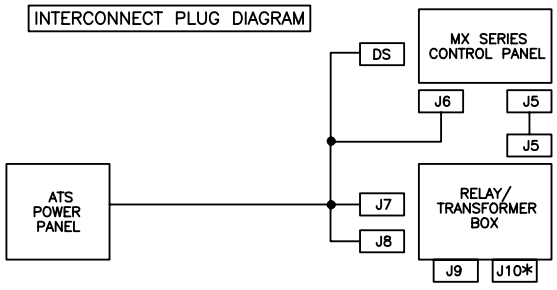








INTERCONNECT PLUG DIAGRAM



LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION		
* OPTIONAL		

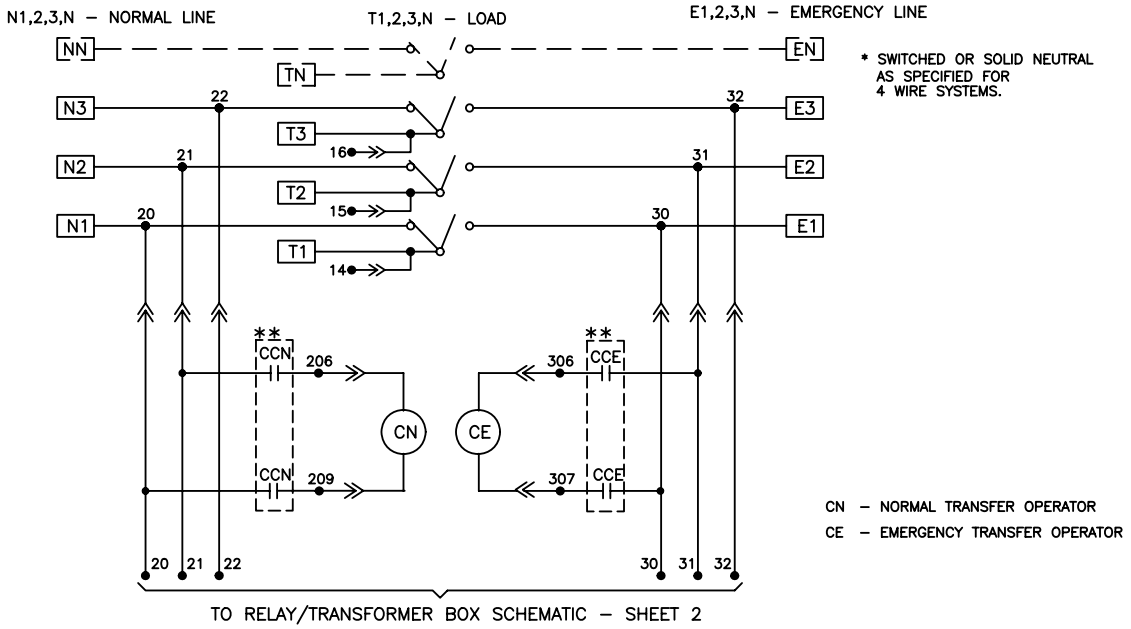
REVISIONS				
REV	ECN NO.	DATE	DWN	ENG
A	S-5757-B	ESTABLISH DWG.		
B	S-5757-D	01/09/96	SDW	SB
C	S-6849	01/28/98	RMC	SB
D	S-6924	05/08/98	EC	SB
E	S-7028	11/02/98	SG	VZ
F	S-7254	10/28/99	EC	MES
G	S-7377	04/27/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE:	RELAY/XFR BOX & INTERCONNECT PLUGS					
JOB/MODEL:	ZTGK40 (400 AMP)					(3/4P)
CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:		
		S5K	N/A	52A–2000		
		DRWN:	ENGR:	DATE:	SCALE:	SHEET: / REV:
		SDW	SB	11/28/95	–	2 OF 2 / G

ATS POWER CIRCUIT SCHEMATIC

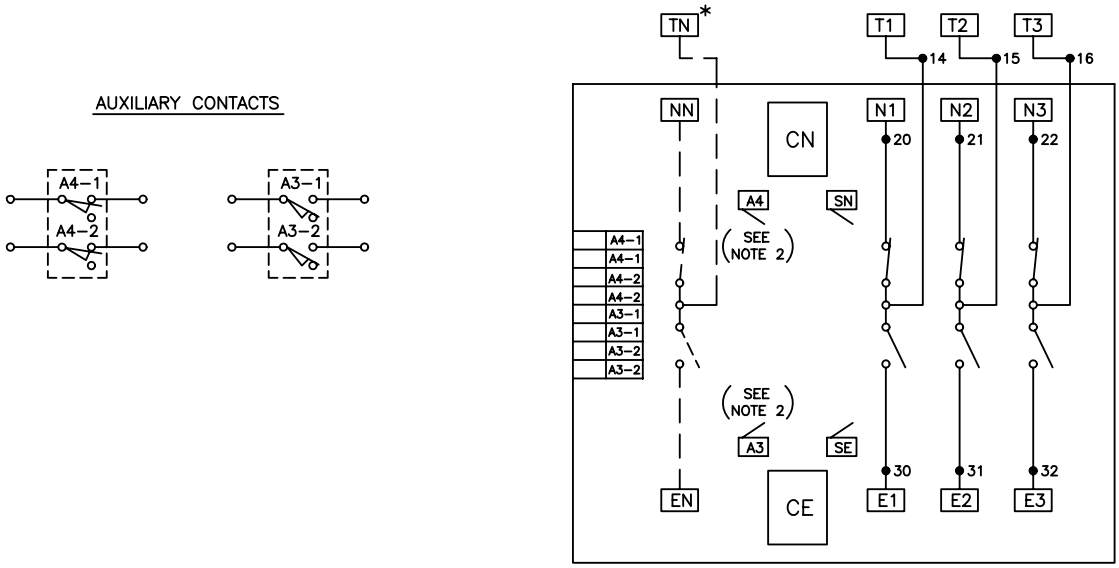


* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEMS.

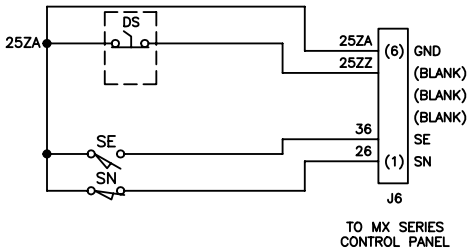
CN – NORMAL TRANSFER OPERATOR

CE – EMERGENCY TRANSFER OPERATOR

ATS POWER PANEL LAYOUT



LIMIT SWITCH SCHEMATIC



SE – EMERGENCY POSITION LIMIT SWITCH

SN – NORMAL POSITION LIMIT SWITCH

DS – DISCONNECT SWITCH ON MX100

LEGEND	REFERENCE	NOTES
●— WIRE CONNECTION —○— WIRE ON TERMINAL BLOCK —≫— WIRE IN INTERCONNECT PLUG * OPTIONAL ** LOCATED ON RELAY/ TRANSFORMER BOX	LEGEND, OPERATION, AND ACCESSORIES: 52A–0900 FOR PRODUCTION ONLY: R/T BOX AND PLUGS – SHEET 2 OF 2 MX100 CONTROLLER – 50A–1000	1. ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE. 2. WHEN (1) A3 & (1) A4 ARE SUPPLIED, LIMIT SWITCHES WILL MOUNT TO RIGHT OF SOLENOIDS. WHEN (2) A3 & (2) A4 ARE SUPPLIED, LIMIT SWITCHES WILL MOUNT TO LEFT OF SOLENOIDS.

REVISIONS

REV	ECN NO.	DATE	DWN	ENG
A	S–5757–B	ESTABLISH DWG.		
B	S–5757–D	01/09/96	SDW	SB
C	S–5757–F	04/26/96	RMC	SB
D	S–6849	01/28/98	RMC	SB
E	S–6876	02/12/98	SG	SB
F	S–6924	05/08/98	EC	SB
G	S–7254	10/28/99	EC	MES
H	S–7450	06/21/00	EC	SB
J	S–7377	05/19/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

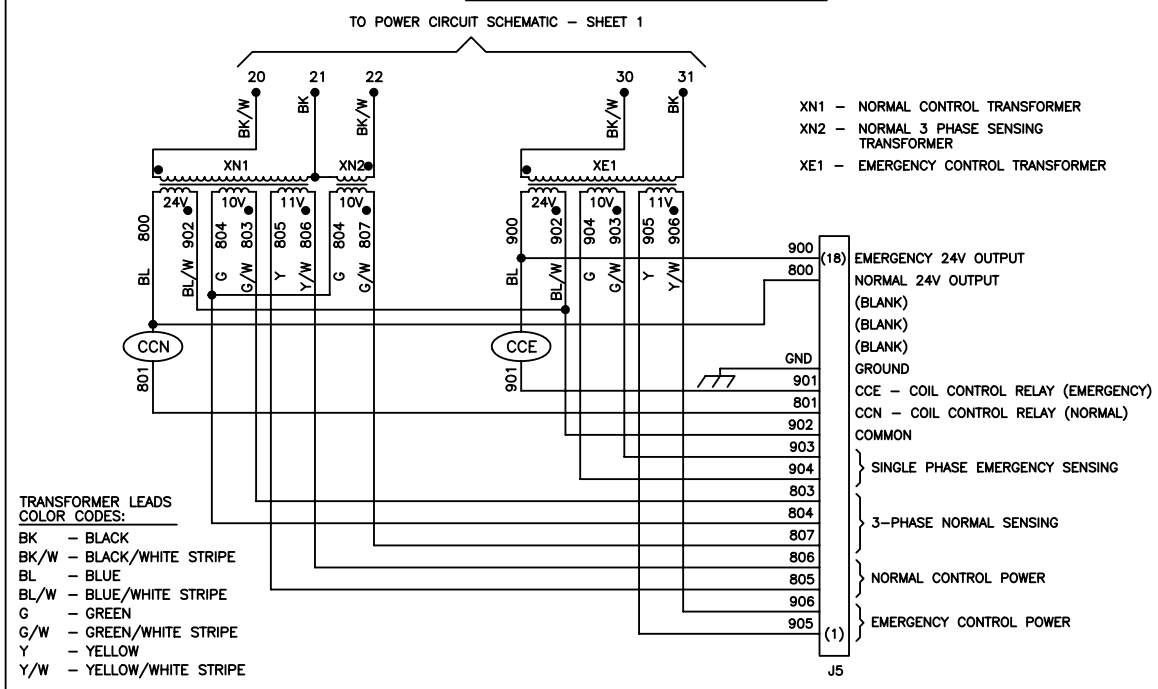
DWG TITLE: ATS POWER CIRCUIT & LIMIT SWITCHES

JOB/MODEL: ZTGK60–120 (600–1200 AMP) (3/4P)

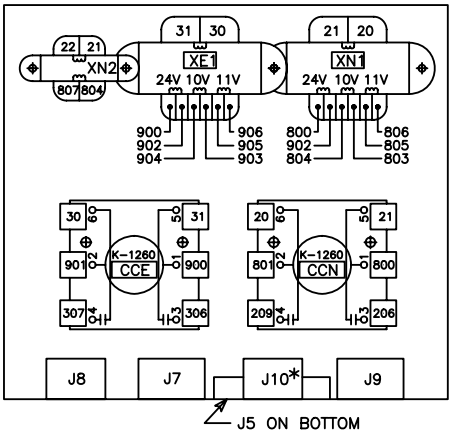
CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	N/A	52A–3000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SDW	SB	11/29/95	–	1 OF 2	J

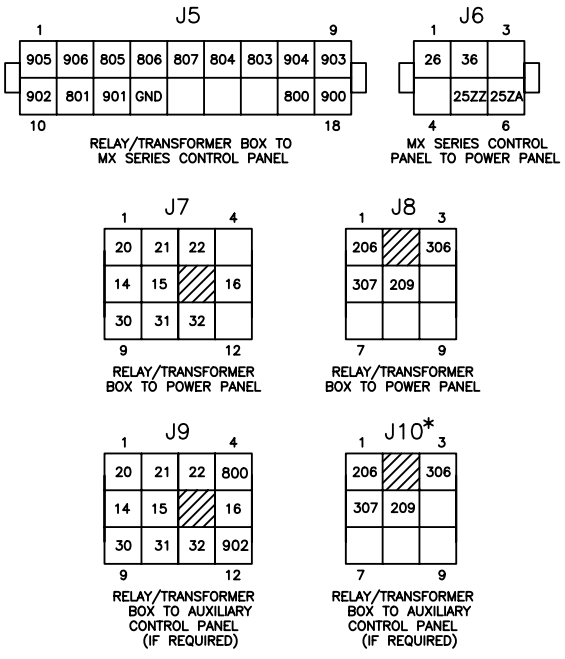
RELAY/TRANSFORMER BOX SCHEMATIC



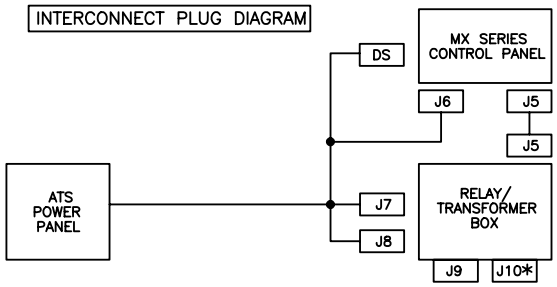
RELAY/TRANSFORMER BOX



INTERCONNECT PLUGS



INTERCONNECT PLUG DIAGRAM



LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION		
* OPTIONAL		

REVISIONS

REV	ECN NO.	DATE	DWN	ENG
A	S-5757-B	ESTABLISH DWG.		
B	S-5757-D	01/09/96	SDW	SB
C	S-5757-F	04/26/96	RMC	SB
D	S-6849	01/28/98	RMC	SB
E	S-6876	02/12/98	SG	SB
F	S-6924	05/08/98	EC	SB
G	S-7254	10/28/99	EC	MES
H	S-7450	06/21/00	EC	SB
J	S-7377	04/27/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: RELAY/XFR. BOX & INTERCONNECT PLUGS

JOB/MODEL: ZTGK60–120 (600–1200 AMP) (3/4P)

CHKD	APPD	CADD	ORDER NUMBER	DRAWING NUMBER
		ACAD	N/A	52A–3000

DRWN	ENGR	DATE	SCALE	SHEET	REV
SDW	SB	11/29/95	–	2 OF 2	J

OPERATION AND MAINTENANCE MANUAL
ZTGD SERIES
40 - 3000 AMPS



ZENITH CONTROLS, INC.®

ISO 9001

52R-1001C
8/98

Table of Contents

Page

Introduction 1

Installation 2

- Equipment Inspection and Storage 2
- Mounting 3
- Power Connections 3
- Control Connections 4
- Final Equipment Inspection 5
- Functional Test 6

Sequence of Operation 7

Maintenance and Testing 9

- Inspection and Cleaning 9
- Servicing 9
- Testing 9
- Troubleshooting 11

Introduction

Zenith Transfer Switches are used to provide a continuous source of power for lighting and other critical loads by automatically transferring from the normal source of power to an emergency source of power in the event that the normal source voltage falls below preset limits.

Voltage sensing and system control is performed via a state-of-the-art microcontroller located on the cabinet door. It is designed to give highly accurate control of the transfer switch system.

Zenith Automatic Delayed Transition Transfer Switches provide a set time delay between the opening of one source and closing into another. This time delay can be used in many applications, such as allowing motor loads to de-energize prior to transfer.

All Zenith transfer switches are designed for use on emergency or standby systems, and are rated for total system or motor loads. Transfer switches are UL Listed under Standard 1008 and CSA Certified under Standard C22.2 No. 178.

This manual provides information on the installation, operation and maintenance of the switch. In addition, a complete information package is supplied with each transfer switch which details the features and accessories provided on that switch. The information package should be kept in a readily accessible location to provide complete reference information on this critically important piece of equipment.

A complete information package includes the following:

- Operation and Maintenance Manual for Power Panel (this manual)
- Operation and Maintenance Manual for Control Panel*
- Specific schematics for each transfer switch*

** Supplied with the transfer switch*

Installation

⚠ DANGER

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Each Zenith transfer switch is factory wired and tested. A complete information package is furnished with each switch which includes:

a. Sequence of operation.
b. Description and operation of all accessories supplied.
c. Power panel connection diagram and schematic.
d. Description and identification of all customer field connections.

Installation of Zenith transfer switches includes:

a. Mounting the transfer switch cabinet.
b. Connection of all Normal, Emergency and Load cables or bus bars.
c. Connection of external control circuits as required.

Equipment Inspection and Storage

Immediately inspect the transfer switch when received to detect any damage which may have occurred during transit. If damage is found or suspected, file claims as soon as possible with the carrier and notify the nearest Zenith representative.

Before installation, it is necessary to store the transfer switch in a clean dry place, protected from dirt and water. Provide ample air circulation and heat, if necessary, to prevent condensation.

Storage Temperature:	-30° C to + 85° C (-22° F to +185° F)
Humidity:	5% to 95% (non-condensing)

Mounting

Adequate lifting means must be used to mount the transfer switch into place. The recommended method for moving the transfer switch using the lifting eyes, where supplied, and a spreader bar is illustrated in *Figure 1*. Enough room should be allowed to open the cabinet doors fully for inspection and servicing of the switch per NEC and local codes.

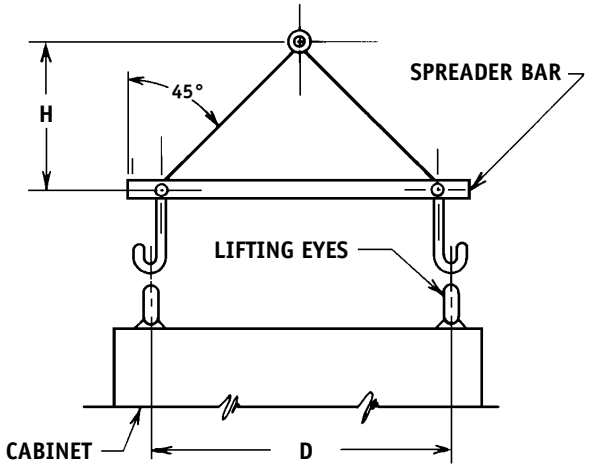


Figure 1

Before drilling conduit entry holes or any accessory mounting holes, cover and protect the switch and control panel to prevent dirt and metal fragments from entering the mechanical and electrical components. Failure to do so may result in damage and malfunction of the switch.

⚠ NOTICE

When lifting the switch using a spreader bar, height H must be equal to half of distance D.

Power Connections

Zenith transfer switches are supplied with UL listed solderless screw type terminals as standard for the Normal, Emergency and Load power connections. *Table 1* lists the number and sizes of cable lugs supplied as standard for each switch amp rating.

Connect the Normal, Emergency, and Load conductors to the clearly marked terminals on the transfer switch. Remove surface oxides from cables by cleaning with a wire brush. Verify that all connections are correct before tightening the lugs. All cable lug connections must be tightened to the proper torque values as shown in *Table 2*.

Do not run cables or wiring behind front-connected transfer switches.

In cases where the Normal, Emergency and Load connections are made to a rear connected bus bar, a compression washer, flat washer, and a minimum grade 5 bolt must be used and torqued to the values in *Table 3*.

Screw Type Terminals for External Power Connections				
Switch Size (Amps)	Normal, Emergency & Load Terminals		Fully Rated Neutral Bar (When Required)	
	Cable Per Pole	Range of Wire Sizes	No. of Cables	Range of Wire Sizes
40	1	#14 to 2 AWG	3	#14 to 1/0 AWG
80	1	#14 to 1/0 AWG	3	#14 to 1/0 AWG
100	1	#14 to 1/0 AWG	3	#14 to 1/0 AWG
150	1	#8 to 3/0 AWG	3	#6 AWG to 300 MCM
225	1	#6 AWG to 250 MCM	3	#6 AWG to 300 MCM
260	1	#6 AWG to 350 MCM	3	#6 AWG to 300 MCM
400	1	#4 AWG to 600 MCM	4	#2 AWG to 600 MCM
600	2	#2 AWG to 600 MCM	8	#2 AWG to 600 MCM
800 1000 1200	4	#2 AWG to 600 MCM	12	#2 AWG to 600 MCM

* over 1200 amps, consult product label or the factory

Table 1

Tightening Torque for Lugs		
Socket Size Across Flats	Torque	
	Lb. - In.	Lb. - Ft.
1/8	45	4
5/32	100	8
3/16	120	10
7/32	150	12
1/4	200	17
5/16	275	23
3/8	375	31
1/2	500	42
9/16	600	50

Table 2

Tightening Torque for Bus Bars		
Bolt Size	Torque Bolt (Grade 5)	
	Lb. - In.	Lb. - Ft.
1/4-20	72	6
5/16-18	132	11
3/8-16	300	25
1/2-13	720	60

Table 3

Control Connections

A complete information package is furnished with each transfer switch including a complete connection diagram and schematic which details all necessary control circuit field connections.

The engine start control wires connect to the engine start relay terminals located to the left of the microprocessor. *Figure 2* shows the location of these terminals.

The terminals are clearly identified by a label on the microcontroller backplate. In the case of manual transfer switches, or in other applications not requiring the microprocessor, clearly marked terminal blocks are provided in the upper left corner of the control panel for the engine start control wires.

⚠ DANGER

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Terminals for field connections to the A3 Emergency auxiliary contacts and the A4 Normal auxiliary contacts are also provided. These terminals are clearly marked and appear on the left side of the power panel. On 400 amp units these terminals appear on the disconnect switch bracket above the operator handle.

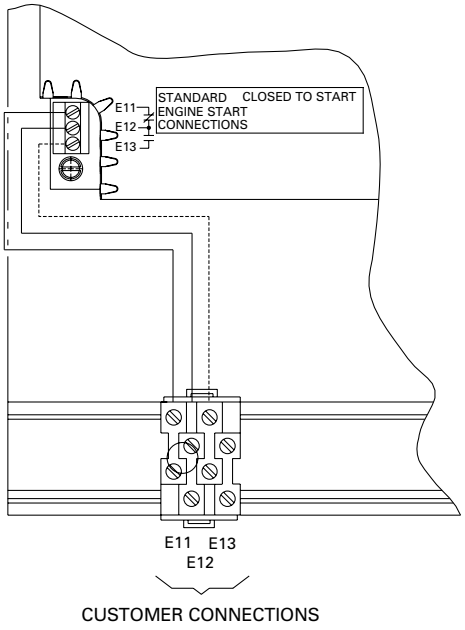


Figure 2

Final Equipment Inspection

Prior to energizing the transfer switch:

a. Remove any debris incurred due to shipment or installation. **DO NOT** use a blower since debris may become lodged in the electrical and mechanical components and cause damage. Use of a vacuum is recommended.
b. Verify that all cabled connections are correct and that phase rotation of both sources match.
c. Check engine start connections and verify the correct connection of all control wires.
d. Check settings of all timers and adjust as necessary. Also adjust any optional accessories as required. [See MX200 manual (50R-2000) for instructions on timer and option adjustments.]
e. Check the integrity of power connections by verifying actual lug torque values as specified in this manual.
f. Make sure that all covers and barriers are installed and properly fastened.

Functional Test

The functional testing of the transfer switch consists of electrical tests described in this section. Before proceeding, refer to the information package supplied with the transfer switch. Read and understand all instructions and review the operation of all accessories provided.

Before starting the operation test, check the equipment rating nameplate on the transfer switch to verify the correct system voltage. An example of the equipment rating nameplate is shown in *Figure 3*.

To begin the test, close the Normal source circuit breaker. The microcontroller will illuminate the Normal Available LED if proper voltage is sensed. Verify the phase to phase voltages at the Normal line terminals.

Next, close the Emergency source breaker and start the engine generator. The Emergency Available LED indicator will illuminate when preset voltage and frequency levels are achieved. Check the phase to phase voltages at the Emergency line terminals. Also, verify that the phase rotation of the Emergency source is the same as the phase rotation of the Normal source.

After the sources have been verified, shut down the engine generator, and put the starting control in the automatic position. Complete the visual inspection of the transfer switch, and close and lock the cabinet door.

Initiate the electrical transfer test by activating the TS test switch. **HOLD THE TEST SWITCH UNTIL TRANSFER TO EMERGENCY IS ACCOMPLISHED.** After the P time delay, the microcontroller will send an engine start signal and sensing will determine when the auxiliary source reaches preset levels. The switch will open out of the Normal source after the time delay of the W timer.

The switch will remain in a neutral position during the duration of the DW timer. When the DW time has elapsed, the switch will complete its transfer by closing into the Emergency source.



Figure 3

Deactivating the test switch will start retransfer to the Normal source. The switch will open out of Emergency after the time delay of the T timer. The switch will remain in a neutral position for the duration of the DT timer. After the time delay of the DT timer, the switch will complete its Transfer by closing into the Normal source. The U engine overrun timer allows the engine generator to run unloaded for a preset cool down period.

⚠ NOTICE

A periodic test of the transfer switch under load conditions is recommended to insure proper operation. (See National Electric Code articles 700 and 701).

Sequence of Operation

Figure 4 is a typical schematic diagram of a Zenith delay transfer switch. The information supplied with the transfer switch includes a schematic diagram and description of operation of all timers and settings.

Transfer of the load to the Emergency source begins automatically when any phase of the Normal source falls below the preset dropout point and this undervoltage failure condition is detected by the MX100 microcontroller. The engine start timer P begins its timing cycle. The P time delay is provided to override momentary outages and to prevent nuisance starting of the engine generator. If the Normal source voltage returns above the pickup setting, the P timing cycle is reset, and the transfer sequence is stopped.

If the normal source voltage does not return before the P time delay is completed, the P timer drops out and sends a starting signal to the engine generator. The microcontroller senses the voltage and frequency of the Emergency source. When both the voltage and the frequency of the Emergency source reach the preset values timer W begins its timing cycle. The W timer provides an adjustable transfer delay to the Emergency source as required.

When the W time is completed, the CCNO relay energizes the CNO solenoid to open the transfer switch out of the Normal source. The switch is now in a neutral (both sources open) position. The switch remains in a neutral position for the duration of the DW time delay. DW is an adjustable time delay between the opening of the Normal source and closing into the Emergency source.

After the DW time delay has elapsed, the CCE relay energizes. The switch then completes transfer to the Emergency source by energizing the CE solenoid. The SE limit switch activates to de-energize the CCE relay.

The sequence for retransfer to the Normal source begins automatically when the microcontroller detects that the voltage on all phases of the Normal source has been restored.

When the Normal source restores, switching to the Normal source is initiated by energizing timer T, beginning its timer cycle. The T timer provides an adjustable delay to insure that the Normal source has stabilized before reconnection to the load. If the Normal source fails before the T time delay completes, the retransfer sequence is stopped.

When the T time delay is completed, the CCEO relay energizes the CEO solenoid to open the switch out of Emergency and into a neutral position. The switch remains in neutral for the DT time delay. When the DT time delay has elapsed, the CCN relay energizes the CN solenoid to complete retransfer of the switch into the normal source. The SN limit switch activates to de-energize the CCN relay. Simultaneously, the engine overrun timer U begins its timing cycle. This timer provides a period of time for the engine generator to run without load and cool down before shutdown.

For complete details of the timers and settings, please refer to the MX100 microcontroller manual (50R-1000).

Typical Transfer Switch Equipment Power Circuit Schematic

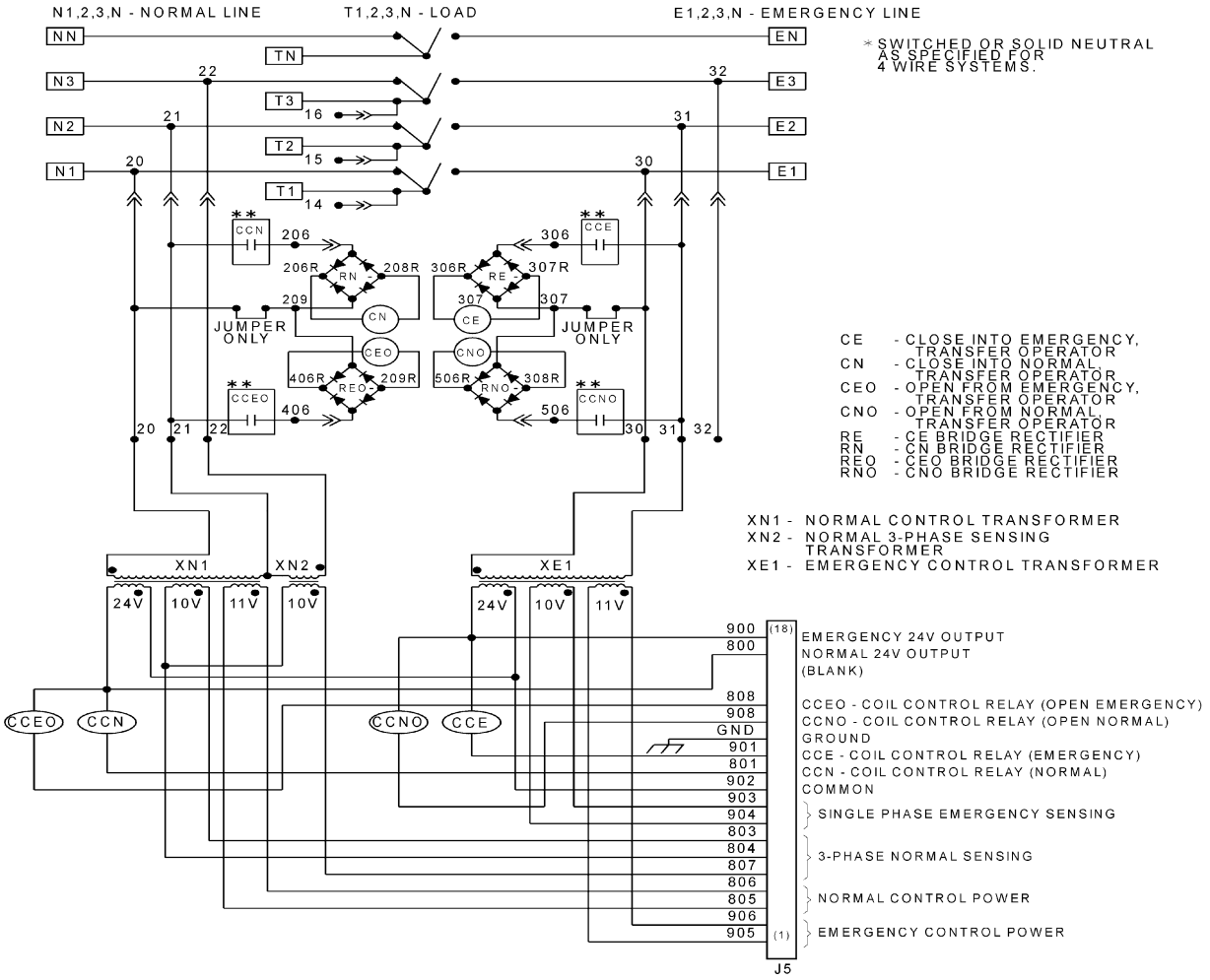


Figure 4

Maintenance and Testing

A preventive maintenance program will insure high reliability and long life for the transfer switch. The preventive maintenance program for the transfer switch should include the following items:

⚠ DANGER

De-energize all sources of power before doing any work on the transfer switch.

Inspection and Cleaning

The switch should be inspected for any accumulation of dust, dirt, or moisture, and should be cleaned by vacuuming or wiping with a dry cloth or soft brush. **DO NOT** use a blower since debris may become lodged in the electrical and mechanical components and cause damage.

Remove the transfer switch barriers and check the condition of the contacts. Any surface deposits must be removed with a clean cloth (**DO NOT USE AN EMERY CLOTH OR A FILE**). If the contacts are pitted or worn excessively, they should be replaced. A general inspection of mechanical integrity should be made to include loose, broken or badly worn parts.

Servicing

All worn or inoperative parts must be replaced using Zenith recommended replacement parts. Please refer to the Replacement Parts manual for specific part information and ordering procedures. Please contact the Zenith Technical Services Department for the Replacement Parts manual.

The operating mechanism of the transfer switch is lubricated with Lubriplate 105. The lubricant applied at the factory provides adequate lubrication for the lifetime of the switch. Should debris contaminate the mechanism, clean and apply additional Lubriplate.

Zenith can provide complete preventive maintenance services. Please contact the Zenith Technical Services Department for additional information.

Testing

A manual operator handle is provided with the transfer switch for maintenance purposes only. Manual operation of the switch must be checked before it is operated electrically. Both power sources **MUST** be disconnected before manual operation of the switch. Insert the handle and operate the transfer switch between the Normal and Emergency positions. The transfer switch should operate smoothly without binding. Return the switch to the Normal position, remove the handle, and return it to the holder provided.

After completing the inspection, cleaning and servicing of the transfer switch, reinstall the switch cover, and close and lock the cabinet door. Reclose the circuit breakers feeding the utility and generator sources to the switch.

Maintenance and Testing *(cont'd)*

Initiate the electrical transfer test by activating the TS test switch. P timer will time out and the microcontroller will send an engine start signal. The switch will remain in a neutral position during the duration of the DW timer. When the DW time has elapsed, the switch will complete its transfer by closing into the Emergency source.

Deactivating the test switch will start retransfer to the Normal source. The switch will open out of Emergency after the time delay of the T timer. The switch will remain in a neutral position for the duration of the DT timer. After the time delay of the DT timer, the switch will complete its Transfer by closing into the Normal source. The U engine overrun timer allows the engine generator to run unloaded for a preset cool down period.

⚠ NOTICE

A periodic test of the transfer switch under load conditions is recommended to insure proper operation. (See National Electric Code articles 700 and 701).

Troubleshooting

Before beginning any troubleshooting activity, refer to the information package supplied with the transfer switch and review the description and operation of all accessories supplied. Also refer to the Installation section of this manual.

Engine Does Not START

Annunciation	Possible Cause	Corrective Action
EMERGENCY AVAILABLE LED off	Engine start wires not terminated properly	Check Engine Start Connections
	Generator in "OFF" position	Investigate why Engine Control Switch was turned off

Engine Does Not STOP

Annunciation	Possible Cause	Corrective Action
DELAY TO ENGINE STOP LED on	**U** timing cycle not complete	Check **U** Timer setting
NORMAL AVAILABLE, NORMAL POSITION and EMERGENCY AVAILABLE LEDs on	Engine start wires not terminated correctly	Check Engine Start Connections
	Generator in "Manual"	Put generator in "Auto"

ATS Will Not Transfer To EMERGENCY

Annunciation	Possible Cause	Corrective Action
EMERGENCY AVAILABLE LED off	Emergency voltage or frequency not within acceptable parameters	Check Engine Start Connections, Generator Breaker, Generator Output, and Engine Control Switch
None	Power supply harness unplugged	Plug in harness
NORMAL POSITION, EMERGENCY POSITION and OPEN POSITION LEDs flashing	Limit switch harness unplugged	Plug in harness
DELAY TO OPEN NORMAL LED on	**W** timing cycle not complete	Check **W** Timer setting
DELAY TO EMERGENCY LED on	**DW** timing cycle not complete	Check **DW** Timer setting

ATS Will Not Transfer To NORMAL

Annunciation	Possible Cause	Corrective Action
NORMAL AVAILABLE LED off	Normal voltage or frequency not within acceptable parameters	Check utility and utility breakers
None	Power supply harness unplugged	Plug in harness
NORMAL POSITION, EMERGENCY POSITION and OPEN POSITION LEDs flashing	Limit switch harness unplugged	Plug in harness
DELAY TO OPEN EMERGENCY LED on	**T** timing cycle not complete	Check **T** Timer setting
DELAY TO NORMAL LED on	**DT** timing cycle not complete	Check **DT** Timer setting



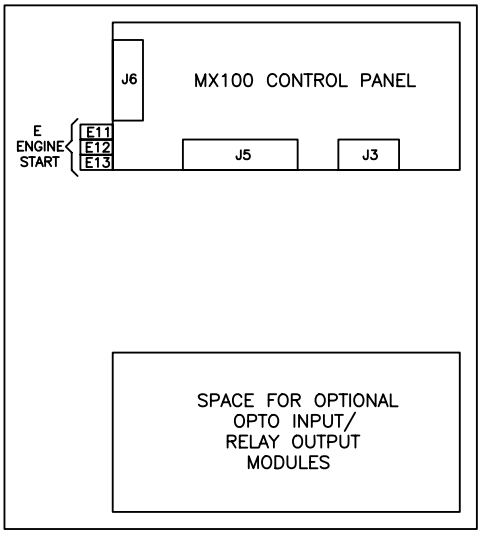
830 West 40th Street
Chicago, IL 60609 USA

Phone: 773 247-6400
Fax: 773 247-7805

www.zenithcontrols.com
E-Mail: zenith@zenithcontrols.com

© 1998 Zenith Controls, Inc.

INSIDE VIEW OF CABINET DOOR

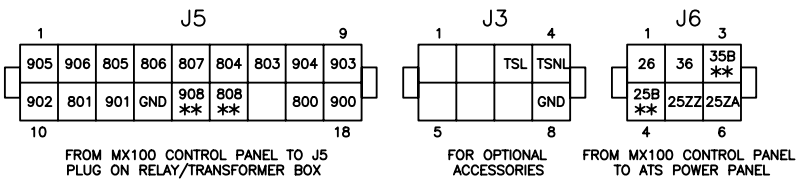


AUXILIARY CONTROL PANEL *

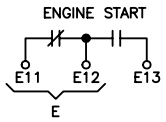
(12" X 18")
(305mm X 457mm)

PILOT DEVICES

INTERCONNECT PLUGS



CUSTOMER CONNECTIONS



CONTACT	RATING
E	5 AMP @ 250 VAC 5 AMP @ 30 VDC
A3, A4	20 AMP @ 125, 250 VAC

LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION		
—○— WIRE ON TERMINAL BLOCK		
* OPTIONAL		
** DELAY UNIT ONLY		

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
A	S-5757-B	ESTABLISH	DWG.	

ZENITH CONTROLS, INC.

TITLE: MX100 INSIDE DOOR VIEW
MODEL: ZTGK,ZTGDK SERIES TRANSFER SWITCHES

DRFT: SDW	DATE:	SCALE:	CHK:	APPD:
ENGR: JC	11/27/95	N/A		

DWG NO.: 50A-1000 REV A
CADD: S5K SHT. 1 OF1

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
R	S-7866 REVISED DWG	07/16/02	GG MAC

ZTG(2/3/4)K SERIES WITH MX100 MICROPROCESSOR-BASED CONTROL PANEL AUTOMATIC TRANSFER SWITCH (ATS) 30-3000 AMP

FOR USE ON EMERGENCY OR STANDBY SYSTEMS - RATED FOR TOTAL SYSTEM & MOTOR LOAD

A. LEGEND

MX Series Microprocessor-Based Control Panel

Standard Features:
- DS..... Disconnect Switch
- TS..... Test Switch

Relay/Transformer Box
- CCE..... Control Relay, Close Emergency
- CCN..... Control Relay, Close Normal
- XE1..... Control Transformer, Emergency
- XN1,XN2..... Control Transformer, Normal

Power Panel
- N1,2,3,(N)..... Normal Line _____
- E1,2,3,(N)..... Emergency Line _____
- T1,2,3,(N)..... Load Connections
- BR..... Bridge Rectifier (ZTG(2/3)K30-400A)
- CA..... CN/CE Capacitor (ZTGK40-260A)
- CE..... Emergency Transfer Operator (ZTG4K 225-400A, 600-3000 Amp)
- CN..... Normal Transfer Operator (ZTG4K 225-400A, 600-3000 Amp)
- CNE..... Main Transfer Operator (ZTG(2/3)K30-400A)
- CN/CE..... Main Transfer Operator (ZTGK40-260A)
- GND..... Ground
- NB..... Neutral Bar (if required)
- RE..... Bridge Rectifier, CE (ZTG4K 225-400A, 1600-3000 Amp)
- RN..... Bridge Rectifier, CN (ZTG4K 225-400A, 1600-3000 Amp)
- SCE,SCN..... CNE Limit Switches (ZTG(2/3)K30-400A)
- SE..... Emergency Position Limit Switch
- SN..... Normal Position Limit Switch

B. OPERATION

When Normal line voltage drops below the preset dropout point, the Normal voltage sensing circuit initiates the engine start circuit.

When Emergency line voltage and frequency reach the preset pickup point, the MX control panel energizes the CCE control relay to operate the main transfer operator. The load is now transferred to the Emergency line. The transfer switch is mechanically locked. The SN limit switch awaits the next operation to Normal.

When the Normal line voltage reaches the preset pickup point, the MX control panel energizes the CCN control relay to operate the main transfer operator. The load the load is now re-transferred back to the Normal line. The transfer switch is mechanically locked. The SE limit switch awaits the next operation to Emergency.

Test Switch

The Test Switch simulates a normal line failure when activated.

To test, activate the Test Switch, thus allowing the transfer switch to transfer to the Emergency position. De-activate the Test Switch. The transfer switch will reset to the Normal position.

Testing at least once a month is recommended. For hospital emergency systems, test once a week.

Disconnect Switch

When the Disconnect Switch is placed in the INHIBIT position, the MX control panel is disengaged and transfer cannot take place.

C. STANDARD ACCESSORIES

Zenith Transfer Switch with MX100 microprocessor-based control panel contains the following standard accessories:

- A3..... Auxiliary Contacts - Emegency Position
- A4..... Auxiliary Contact - Normal Position
- C/DT..... Plant Exercise Timer
- E..... Engine Start Contact
- L1..... Emergency Position Light
- L2..... Normal Position Light
- L3..... Normal Available Light
- L4..... Emergency Available Light
- P..... Time Delay to Engine Start
- R50..... In-Phase Monitor
- T..... Time Delay to Normal
- U..... Time Delay to Engine Cool Down
- W..... Time Delay to Emergency
- YEN..... Pushbutton to Bypass T/W Time Delays

D. OPTIONAL ACCESSORIES

Zenith Transfer Switch with MX100 microprocessor-based control panel has the capability for additional accessories. The following is a description of the optional accessories. Those options checked are supplied on this unit. See additional pages for complete legend and operation.

- ☐ A6 Motor Disconnect. To de-energize external motor control circuit prior to transfer in either direction.
- ☐ C/D Plant Exercise Clock.
- ☐ CTAP Chicago Transfer Alarm Panel.
- ☐ HT Heater with Thermostat.
- ☐ Q2 Remote peak shave or area protection circuit. Includes bypass for automatic return to Normal if Emergency line fails and Normal is present.
- ☐ Q3 Remote Inhibit transfer to Emergency Circuit. Energizing QR3 input allows transfer to Emergency.
- ☐ T3/W3 Pre-Signal Contact. Closes a dry contact prior to transfer in either direction.
- ☐ ZNET Communications provisions.
- ☐ 6A Maintained Test Switch.

NOTES:

1. ⚠ CAUTION: In using a 3 phase, 4 wire delta or open delta power supply (usually 120/240 volts, sometimes listed as 120/208 volts) with one leg having a grounded center tap, one line will be 160 to 208 volts to ground. When such a system is used it is necessary to connect the high leg to N2. DO NOT CONNECT 120 VOLT LOAD CIRCUIT TO THE HIGH LEG.
2. GROUNDING TERMINAL: A grounding terminal (GND) is provided. When installing open type switches connect this terminal to the metal enclosure or an equivalent earth ground.
3. ⚠ WARNING - TO ENSURE AGAINST SHOCK OR ACCIDENT HAZARD, DISCONNECT ALL SOURCES OF SUPPLY BEFORE SERVICING.
4. ON SINGLE PHASE UNITS WHERE THE EMERGENCY SOURCE IS A UTILITY LINE, CONNECT EMERGENCY LINE SO THAT MINIMUM VOLTAGE IS MEASURED FROM N1 TO E1.
5. ON SINGLE PHASE (2 POLE) UNITS, THE CENTER POLE IS NOT SUPPLIED. RIGHT HAND POLE IS NOT SUPPLIED ON 400 AMP UNITS.
6. FOR F14 AND F17 UNITS, THE DISCONNECT SWITCH (DS) IS AN OPTIONAL ACCESSORY, NOT A STANDARD FEATURE.

GE PROPRIETARY AND CONFIDENTIAL INFORMATION
This document is the property of General Electric ("GE") and contains proprietary information of GE. This document is loaned on the express condition that neither it nor the information contained therein shall be disclosed to others without the express, written consent of GE Industrial Systems, and that the information shall be used by the recipient only as approved expressly by GE Industrial Systems. This document shall be returned to GE upon its request. This document may be subject to certain restrictions under U.S. export controls laws and regulations.

THIRD ANGLE PROJECTION

FOR ADDITIONAL INFO REFER TO
APPLIED PRACTICES
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
2 PL. DECIMALS ± .020
3 PL. DECIMALS ± .005
ANGLES ± 1°
FRACTIONS ± 1/64
FINISH

SIGNATURES		DATE
MODEL	SB	12/21/95
DETAIL		
CHECKED		
ENGRG		
MFG		
QUALITY		
ISSUED		

DRAWING FILE:
MODEL / ASSEMBLY FILE: ZTG(2/3/4)K3-300 (30-3000A)
CTQs ⊖ CRITICAL TO QUALITY CHARACTERISTIC
AutoCad Generated

GE Zenith Controls

TITLE
LEGEND, OPERATION & ACCESSORIES

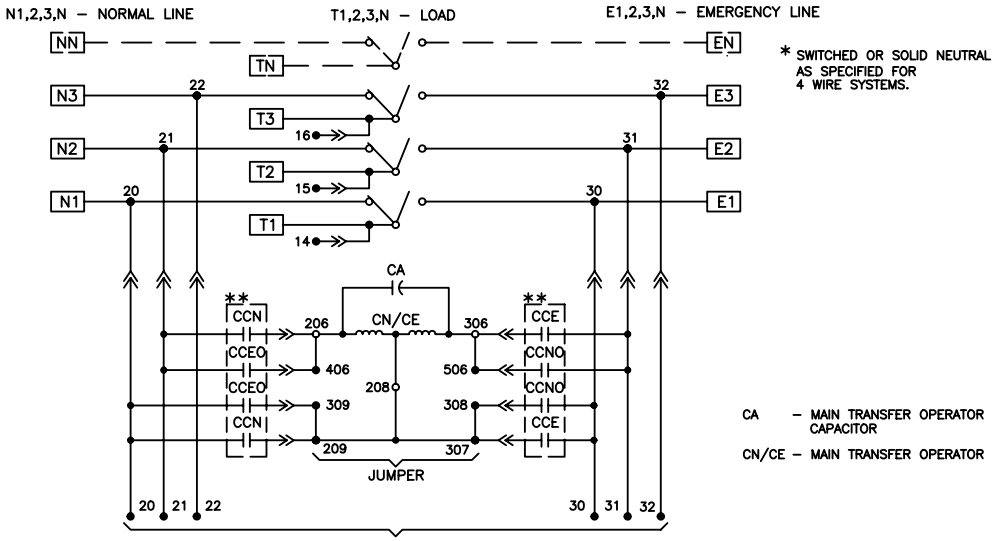
FIRST MADE FOR: -

SIZE	CAGE CODE	DWG NO
B		52A-0900

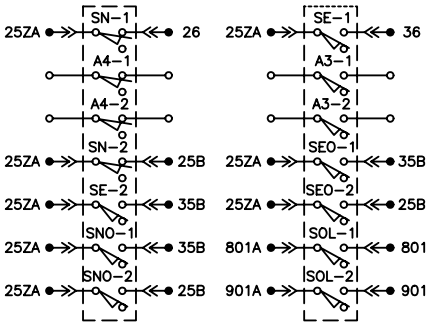
SCALE: - SHEET 1 OF 1

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
G	S-7708-1 REVISED DWG.	03/22/02	RMC BL

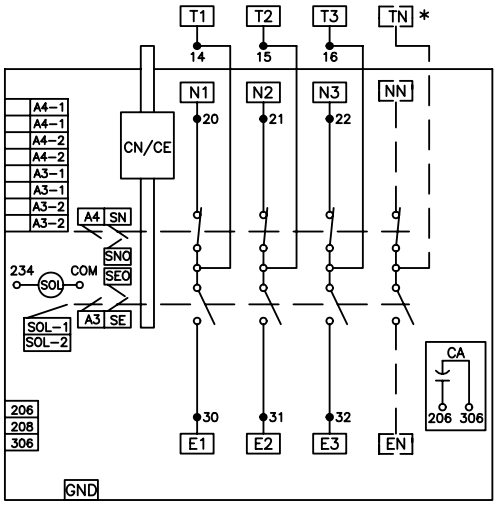
CONTROL CIRCUIT SCHEMATIC



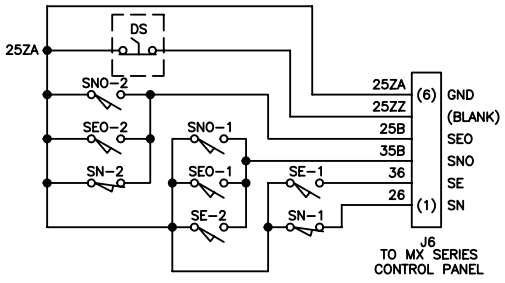
AUXILIARY CONTACTS



ATS POWER PANEL LAYOUT



LIMIT SWITCH SCHEMATIC



SE – EMERGENCY POSITION LIMIT SWITCH

SN – NORMAL POSITION LIMIT SWITCH

SEO – EMERGENCY OPEN POSITION LIMIT SWITCH

SNO – NORMAL OPEN POSITION LIMIT SWITCH

DS – DISCONNECT SWITCH ON MX100

REFERENCE
LEGEND, OPERATION AND ACCESSORIES: 52A-0900D
NOTES
ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.
LEGEND
WIRE CONNECTION
WIRE ON TERMINAL BLOCK
WIRE IN INTERCONNECT PLUG
* OPTIONAL
** LOCATED ON RELAY/ TRANSFORMER BOX.

GE PROPRIETARY AND CONFIDENTIAL INFORMATION
This document is the property of General Electric ("GE") and contains proprietary information of GE. This document is loaned on the express condition that neither it nor the information contained therein shall be disclosed to others without the express written consent of GE Industrial Systems, and that the information shall be used by the recipient only as approved expressly by GE Industrial Systems. This document shall be returned to GE upon its request. This document may be subject to certain restrictions under U.S. export controls laws and regulations.

THIRD ANGLE PROJECTION

FOR ADDITIONAL INFO REFER TO
APPLIED PRACTICES
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
2 PL. DECIMALS ± .020
3 PL. DECIMALS ± .005
ANGLES ± 1°
FRACTIONS ± 1/64
FINISH
AutoCad Generated

SIGNATURES		DATE
MODEL	RMC	01/10/96
DETAIL		
CHECKED		
ENGRG	SB	01/10/96
MFG		
QUALITY		
ISSUED		

DRAWING FILE: 52a-4000-g-1.dwg
MODEL / ASSEMBLY FILE: Z7CJX4-26E/F (40-260 AMP)
CTQs ⊖ CRITICAL TO QUALITY CHARACTERISTIC

GE Zenith Controls

TITLE
ATS POWER CIRCUIT & LIMIT SWITCHES

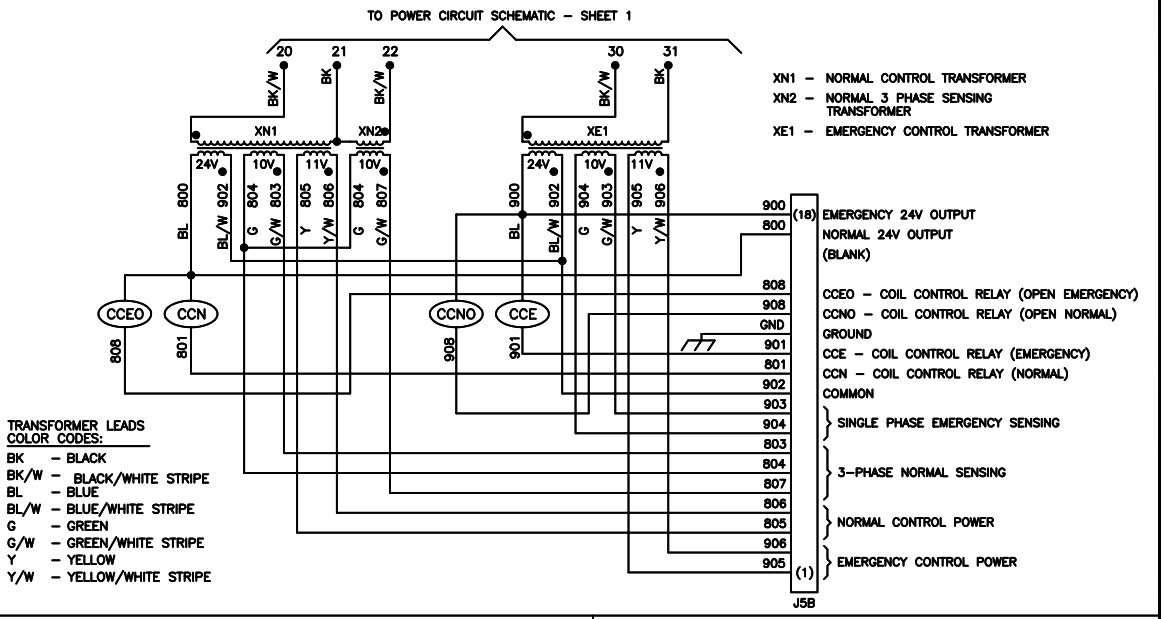
FIRST MADE FOR:

SIZE	CAGE CODE	DWG NO
B		52A-4000

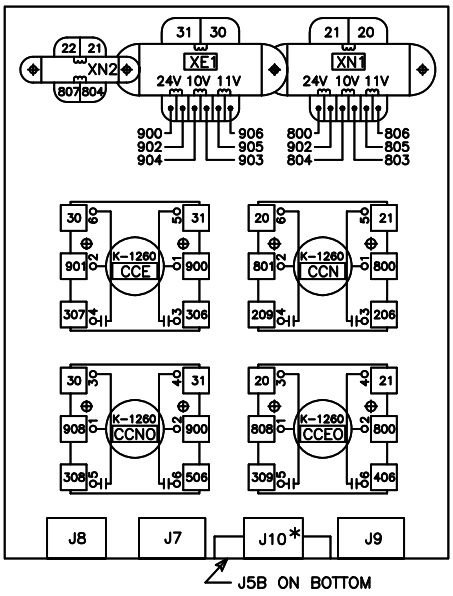
SCALE: N/A SHEET 1 OF 3

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
G	S-7708-1 REVISED DWG.	03/22/02	RMC BL

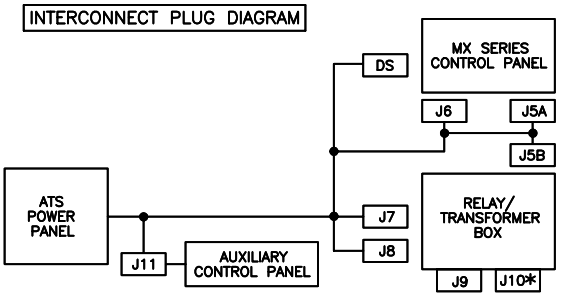
RELAY/TRANSFORMER BOX SCHEMATIC



RELAY/TRANSFORMER BOX



INTERCONNECT PLUG DIAGRAM



INTERCONNECT PLUGS

J5B

1								9
905	906	805	806	807	804	803	904	903
902	801	901	GND	908	808		800	900
10								18

RELAY/TRANSFORMER BOX TO MX SERIES CONTROL PANEL PLUG J5A AND TO POWER PANEL

J6

1		3
26	36	35B
25B	25ZZ	25ZA
4		6

MX SERIES CONTROL PANEL TO POWER PANEL

J7

1			4
20	21	22	
14	15		16
30	31	32	
9			12

RELAY/TRANSFORMER BOX TO POWER PANEL

J8

1		3
206		306
307	209	406
308	309	506
7		9

RELAY/TRANSFORMER BOX TO POWER PANEL

J9

1			4
20	21	22	800
14	15		16
30	31	32	902
9			12

RELAY/TRANSFORMER BOX TO AUXILIARY CONTROL PANEL

J10*

1		3
206		306
307	209	406
308	309	506
7		9

RELAY/TRANSFORMER BOX TO AUXILIARY CONTROL PANEL (IF REQUIRED)

J11

1			4
20	21	800	800
234	COM	801A	901A
30	31	900	900
9			12

AUXILIARY CONTROL PANEL TO POWER PANEL

LEGEND
- WIRE CONNECTION
- * OPTIONAL

GE PROPRIETARY AND CONFIDENTIAL INFORMATION
This document is the property of General Electric ("GE") and contains proprietary information of GE. This document is loaned on the express condition that neither it nor the information contained therein shall be disclosed to others without the express written consent of GE, Maynard Systems, and that the information shall be used by the recipient only as approved expressly by GE in writing. Systems. This document shall be returned to GE upon its request. This document may be subject to certain restrictions under U.S. export controls laws and regulations.

THIRD ANGLE PROJECTION

FOR ADDITIONAL INFO REFER TO
APPLIED PRACTICES
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
2 PL DECIMALS ± .020
3 PL DECIMALS ± .005
ANGLES ± 1°
FRACTIONS ± 1/64
FINISH

AutoCad Generated

SIGNATURES		DATE
MODEL	RMC	01/10/96
DETAIL		
CHECKED		
ENGRG	SB	01/10/96
MFG		
QUALITY		
ISSUED		

DRAWING FILE: 52a-4000-g-2.dwg
MODEL / ASSEMBLY FILE: Z7GDX4/26E/F (40-260 AMP)
CTQs ⊖ CRITICAL TO QUALITY CHARACTERISTIC

GE Zenith Controls

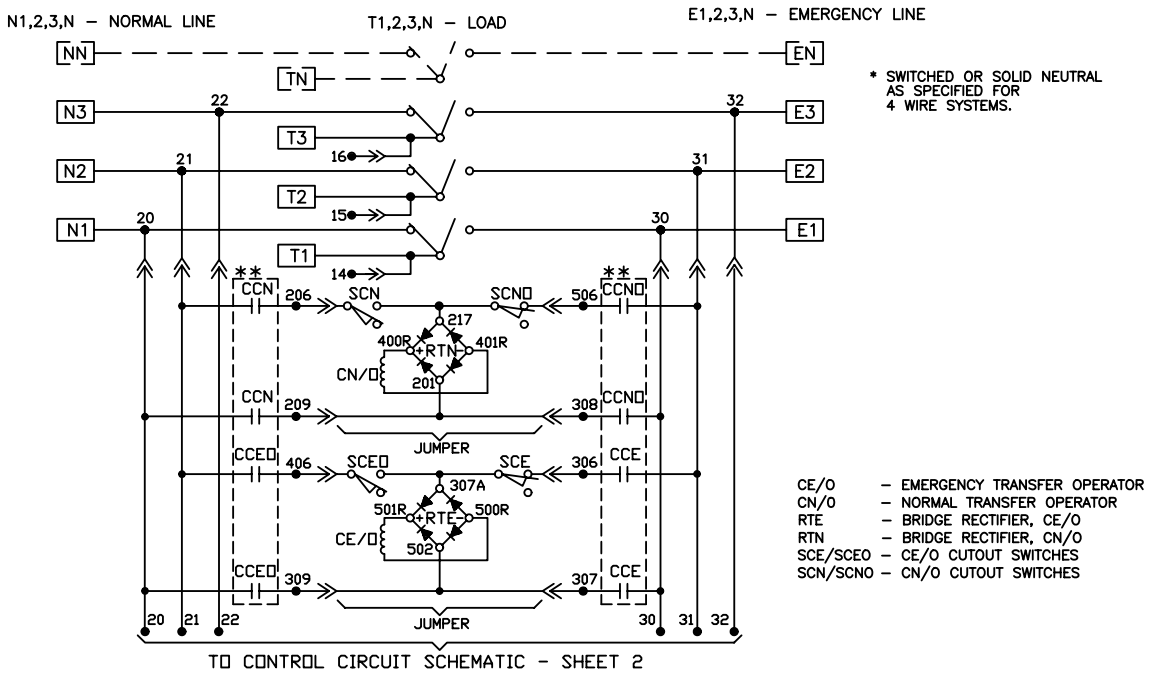
TITLE
RELAY/XFR BOX & INTERCONNECT PLUGS

FIRST MADE FOR:

SIZE	CAGE CODE	DWG NO
B		52A-4000

SCALE: N/A | SHEET 2 OF 3

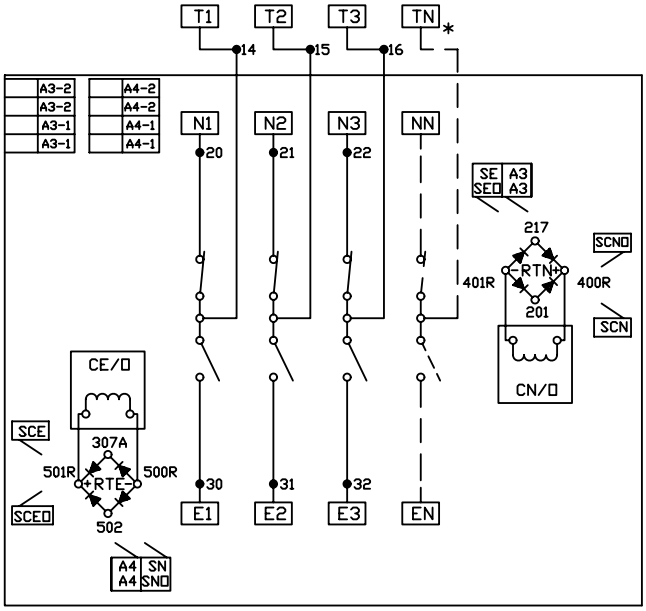
ATS POWER CIRCUIT SCHEMATIC



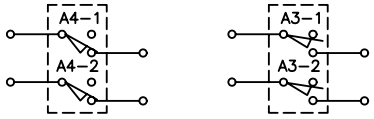
* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEMS.

CE/O – EMERGENCY TRANSFER OPERATOR
CN/O – NORMAL TRANSFER OPERATOR
RTE – BRIDGE RECTIFIER, CE/O
RTN – BRIDGE RECTIFIER, CN/O
SCE/SCEO – CE/O CUTOUT SWITCHES
SCN/SCNO – CN/O CUTOUT SWITCHES

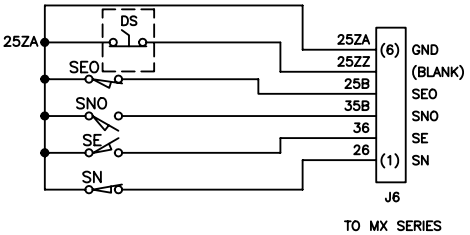
ATS POWER PANEL LAYOUT



AUXILIARY CONTACTS



LIMIT SWITCH SCHEMATIC



SEO – EMERGENCY OPEN POSITION LIMIT SWITCH
SNO – NORMAL OPEN POSITION LIMIT SWITCH
SE – EMERGENCY POSITION LIMIT SWITCH
SN – NORMAL POSITION LIMIT SWITCH
DS – DISCONNECT SWITCH ON MX100

LEGEND	REFERENCE	NOTES
●— WIRE CONNECTION o— WIRE ON TERMINAL BLOCK ≫ WIRE IN INTERCONNECT PLUG * OPTIONAL ** LOCATED ON RELAY/ TRANSFORMER BOX	LEGEND, OPERATION, AND ACCESSORIES: 52A–0900D FOR PRODUCTION ONLY: R/T BOX AND PLUGS – SHEET 2 OF 2 MX100 CONTROLLER – 50A–1000	ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS				
REV	ECN NO.	DATE	DWN	ENG
A	S–5757–B	ESTABLISH DWG.		
B	S–5757–D	01/09/96	SDW	SB
C	S–6849	01/28/98	RMC	SB
D	S–6924	05/11/98	EC	SB
E	S–7254	10/28/99	EC	MES
F	S–7377	05/19/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

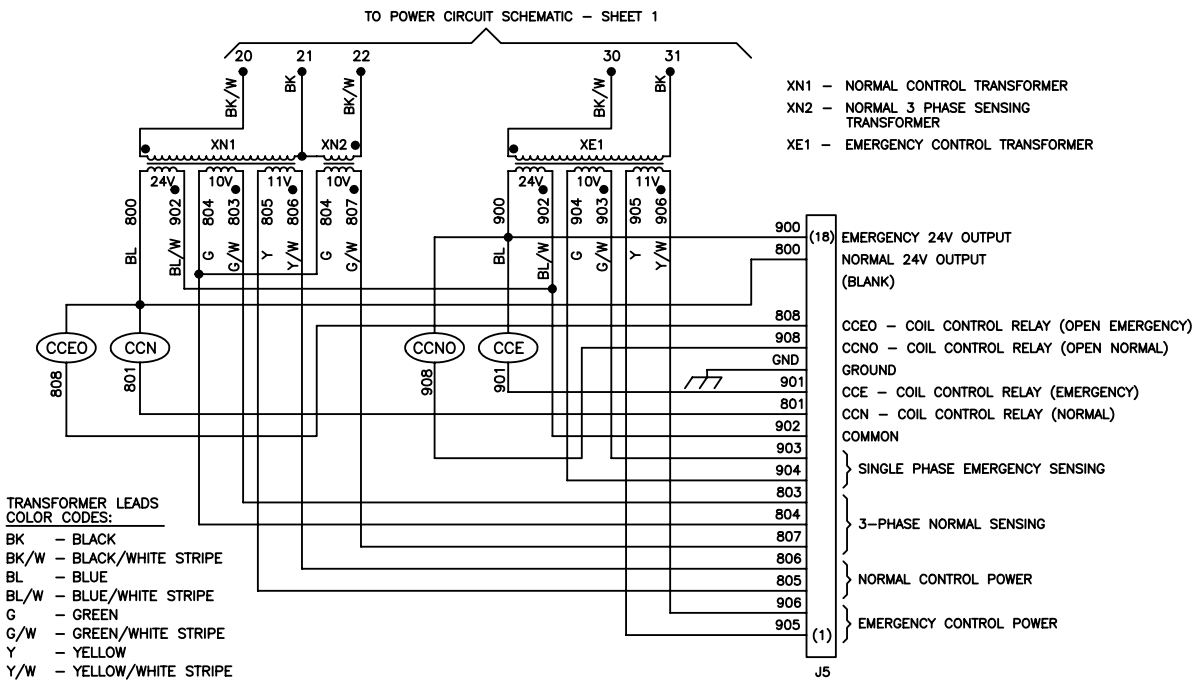
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: ATS POWER CIRCUIT & LIMIT SWITCHES
JOB/MODEL: ZTGDK40 (400 AMP) (3/4P)

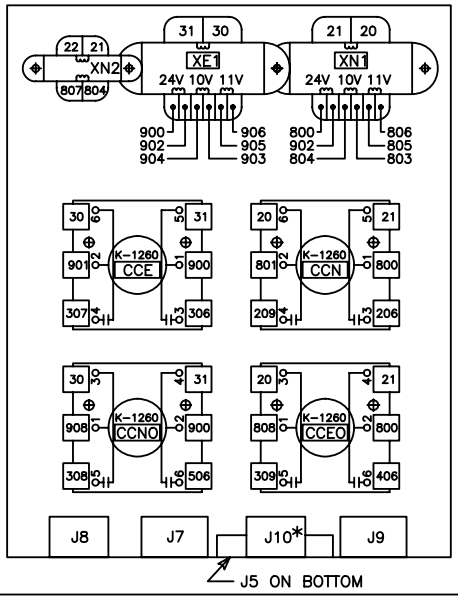
CHKD	APPD	CADD	ORDER NUMBER	DRAWING NUMBER
		ACAD	N/A	52A–5000

DRWN	ENGR	DATE	SCALE	SHEET	REV
SDW	SB	11/29/95	–	1 OF 2	F

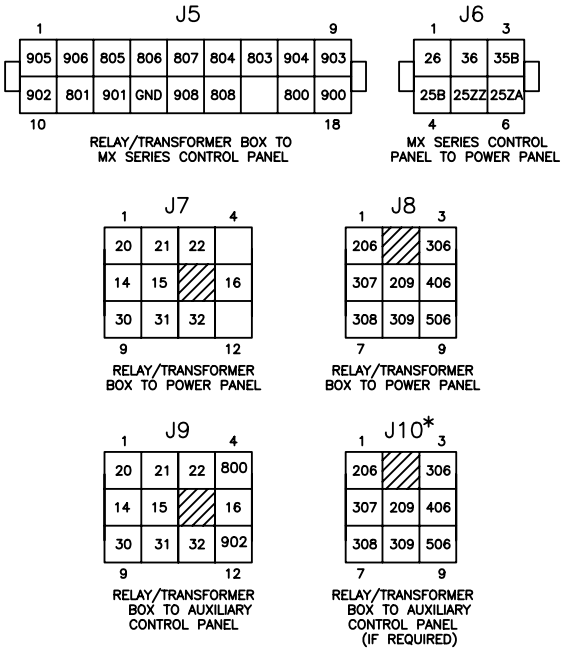
RELAY/TRANSFORMER BOX SCHEMATIC



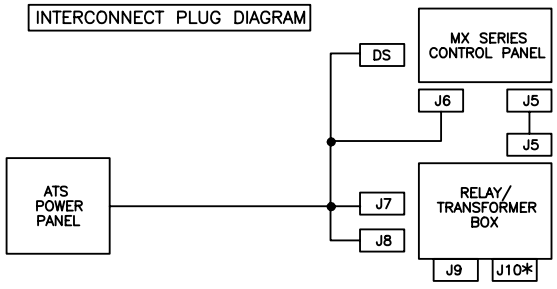
RELAY/TRANSFORMER BOX



INTERCONNECT PLUGS



INTERCONNECT PLUG DIAGRAM



LEGEND	REFERENCE	NOTES
●— WIRE CONNECTION		
* OPTIONAL		

REVISIONS				
REV	ECN NO.	DATE	DWN	ENG
A	S-5757-B	ESTABLISH DWG.		
B	S-5757-D	01/09/96	SDW	SB
C	S-6849	01/28/98	RMC	SB
D	S-6924	05/11/98	EC	SB
E	S-7254	10/28/99	EC	MES
F	S-7377	04/27/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

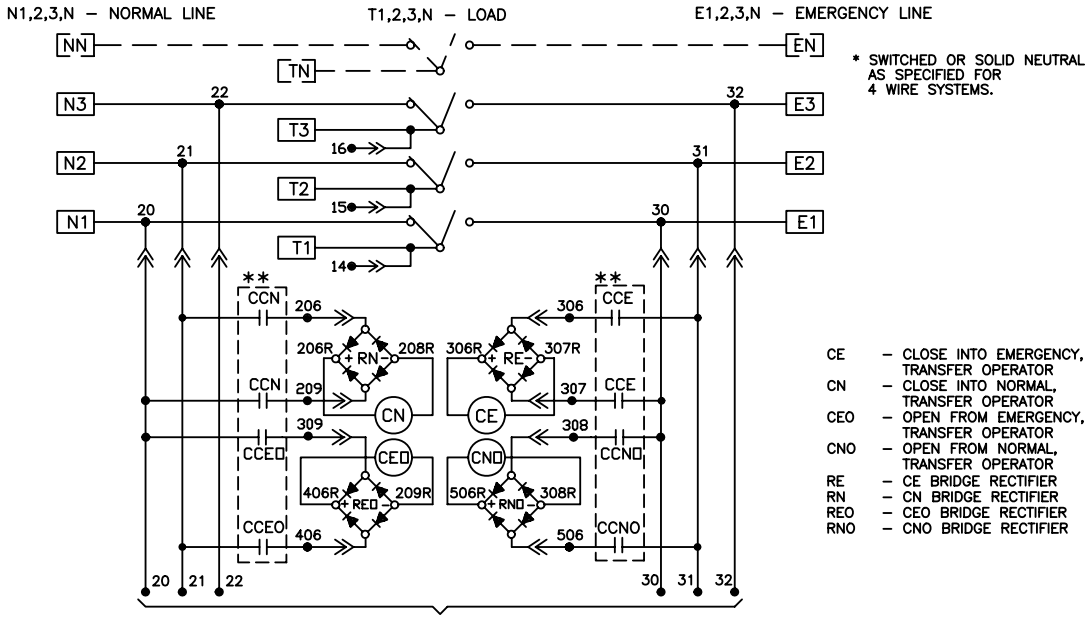
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: RELAY/XFR BOX & INTERCONNECT PLUGS
JOB/MODEL: ZTGDK40 (400 AMP) (3/4P)

CHKD	APPD	CADD	ORDER NUMBER	DRAWING NUMBER
		ACAD	N/A	52A-5000

DRWN	ENGR	DATE	SCALE	SHEET	REV
SDW	SB	11/29/95	–	2 OF 2	F

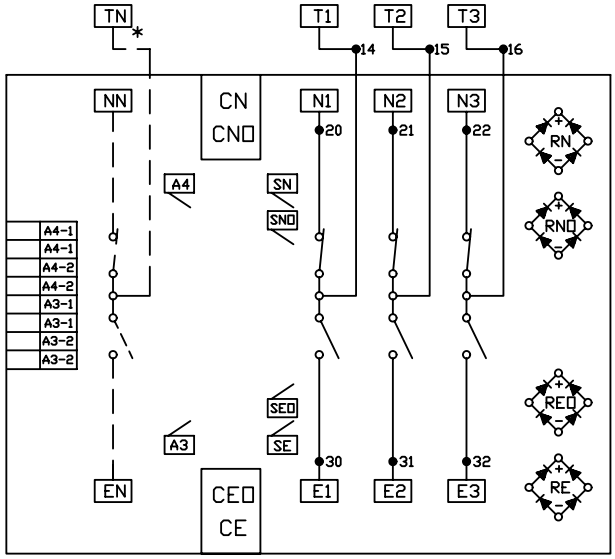
ATS POWER CIRCUIT SCHEMATIC



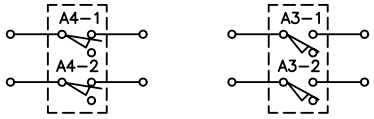
* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEMS.

CE – CLOSE INTO EMERGENCY, TRANSFER OPERATOR
CN – CLOSE INTO NORMAL, TRANSFER OPERATOR
CEO – OPEN FROM EMERGENCY, TRANSFER OPERATOR
CNO – OPEN FROM NORMAL, TRANSFER OPERATOR
RE – CE BRIDGE RECTIFIER
RN – CN BRIDGE RECTIFIER
REO – CEO BRIDGE RECTIFIER
RNO – CNO BRIDGE RECTIFIER

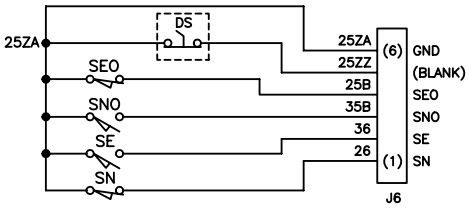
ATS POWER PANEL LAYOUT



AUXILIARY CONTACTS



LIMIT SWITCH SCHEMATIC



SEO – EMERGENCY OPEN POSITION LIMIT SWITCH
SNO – NORMAL OPEN POSITION LIMIT SWITCH
SE – EMERGENCY POSITION LIMIT SWITCH
SN – NORMAL POSITION LIMIT SWITCH
DS – DISCONNECT SWITCH ON MX100

LEGEND	REFERENCE	NOTES
● WIRE CONNECTION ○ WIRE ON TERMINAL BLOCK ≫ WIRE IN INTERCONNECT PLUG * OPTIONAL ** LOCATED ON RELAY/ TRANSFORMER BOX	LEGEND, OPERATION, AND ACCESSORIES: 52A-0900D FOR PRODUCTION ONLY: R/T BOX AND PLUGS – SHEET 2 OF 2 MX100 CONTROLLER – 50A-1000	ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS				
REV	ECN NO.	DATE	DWN	ENG
A	S-5757-B	ESTABLISH DWG.		
B	S-5757-D	01/09/96	SDW	SB
C	S-5757-F	04/26/96	RMC	SB
D	S-6849	01/28/98	RMC	SB
E	S-6876	02/12/98	SG	SB
F	S-6924	05/11/98	SG	SB
G	S-6969	08/14/98	SG	SB
H	S-7254	10/28/99	EC	MES
J	S-7377	05/19/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

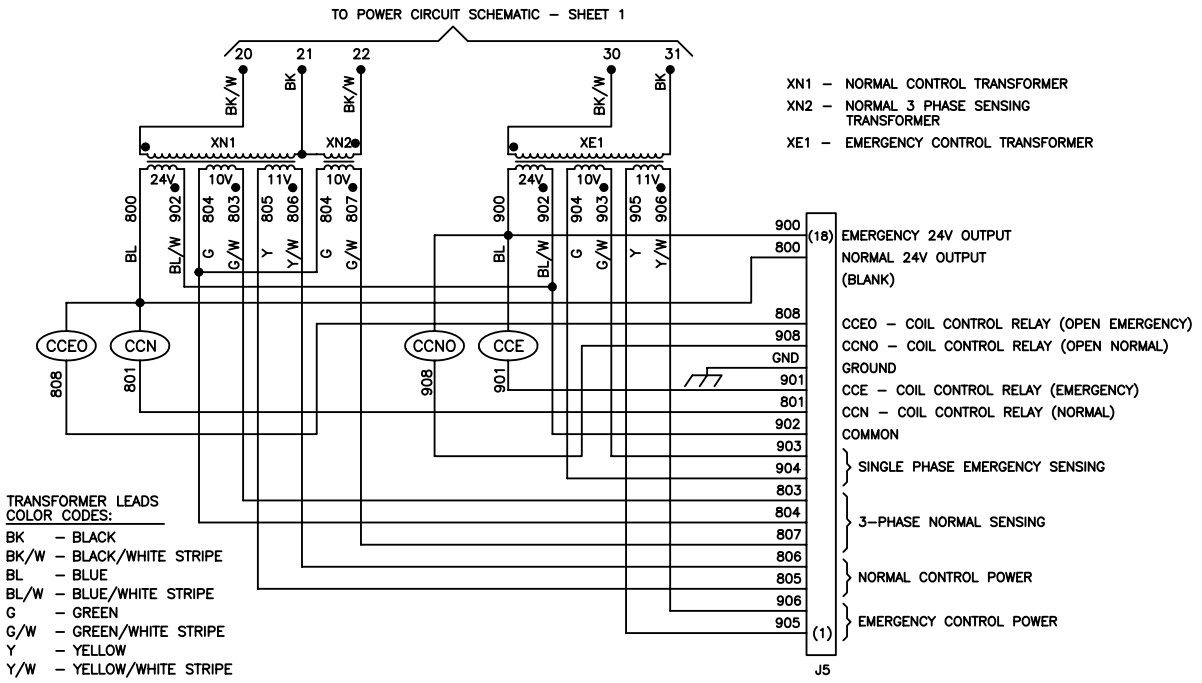
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: ATS POWER CIRCUIT & LIMIT SWITCHES
JOB/MODEL: ZTGDK60-300 (600-3000 AMP) (3/4P)

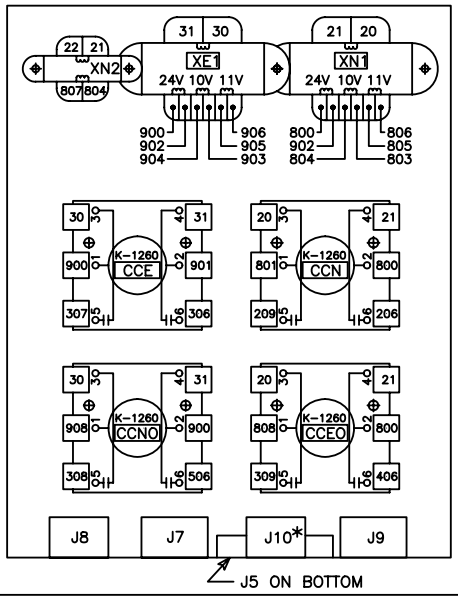
CHKD	APPD	CADD	ORDER NUMBER	DRAWING NUMBER
		ACAD	N/A	52A-6000

DRWN	ENGR	DATE	SCALE	SHEET	REV
SDW	SB	11/30/95	–	1 OF 2	J

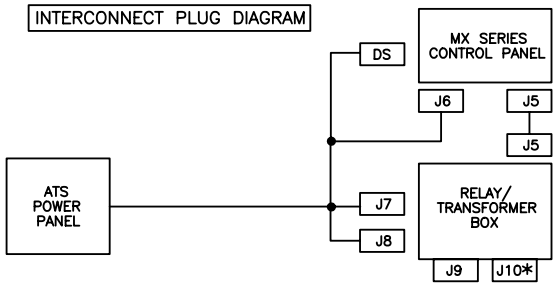
RELAY/TRANSFORMER BOX SCHEMATIC



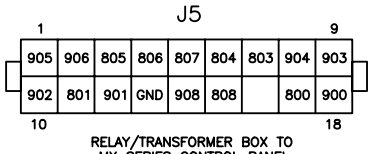
RELAY/TRANSFORMER BOX



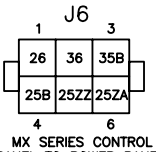
INTERCONNECT PLUG DIAGRAM



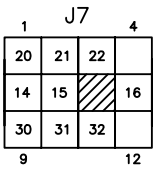
INTERCONNECT PLUGS



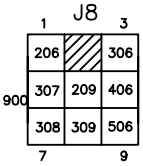
RELAY/TRANSFORMER BOX TO MX SERIES CONTROL PANEL



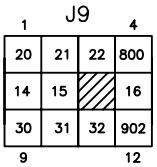
MX SERIES CONTROL PANEL TO POWER PANEL



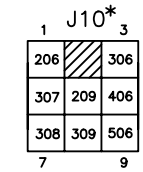
RELAY/TRANSFORMER BOX TO POWER PANEL



RELAY/TRANSFORMER BOX TO POWER PANEL



RELAY/TRANSFORMER BOX TO AUXILIARY CONTROL PANEL (IF REQUIRED)



RELAY/TRANSFORMER BOX TO AUXILIARY CONTROL PANEL (IF REQUIRED)

LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION		
* OPTIONAL		

REVISIONS

REV	ECN NO.	DATE	DWN	ENG
A	S-5757-B	ESTABLISH DWG.		
B	S-5757-D	01/09/96	SDW	SB
C	S-5757-F	04/26/96	RMC	SB
D	S-6849	01/28/98	RMC	SB
E	S-6876	02/12/98	SG	SB
F	S-6924	05/11/98	EC	SB
G	S-6969	08/14/98	SG	SB
H	S-7254	10/28/99	EC	MES
J	S-7377	04/27/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: RELAY/XFR BOX & INTERCONNECT PLUGS

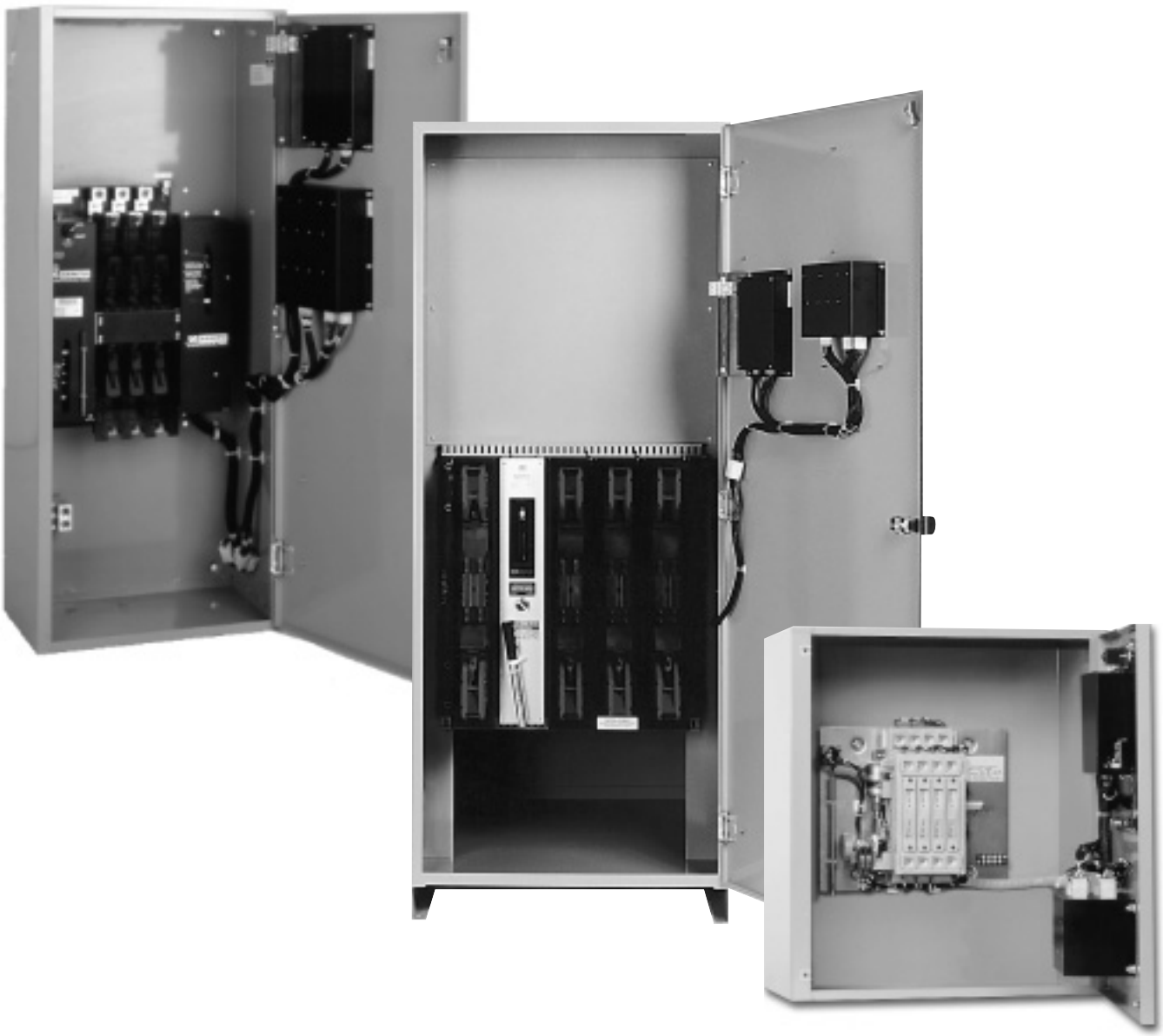
JOB/MODEL: ZTGDK60-300 (600-3000 AMP) (3/4P)

CHKD	APPD	CADD	ORDER NUMBER	DRAWING NUMBER
		ACAD	N/A	52A-6000

DRWN	ENGR	DATE	SCALE	SHEET	REV
SDW	SB	11/30/95	–	2 OF 2	J

ZTS/ZTSD Series Transfer Switches
40-4000 Amps

GE Zenith Controls



53R-1000E
5/02

Operation and Maintenance Manual

Authorized Service

For GE parts and service, call: 773 299-6600

Table of Contents

	Page
Introduction	ii
Safety	1
Equipment Inspection and Storage	1
Final Equipment Inspection	1
Mounting	1
Installation	2
Power Connections	2
Engine Start Control Connections	2
Functional Test	3
Initial Energization	4
Control Connections	5
Sequence of Operation — Standard Transition	5
Normal Power Failure	5
Restoration of Normal Power	6
Sequence of Operation — Delayed Transition	6
Power Failure Sequence of Operation	7
Maintenance and Testing	9
Inspection and Cleaning	9
Servicing	9
Testing	9
Troubleshooting and Diagnostics	10

	Page
Appendix A — MX200	11
Operation & Maintenance	11
Option Connections	12
Programmable Options	15
User Settings - SET Menu	16
User Settings - CNFG Menu	17
User Settings - ALT Menu	18
Setting System Clock	19
Setting Plant Exerciser C/D	19
Exerciser Types	20
Timers	22
Timer Designations	23
Sensors	24
Optional Pilot Devices	26
Testing	27
Index of Terms	28
Appendix B — ZTSH	29
Installation	29
Operation & Features	30
Adjustments & Settings	31
Control Layout	33

Introduction

GE Zenith Transfer Switches are used to provide a continuous source of power for lighting and other critical loads by automatically transferring from the normal source of power to an emergency source of power in the event that the normal source voltage falls below preset limits.

Voltage sensing and system control is performed via a state-of-the-art microcontroller located on the cabinet door. It is designed to give highly accurate control of the transfer switch system.

All GE Zenith transfer switches are designed for use on emergency or standby systems, and are rated for total system or motor loads. Transfer switches are UL Listed under Standard 1008 and CSA Certified under Standard C22.2 No. 178 and IEC Listed under Standard 947.

NOTE: A protective device such as a molded care circuit breaker or fused disconnect switch MUST be installed on both sources of incoming power for circuit protection and as a disconnection device.

Safety

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

The safe operation of your switch is GE Zenith's focus. The proper storage, installation, operation and maintenance will help increase the life of the switch.

⚠ CAUTION ⚠

Due to hazardous voltage and current, GE Zenith recommends that a GE Zenith Certified technician or a qualified electrician must perform the installation and maintenance of the switch.

Equipment Inspection and Storage

Once you have received the transfer switch, inspect it for any damage. This includes damage to the enclosure, power panel, control panel and wiring harness. If any damage is found or suspected, file a claim as soon as possible with the carrier and notify the nearest GE Zenith representative.

Before installation, it is necessary to store the transfer switch in a clean dry place, protected from dirt and water. Provide ample air circulation and heat, if necessary, to prevent condensation.

Storage Temperature	Operating Temperature (Ambient):	Humidity
-30°C to +75°C (-22°F to +167°F)	**40-400 AMP** *(molded shell)* -20°C to +65°C (-4°F to +149°F) **40-4000 AMP** *(all other frame and panel types)* -20°C to +60°C (-4°F to +140°F)	5% to 95% (non-condensing)

Final Equipment Inspection

Prior to energizing the transfer switch:

1. Remove any debris incurred, with a vacuum, due to shipment or installation.

⚠ WARNING ⚠

Do not use a blower since debris may become lodged in the electrical and mechanical components and cause damage.

2. Verify that all cabled connections are correct and that phase rotation of both sources match.
3. Check engine start connections and verify the correct connection of all control wires.
4. Check settings of all timers and adjust as necessary. Also adjust any optional accessories as required.
5. Check the integrity of power connections by verifying actual lug torque values as specified in the power panel manual.
6. Make sure that all covers and barriers are installed and properly fastened.

NOTE: Power Panels ship from GE Zenith in the Normal Position.

Each GE Zenith transfer switch is factory wired and tested. A complete information package is furnished with each switch which includes:

a. Sequence of operation.
b. Description and operation of all accessories supplied.
c. Power panel connection diagram and schematic.
d. Description and identification of all customer field connections.

Installation of GE Zenith transfer switches includes:

a. Mounting the transfer switch cabinet.
b. Connection of all Normal, Emergency, and Load cables or bus bars.
c. Connection of external control circuits as required.

Mounting

Adequate lifting means must be used to mount the transfer switch into place. The recommended method for moving the transfer switch using the lifting eyes, where supplied, and a spreader bar is illustrated in *Figure 1.* Enough room should be allowed to open the cabinet doors fully for inspection and servicing of the switch

⚠ CAUTION ⚠

Before drilling conduit entry holes or any accessory mounting holes, cover and protect the switch and control panel to prevent dirt and metal fragments from entering the mechanical and electrical components.

Failure to do so may result in damage and malfunction of the switch.

Installation

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Power Connections

GE Zenith transfer switches are supplied with UL listed solderless screw type terminals as standard for the Normal, Emergency and Load power connections. *Table 1* lists the number and sizes of cable lugs supplied as standard for each switch amp rating.

Connect the Normal, Emergency, and Load conductors to the clearly marked terminals on the transfer switch. Remove surface oxides from cables by cleaning with a wire brush. Verify that all connections are correct before tightening the lugs. All cable lug connections must be tightened to the proper torque values as shown in *Table 2*.

NOTE: Do not run cables or wiring behind front-connected transfer switches.

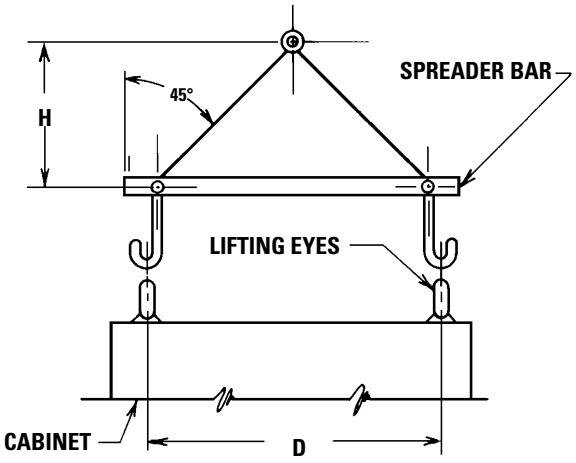


Figure 1

NOTE: When lifting the switch using a spreader bar, height H must be equal to half of distance D.

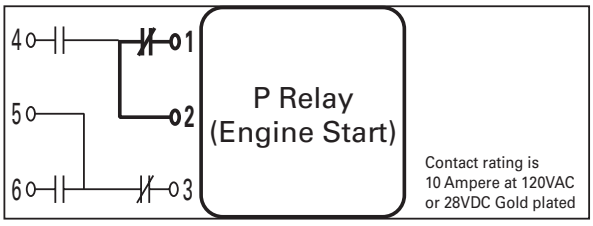
Screw Type Terminals for External Power Connections				
Switch Size (Amps)	Normal, Emergency & Load Terminals		Neutral Bar (When Required)	
	Cable Per Pole	Range of Wire Sizes	No. of Cables	Range of Wire Sizes
40	1	#8 to 1/0 AWG	3	#8 to 1/0 AWG
80	1	#8 to 1/0 AWG	3	#8 to 1/0 AWG
100	1	#8 to 1/0 AWG	3	#8 to 1/0 AWG
150	1	#8 to 3/0 AWG	3	#8 AWG to 300 MCM
200, 225, 250*	1	#6 AWG to 250 MCM	3	#6 AWG to 300 MCM
260, 300*, 400	1	#4 AWG to 600 MCM	3	#4 AWG to 300 MCM
600	2	#2 AWG to 600 MCM	8	#2 AWG to 600 MCM
800, 1000, 1200	4	#2 AWG to 600 MCM	12	#2 AWG to 600 MCM
1600, 2000 2600, 3000, 4000	Line, load and neutral terminals are located in the rear of the switch and arranged for bus bar locations			

Engine Start Control Connections

Engine-start control wires connect to control terminals below of the MX200. Engine start terminals are indicated by a schematic symbol (the symbol indicates the contact state for a de-energized Normal source). *Figure 2* shows the engine-start contacts.

Make all other necessary control connections to the control panel terminal blocks per the schematics supplied with the ATS.

NOTE: All control wires (18-12 AWG) must be torqued to 19 in/lbs.



⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Tightening Torque for Lugs		
Socket Size Across Flats	Torque	
	Lb. - In.	Lb. - Ft.
1/8	45	4
5/32	100	8
3/16	120	10
7/32	150	12
1/4	200	17
5/16	275	23
3/8	375	31
1/2	500	42
9/16	600	50

Table 2

The engine-start terminals are clearly identified by a label on the microcontroller backplate. In the case of manual transfer switches, or in other applications not requiring the microprocessor, clearly marked terminal blocks are provided in the upper left corner of the control panel for the engine start control wires.

Terminals for field connections to the A3 Emergency auxiliary contacts and the A4 Normal auxiliary contacts are also provided. These terminals are clearly marked and appear on the side of the power panel (right hand side for 30-400 A switch). On 400 amp metal frame units these terminals appear on the bracket above the operator handle.

Functional Test

Functional testing of the ATS consists of electrical tests described in this section. Before proceeding, refer to the information package supplied with the ATS and read and understand the information on all accessories provided.

⚠ CAUTION ⚠

Certain accessories, per specific schematics, can inhibit automatic transfer.

1. Unlock the enclosure.
2. Open the enclosure.
3. Verify the correct system voltage.

   NOTE: The equipment rating nameplate on the transfer switch lists the voltage. See *Figure 3*.

4. Close the Normal source circuit. breaker.

   NOTE: The controller will illuminate the Normal Available LED if proper voltage is sensed.

5. Verify the phase to phase voltages at the Normal line terminals.
6. Close the Emergency source circuit breaker.
7. Start the generator's engine.

   NOTE: The controller will illuminate the Emergency Available LED when preset voltage and frequency levels are reached.

8. Verify the phase to phase voltages at the Emergency line terminals.
9. Verify that the phase rotation of the Emergency source is the same as the phase rotation of the Normal source.



10. Shut down the generator's engine.
11. Place the starting control in the Automatic position.
12. Complete the visual inspection of the transfer switch.
13. Close the enclosure.
14. Lock the enclosure.

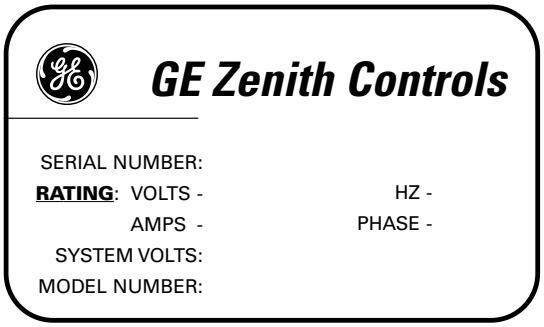


Figure 3

⚠ CAUTION ⚠

Engine Gen-Set could start when engine control wires are attached.

Initial Energization

After all options and accessories are checked and verified, follow these steps to set up the ATS. Refer to MX200 display *Figure 4*. The annunciation LEDs illuminate to indicate (1) source availability, (2) ATS position, and (3) MX200 control functions.

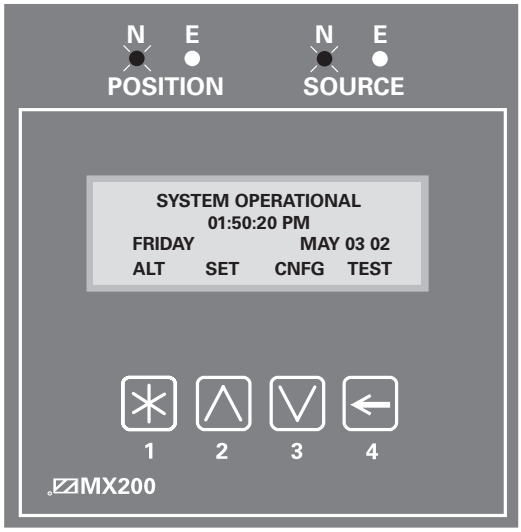


Figure 4 – Standard Transition Annunciation LEDs and Test Switch

NOTE: If a diagnostic message is visible, refer to Troubleshooting and Diagnostics.

1. Unlock the enclosure.
2. Open the enclosure.
3. Place the Disconnect Switch in the Inhibit.

NOTE: This step is only performed if the "DS" Option was purchased.

4. Close the external (up-stream) Normal circuit breaker.

NOTE: The normal Available and Normal Position LED's will illuminate.

NOTE: If the Normal Available LED does not illuminate, verify that the Normal Source Voltage is above the preset pick-up value.

NOTE: On the initial start-up, the Delay to Engine Stop Timer will display for the duration of its setting.

NOTE: The Gen-Set will start and run while Delay to Engine Stop is timing.

5. Close the External (up-stream) Emergency line circuit breaker.
6. Start the engine generator in MANUAL mode.

NOTE: When the voltage and frequency reach preset values, the Emergency Available LED will illuminate.

7. Verify the phase to phase voltages at the Emergency line terminals.
8. Verify that the phase rotation of the Emergency source is the same as the phase rotation of the Normal source.



9. Shut down the generator's engine. (Place in Automatic Mode.)

NOTE: The Emergency Available LED will turn off.

NOTE: The engine generator will continue to run if the Delay to Engine Stop Timer is displayed.

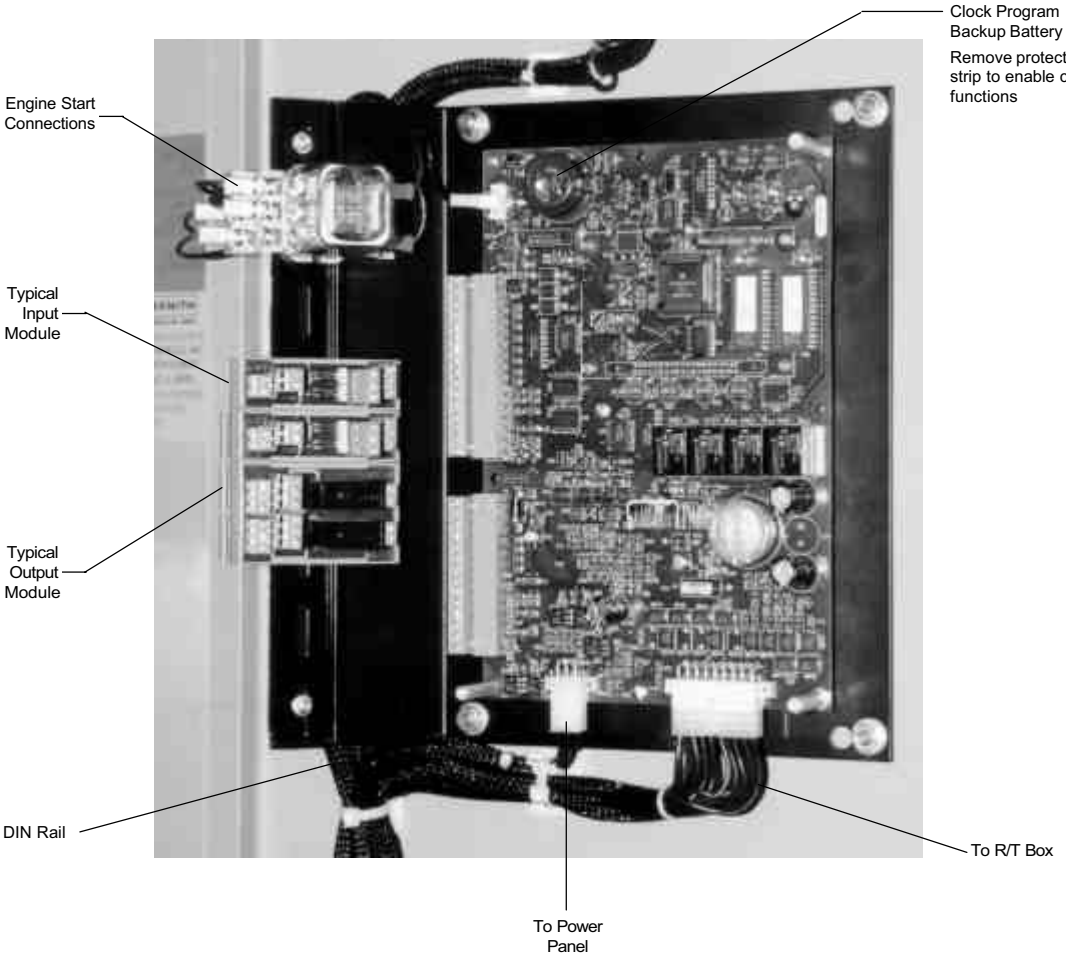
10. Place the disconnect switch to ENABLE.
11. Complete the visual inspection of the transfer switch.
12. Close the enclosure.
13. Lock the enclosure.

⚠ WARNING ⚠

When performing a hi-pot or dielectric test on the power section, DISCONNECT the control panel plugs from the microprocessor to avoid potential damage.

Installation *(cont'd)*

Control Connections



Sequence of Operation - Standard Transition

Operation Sequence

Normal Power Failure. When Normal voltage has fallen below the preset dropout value, the engine start (P) timer begins its timing cycle (factory set 3 seconds). The P timer allows for momentary undervoltage conditions in the Normal source without triggering the generator to start. If the Normal voltage remains below the dropout point throughout the P timing cycle, a generator start signal will be sent. The MX200 then monitors generator voltage and frequency to determine if they are within preset parameters. When the generator voltage and frequency reach acceptable limits the W timer begins its timing cycle. The W timer governs either the time delay for transfer to Emergency or to the open position (standard or delayed transition, respectively).

The W timer (typically 1 second) assures that the generator voltage and frequency are stable before transfer.

The transfer to Emergency sequence is then completed as follows:

Standard Transition—after the W time delay, the ATS transfers to Emergency position and load power is supplied by the generator.

Standard Transition w/A6 or T3/W3—following the W time delay, the presignal is initiated. The TA6 timer is started. The TA6 time delay is typically set to 5 seconds. After the TA6, the ATS transfers to Emergency.

Sequence of Operation - Standard Transition

When the W time is completed, the CCE relay energizes the CE solenoid to close the transfer switch into the emergency source. The SE limit switch activates to de-energize the CCE relay.

Restoration of Normal Power. When Normal power reaches the preset pickup value, the T timer begins its timing cycle (factory set 30 minutes). The T timer is used to ensure that the Normal source has fully restored before retransfer. If Normal voltage remains above the pickup values for the duration of the T timer, transfer to Normal position is performed.

Retransfer is accomplished as follows:

Standard Transition—ATS transfers to the Normal position and the load power is supplied by utility.

Delayed Transition—the switch opens out of Emergency to the Open position. The DT timer activates, typically set to 5 seconds. After the DT time delay, the switch completes transfer to Normal.

Delayed Transition w/A6 or T3/W3—following the W time delay, the presignal is initiated. The TA6 timer is started. The TA6 time delay is typically set to 5 seconds. After the TA6, the ATS transfers to the open position. The DT timer activates, typically set to 5 seconds. After the DT time delay, the switch completes transfer to Normal.

When the T time delay is completed, the CCN relay energizes the CN solenoid to retransfer the switch into the normal source. The SN limit switch activates to de-energize the CCN relay. Simultaneously, the engine over-run timer U begins its timing cycle. This timer provides a period of time for the engine generator to run without load and cool down before shutdown.

Sequence of Operation - Delayed Transition

Transfer of the load to the Emergency source begins automatically when any phase of the Normal source falls below the preset dropout point and this undervoltage failure condition is detected by the MX200 microcontroller. The engine start timer P begins its timing cycle. The P time delay is provided to override momentary outages and to prevent nuisance starting of the engine generator. If the Normal source voltage returns above the pickup setting, the P timing cycle is reset, and the transfer sequence is stopped.

If the normal source voltage does not return before the P time delay is completed, the P timer drops out and sends a starting signal to the engine generator. The microcontroller senses the voltage and frequency of the Emergency source. When both the voltage and the frequency of the Emergency source reach the preset values timer W begins its timing cycle. The W timer provides an adjustable transfer delay to the Emergency source as required.

When the W time is completed, the CCNO relay energizes the CNO solenoid to open the transfer switch out of the Normal source. The switch is now in a neutral (both sources open) position. The switch remains in a neutral position for the duration of the DW time delay. DW is an adjustable time delay between the opening of the Normal source and closing into the Emergency source.

After the DW time delay has elapsed, the CCE relay energizes. The switch then completes transfer to the Emergency source by energizing the CE solenoid. The SE limit switch activates to de-energize the CCE relay. The sequence for retransfer to the Normal source begins automatically when the microcontroller detects that the voltage on all phases of the Normal source has been restored.

When the Normal source restores, switching to the Normal source is initiated by energizing timer T, beginning its timer cycle. The T timer provides an adjustable delay to insure that the Normal source has stabilized before reconnection to the load. If the Normal source fails before the T time delay completes, the retransfer sequence is stopped.

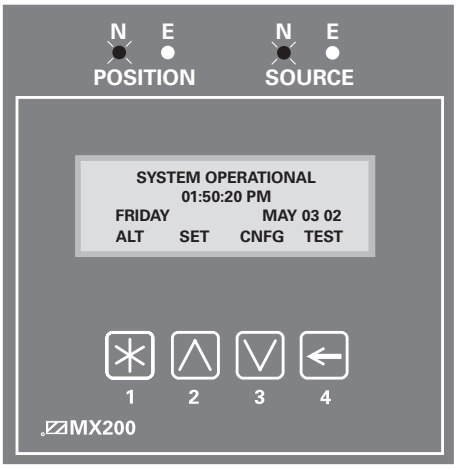
When the T time delay is completed, the CCEO relay energizes the CEO solenoid to open the switch out of Emergency and into a neutral position. The switch remains in neutral for the DT time delay. When the DT time delay has elapsed, the CCN relay energizes the CN solenoid to complete retransfer of the switch into the normal source. The SN limit switch activates to de-energize the CCN relay. Simultaneously, the engine overrun timer U begins its timing cycle. This timer provides a period of time for the engine generator to run without load and cool down before shutdown.

NOTE: If option A6 or T3/W3 are supplied, then time delay features activate prior to the transfer of this switch to the open position.

NOTE: For setup/operations of microprocessor see Appendix A

Power Failure Sequence of Operation

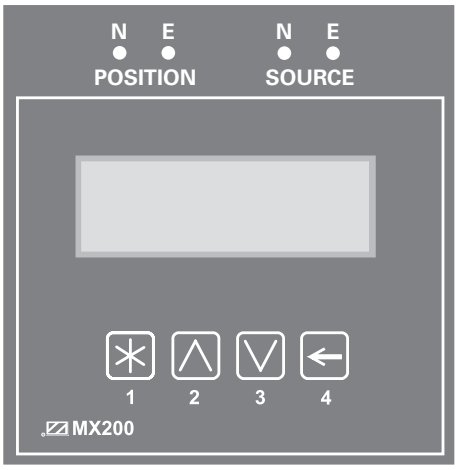
LEDs Green - Green



Normal Source Available

ATS Normal Position

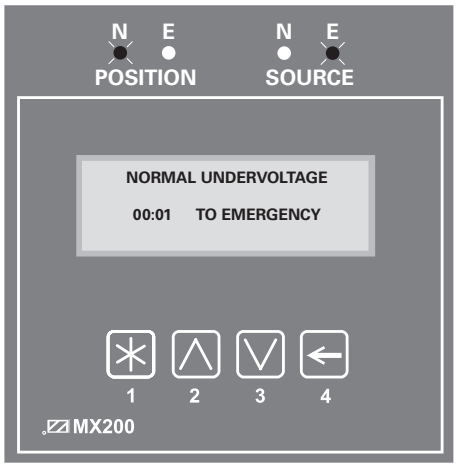
LEDs OFF



Normal Source Failed

Engine Starts After ENG START DELAY (P) (No Power Available)

LEDs Green - Red



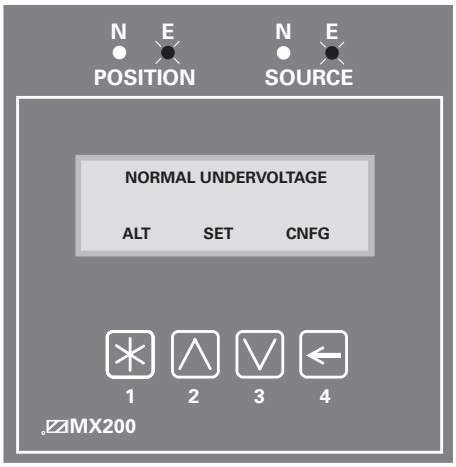
ENG START DELAY Lapsed

Emergency Source Available

Transfer TO EMERGENCY Timing (W)

Power Failure Sequence of Operation

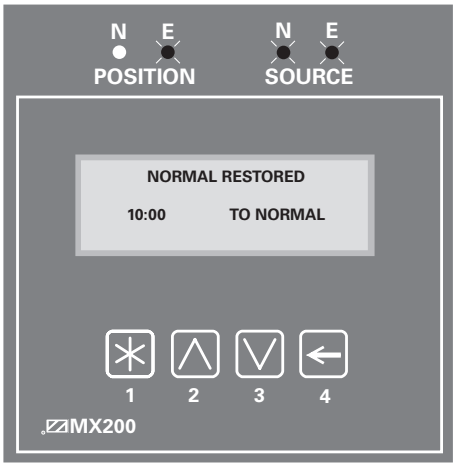
LEDs Red - Red



TO EMERGENCY
Lapsed (W)

ATS Transferred to
Emergency Position

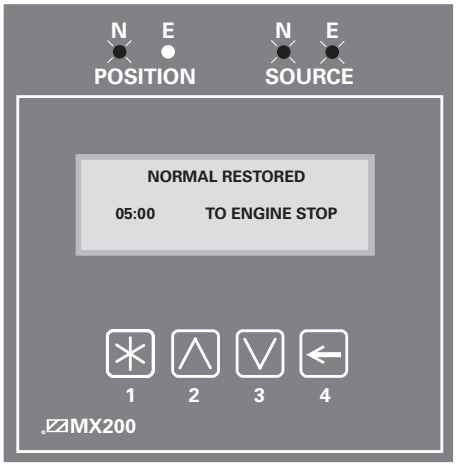
LEDs Red - Green - Red



Normal Source Returned

TO NORMAL Timing (T)

LEDs Green - Green - Red



Transfer TO NORMAL
Lapsed (T)

ATS Transferred to
Normal Position

Once ENGINE STOP
is complete,
return to Screen #1

Maintenance and Testing

⚠ CAUTION ⚠

Due to hazardous voltage and current, GE Zenith recommends that a GE Zenith Certified technician or a qualified electrician must perform the installation and maintenance of the switch.

⚠ WARNING ⚠

Both power sources must be disconnected before manual operation of the switch.

A preventive maintenance program will insure high reliability and long life for the transfer switch. The preventive maintenance program for the transfer switch should include the following items:

Inspection and Cleaning

The switch should be inspected for any accumulation of dust, dirt, or moisture, and should be cleaned by vacuuming or wiping with a dry cloth or soft brush. do not use a blower since debris may become lodged in the electrical and mechanical components and cause damage.

Remove the transfer switch barriers and check the condition of the contacts. Any surface deposits must be removed with a clean cloth (do not use emery cloth or a file). If the contacts are pitted or worn excessively, they should be replaced. A general inspection of mechanical integrity should be made to include loose, broken or badly worn parts.

Servicing

All worn or inoperative parts must be replaced using GE Zenith recommended replacement parts. Please refer to the Replacement Parts manual for specific part information and ordering procedures. Please contact the GE Zenith Technical Services Department for the Replacement Parts manual.

The operating mechanism of the transfer switch is lubricated with Lubriplate 105. The lubricant applied at the factory provides adequate lubrication for the lifetime of the switch. Should debris contaminate the mechanism, clean and apply additional Lubriplate.

GE Zenith can provide complete preventative maintenance services. Please contact the GE Zenith Technical Services Department for additional information.

Testing

A manual operator handle is provided with the transfer switch for maintenance purposes only. Manual operation of the switch must be checked before it is operated electrically. **Both power sources must be disconnected before manual operation of the switch.** Insert the handle and operate the transfer switch between the Normal and Emergency positions. The transfer switch should operate smoothly without binding. Return the switch to the Normal position, remove the handle, and return it to the holder provided.

After completing the inspection, cleaning and servicing of the transfer switch, reinstall the switch cover, and close and lock the cabinet door. Reclose the circuit breakers feeding the utility and generator sources to the switch.

Initiate the electrical transfer test by activating the test switch. P timer will time out and the microcontroller will send an engine start signal. When the W time has elapsed, the switch will complete its transfer by closing into the Emergency source.

Deactivating the test switch will start retransfer to the Normal source. The switch will complete its retransfer to Normal after the time delay of the T timer. The U engine overrun timer allows the engine generator to run unloaded for a preset cool down period.

NOTE: A periodic test of the transfer switch under load conditions is recommended to insure proper operation. (See National Electric Code articles 700 and 701).

⚠ WARNING ⚠

When performing a hi-pot or dielectric test on the power section, DISCONNECT the control panel plugs from the microprocessor to avoid potential damage.

Troubleshooting and Diagnostics

⚠ DANGER ⚠

HAZARDOUS VOLTAGES CAN CAUSE SEVERE INJURY OR DEATH.
These charts may indicate problems that require authorized GE Zenith service personnel.
Hazardous voltages may exist on termination plugs other than those that go into the MX100.

General Troubleshooting

The following troubleshooting guide is used to recognize, and determine basic faults. When using this guide, it will ask several questions about the condition of the switch. This guide will then list an order of the possible faults. You will then look at the first suspected fault to determine if it is the problem. If it is not a fault, you go to the second suspected fault. If you go through all of the suspected faults, or the chart instructs you to, call a GE Zenith Representative for further assistance.

NOTE: When you use the troubleshooting charts, the Annunciation column refers to the LED's on the control panel.

Symptom	Annunciation	Possible Cause(s)	Corrective Action
Engine does not START	EMERGENCY AVAILABLE LED off	Engine start wires not terminated properly	Check engine start connections
		Generator is in OFF position	Investigate why Engine Control Switch was turned off
Engine does not stop	LCD Display - "Delay to Engine Stop"	U timing cycle not complete	Check U timer setting
	NORMAL POSITION, and NORMAL and EMERGENCY AVAILABLE LEDs on, but U timer has timed out	Engine start wires not terminated correctly	Check Engine Start Connections
		Generator in MANUAL	Place generator in AUTO
ATS will not transfer to EMERGENCY	EMERGENCY AVAILABLE LED off	Emergency voltage or frequency not within acceptable parameters	Check: Engine Start Connections, Generator Breaker, Generator Output, and Engine Control Switch
	None	Power supply connector unplugged	Plug in connector
	LCD Display - "Diagnostic Code 001"	Limit switch or RT box connector unplugged	Call Technical Services
	LCD Display - "Delay to Emergency"	**W** timing cycle not complete	Check **W** Timer setting
ZTSDL Series	LCD Display - "Delay to Emergency"	**DW** timing cycle not complete	Check **DW** Timer setting
ATS will not transfer to NORMAL	NORMAL AVAILABLE LED off	Normal voltage or frequency not within acceptable parameters	Check utility and utility breakers
	None	Power supply connector unplugged	Plug in connector
	LCD Display - "Diagnostic Code 001"	Limit switch or RT box connector unplugged	Call Technical Services
	LCD Display - "Delay to Normal"	**T** timing cycle not complete	Check **T** Timer setting
ZTSDL Series	LCD Display - "Delay to Emergency"	**DT** timing cycle not complete	Check **DT** Timer setting

Appendix A - MX200 Operation and Maintenance

The MX200 CONTROLLER consists of two major assemblies:

I. The **Microprocessor** contains the following:

A. Customer Input and Output (I/O) for system interface. Located on the left hand side of the back of the unit (see figure 1)

1. I/O accessories that can be found here are:
   a. Engine start relay P output
   b. Source Availability A1 and A1E output (optional)
   c. Pre-Signal to transfer T3, W3 and A6 output (optional)
   d. Transfer Inhibit Q3 and Q7 input (optional)
   e. Remote test Q2 input (optional)
   f. Load shed R15 input (optional)
   g. Network interface ZNET200 input/output (optional)

B. LCD and Keypad located on the exterior of the door (see figure 2)

1. User accessibility to the following:
   a. LED indication of source availability
   b. LED indication of transfer switch position
   c. LCD screen indicates:
      (1) timer count down (numeric)
      (2) event reporting (text)
   d. Keypad provides user interface to: *[in conjunction with LCD screen]*
      (1) Setting sensors and timers
      (2) Configuring logic accessories

II. The **R/T box** (relay transformer box) contains the following: (see figure 1)

A. Relays which are required for controller output to energize the transferring mechanism of the transfer switch at line voltage.

B. Transformers which drop line voltage to control level for controller input.

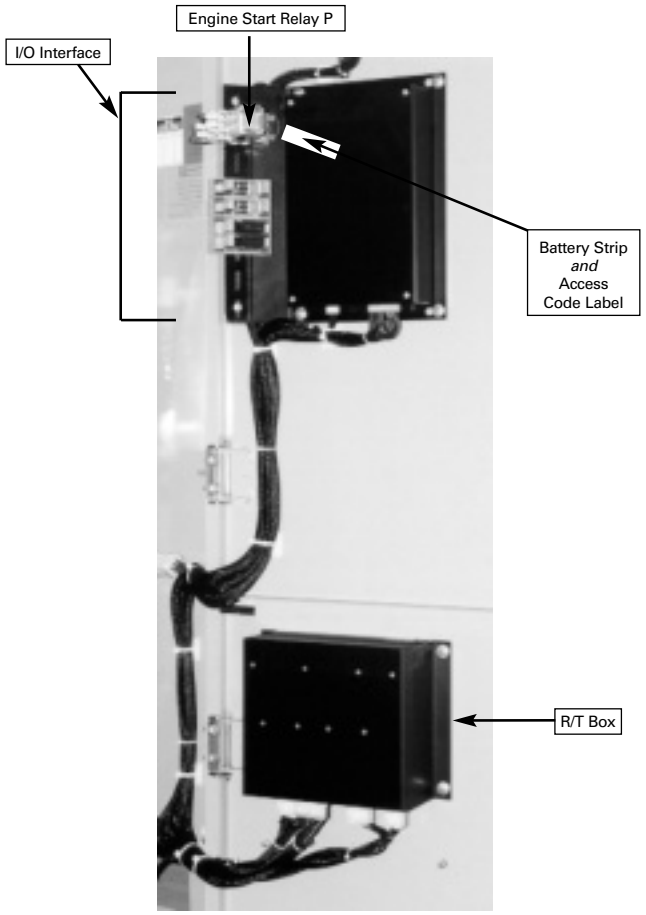


Figure 1

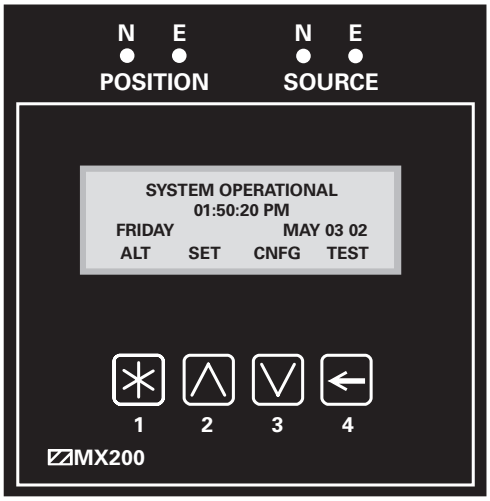


Figure 2

Appendix A - MX200 Operation and Maintenance

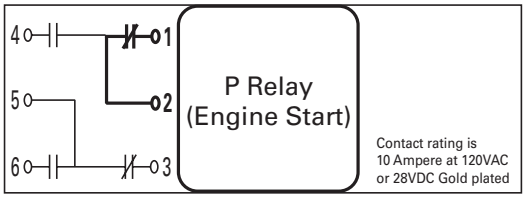
⚠ DANGER ⚠

HAZARDOUS VOLTAGES CAN CAUSE SEVERE INJURY OR DEATH.
Turn OFF all power installation, adjustment, or removal of transfer switch or any of its components.
Connecting Engine Start may cause Generator to start. Before connecting, turn Generator OFF.

Engine Control Connections (E contacts)

Connections for Engine Control are located on the upper left side of the unit (see figure 1). The P relay provides this output. This contact is controlled by the P timer. To change response time to Normal power outage (see page 7 and 8).

E



The above diagram represents a de-energized P relay (utility shown de-energized). The majority of generator manufacturers require a contact closure to start Engine. Use terminals #1 and #2.

Note 1: Bypass Isolation Transfer Switches have an auxiliary Engine Start feature. This provides an Engine Start even if the ATS and controls are isolated (*THIS IS A STANDARD FEATURE EXCLUSIVELY ON ZENITH BYPASS PRODUCTS*). The Customer connections on these products are located on the Power Panel, upper right-hand corner. Please refer to the Power Panel instruction manual for complete details.

Note 2: Products equipped with Engine control options such as S1, S2 or P2 provide customer connections on an auxiliary terminal block located on the MX200 DIN rail or auxiliary control panel. Please refer to corresponding option drawing.

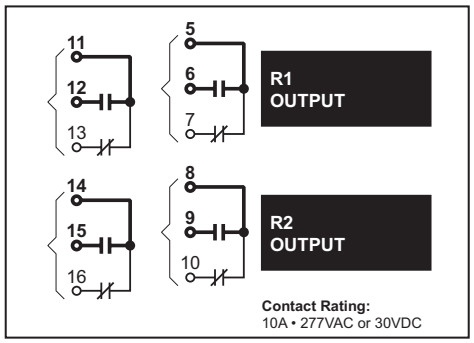
Generally the input and output options are located below the P relay on the same DIN rail (see figure 1). In some cases it may be necessary to mount additional accessories on an auxiliary panel.

Output Option Connections

Auxiliary contact(s) that operate(s) based on Normal source availability. Contacts located on R1 and/or R2. Refer to labeling.

Example: Terminal numbers 11 and 12 are closed when Normal source is acceptable (11 and 13 are open). When the Normal source is unacceptable, the opposite is true. Diagrams are shown with Normal unavailable.

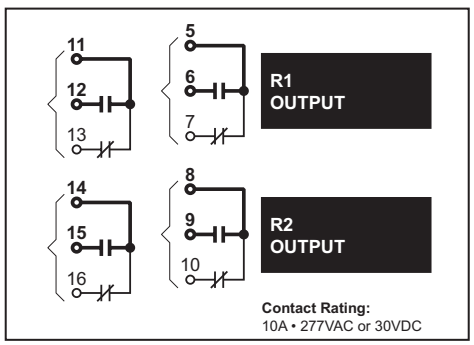
A1



Auxiliary contact(s) that operate(s) based on Emergency source availability. Contacts located on R1 and/or R2. Refer to labeling.

Example: Terminal numbers 11 and 12 are closed when Emergency source is acceptable (11 and 13 are open). When the Emergency source is unacceptable, the opposite is true. Diagrams are shown with Emergency unavailable.

A1E



Appendix A - MX200 Option Connections

⚠ DANGER ⚠

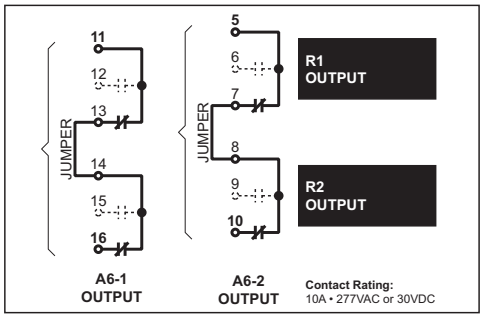
HAZARDOUS VOLTAGES CAN CAUSE SEVERE INJURY OR DEATH.
Turn OFF all power installation, adjustment, or removal of transfer switch or any of its components.

Output Option Connections (Cont.)

A3/A4

These connections are located on the Power Panel. Exact location depends upon which model is used. Refer to the Power Panel instruction manual for details. In all cases the A4 contact closes when the Transfer Switch is in the Normal position and the A3 contact closes when the Transfer Switch is in the Emergency position.

A6



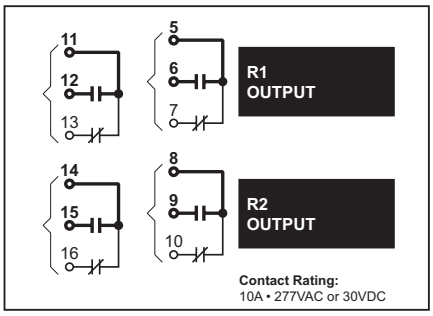
Auxiliary contact(s) that open prior to transfer in either direction.

Example: Terminals 11 to 16 will open five* seconds prior to transfer in either direction and close instantaneously after transfer.

* Pre-signal time is adjustable via T3/W3 timers (see page 11, 19 and 20)

For complete sequence of operation, see page ?

T3/W3

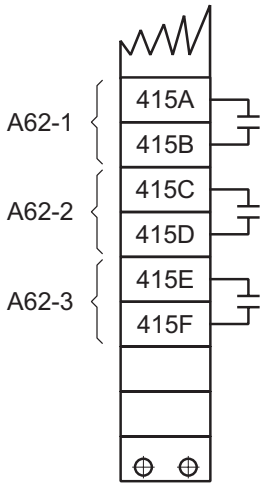


Auxiliary contacts that close five* seconds prior to transfer, and open instantaneously after transfer. Contacts located on R1 and/or R2. Refer to labeling.

- T3 is prior to transfer to Normal.
- W3 is prior to transfer to Emergency.
- T3/W3 is canceled when transfer is due to source outage.

*pre-signal time is adjustable (see page 11, 19 and 20)

A62



Contact Ratings:
5A 250 VAC

Auxiliary contact(s) that open prior* to transfer in either direction and close in sequence** after transfer.

All A62 contacts will open five* seconds prior to transfer in either direction. Contacts close after transfer when their corresponding timers have timed out.

- A62-1 contact sequence timer is T62-1
- A62-2 contact sequence timer is T62-2
- A62-3 contact sequence timer is T62-3

Example: When all three sequence timers are set for 5 seconds:

- A62-1 closes 5 seconds after transfer and starts T62-2 timer
- A62-2 will close 10 seconds after transfer and then start the T62-3 timer
- A62-3 will then close 15 seconds after transfer and so on.

* pre-signal time is adjustable via T3/W3 timers (see page 11, 19 and 20)

** sequence timers are adjustable and located on the auxiliary panel

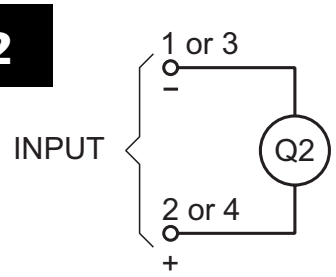
Appendix A - MX200 Options Connections

⚠ DANGER ⚠

HAZARDOUS VOLTAGES CAN CAUSE SEVERE INJURY OR DEATH.
Turn OFF all power installation, adjustment, or removal of transfer switch or any of its components.

Input Option Connections

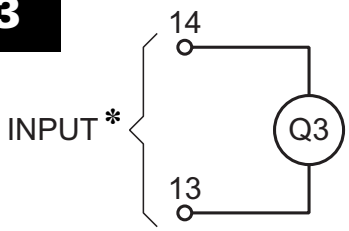
Q2



Remote Peak Shave or Area Protection Circuit
Energize Q2 input to simulate a Normal line failure causing the Generator to start and transfer the load to Emergency. Should Emergency fail during this operation, the Transfer Switch will retransfer back to Normal.

Q2 Input Modules:
120VAC INPUT (*Standard*)
24V (AC or DC) or 12VDC INPUT (*Optional*)

Q3

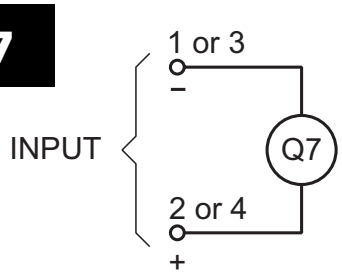


Remote Inhibit Transfer to Emergency Circuit
Voltage applied to Q3 input will allow transfer to Emergency. Conversely, no input on Q3 will inhibit transfer to Emergency.

* To enable Q3 option, engage Q3 jumper.

Q3 Relay:
120VAC *(Standard)*
24VAC; K-1242, 24VDC *(Optional)*

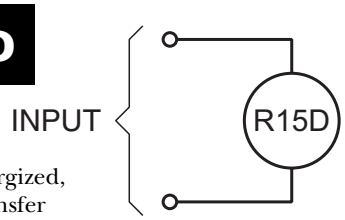
Q7



Remote Inhibit Transfer to Normal Circuit
Energize Q7 input to prevent transfer to Normal.

Q7 Input Modules:
120VAC INPUT (*Standard*)
24V (AC or DC) or 12VDC INPUT (*Optional*)

R15/R15D



Load Shed
Input, that when energized, causes the unit to transfer out of the Emergency position. The customer can use this to prevent generator overload.

On a ***Standard*** transfer switch, the R15 will transfer the unit to a dead Normal.

On a ***Delay*** transfer switch, the R15D will transfer the unit to a neutral (open) position. (Unit will transfer to Normal if acceptable)

Q3 is used to keep the unit from transferring back to Emergency.

R15/R15D Relay:
120VAC *(Standard)*

Communication Connections

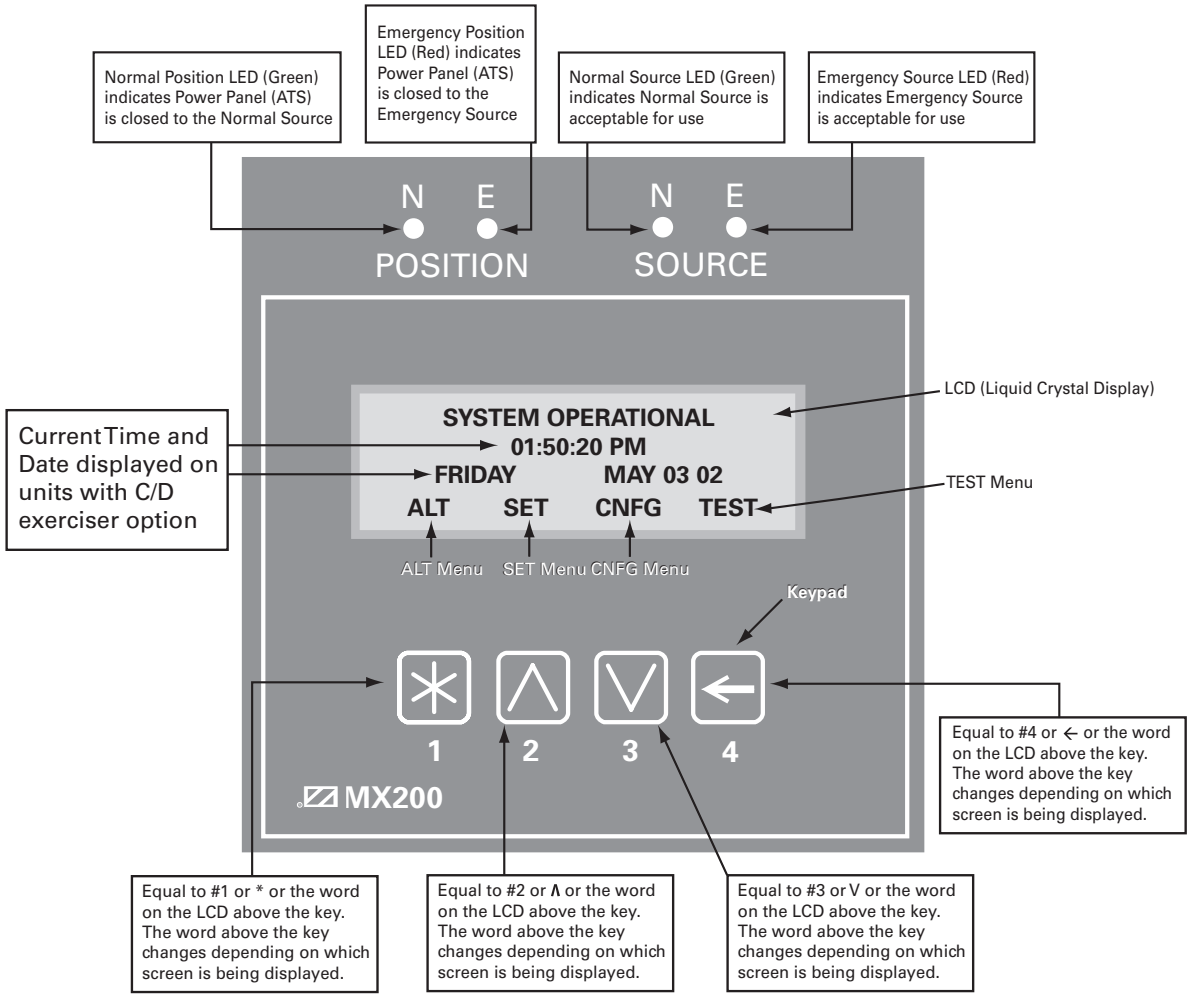
ZNET200

Network card allows communication of ATS position, available source, timers running, etc. to a remote annunciator panel, PC or PLC via one pair of twisted wires. Connections located below P relay. Refer to labeling. Network cable to be Belden 8471, 16AWG (unshielded two conductor twisted pair, not included).

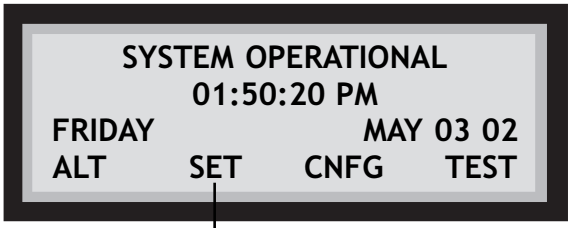
Appendix A - MX200 Programmable Options

These options are accessible through the LCD and keypad (see figure below). To become familiar with the options loaded into a particular unit, scrolling through the SET and CNFG menu will show the descriptions of the options (see page 11 and 12). These menus are the very same menus that are used to access the setting and/or configuration of these options. The SET (setting) menu is primarily used to show or change, time and voltage settings. The CNFG menu is primarily used to turn an option on or off. When scrolling through these menus, no changes can be made without entry of the access code. The factory set six-digit access code is located on a white label on the back of the unit (see figure 1).

The MX200 has many logic options. Each controller is downloaded with options at the time of manufacture. The collection of options that any one controller has is specified at the time of order placement. The following pages include all the options that can reside in the controller. Not all units include all options.



Appendix A - MX200 User Settings (SET Menu)



- * SYSTEM CLOCK (pg. 14)
- * EXERCISER EVENTS (pg. 15)
- N PICKUP VOLTAGE (pg. 22)
- N DROPOUT VOLTAGE (pg. 22)
- N PICKUP FREQ (pg. 22)
- E PICKUP VOLTAGE (pg. 23)
- E DROPOUT VOLTAGE (pg. 23)
- E PICKUP FREQ (pg. 23)
- ENG START DELAY (pg. 18)
- * DELAY TO EMERG PRE SIGNAL (pgs. 19-20)
- * EMERG PRE SIGNAL (pgs. 19-20)
- * DELAY TO OPEN NORMAL (pgs. 18 and 20)
- DELAY TO EMERG (pgs. 18 and 20)
- DELAY TO NORMAL (pgs. 18 and 20)
- * DELAY TO NORMAL PRE SIGNAL
- * NORMAL PRE SIGNAL (pgs. 19-20)
- * DELAY TO EMERG OPEN (pgs. 18-20)
- ENG STOP DELAY (pgs. 18 and 20)
- CALIBRATE NORMAL
- CALIBRATE EMERGENCY

* optional

Change adjustable values through keypad via SET menu.

Key stroke (SET ^ 2) (SELECT ^ v 2 3) scroll to accessory description to be changed, then (SET ← 4).

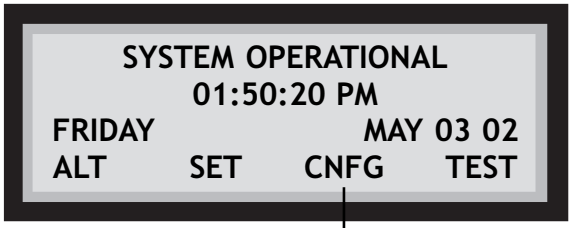
Enter six-digit access code (******) ♦

(SET ← 4) (SELECT ^ v 2 3) scroll to choose New Value

(STORE ← 4) this will be repeated for each digit to be set then (BACK * 1) to get out of SET screens and save your changes.

♦ The factory assigned six-digit access code is located on the white label on the back of the controller (see figure 1).

Appendix A - MX200 CNFG Menu



* N OVER VOLTAGE (pg. 22)

* N UNDER FREQ (pg. 22)

* N OVER FREQ (pg. 22)

* E OVER VOLTAGE (pg. 23)

* E OVER FREQ (pg. 23)

* IN PHASE MONITOR (pg. 21)

TRANSFER COMMIT (pg. 26)

* EXERCISER (pgs. 15-17)

TEST MENU KEY

DATE STYLE

* CONFIG NO TRANSFER (pg. 21)
(Phase Rotation)

* optional

Turn options ON or OFF via keypad through the CNFG menu.

Key stroke (CNFG ∨ 3) (SELECT ∧ 2 ∨ 3) scroll to accessory description then (CNFG ← 4)

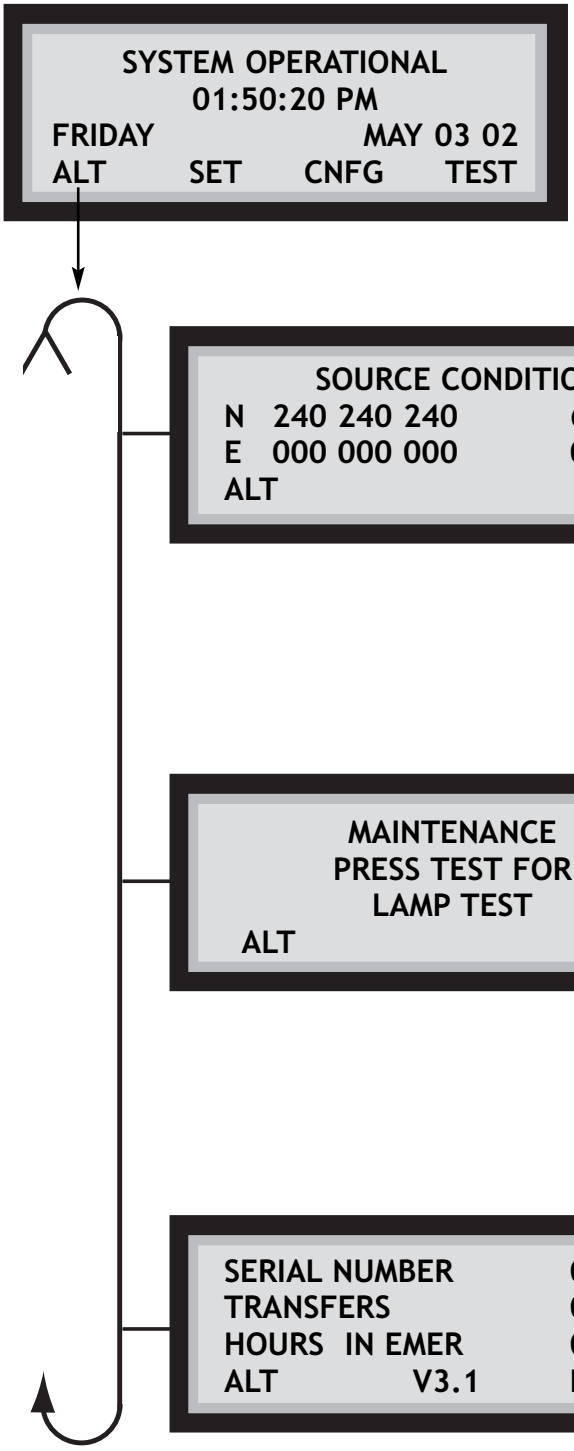
enter six-digit access code (******)♦

(CNFG ← 4) (∨ 3) scroll to ON or OFF

(STORE ← 4) (BACK * 1) to get out of CNFG screen and save changes.

♦ The factory assigned six-digit access code is located on the white label on the back of the controller (see figure 1).

Appendix A - MX200 ALT Menu



This screen displays line to line voltage values of both sources (A to B, B to C and A to C). Frequency of both sources is also displayed. Display will remain once selected, until transfer occurs. This is an alternate main screen.

This screen provides a lamp test.

Pressing (TEST 4) key will test LEDs above screen. This display will revert back to SYSTEM OPERATIONAL after 5 seconds.

This screen provides:

SERIAL NUMBER of the transfer switch unique to each switch.
TRANSFERS is a count of how many times the unit has transferred to Emergency (Total).
HOURS IN EMER is a running total of hours the unit has provided Emergency to the load.
V# is the software version number.

Appendix A - MX200 Operation and Maintenance

How to Set the System Clock

Set **SYSTEM CLOCK**, time and date:

- Only controllers with the Plant exerciser (C/D) option will show a system clock.
- When the controller does not have this option, the second and third line of the display will be blank during **SYSTEM OPERATIONAL** screen.
- When the clock is present but not set, the display will show **SET SYSTEM CLOCK** on the second line of the **SYSTEM OPERATIONAL** screen.
- The **SYSTEM OPERATIONAL** screen will show time (hours, minutes and seconds) on the second line if the system clock has been set. (Date on third line)

Set the system clock via the SET menu:
(Start from **SYSTEM OPERATIONAL** screen)

1. Remove battery protective white plastic strip near P relay (see figure 1)*
2. Press **SET**
3. Scroll to **SET SYSTEM CLOCK** using the up and down keys (SELECT)
4. Press **SET**
5. **ENTER ACCESS CODE** located on the white label on the back of the controller (see figure 1)
6. Press **SET**
7. Use the up and down keys to change the hour value (AM or PM is also selected)
8. Press **STORE** (this will enter this value and move cursor to minutes)
9. Use the up and down keys to change the minutes
10. Press **STORE** (this will enter this value and move cursor to month)
11. Use the up and down keys to change the month
12. Press **STORE** (this will enter this value and move cursor to date)
13. Use the up and down keys to change the date
14. Press **STORE** (this will enter this value and move cursor to year)
15. Use the up and down keys to change year
16. Press **STORE** (this will enter this value and complete the clock setting)
17. To edit settings, press **SET** and repeat steps 6 - 16
18. If the setting is satisfactory, press BACK (unit then returns to the **SYSTEM OPERATIONAL** screen)

* *Replacement battery Part # K-4100*
Battery will last 5 years and provides power to retain clock function only (Controller functions without battery)

How to Set the Plant Exerciser C/D

- Units equipped with this option will display the time of day on second line of **SYSTEM OPERATIONAL** screen (if time is correct, go to step one; if not, see page 14 "How to Set the System Clock").
- When the second line displays **SET SYSTEM CLOCK** the unit is equipped with the exerciser option, but the **SYSTEM CLOCK** has not been set. **SYSTEM CLOCK** must be set before proceeding (see page 14 "How to Set the System Clock").
- When a unit is not equipped with this option, the second and third line of the **SYSTEM OPERATIONAL** screen will be blank (Plant Exerciser option is not installed).

Verify the Exerciser is on with the following:

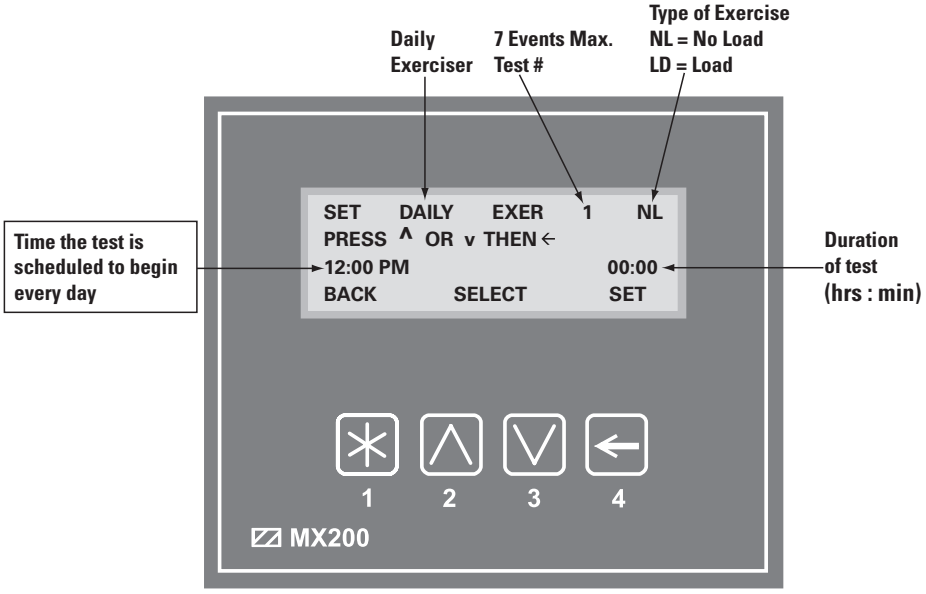
1. Beginning from the **SYSTEM OPERATIONAL** screen, press **CNFG**
2. Using up and down keys, scroll to **CONFIG EXERCISER** screen
3. The lower right-hand corner (above **CNFG**) will show on or off
4. If **on**: press **BACK** and skip to step 12
5. If **off**: continue
6. Press **CNFG**
7. Enter **ACCESS CODE** located on white label on the back of the controller (see figure 1)
8. Press **CNFG**
9. Select "**on**" using up and down keys
10. Press **STORE**
11. Press **BACK** to return the **SYSTEM OPERATIONAL** screen.

Set the **PLANT EXERCISER** via the **SET** menu after verifying the unit is equipped with this option and it is turned on as per above:

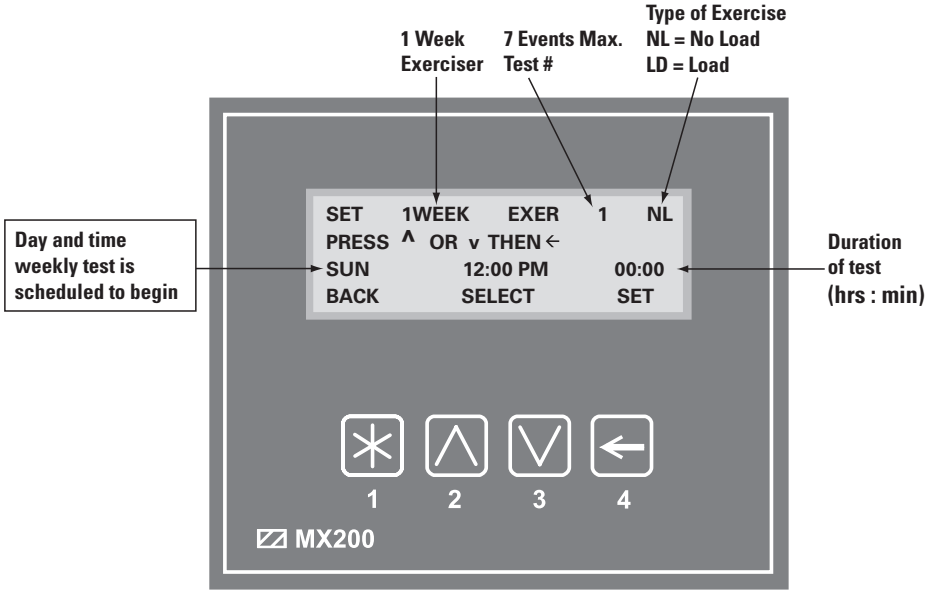
12. Beginning from the **SYSTEM OPERATIONAL** screen, press **SET**
13. Using up and down keys, scroll to **SET PLANT EXERCISER** screen (if this screen cannot be found begin at the top of the page)
14. Press **SET**
15. Enter **ACCESS CODE** located on white label on the back of the controller (see figure 1)
16. Press **SET**
17. The **SET 1WEEK EXER** screen is now displayed (refer to page 16 and 17 to verify type of exerciser installed; 1WEEK, 2WEEK, DAILY OR CLNDR)
18. Press **SET** again
19. Cursor is indicated as a line under character to be changed, move cursor via **STORE** key
20. Change values with up and down keys, press **STORE** after each entry (test duration is hours and minutes)
21. Press **STORE** when complete, until **SAVING RECORD** is displayed
22. Press **BACK** twice when done to return to the **SYSTEM OPERATIONAL** screen.

Appendix A - MX200 Exerciser Types

Daily Exerciser

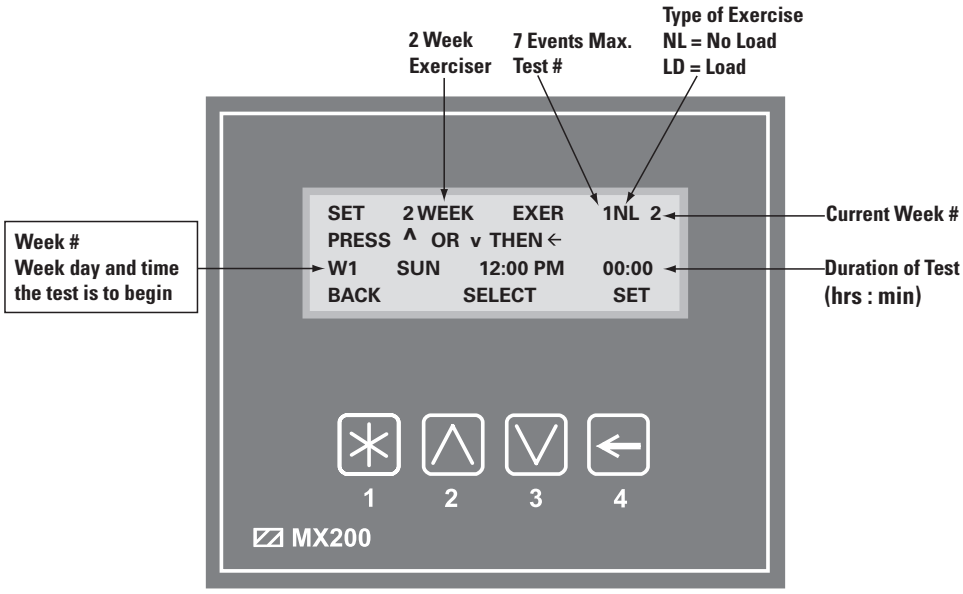


1 Week Exerciser

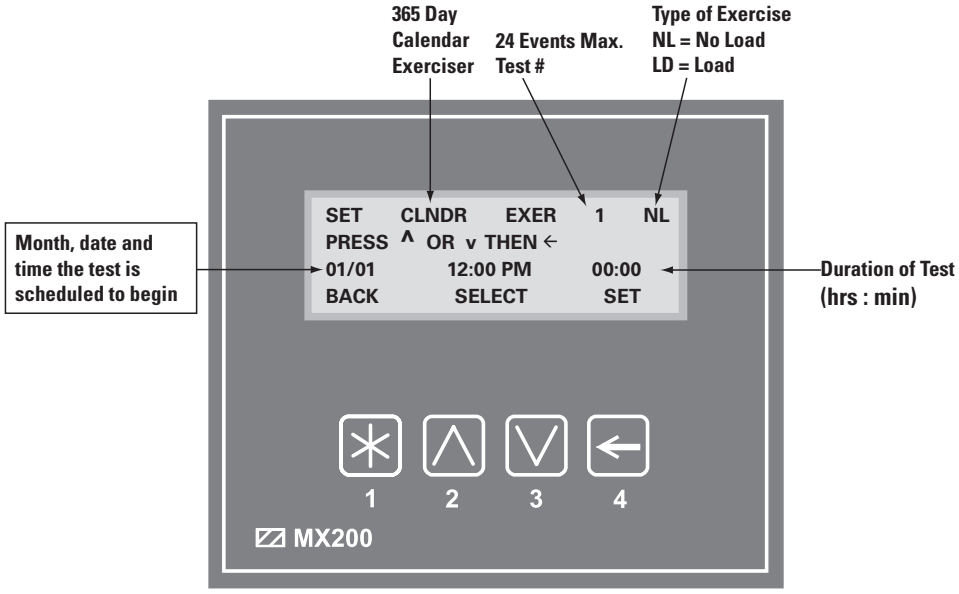


Appendix A - MX200 Exerciser Types

2 Week Exerciser



365 Day Calendar Exerciser



Appendix A - MX200 Timers

P (Engine Start Timer)

adjust via SET menu *(see page 11)* Factory default 3 seconds

- The purpose of this timer is to ensure that the transfer switch does not start the engine when the Normal power outage is very short.
- The P time range is 0 to 10 seconds in 1/10 of a second increments.
- Timer begins when the Normal fails to meet adjusted parameters.
- When the time setting has lapsed, P relay contacts will operate to start engine (DPDT).

W (Transfer to Emergency Timer)

adjust via SET menu *(see page 11)* Factory default 1 second

- The purpose of this timer is to ensure the Generator is stable before transfer.
- The W time range is 0 to 5 minutes in 1 second increments.
- Timer begins once the Generator output satisfies adjusted parameters.
- When time setting has lapsed, transfer to Generator will be initiated.

T (Transfer to Normal Timer)

adjust via SET menu *(see page 11)* Factory default 30 minutes

- The purpose of this timer is to verify that the Normal source has consistently met the sensor parameters for a minimum duration.
- The T time range is 0 to 60 minutes in 1 second increments.
- The T timer begins when Normal satisfies sensor parameters.
- When the timer setting has lapsed, retransfer back to Normal will be initiated. (Timer bypassed upon Emergency failure)

U (Engine Cool Down Timer)

adjust via SET menu *(see page 11)* Factory default 5 minutes

- The purpose of this timer is to run the Generator unloaded prior to stop.
- The time range is 0 to 60 minutes in 1 second increments.
- The timer begins once the transfer switch has transferred to Normal.
- When the timer setting has lapsed, the P relay will operate to stop engine.

DT/DW (Open Delay Timers)

adjust via SET menu *(see page 11)* Factory default 5 seconds

- Both DT and DW are center position timers for Delay style ATS Power Panels.
- The purpose of these timers is to control the center off position of delay power panels to allow the back EMF of the load to decay before re-energizing the load.
- These timers have a range of 0 to 10 minutes in increments of one second.
- DT controls how long the ATS stays open when transferring from Emergency to Normal.
- DW controls how long the ATS stays open when transferring from Normal to Emergency.

T3/W3, A6 and A62 (Pre-signal Timers)

adjust via SET menu *(see page 11)*

output connection *(see page 5-7)*

Factory default 20 seconds

- Both T3 and W3 are pre-signal timers.
- The purpose of these timers is to provide an output prior to transfer.
- These outputs are provided to coordinate building systems preparedness for the impending interruption that will occur when transferring from one live source to another.
- These timers have a range of 0 to 60 seconds in increments of one second.
- Output is relay contacts (DPDT).
- T3 takes place prior to transfer to Normal and W3 takes place prior to transfer to Emergency.
- These timers are bypassed when transferring from a dead source (power outage).
- Outputs from these timers are commonly used in conjunction with elevators and UPS systems.

Example: A five second T3 timer setting will give a relay output of a 5 second duration, during the last 5 seconds prior to transferring to the Normal source. Once the ATS is in the Normal position, the T3 signal is terminated.

Note: The operation of T3 time is added to the T time (T+T3 = transfer delay to Normal). Both T and T3 are canceled if the generator fails during transfer delay. The operation of W3 time is added to the W time (W+W3 = transfer delay to Emergency). W3 is canceled during Normal power loss transfer to Emergency. W3 is only active during testing. W timer is always used when transferring to Emergency.

- **A6** provides contact pre-signal in both directions and is normally closed.
- **A6** utilizes T3/W3 timers to provide pre-signal time setting. This option is configured without the dead source bypassing feature utilized on the standard T3/W3 operating scheme.
- **A62** option utilizes independent external timers to sequence contact outputs after transfer. These contacts are normally closed contacts that open prior to transfer in both directions (pre-signal duration determined by T3/W3 setting) and re-close in sequence after the transfer is complete (determined by the external timers designated T61, T62, T63…).
- **A62** option is commonly used to shed multiple motor loads prior to transfer and sequentially add these loads after transfer is complete. This option is configured without the bypassing feature utilized on the standard T3/W3 operating scheme.

* optional

Timer Designations as they appear in the SET menu

ATS Type	P	W	W3 (A6)	DW	T	T3 (A6)	DT	U
Standard ATS	ENG. START DELAY	TO EMERGENCY	→	→	TO NORMAL	→	→	ENG. STOP DELAY
Standard ATS with pre-signal option; T3/W3, A6 or A62	ENG. START DELAY	TO PRESIGNAL	EMERGENCY PRESIGNAL	→	TO N-PRE	NORMAL PRESIGNAL	→	ENG. STOP DELAY
Delay ATS	ENG. START DELAY	TO OPEN N	→	TO EMERGENCY	TO OPEN E	→	TO NORMAL	ENG. STOP DELAY
Delay ATS with pre-signal option; T3/W3, A6 or A62	ENG. START DELAY	TO E-PRE	TO OPEN N	TO EMERGENCY	TO N-PRE	TO OPEN E	TO NORMAL	ENG. STOP DELAY

NORMAL FAILS → TRANSFER TO EMERGENCY → NORMAL RETURNS → TRANSFER TO NORMAL → ENGINE COOLDOWN →

Appendix A - MX200 Sensors / Normal Sensors

*R50 (In Phase Monitor)

can be turned on or off via CNFG menu *(see page 12)*
Factory default off

- This feature restricts ***live source to live source transfers*** to occur only when sources are within 7 electrical degrees or less of each other (***Live source to live source transfers*** usually occur during transfer back to Normal or testing).
- R50 does not change the operation of the ATS in a power failure mode.
- R50 operation occurs after all timer functions have lapsed.
- Once the transfer timers have lapsed, the CHECKING FOR SOURCE SYNCHRONISM will be displayed.
- Transfer will then take place once the sources come into sync.
- In the event that the sources do not come within 7 electrical degrees of each other, within 60 seconds the unit will display the message: SYNCH CHECKING PRESS ← TO BYPASS.
- If ← is pressed at this point, the following will be displayed: WARNING PRESSING ← MAY CAUSE DAMAGE TO LOAD DUE TO OUT OF PHASE TRANSFER. Pressing ← again will then actually bypass the R50.
- Since this is a passive device the amount of time that it takes to sync is dependent on the frequency difference between the two sources.
- The Normal source is usually a utility and the frequency is not within the control of the consumer. The Emergency source needs to be adjusted to create an adequate difference in order for the transfer to happen in a timely fashion.

Note: **For optimum performance the generator should be adjusted maximum 2 Hertz above or below the utility frequency, minimum .1 Hertz different (58 to 59.9) or (60.1 to 62) Hertz** *(adjustment of generator to 60.0 hz will cause lengthy transfer delay).*

*R16(Phase Sequencing/Rotation)

can be turned on or off via CNFG menu *(see page 12)*

Factory default on this feature prevents ***live source to live source transfers*** from occurring between dissimilar phase sequences. This condition is primarily caused by an installation error. Connections from the Normal and Emergency need to be verified, compared and corrected to remedy the inconsistent phase rotation between the two sources.

WARNING: Turning off this option can cause severe damage to loads.

Pick Up Voltage

Factory Default: 90%
This adjustment determines the minimum acceptable voltage required to transfer to Normal. Adjust via the SET menu. Range is 85 to 100% in 1% increments *(see page 11)*. Once satisfied, the T timer will begin timing to transfer to Normal.

Pick Up Frequency

Factory Default: 95%
This adjustment determines the minimum acceptable frequency required to transfer to Normal. Adjust via the SET menu. Range is 90 to 100% in 1% increments *(see page 11)*. Once satisfied, the T timer will begin timing to transfer to Normal.

Drop Out Voltage

Factory Default: 80%
This adjustment determines the low voltage threshold. Adjust via the SET menu. Range is 75 to 98% in 1% increments *(see page 11)*. Drop out must be a minimum of 2% below pickup setting. Once voltage falls below threshold, P timer begins timing to signal generator to start.

Over Voltage (R1)

This feature, when on, provides a maximum voltage threshold at 110% of nominal system voltage. Turn on or off via CNFG menu *(see page 12)*. Once threshold is exceeded, P timer begins timing to signal generator to start.

Under Frequency (J1N)

This feature, when on, provides a minimum frequency threshold at 2Hz below pick up frequency. Turn on or off via the CNFG menu *(see page 12)*. Once the frequency drops below this threshold for more than 5 seconds, the P timer will begin timing to signal the generator to start.

Over Frequency (J2N)

This feature, when on, provides a maximum frequency threshold of 2 Hz above nominal frequency. Turn on or off via CNFG menu *(see page 12)*. Once frequency exceeds threshold, P timer begins timing to signal generator to start.

* optional

Appendix A - MX200 Emergency Sensors / Optional Pilot Devices

Pick Up Voltage

Factory Default: 90%

This adjustment determines the minimum acceptable voltage. Adjust via the SET menu. Range is 85 to 100% in 1% increments *(see page 11)*. Once satisfied, the W timer will begin timing to transfer to Emergency.

Pick Up Frequency

Factory Default: 95%

This adjustment determines the minimum acceptable frequency. Adjust via the SET menu. Range is 90 to 100% in 1% increments *(see page 11)*. Once satisfied, the W timer will begin timing to transfer to Normal.

Drop Out Voltage

Factory Default: 80%

This adjustment determines the low voltage threshold. Adjust via the SET menu. Range is 75 to 98% in 1% increments *(see page 11)*. Drop out must be a minimum of 2% below pickup setting. Once voltage falls below threshold, the T timer will be bypassed to expedite the transfer to Normal.

*Over Voltage (R8)

This feature, when on, provides a maximum voltage threshold at 110% of nominal voltage. Turn on or off via CNFG menu *(see page 12)*. Once this threshold is exceeded, the T timer will be bypassed to expedite the transfer to Normal.

*Over Frequency (J2E)

This feature, when on, provides a maximum frequency threshold of 2Hz above of nominal frequency. Turn on or off via the CNFG menu *(see page 12)*. Once the frequency exceeds this threshold, the T timer will be bypassed to expedite the transfer to Normal.

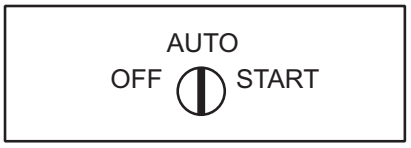
Over Frequency

This feature provides a minimum frequency threshold at 2 Hz below pick up frequency. Once the frequency drops below this threshold, if sustained for more than 5 seconds, the T timer will be bypassed to expedite the transfer to Normal.

Door Mounted Options

The S options are usually options related to a manually operated switch mounted on the door of the enclosure, which provides access to a feature or function.

S1



Selector Switch

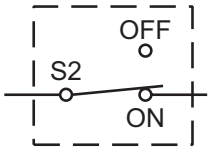
Provides start-stop control of the engine from the transfer switch panel.

AUTO Position provides Normal operation of the transfer switch and the engine.

OFF Position disconnects the transfer switch start contact from the engine. Then engine can only be started manually in this position.

START Position closes the circuit to the engine, causing it to start and run until the switch is moved from the start position.

S2



Engine Disconnect Switch

Interrupts the engine start circuit when in the "OFF" position.

* optional

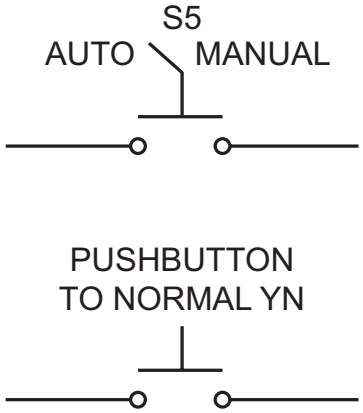
Appendix A - MX200 Optional Pilot Devices

Auto/Manual Retransfer Selector Switch

In **AUTO**, retransfer to Normal is Automatic after T timer times out. T time delay is bypassed if Emergency fails.

In **MANUAL**, retransfer to Normal occurs upon manual depression of YN or if Emergency fails.

S5



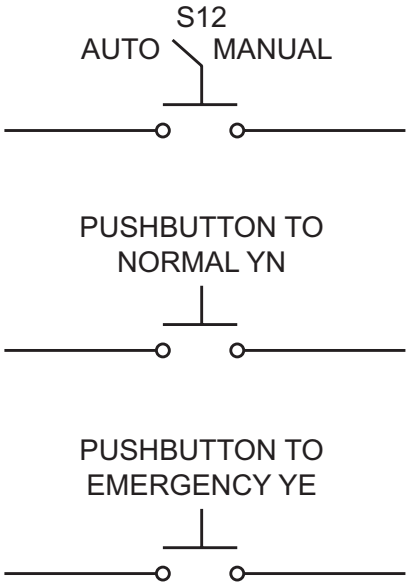
Auto/Manual Selector Switch

When the S12 is in the AUTO position, the Automatic Transfer Switch functions automatically as specified with the switch drawing.

When the S12 Switch is in the MANUAL position, the Automatic Transfer Switch will transfer either direction only by depression of Normal (YN) or Emergency (YE) Pushbutton.

NOTE: When in MANUAL, the switch maintains position, even if the selected power fails.

S12



Transfer Commit

can be turned on or off via CNFG menu
(this feature is standard)(see page 12)

When the Transfer commit is set to the Y (Yes) position

- The ATS is committed to transfer to the Emergency position once the W timer has begun timing, even if Normal returns before the transfer to Emergency occurs.
- This is to ensure that the transfer takes place, because one outage is often followed by another.

When the transfer commit is set to N (No) position
(factory default)

- The ATS is not committed to transfer unless the outage duration is longer than the timers that precede the transfer to the Emergency position.
- This assumes that the outage will be an isolated event.

S13

Test Switch, Three Position, Key Operated (Spring Return to Center)

Holding the Selector Switch in **TEST** will transfer the ATS to Emergency. Releasing the switch (to **AUTO** position) will return the ATS to Normal through the **T** timer function.

Holding the Selector Switch in **YN** Normal position will bypass the **T** timer and immediately transfer the ATS back to Normal. Releasing the Selector Switch allows the Selector Switch to return to **AUTO** position.

S14

Appendix A - MX200 Testing

⚠ NOTICE ⚠

A periodic test of the transfer switch under load conditions is recommended to insure proper operation. (See National Electric Code articles 700 and 701)

Start generator and verify proper voltage, frequency and phase sequence (match to Normal). Shut down gen set and place in Auto. Complete the visual inspection of the transfer switch, and close the cabinet door.

Initiate the test by pressing the TEST button on the LCD keypad. The controller will then prompt for your access code (as shown on Figure 1). After entering the code, three test options will appear—STD LOAD, FAST LOAD and NO LOAD (See Figure 3).

- **STD LOAD** test starts the generator and using the current timer settings, transfers the load to the Emergency source.
- **FAST LOAD** test presets timer values to a maximum 30 seconds during the test. After completion of the test, all timers are reset to their original values. (T3, W3, DT and DW remain)
- **NO LOAD** test starts the generator but does not transfer the load to the Emergency source. Press and hold the desired test option button until the switch transfers to the Emergency source (load test) or until the generator has been run for the desired amount of time (no load test). Releasing the test button before W timer timeout will abort the test (Exception: see transfer commit option, page 26).

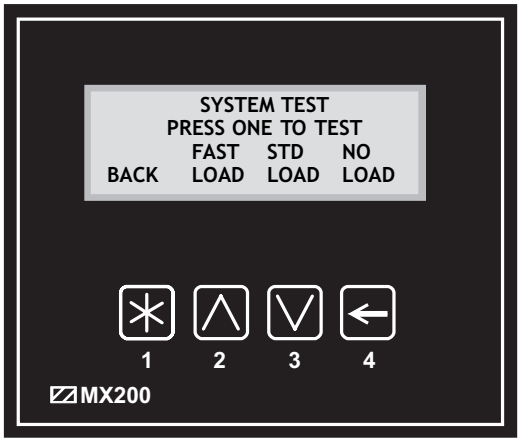


Figure 3

When the test is initiated, the controller first starts the P timer. Upon completion of the P time delay, an engine start signal is sent. After Emergency has reached preset levels, the W timer begins its timing cycle. This timer is used to ensure the voltage and frequency of Emergency has stabilized before transfer. If either the voltage or frequency of Emergency fall below preset limits the test will be terminated, and the U timer will time out. If the voltage and frequency remain within preset limits for the duration of the W time delay, the transfer switch will close into the Emergency source.

Deactivating the test switch initiates retransfer to the Normal source. The switch will retransfer after the time delay of the T timer. This timer is used to ensure that the Normal source is stable before retransfer. Immediately after retransfer, the U timer begins its timing cycle. The U timer is the engine cool down timer which allows the engine generator to run unloaded.

NOTE: Only the P timer is used during the no load test.

Appendix A - MX200 Index of Terms

Term	Definition	Page
A1	Normal Availability output relay contact	11
A1E	Emergency Availability output relay contact	11
A3	Emergency position output contact	13
A4	Normal position output contact	13
A6	Pre-signal contact either direction	13
A62	A6 with sequential pick up after transfer	13
Access Code	Six numeric digit required for program changes	15
ALT	Alternate Main Screen	15
ATS	Automatic Transfer Switch	23
Aux. Panel	Auxiliary Control Panel	
Battery	Clock Battery K-4100	19
CNFG	Menu for configure parameters	11
D Type Switch	Transfer switch with an off position (3 position)	22
DS	Disconnect Switch (located on Power Panel)	22
DT	Delay Timer from open to Normal (D Type Switch)	22
DW	Delay Timer from open to Emergency (D Type Switch)	22
E	Emergency	
E-Contact	Engine Start output relay contact	12
Emergency	Alternate Power Plant / Engine Generator Set	
Exerciser Clock	Time clock for automatic generator test	20
Input	Voltage applied from a remote source	
J1N	Normal Under Frequency Sensor	24
J2E	Emergency Over Frequency Sensor	25
J2N	Normal Over Frequency Sensor	24
Keypad	User interface keys	11
LCD	Liquid Crystal Display	11
LED	Light Emitting Diode	15
MX200	Micro processor based controller	
N	Normal	
Normal	Utility power (preferred source)	
Output	Indication via dry contacts	11-13
P	Delay timer to Engine Start	11
P2	Extended time range P	
Pre-Signal	Signal prior to transfer	11
Power Panel	Structure that transfers load between two sources of power	
Q2	Input for Remote Peak Shave/Test	11
Q3	Input to inhibit transfer to Emergency	11
Q7	Input to inhibit transfer to Normal	11
R1	Normal Over Voltage Sensor	24
R8	Emergency Over Voltage Sensor	
R15 (load shed)	Input to transfer off Emergency to dead Normal	14
R15D (load shed)	Input to transfer off Emergency to open position (D Type Switch)	14
R16	Phase sequence sensor	
R50	In phase monitor	
Retransfer	Transfer back to Normal source	
RT box	Relay Transformer Box	11
S1	Selector; Engine (OFF-AUTO-START)	25
S12	Selector; Automatic or Manual ATS	26
S13	Transfer Commit	26
S14	Selector; Test-Auto-YN	26
S2	Selector; Engine (OFF-ON)	25
S5	Selector; Auto or Manual retransfer	26
SET	Menu for Setting parameters	15
T	Delay timer to transfer to Normal	22
T3	Pre-signal to Normal transfer timer	13
Test	Simulated utility power outage	
Test Switch	Simulates utility power outage	
U	Engine cool down timer	22
UPS	Uninterruptable Power Source	
W	Delay timer to transfer to Emergency	22
W3	Pre-signal to Emergency transfer timer	22
YE	Push button to Emergency	
YN	Push button to Normal	
ZNET200	Network communication card	14
ZTS	Zenith Transfer Switch	

Appendix B - ZTSH Installation

Control Connections

A complete information package is furnished with each transfer switch including a complete connection diagram and schematic which details all necessary control circuit field connections.

The engine start control wires connect to the terminals specified in the upper left corner of the control panel. *Figure 2* shows the location of these terminals on the standard SSRCP printed circuit board mounted on the steel backplate. These terminals are clearly identified by a pre-printed label attached to the steel control panel. In the case of manual transfer switches, or in other applications not requiring the standard control panel, clearly marked terminal blocks are provided in the upper left corner of the control panel for the engine start control wires.

Terminals for field connections to the A3 Emergency auxiliary contacts and the A4 Normal auxiliary contacts are also provided. These terminals are clearly marked and appear on the side of the power panel. On 400 amp units these terminals appear on the disconnect switch bracket above the operator handle, and are marked as illustrated in *Figure 3*.

Make all other necessary external control connections to the appropriate terminal blocks located on the control panel. Insure that all connections are tightened to the torque specified in *Figure 1*.

Control Wire Connections	
Wire Size (AWG)	**Torque Lb. - In.**
18-16	19
14-8	19
6-4	36

Figure 1

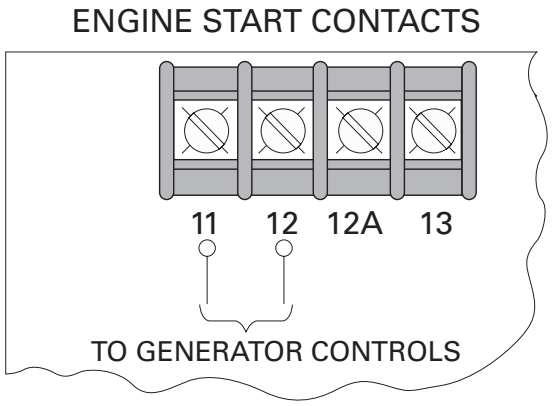


Figure 2

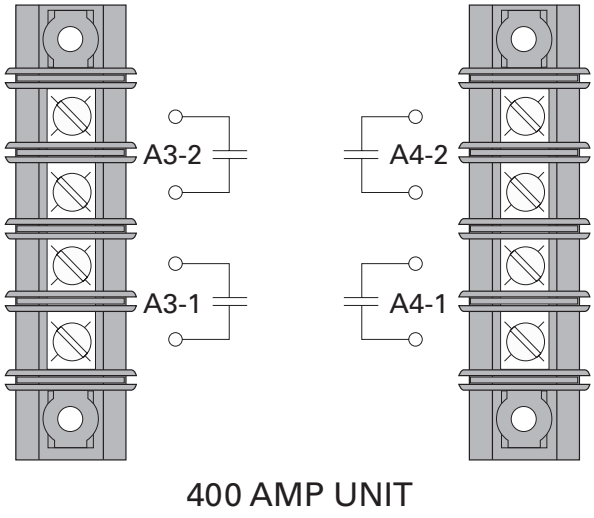


Figure 3

Appendix B - ZTSH Operation and Features

Sequence of Operation

The information package supplied with the transfer switch includes a schematic diagram and description of operation of all accessories provided.

The sequence for load transfer to the Emergency source begins automatically when any phase of the Normal source falls below the preset dropout point and this undervoltage failure condition is detected by the solid state phase relays B1, B2, B3.

The phase relays drop out, de-energizing the normal control relay CR, and engine start timer P1 begins its timing cycle. The P1 time delay is provided to override momentary outages and to prevent nuisance starting of the engine generator. If the Normal source voltage returns above the pickup setting of the phase relays, the P1 timing cycle is reset to zero by the re-energization of the CR relay.

If the normal source voltage does not return before the P1 time delay is completed, the P1 timer drops out and sends a starting signal to the engine generator. An emergency voltage and frequency sensing relay VFSM monitors the voltage and frequency of the Emergency source. When both the voltage and the frequency of the Emergency source reach the preset pickup points, the VFSM relay initiates the transfer to the Emergency source and timer W begins its timing cycle. The W timer provides an adjustable transfer delay to the Emergency source as required.

When the W time delay is completed, the Emergency control relay RT energizes and picks up the power relay, CE1 or CCE. The power relay connects voltage from the Emergency source to the Emergency switch operating circuit caaausing the switch to transfer its main contacts to the Emergency source. The switch is mechanically locked in the Emergency position. The power relay and Emergency operator are de-energized when the SE limit switch is activated by the operator. The SN limit switch is deactivated at the same time, readying the Normal control circuit for retransfer when the Normal source is restored.

The sequence for retransfer to the Normal source begins automatically when the voltage on all phases of the Normal source reach the preset pickup point and this condition is detected by the solid state phase relays.

When the Normal source restores, the solid state phase relays B1, B2, B3 pick up and initiate retransfer of the switch to the Normal source by energizing timer T and beginning its timing cycle. The T timer provides an adjustable delay to ensure that the Normal source has stabilized before reconnection to the load. If the Normal source fails before the T time delay is completed, the phase relays drop out and the T timing cycle is reset to zero.

When the T time delay is completed, the Normal control relay CR energizes and picks up the power relay, CN1 or CNN. The power relay connects voltage from the normal source to the Normal switch operating circuit causing the retransfer of the main switch contacts to the normal source. The switch is mechanically locked in the Normal position. The power relay and the Normal operator are de-energized when the SN limit switch is activated by the operator. The SN limit switch also energizes the engine over-run timer U and begins its timing cycle. The timer provides a period of timefor the engine generator to run without load and cooldown before shutdown. After the U time delay is completed, the P1 timer is energized and the engine generator is shutdown.

Appendix B - ZTSH Adjustments and Settings

Solid State Timers

Solid state timers are adjustable from 0.1 second to 100 hours. The red timing indicator in the upper left corner flashes as the timer progresses through the timing cycle. When the timing cycle is completed, the indicator remains illuminated. A flathead screwdriver is required to change the setting, as shown in *Figure 7*.

The time unit is selected by turning the rotary switch at the lower right of the timer. Four selections are available: "Seconds", "Minutes", "Hours", "10 Hours". The time unit selected is displayed in the window below the time setting dial.

The time range is selected by turning the rotary switch at the lower left of the timer. Four ranges are available: "0-0.5", "0-1.0", "0-5.0", "0-10.0". The dial digits appear in the windows around the time setting knob.

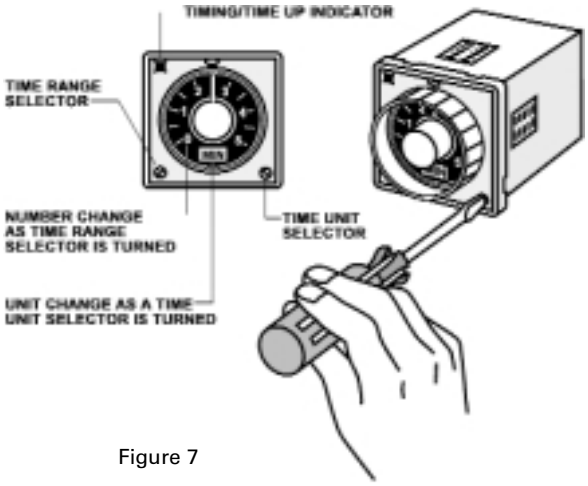


Figure 7

⚠ CAUTION ⚠

Do NOT change the setting while the timer is energized. Timer malfunction or damage may occur.

The factory setting of the solid state timers used in the Zenith standard package are shown in *Table 4*.

Timer	Factory Setting
T	30 minutes
U	5 minutes
W	1 second

Table 4

Voltage/Frequency Sensor (VSFM)

The pickup point may be adjusted by rotating the adjustment screw as shown in *Figure 8*. Counter-clockwise rotation increases the pickup voltage.

Pickup Voltage (at 100% Frequency)
Adjustable: 80% to 95%
Factory Set: 90%
Pickup Frequency
Adjustable: 80% to 100%
Factory Set: 95%

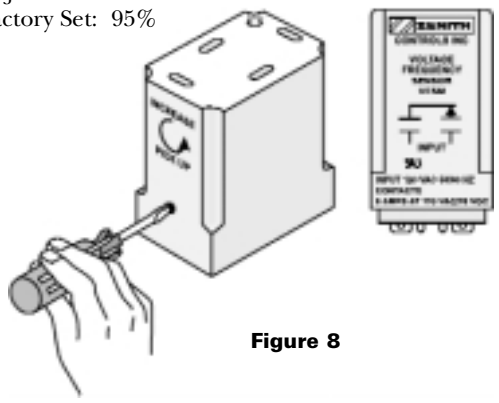


Figure 8

Solid State Phase Relay (ARSM)

The pickup and dropout points may be adjusted by using the following procedure. Use of a variable voltage supply (Variac) is required. The relay is illustrated in *Figure 9*.

1. Turn the pickup adjustment fully clockwise.
2. Turn the dropout adjustment fully counter-clockwise.
3. Set Variac to the desired pickup voltage.
4. Rotate the pickup adjustment counterclockwise very slowly until the relay picks up. The LED will illuminate.
5. Set Variac to the desired dropout voltage.
6. Rotate the dropout adjustment clockwise very slowly until the relay drops out. The LED will go out.
7. Verify the setting by raising the voltage until the relay picks up and lowering the voltage until the relay drops out.

Pickup Voltage:
75% to 115% of Nominal
Factory Set:
90% of Nominal

Dropout Voltage:
55% to 105% of Nominal
Factory Set:
80% of Nominal

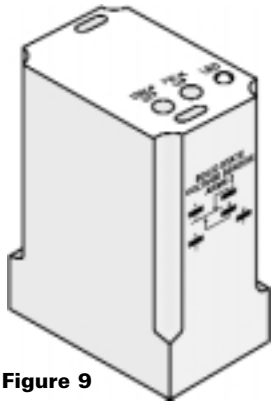


Figure 9

Appendix B - ZTSH Adjustments and Settings

ELECTRONIC TIME SWITCH Z2000-2A

This time switch is used for the C/D option.
Time switch Z2000-1A is used for the C option.

A. Setting Time and Day

Press and hold "🕒" button during the Following adjustments:

1) Press "d" to set day pointer to correct day:
   1 = Monday...7 = Sunday
2) Press "h" to set the hour. The time of day is expressed in 24-hour military time:
   04:00 = 4 a.m.....20:00 = 8 p.m.
3) Press "m" to set minutes
4) Release "🕒" button. Clock is running

B. Programming

Twenty-four total ON or OFF settings are available on one, several, or all days of the week.

1) Press Prog button. The blank program entry field will appear with two flashing points: "__:__"
2) Press either C1 or C2 depending on which channel you wish to program.
3) Next, select either ON or OFF by pressing C1 or C2 which toggles the ON/OFF mode.
4) You will now see the pointer flashing above 1 for Monday. To lock in Monday, press Prog. If you want to enter further days, press d then Prog to lock them in. Solid pointers must be displayed over each day that the switching command is required.
5) Once the days are selected, press "h" button to enter the desired hour and press "m" to enter the desired minutes. To enter the program into the time switch, press "Prog". When the programming is complete, press "🕒" to return the clock run mode. If the "🕒" button is not depressed, it will switch to the clock run mode after 60 seconds.

C. Installation and Start-Up with Automatic Summer/Winter Time Adjustment

1) After applying A.C. power, press the "Res" button.
2) Press "C1" until dot 3 appears (see *Table 1*).
3) Press "Prog" to display 1997, press "d" until appropriate year is displayed.
4) Press "Prog" to display 01.01. month and day.
5) Press "m" to set the month and "d" to set the day. Then press the "Prog" button.
6) Press and hold the "🕒" button during the following adjustments:
   To set day, press "d" to position "t" over correct day, (1=Monday,...7=Sunday).
   To set hour, press "h" to correct hour (AM or PM).
   To set minutes, press "m" to correct minute.
   Release "🕒" button. Clock is now running.

D. Programming

24 total "ON" and "OFF" settings are available on one, several or all days of the week. Press "Prog" button, see __:__ __ display with two flashing points. This is the blank program entry field. Press "C1" or "C2" depending on which channel you will program first. Assume, for example, "C1" first. Select either "C1", "ON" or "OFF" by again pressing "C1" which toggles the ON/OFF mode. You will now see the pointer "t" flashing above 1(Monday). If you wanted to enter a program starting Monday you would now press "Prog" to lock in Monday. If you wanted further days press "d" then "Prog" to lock them in. If the switching command was required Monday thru Friday, five solid pointers must be displayed over 1 thru 5; for the entire week, 1 thru 7. Once days are selected, press "h" to enter desired switching hour, then press "m" to enter desired switching minutes. Now to enter the program into the timer press "Prog". When programming is finished press "🕒" to return to clock run mode. If the "🕒" button is not pressed, the timer will switch to clock run mode after 60 seconds. After programming, recheck and reset the time of day, if necessary.

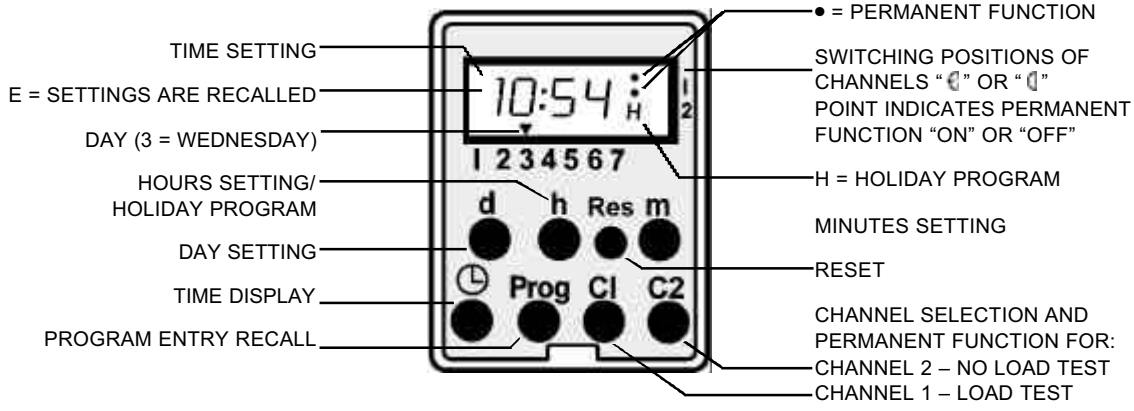
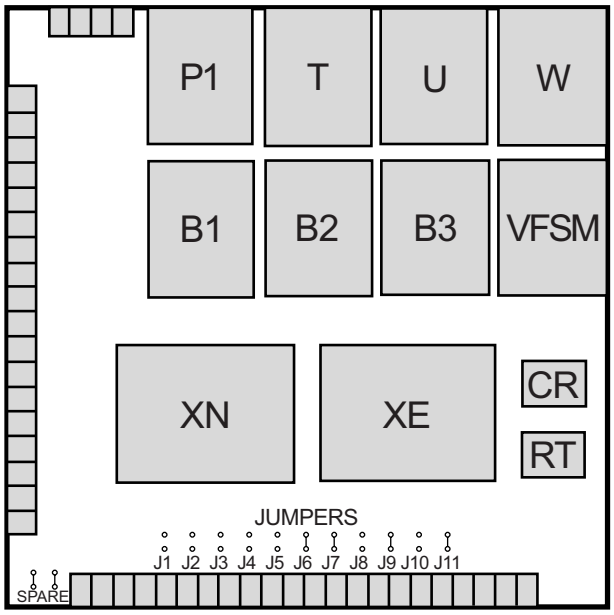


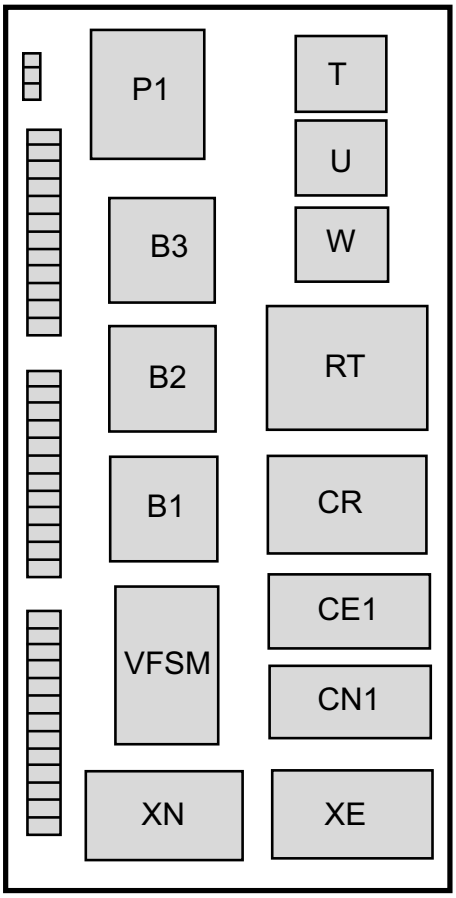
Figure 9

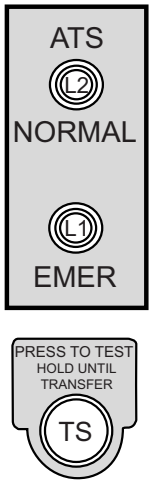
Appendix B - ZTSH Control Layout

Standard Control Panel (SSRCP)



JUMPER	CONNECTS POINTS	REMOVE WHEN ACCESSORIES USED
J1	23, 23A	B1
J2	23A, 23B	B2
J3	23B, 23C	B3
J4	23C, 23Z	JIN, TS, C/D
J5	23Z, 27	T, YN
J6	25, 25Z	T3, R4
J7	28, 28Z	S1, C, C/D
J8	28Z, 29	P1 & U
J9	33A, 33Y	ER1, 2, 3, J1E
J10	33Z, 37	W
J11	35, 35Z	R4, W3





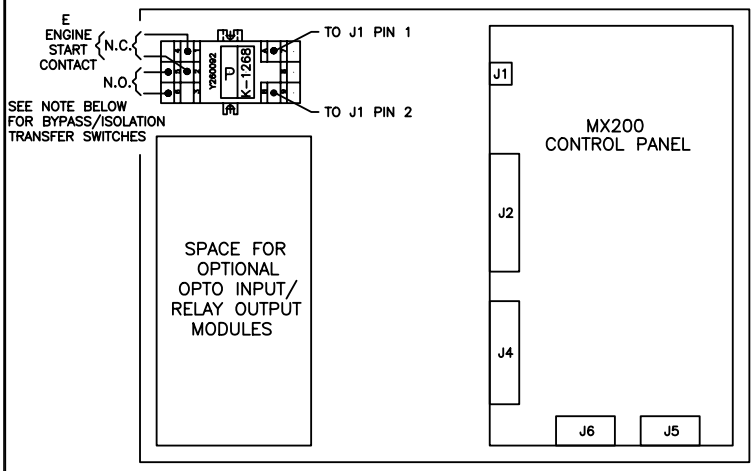
TAG	DESCRIPTION
L1 L2	ATS Emergency Position Indicator ATS Normal Position Indicator Lens (Normal) Lens (Emergency) Bulb Socket Emergency Bulb Normal Bulb
TS	Test Switch Operator, Momentary Contact Block N.C. Contact Mounting Base



GE Zenith Controls

A Division of GE Power Switching & Controls
General Electric Company
830 West 40th Street, Chicago, IL 60609 USA
773 299-6600, Fax: 773 247-7805
www.zenithcontrols.com

INSIDE VIEW OF CABINET DOOR



PILOT DEVICES

AUXILIARY CONTROL PANEL*

(12" X 18")
(305mm X 457mm)

NOTE: J2,J4 TERMINALS FOR ADDED OPTIONAL ACCESSORIES ONLY.

INTERCONNECT PLUGS

J1

1	
A	
B	
2	

FROM MX250 CONTROL PANEL TO P RELAY

J5

1								9
905	906	805	806	807	804	803	904	903
902	801	901	GND	908 **	808 **	907 ***	800	900
10								18

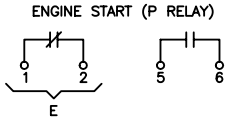
FROM MX150 CONTROL PANEL TO J5 PLUG ON RELAY/TRANSFORMER BOX

J6

1		3
26	36	35B **
25B **	25ZZ	25ZA
4		6

FROM MX150 CONTROL PANEL TO ATS POWER PANEL

CUSTOMER CONNECTIONS



RELAY	CONTACT	RATING
P	E	10 AMP @ 240 VAC 10 AMP @ 28 VDC
	A3, A4	20 AMP @ 125, 250 VAC

LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —○— WIRE ON TERMINAL BLOCK * OPTIONAL ** DELAY UNIT ONLY *** 3-PHASE SENSING ON EMERGENCY		FOR BYPASS/ISOLATION TRANSFER SWITCHES CONSULT STANDARD DIAGRAM FOR INTERCONNECTION OF ENGINE START P RELAY WITH TEST PLUG.

REVISIONS				
REV	ECN NO.	DATE	DFT	ENG
A	S-5757	ESTABLISH DWG.		
B	S-6612	11/04/96	SG	SB
C	S-6770	08/20/97	SG	SB

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION.
DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: MX200 INSIDE DOOR VIEW
JOB/MODEL: ZTS(D)L SERIES TRANSFER SWITCHES

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	-	50A-2000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SDW	JC	03/06/95	N/A	1 OF 1	C

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
G	S-7598 ADD R1 & R16	01/11/01	SB

ZTSL SERIES WITH MX200 MICROPROCESSOR-BASED CONTROL PANEL AUTOMATIC TRANSFER SWITCH (ATS) 40-4000 AMP

FOR USE ON EMERGENCY OR STANDBY SYSTEMS - RATED FOR TOTAL SYSTEM & MOTOR LOAD

A. LEGEND

MX Series Microprocessor-Based Control Panel

Standard Features:

DS..... Disconnect Switch
L1..... Emergency Position Light
L2..... Normal Position Light
L3..... Normal Available Light
L4..... Emergency Available Light

Relay/Transformer Box

CCE..... Control Relay, Close Emergency
CCN..... Control Relay, Close Normal
XE1,(XE2*)..... Control Transformer, Emergency
XN1,XN2..... Control Transformer, Normal

Power Panel

N1,2,3,(N)..... Normal Line _____
E1,2,3,(N)..... Emergency Line _____
T1,2,3,(N)..... Load Connections

BR..... Bridge Rectifier (400 Amp)
CA..... CN/CE Capacitor (200-260 Amp)
CE..... Emergency Transfer Operator (600-4000 Amp)
CE2..... Emergency Transfer Operator (4000 Amp)
CN..... Normal Transfer Operator (600-4000 Amp)
CN2..... Normal Transfer Operator (4000 Amp)
CNE..... Main Transfer Operator (400 Amp)
CN/CE..... Main Transfer Operator (40-260 Amp)
GND..... Ground
NB..... Neutral Bar (if required)
RE..... Bridge Rectifier, CE (1600-4000 Amp)
RN..... Bridge Rectifier, CN (1600-4000 Amp)
SCE,SCN..... CNE Limit Switches (400 Amp)
SE..... Emergency Position Limit Switch
SN..... Normal Position Limit Switch

Interconnect Plugs

J1, J2, J4, J5, J6, J7 and J8
J9 and J10..... For Panel Mounted Optional Accessories

B. OPERATION

When Normal line drops below the preset dropout point, the Normal voltage sensing circuit initiates the engine start circuit.

When Emergency line voltage and frequency reach the preset pickup point, the MX control panel energizes the CCE control relay to operate the main transfer operator. The load is now transferred to the Emergency line. The transfer switch is mechanically locked. SN limit switch awaits the next operation to Normal.

When Normal line voltage reaches the preset pickup point, the MX control panel energizes the CCN control relay to operate the main transfer operator. The load is now re-transferred back to the Normal line. The transfer switch is mechanically locked. SE limit switch awaits the next operation to Emergency.

Test Switch

The Test Switch simulates a normal line failure when activated.

To test, activate the Test Switch, thus allowing the transfer switch to transfer to the Emergency position. De-activate the Test Switch. The transfer switch will reset to the Normal position.

Testing at least once a month is recommended. For hospital emergency systems, test once a week.

Disconnect Switch

When the Disconnect Switch is placed in the INHIBIT position, the MX control panel is disengaged and transfer cannot take place.

* Optional 3 Phase Sensing on Emergency for ZTSL series only.

C. ACCESSORIES

Zenith Transfer Switch with MX200 microprocessor-based control panel has the capability for additional accessories. The following is a description of the optional accessories. Those options checked are supplied on this unit. See additional pages for complete legend and operation.

☐ A1 Auxiliary Contact, S.P.D.T., operates on Normal line failure.

☐ A1E Auxiliary Contact, S.P.D.T., operates on Emergency line failure.

☐ A3 Auxiliary Contact S.P.S.T. Emergency Position.

☐ A4 Auxiliary Contact S.P.S.T. Normal Position.

☐ A6 Motor Disconnect. To de-energize external motor control circuit 0-60 seconds (adjustable) prior to transfer in either direction.

☐ C Plant Exerciser. Automatically starts generator for selected time intervals.

☐ C/D Plant Exerciser. Automatically starts generator to run unloaded or simulate a power failure and starts generator to run under load.

☐ CTAP Chicago Transfer Alarm Panel.

☐ E Engine Start Contact.

☐ J1N Normal Under Frequency Sensing.

☐ J2E Emergency Over Frequency Sensing.

☐ J2N Normal Over Frequency Sensing.

☐ K Frequency Meter to indicate load frequency.

☐ M1 Ammeter. Single Phase.

☐ M2 Ammeter. Three Phase.

☐ M3 Voltmeter. Single Phase.

☐ M4 Voltmeter. Three Phase.

☐ N1 Running Time Meter.

☐ P Time Delay to Engine Start.

☐ Q2 Remote peak shave or area protection circuit. Energizing QR2 input will transfer to Emergency. Includes bypass for automatic return to Normal if Emergency line fails and Normal is present.

☐ Q3 Remote Inhibit transfer to Emergency Circuit. Energizing QR3 input allows transfer to Emergency.

☐ Q7 Remote Inhibit Transfer to Normal Circuit. Energizing QR7 input prevents transfer to Normal.

☐ R1 Overvoltage sensing on Normal, single phase or three phase.

☐ R8 Three Phase Over Voltage Sensing on Emergency.

☐ R15 Load Shed. Should the Emergency source become overloaded, a signal will be given to open out of Emergency position.

☐ R16 Phase Sequence Sensing.

☐ R17 Three Phase Under Voltage Sensing on Emergency.

☐ R50 In-Phase Monitor. Prevents transfer until two sources are in-phase.

☐ S1 Three Position Engine Control Selector Switch: "OFF" "AUTO" "START".

☐ S3 Prime Source Selector Switch. Allows choice of Source 1 or Source 2 as Primary Source.

☐ S5 Auto/Manual Return to Normal Selector Switch. In AUTO position, re-transfer to Normal is automatic after T timer times out. In MANUAL position, re-trasfer to Normal is upon depression of YN or if Emergency fails.

☐ S9 Remote Test Circuit. Energizing S9 input will perform a test operation. Includes bypass for automatic return to Normal if Emergency line fails and Normal is present.

☐ S12 Auto/Manual Transfer Selector Switch. In AUTO position, the transfer switch functions automatically as specified with drawing. In MANUAL position, the transfe switch will transfer by depression of YN (to Normal) or YE (to Emergency). Once transferred in MANUAL position, the transfer switch maintains the selected position, even if the selected source failed.

☐ S13 Commit/No-Commit Selector Switch. In "Commit" position, transfer switch will commit transfer to Emergency when Normal fails. In "No-Commit" position, transfer switch will not transfer to Emergency should Normal restore before time delay to Emergency times out.

☐ T Time Delay to Normal.

☐ T3/W3 Pre-signal Auxiliary Contact, S.P.S.T. Operates 0-60 seconds (adjustable) prior to transfer in either direction.

☐ U Time Delay to Engine Cool Down.

☐ W Time Delay to Emergency.

☐ YE Pushbutton Transfer to Emergency. Provides manual control of transfer to Emergency source. If time delay accessory W is supplied, pushbutton bypasses time delay for immediate transfer; otherwise, transfer to Emergency will be automatic after time delay.

☐ YN Pushbutton Transfer to Normal. Provides manual control of transfer to Normal source. If time delay accessory T is supplied, pushbutton bypasses time delay for immediate transfer; otherwise, transfer to Normal will be automatic after time delay.

☐ ZNET Communications provisions.

☐ Other: _____

NOTES:

1. ⚠ CAUTION: In using a 3 phase, 4 wire delta or open delta power supply (usually 120/240 volts, sometimes listed as 120/208 volts) with one leg having a grounded center tap, one line will be 160 to 208 volts to ground. When such a system is used it is necessary to connect the high leg to N2. DO NOT CONNECT 120 VOLT LOAD CIRCUIT TO THE HIGH LEG.
2. GROUNDING TERMINAL: A grounding terminal (GND) is provided. When installing open type switches connect this terminal to the metal enclosure or an equivalent earth ground.
3. ⚠ WARNING - TO ENSURE AGAINST SHOCK OR ACCIDENT HAZARD, DISCONNECT ALL SOURCES OF SUPPLY BEFORE SERVICING.
4. ON SINGLE PHASE UNITS WHERE THE EMERGENCY SOURCE IS A UTILITY LINE, CONNECT EMERGENCY LINE SO THAT MINIMUM VOLTAGE IS MEASURED FROM N1 TO E1.
5. ON SINGLE PHASE (2 POLE) UNITS, CENTER POLE IS NOT SUPPLIED. RIGHT-HAND POLE IS NOT SUPPLIED ON 400 AMP UNITS.

GE PROPRIETARY AND CONFIDENTIAL INFORMATION
This document is the property of General Electric ("GE") and contains proprietary information of GE. This document is loaned on the express condition that neither it nor the information contained therein shall be disclosed to others without the express written consent of GE Industrial Systems, and that the information shall be used by the recipient only as approved expressly by GE Industrial Systems. This document shall be returned to GE upon its request. This document may be subject to certain restrictions under U.S. export controls laws and regulations.

THIRD ANGLE PROJECTION

FOR ADDITIONAL INFO REFER TO
APPLIED PRACTICES
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
2 PL. DECIMALS ± .020
3 PL. DECIMALS ± .005
ANGLES ± 1°
FRACTIONS ± 1/64
FINISH ✓
AutoCad Generated

SIGNATURES		DATE
MODEL	SG	01/11/01
DETAIL		
CHECKED		
ENGRG	SB	01/11/01
MFG		
QUALITY		
ISSUED		

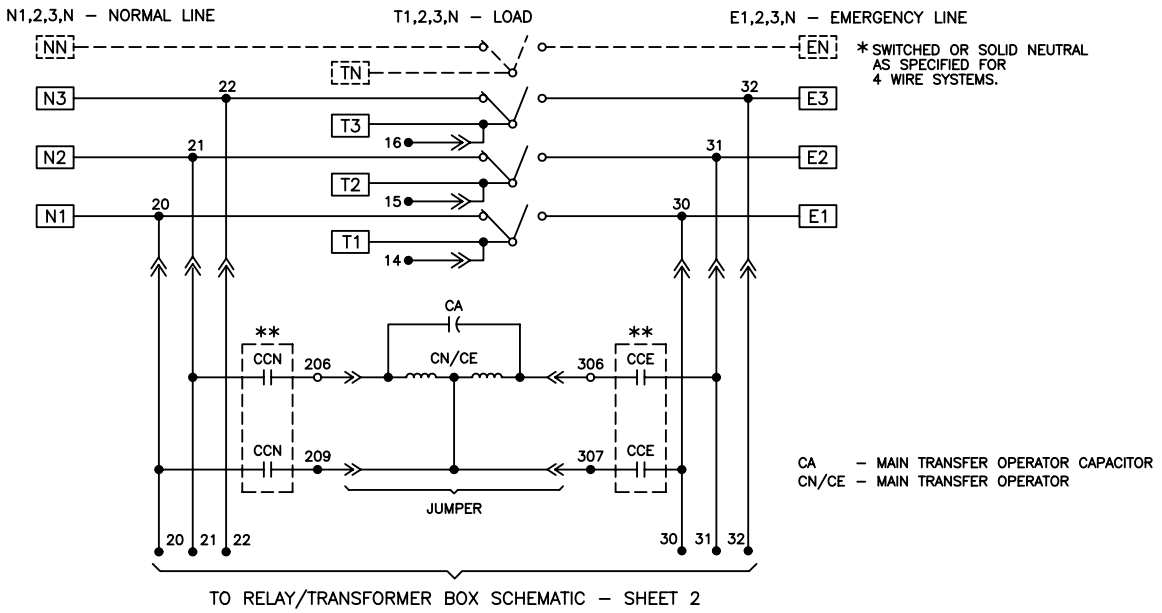
DRAWING FILE: 53a-0900-g-1.dwg
MODEL / ASSEMBLY FILE: ZTSL4-400 (40-4000 A)
CTQs ⊖ CRITICAL TO QUALITY CHARACTERISTIC

GE Zenith Controls

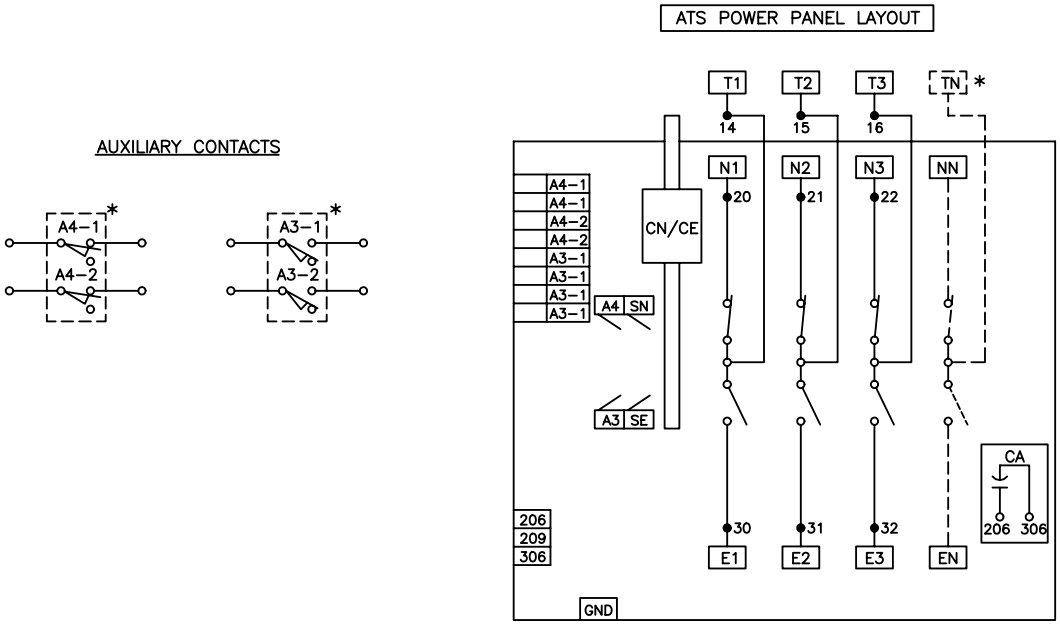
TITLE
LEGEND, OPERATION, AND ACCESSORIES

FIRST MADE FOR:
SIZE B | CAGE CODE | DWG NO 53A-0900
SCALE: - | SHEET 1 OF 1

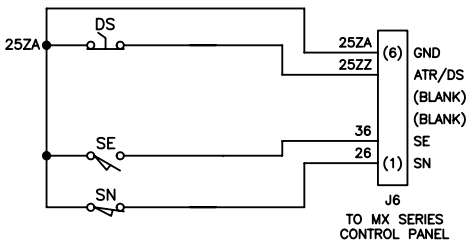
ATS POWER CIRCUIT SCHEMATIC



ATS POWER PANEL LAYOUT



LIMIT SWITCH SCHEMATIC



DS – DISCONNECT SWITCH ON MX200

SE – EMERGENCY POSITION LIMIT SWITCH

SN – NORMAL POSITION LIMIT SWITCH

LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —o— WIRE ON TERMINAL BLOCK —≫— WIRE IN INTERCONNECT PLUG * OPTIONAL ** LOCATED ON RELAY/ TRANSFORMER BOX	LEGEND, OPERATION, AND ACCESSORIES: 53A–0900 FOR PRODUCTION ONLY: R/T BOX AND PLUG– SHEET 2 MX200 CONTROLLER– 50A–2000	ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS				
REV	ECN NO.	DATE	DFT	ENG
A	S–5757	ESTABLISH DWG.		
B	S–6536	07/29/96	SG	SB
C	S–6849	01/28/98	RMC	SB
D	S–7179	06/25/99	DF	SB
E	S–7377	03/15/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

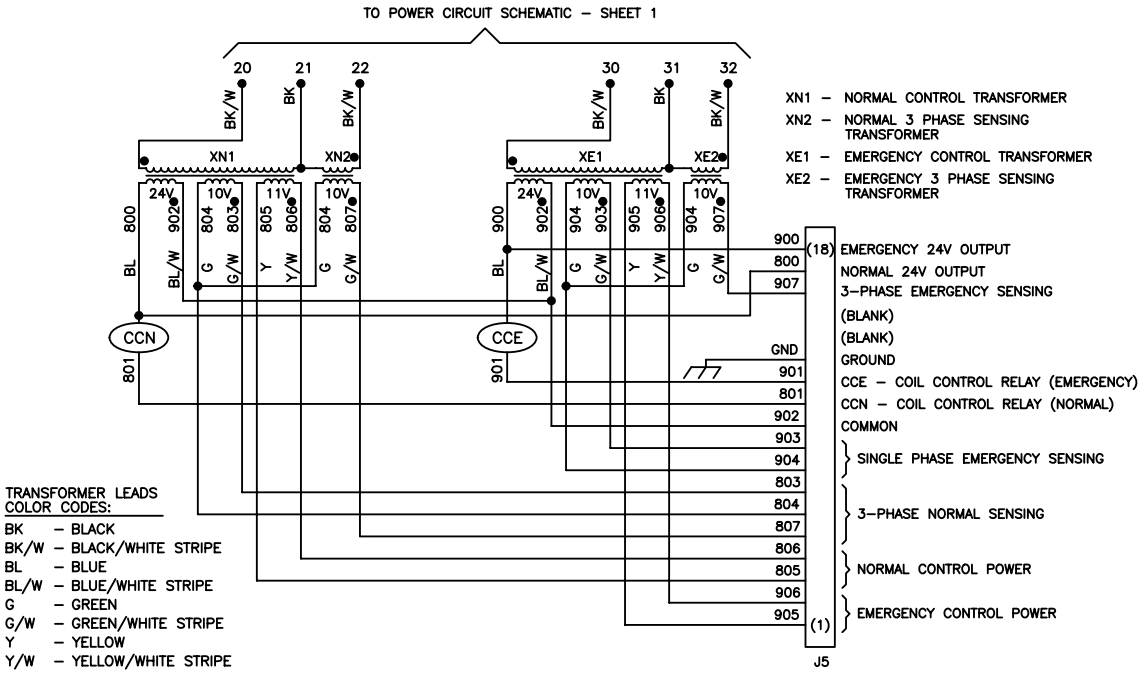
DWG TITLE: ATS POWER CIRCUIT & LIMIT SWITCHES

JOB/MODEL: ZTSL22–26 (225–260 AMP)

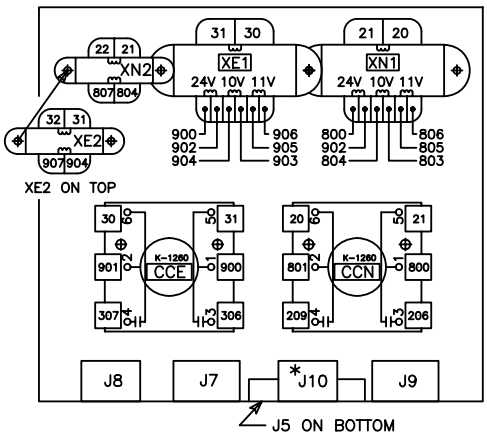
CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	53A–1000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SDW	JC	03/06/95	–	1 OF 2	E

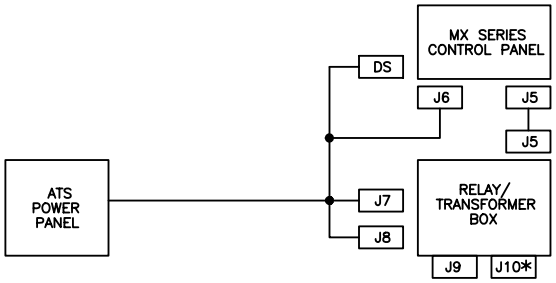
RELAY/TRANSFORMER BOX SCHEMATIC



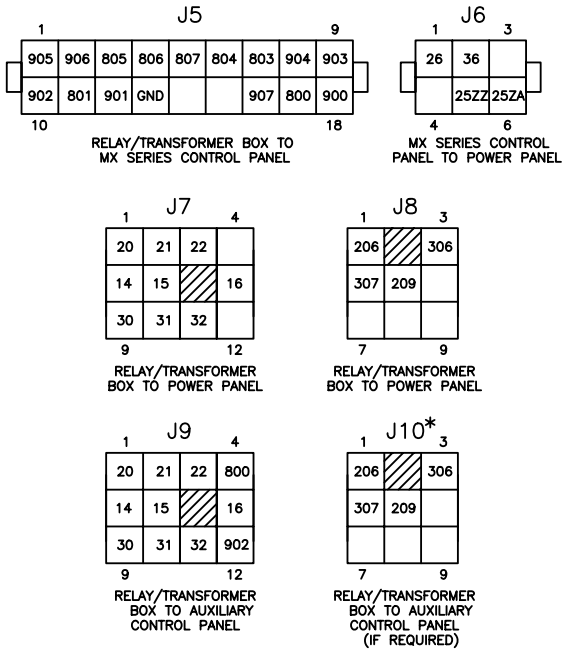
RELAY/TRANSFORMER BOX



INTERCONNECT PLUG DIAGRAM



INTERCONNECT PLUGS



LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION		
* OPTIONAL		

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S–5757	ESTABLISH DWG.		
B	S–6536	07/29/96	SG	SB
C	S–6849	01/28/98	RMC	SB
D	S–7179	06/25/99	DF	SB
E	S–7377	03/15/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

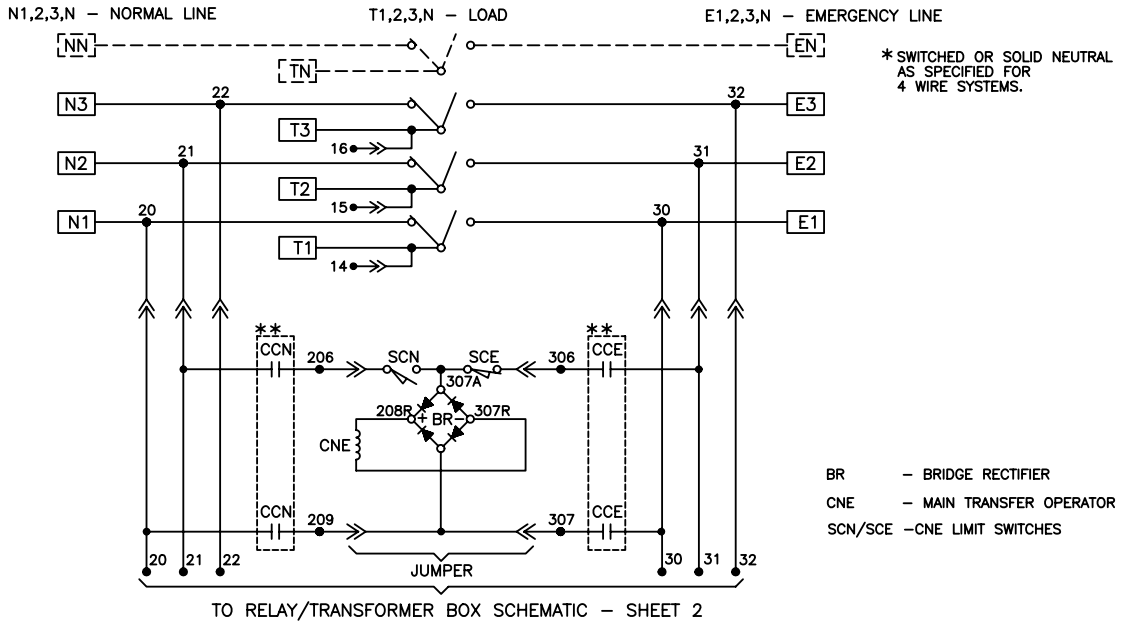
DWG TITLE: RELAY/XFR BOX & INTERCONNECT PLUGS

JOB/MODEL: ZTSL22–26 (225–260 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	53A–1000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SDW	JC	04/28/95	N/A	2 OF 2	E

ATS POWER CIRCUIT SCHEMATIC



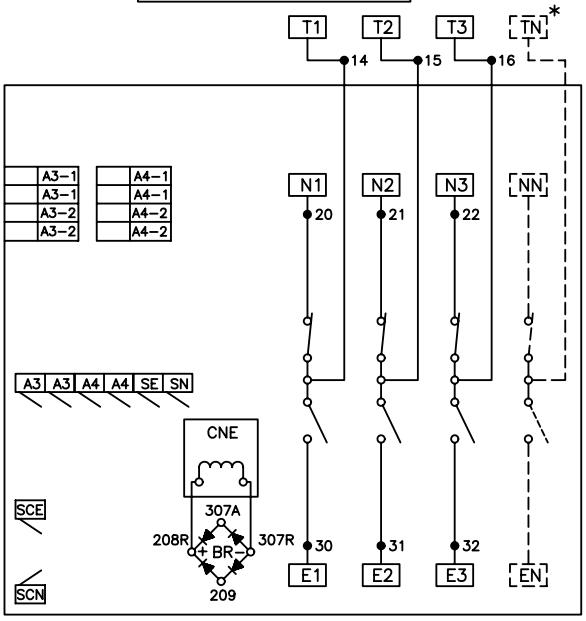
* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEMS.

BR – BRIDGE RECTIFIER

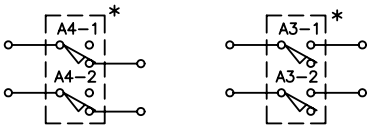
CNE – MAIN TRANSFER OPERATOR

SCN/SCE – CNE LIMIT SWITCHES

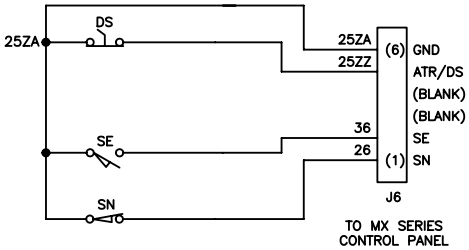
ATS POWER PANEL LAYOUT



AUXILIARY CONTACTS



LIMIT SWITCH SCHEMATIC



DS – DISCONNECT SWITCH ON MX200

SE – EMERGENCY POSITION LIMIT SWITCH

SN – NORMAL POSITION LIMIT SWITCH

LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —○— WIRE ON TERMINAL BLOCK —≫— WIRE IN INTERCONNECT PLUG * OPTIONAL ** LOCATED ON RELAY/ TRANSFORMER BOX	LEGEND, OPERATION, AND ACCESSORIES: 53A–0900 FOR PRODUCTION ONLY: R/T BOX AND PLUG– SHEET 2 MX200 CONTROLLER– 50A–2000	ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS					
REV	ECN NO.	DATE	DFT	ENG	
A	S–5757	ESTABLISH DWG.			
B	S–6536	07/29/96	SG	SB	
C	S–6849	01/28/98	RMC	SB	
D	S–7179	06/25/99	DF	SB	
E	S–7377	03/15/00	SG	MES	

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

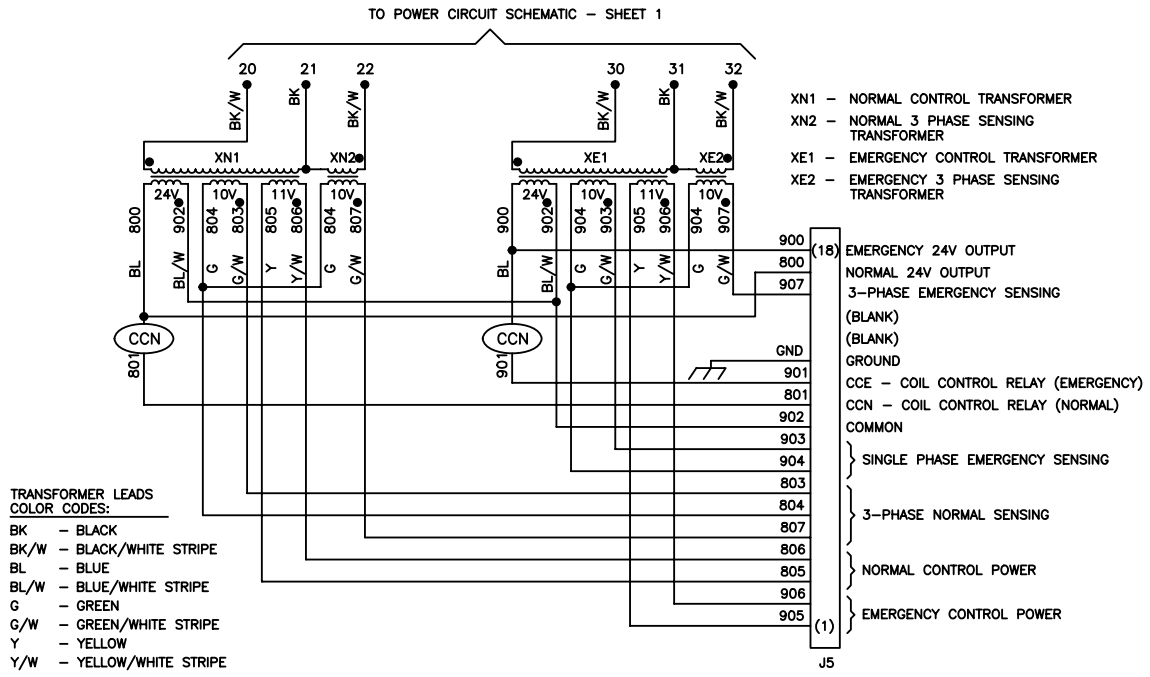
DWG TITLE: ATS POWER CIRCUIT & LIMIT SWITCHES

JOB/MODEL: ZTSL40 (400 AMP)

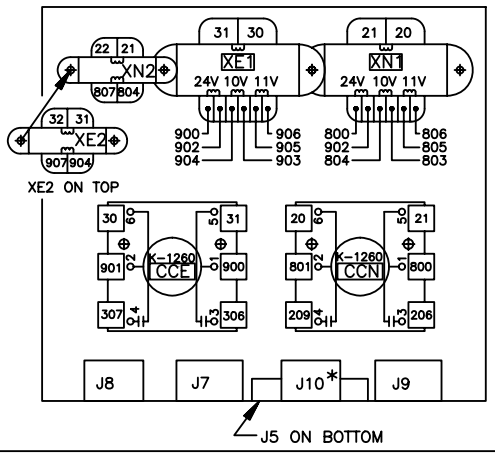
CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	53A–2000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
BRB	JC	05/29/95	–	1 OF 2	E

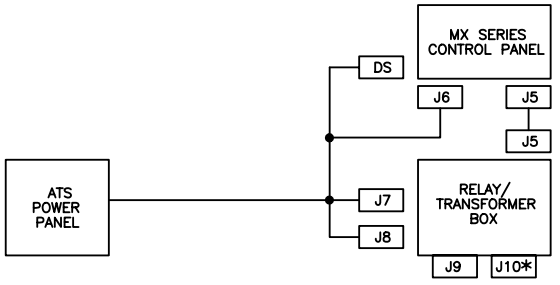
RELAY/TRANSFORMER BOX SCHEMATIC



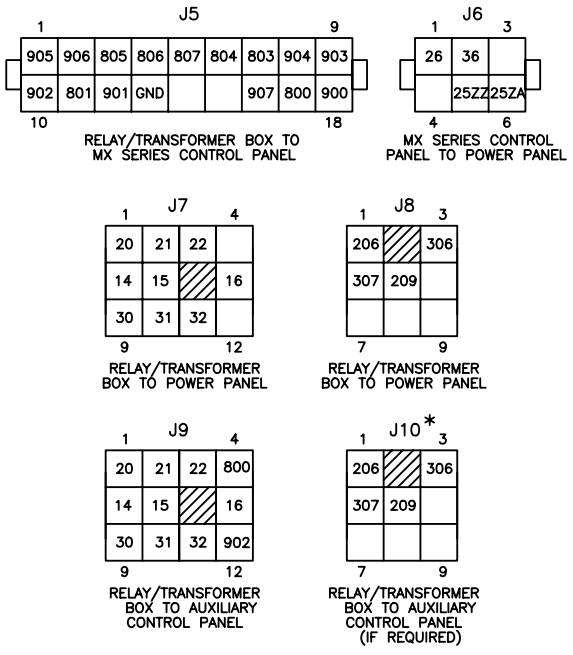
RELAY/TRANSFORMER BOX



INTERCONNECT PLUG DIAGRAM



INTERCONNECT PLUGS



LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION * OPTIONAL		

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S–5757	ESTABLISH DWG.		
B	S–6536	07/29/96	SG	SB
C	S–6849	01/28/98	RMC	SB
D	S–7179	06/25/99	DF	SB
E	S–7377	03/15/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

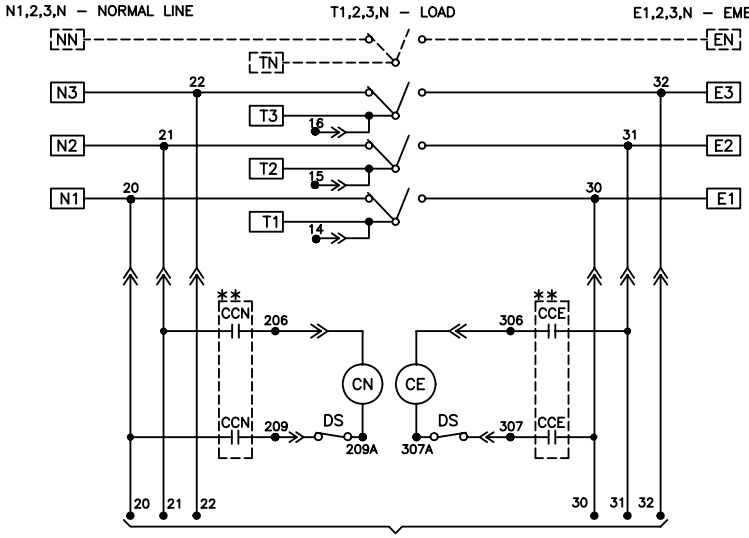
DWG TITLE: RELAY/XFR BOX & INTERCONNECT PLUGS

JOB/MODEL: ZTSL40 (400 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	53A–2000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
BRB	JC	05/29/95	N/A	2 OF 2	E

ATS POWER CIRCUIT SCHEMATIC

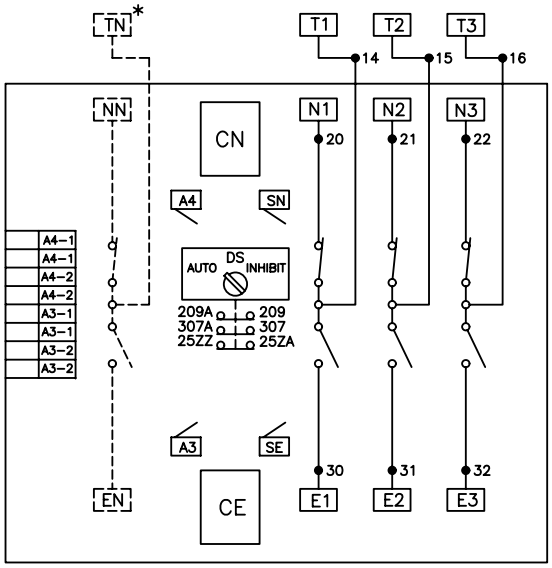


* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEMS.

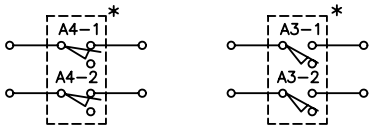
DS – DISCONNECT SWITCH
CN – NORMAL TRANSFER OPERATOR
CE – EMERGENCY TRANSFER OPERATOR

TO RELAY/TRANSFORMER BOX SCHEMATIC – SHEET 2

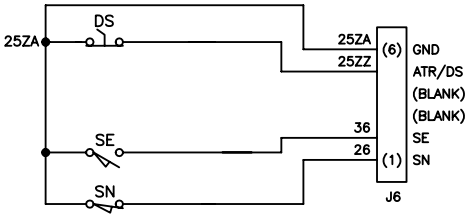
ATS POWER PANEL LAYOUT



AUXILIARY CONTACTS



LIMIT SWITCH SCHEMATIC



TO MX SERIES CONTROL PANEL

DS – DISCONNECT SWITCH
SE – EMERGENCY POSITION LIMIT SWITCH
SN – NORMAL POSITION LIMIT SWITCH

LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —○— WIRE ON TERMINAL BLOCK —≫— WIRE IN INTERCONNECT PLUG * OPTIONAL ** LOCATED ON RELAY/ TRANSFORMER BOX	LEGEND, OPERATION, AND ACCESSORIES: 53A-0900 FOR PRODUCTION ONLY: R/T BOX AND PLUG– SHEET 2 MX200 CONTROLLER– 50A-2000	ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS				
REV	ECN NO.	DATE	DFT	ENG
A	S-5757	ESTABLISH DWG.		
B	S-6536	07/29/96	SG	SB
C	S-6849	01/28/98	RMC	SB
–	–	08/03/99	RMC	MW
D	S-7377	03/15/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

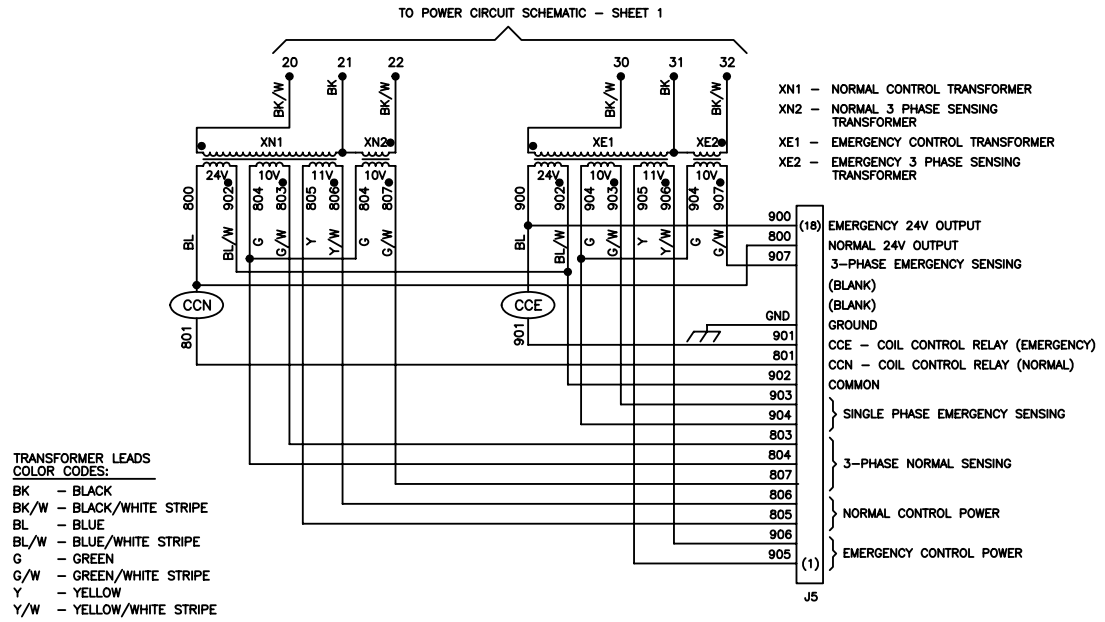
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: RELAY/XFR. BOX & INTERCONNECT PLUGS
JOB/MODEL: ZTSL60–120 (600–1200 AMP)

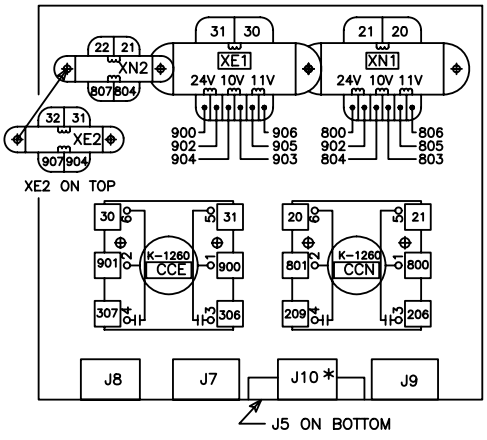
CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	—	53A–3000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
BRB	JC	05/29/95	—	1 OF 2	D

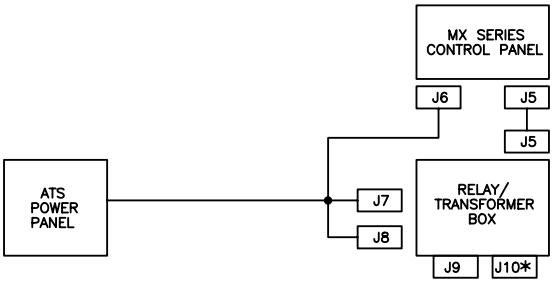
RELAY/TRANSFORMER BOX SCHEMATIC



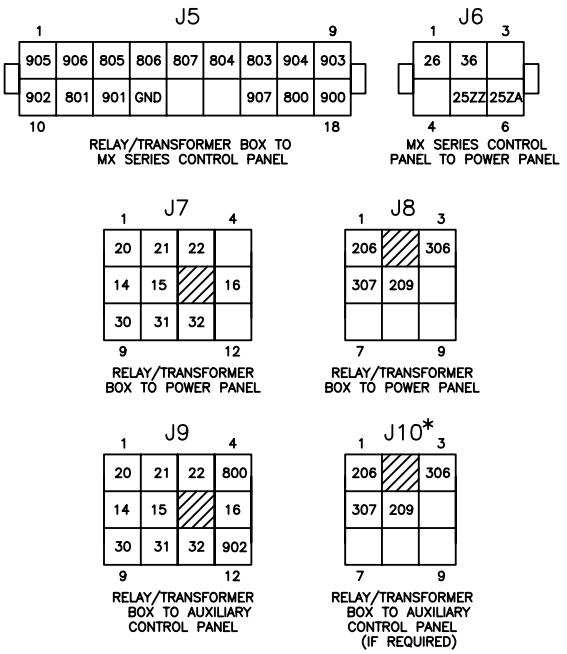
RELAY/TRANSFORMER BOX



INTERCONNECT PLUG DIAGRAM



INTERCONNECT PLUGS



LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION		
* OPTIONAL		

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S–5757	ESTABLISH DWG.		
B	S–6536	07/29/96	SG	SB
C	S–6849	01/28/98	RMC	SB
–	–	08/02/99	RMC	CMC
–	–	08/02/99	RMC	CMC
D	S–7377	03/15/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

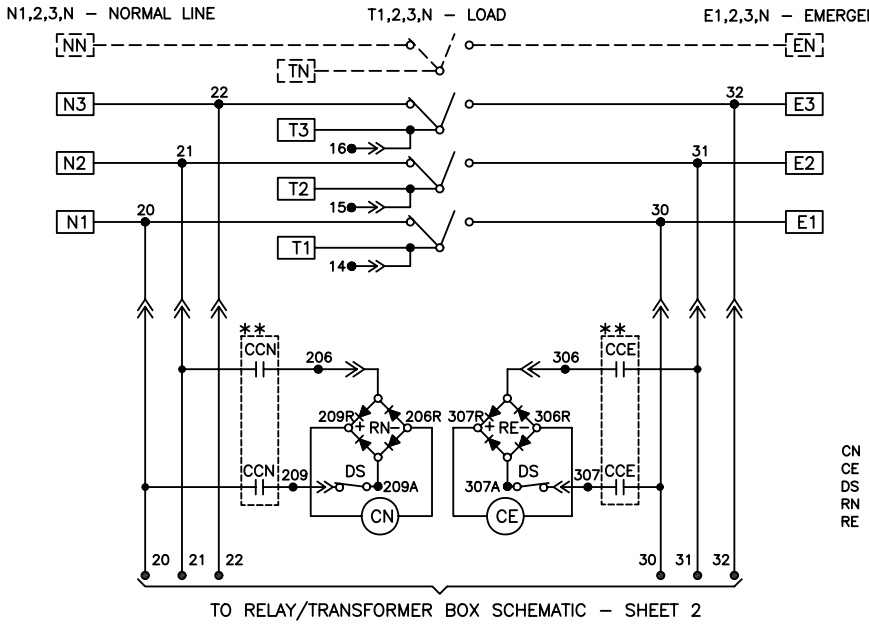
DWG TITLE: RELAY/XFR. BOX & INTERCONNECT PLUGS

JOB/MODEL: ZTSL60–120 (600–1200 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	53A–3000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
BRB	JC	05/29/95	–	2 OF 2	D

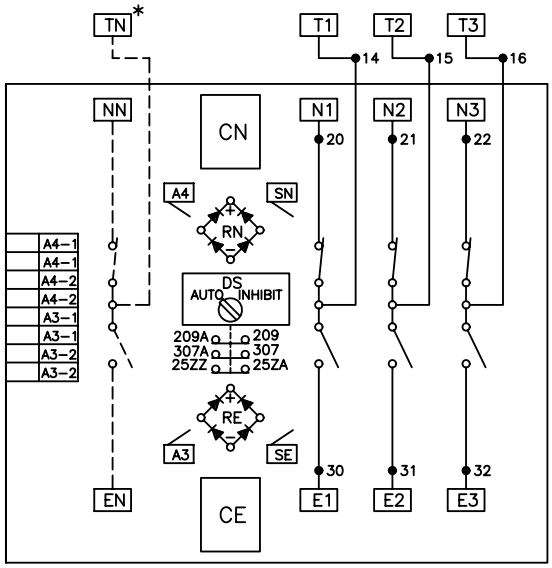
ATS POWER CIRCUIT SCHEMATIC



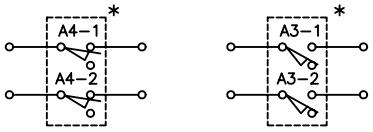
* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEMS.

CN – NORMAL TRANSFER OPERATOR
CE – EMERGENCY TRANSFER OPERATOR
DS – DISCONNECT SWITCH
RN – NORMAL BRIDGE RECTIFIER
RE – EMERGENCY BRIDGE RECTIFIER

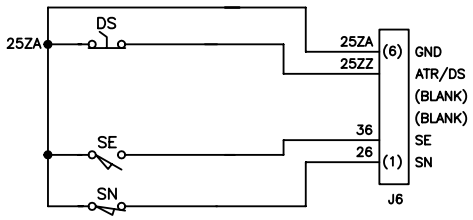
ATS POWER PANEL LAYOUT



AUXILIARY CONTACTS



LIMIT SWITCH SCHEMATIC



DS – DISCONNECT SWITCH
SE – EMERGENCY POSITION LIMIT SWITCH
SN – NORMAL POSITION LIMIT SWITCH

LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —○— WIRE ON TERMINAL BLOCK ≫ WIRE IN INTERCONNECT PLUG * OPTIONAL ** LOCATED ON RELAY/TRANSFORMER BOX	LEGEND, OPERATION, AND ACCESSORIES: 53A–0900 FOR PRODUCTION ONLY: R/T BOX AND PLUG–SHEET 2 MX200 CONTROLLER–50A–2000	ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS				
REV	ECN NO.	DATE	DFT	ENG
A	S–5757	ESTABLISH DWG.		
B	S–6536	07/29/96	SG	SB
C	S–6849	02/05/98	RMC	JPK
D	S–7353	02/23/00	SG	MES
E	S–7377	03/15/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

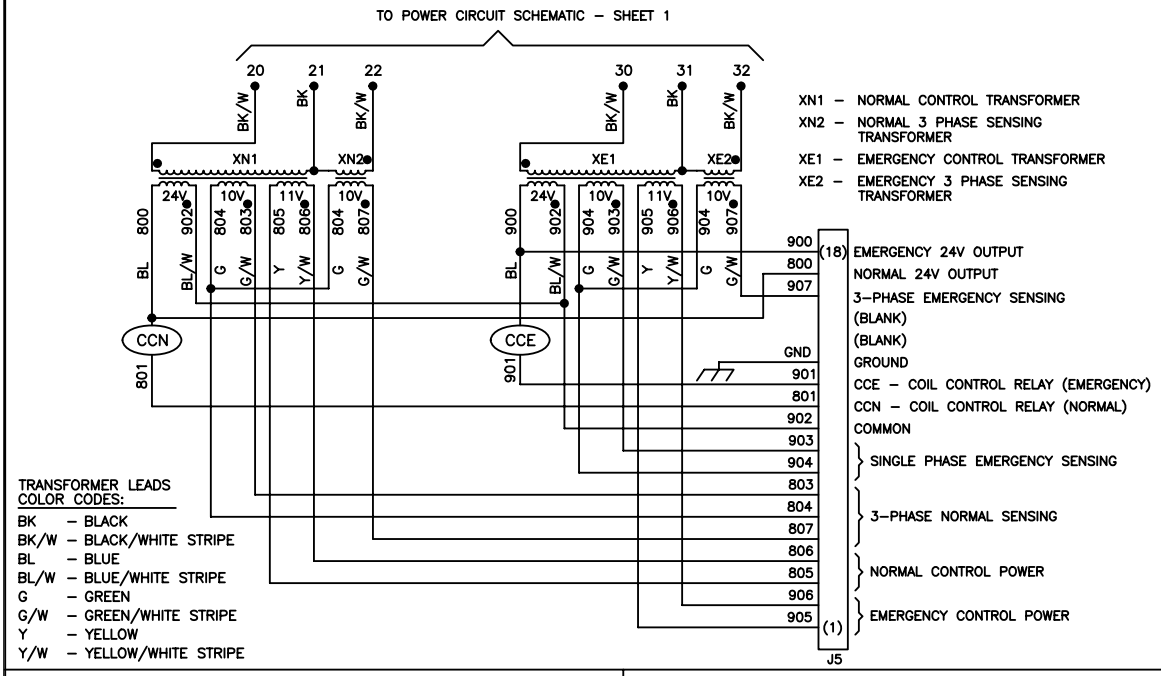
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: ATS POWER CIRCUIT & LIMIT SWITCHES
JOB/MODEL: ZTSL160–300 (1600–3000 AMP)

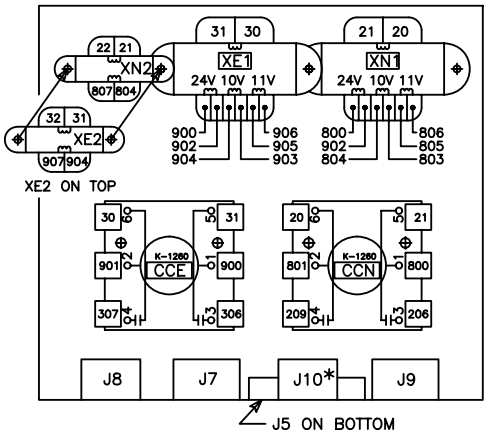
CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	53A–4000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
BRB	JC	05/29/95	–	1 OF 2	E

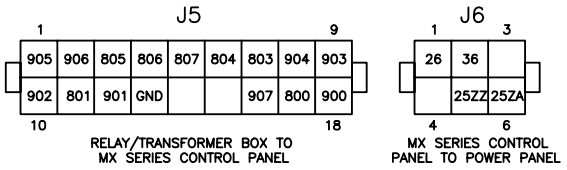
RELAY/TRANSFORMER BOX SCHEMATIC

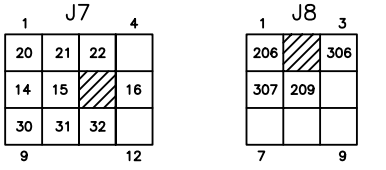


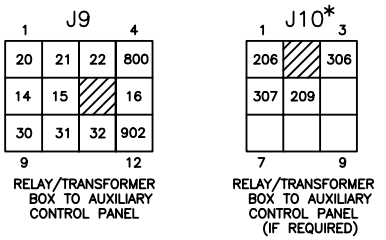
RELAY/TRANSFORMER BOX



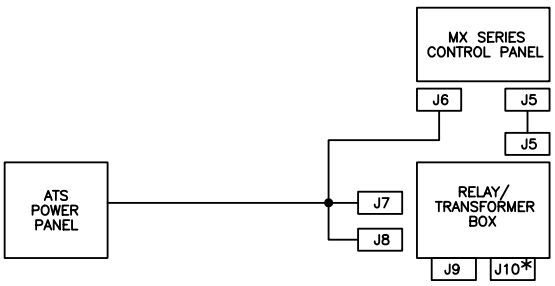
INTERCONNECT PLUGS







INTERCONNECT PLUG DIAGRAM



LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION		
* OPTIONAL		

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S–5757	ESTABLISH DWG.		
B	S–6536	07/29/96	SG	SB
C	S–6849	02/05/98	RMC	JPK
D	S–7353	02/23/00	SG	MES
E	S–7377	03/15/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: RELAY/XFR BOX & INTERCONNECT PLUGS

JOB/MODEL: ZTSL160–300 (1600–3000 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	53A–4000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SDW	JC	05/09/95	–	2 OF 2	E

ZENITH CONTROLS, INC.

OPERATION AND MAINTENANCE MANUAL
ZTSDL SERIES POWER PANEL
40 - 4000 AMPS



ISO 9001

53R-1001B
1/98

INTRODUCTION

Zenith Transfer Switches are used to provide a continuous source of power for lighting and other critical loads by automatically transferring from the normal source of power to an emergency source of power in the event that the normal source voltage falls below preset limits.

Voltage sensing and system control is performed via a state-of-the-art microcontroller located on the cabinet door. It is designed to give highly accurate control of the transfer switch system.

All Zenith transfer switches are designed for use on emergency or standby systems, and are rated for total system or motor loads. Transfer switches are UL Listed under Standard 1008 and CSA Certified under Standard C22.2 No. 178.

This manual provides information on the installation, operation and maintenance of the switch. In addition, a complete information package is supplied with each transfer switch which details the features and accessories provided on that switch. The information package should be kept in a readily accessible location to provide complete reference information on this critically important piece of equipment.

A complete information package includes the following:
- Operation and Maintenance Manual for Power Panel (this manual)
- Operation and Maintenance Manual for Control Panel*
- Specific schematics for each transfer switch*

* Supplied with the transfer switch

TABLE OF CONTENTS

Section I **INSTALLATION 1**
1. Equipment Inspection & Storage 1
2. Mounting 1
3. Power Connections 1
4. Control Connections 2
5. Final Equipment Inspection 3
6. Functional Test 3

Section II **OPERATION AND FEATURES 5**

Section III **MAINTENANCE AND TESTING 7**
1. Inspection and Cleaning 7
2. Servicing 7
3. Testing 7
4. Troubleshooting 8

SECTION I - INSTALLATION

⚠ DANGER

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Each Zenith transfer switch is factory wired and tested. A complete information package is furnished with each switch which includes:

a. Sequence of operation.
b. Description and operation of all accessories supplied.
c. Power panel connection diagram and schematic.
d. Description and identification of all customer field connections.

Installation of Zenith transfer switches includes:

a. Mounting the transfer switch cabinet.
b. Connection of all Normal, Emergency, and Load cables or bus bars.
c. Connection of external control circuits as required.

1. EQUIPMENT INSPECTION & STORAGE

Immediately inspect the transfer switch when received to detect any damage which may have occurred during transit. If damage is found or suspected, file claims as soon as possible with the carrier and notify the nearest Zenith representative.

Before installation, it is necessary to store the transfer switch in a clean dry place, protected from dirt and water. Provide ample air circulation and heat, if necessary, to prevent condensation.

Storage Temperature:
-30 C to + 65 C (-22 F to +149 F)

Operating Temperature (Ambient):
-20 C to +75 C (-4 F to +167 F) [40-260 Amps]
-20 C to +40 C (-4 F to +104 F) [400-4000 Amps]

Humidity:
5% to 95% (non-condensing)

2. MOUNTING

Adequate lifting means must be used to mount the transfer switch into place. The recommended method for moving the transfer switch using the lifting eyes and a spreader bar is illustrated in *Figure 1.* Enough room should be allowed to open the cabinet doors fully for inspection and servicing of the switch per NEC and local codes.

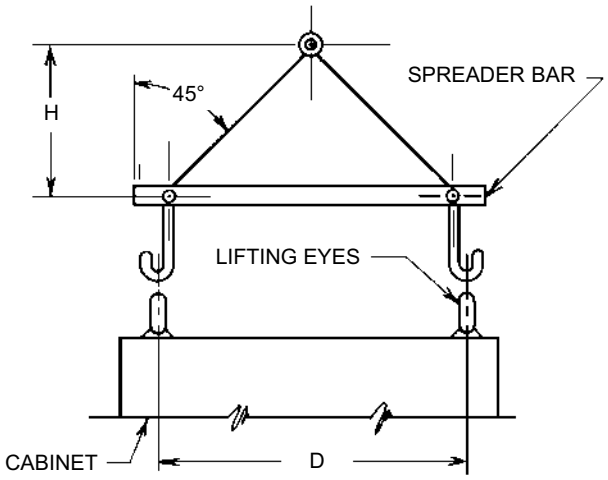


Figure 1

⚠ NOTICE

When lifting the switch using a spreader bar, height H must be equal to half of distance D.

Before drilling conduit entry holes or any accessory mounting holes, cover and protect the switch and control panel to prevent dirt and metal fragments from entering the mechanical and electrical components. Failure to do so may result in damage and malfunction of the switch.

3. POWER CONNECTIONS

Zenith transfer switches are supplied with UL listed solderless screw type terminals as standard for the Normal, Emergency and Load power connections. *Table 1* lists the number and sizes of cable lugs supplied as standard for each switch amp rating.

Connect the Normal, Emergency, and Load conductors to the clearly marked terminals on the transfer switch. Remove surface oxides from cables by cleaning with a wire brush. Verify that all connections are correct before tightening the lugs. All cable lug connections must be tightened to the proper torque values as shown in *Table 2.*

Do not run cables or wiring behind front-connected transfer switches.

In cases where the Normal, Emergency and Load connections are made to a rear connected bus bar, a compression washer, flat washer, and a minimum grade 5 bolt must be used and torqued to the values in *Table 3.*

Screw Type Terminals for External Power Connections				
Switch Size (Amps)	Normal, Emergency & Load Terminals		Fully Rated Neutral Bar (When Required)	
	Cable Per Pole	Range of Wire Sizes	Number of Cables	Range of Wire Sizes
40	1	#14 to 2 AWG	3	#14 to 1/0 AWG
80	1	#14 to 1/0 AWG	3	#14 to 1/0 AWG
100	1	#14 to 1/0 AWG	3	#14 to 1/0 AWG
150	1	#8 to 3/0 AWG	3	#6 AWG to 300 MCM
225	1	#6 AWG to 250 MCM	3	#6 AWG to 300 MCM
260	1	#6 AWG to 350 MCM	3	#6 AWG to 300 MCM
400	1	#4 AWG to 600 MCM	4	#2 AWG to 600 MCM
600	2	#2 AWG to 600 MCM	8	#2 AWG to 600 MCM
800	4	#2 AWG to 600 MCM	12	#2 AWG to 600 MCM
1000	4	#2 AWG to 600 MCM	12	#2 AWG to 600 MCM
1200	4	#2 AWG to 600 MCM	12	#2 AWG to 600 MCM
1600	Line and load terminals are located in rear and arranged for bus bar connection.		12	3/0 AWG to 750 MCM
2000			12	3/0 AWG to 750 MCM
3000			12	3/0 AWG to 750 MCM
4000			12	3/0 AWG to 750 MCM

Table 1

Tightening Torque for Lugs		
Socket Size Across Flats	Torque	
	Lb.-In.	Lb.-Ft.
1/8	45	4
5/32	100	8
3/16	120	10
7/32	150	12
1/4	200	17
5/16	275	23
3/8	375	31
1/2	500	42
9/16	600	50

Table 2

Tightening Torque for Bus Bars		
Bolt Size	Torque Bolt (Grade 5)	
	Lb.-In.	Lb.-Ft.
1/4-20	72	6
5/16-18	132	11
3/8-16	300	25
1/2-13	720	60

Table 3

4. CONTROL CONNECTIONS

A complete information package is furnished with each transfer switch including a complete connection diagram and schematic which details all necessary control circuit field connections.

The engine start control wires connect to the engine start relay terminals located to the left of the microcontroller. *Figure 2* shows the location of these terminals. The terminals are clearly identified by a label on the controller backplate. In the case of manual transfer switches, or in other applications not requiring the controller, clearly marked terminal blocks are provided in the upper left corner of the control panel for the engine start control wires.

Terminals for field connections to the A3 Emergency auxiliary contacts and the A4 Normal auxiliary contacts are also provided. These terminals are clearly marked and appear on the left side of the power panel. On 400 amp units these terminals appear on the disconnect switch bracket above the operator handle.

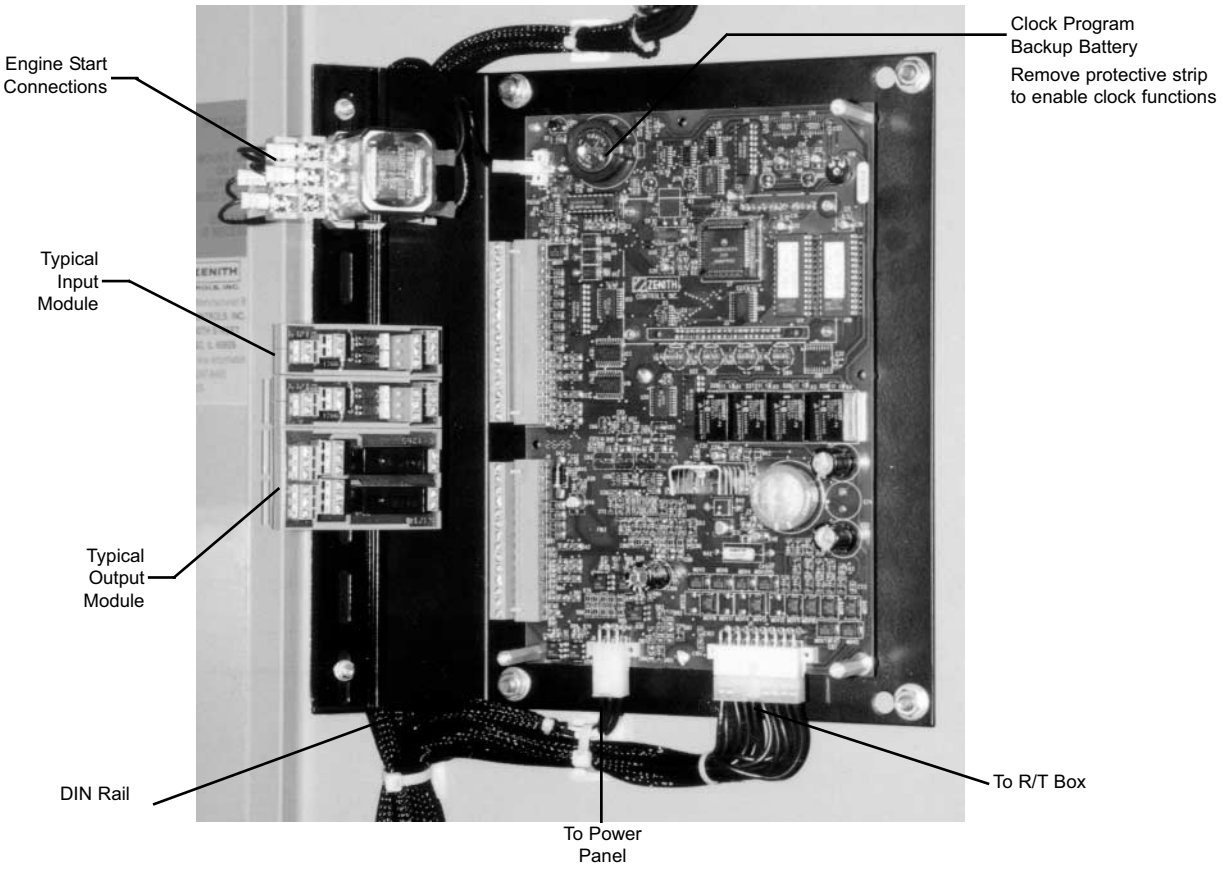


Figure 2

5. FINAL EQUIPMENT INSPECTION

Prior to energizing the transfer switch:

a. Remove any debris incurred due to shipment or installation. DO NOT use a blower since debris may become lodged in the electrical and mechanical components and cause damage. Use of a vacuum is recommended.
b. Verify that all cabled connections are correct and that phase rotation of both sources match.
c. Check engine start connections and verify the correct connection of all control wires.
d. Check settings of all timers and adjust as necessary. Also adjust any optional accessories as required. [See MX200 manual (50R-2000) for instructions on timer and option adjustments.] Remove battery protective strip to enable clock functions
e. Check the integrity of power connections by verifying actual lug torque values as specified in this manual.
f. Make sure that all covers and barriers are installed and properly fastened.

6. FUNCTIONAL TEST

The functional testing of the transfer switch consists of electrical tests described in this section. Before proceeding, refer to the information package supplied with the transfer switch. Read and understand all instructions and review the operation of all accessories provided. Before starting the operation test, check the equipment rating nameplate on the transfer switch to verify the correct system voltage. An example of the equipment rating nameplate is shown in *Figure 3*.

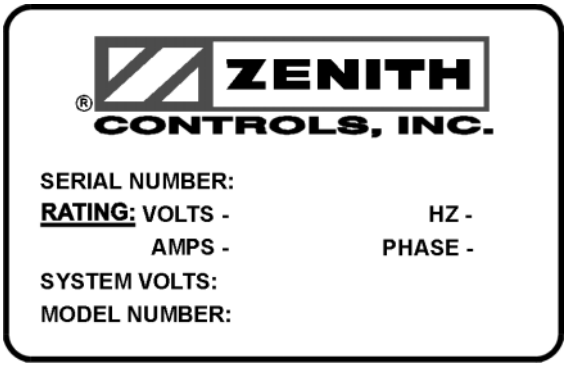


Figure 3

To begin the test, close the Normal source circuit breaker. The controller will illuminate the Normal Available LED if proper voltage is sensed. Verify the phase to phase voltages at the Normal line terminals.

Next, close the Emergency source breaker and start the engine generator. The Emergency Available LED indicator will illuminate when preset voltage and frequency levels are reached. Check the phase to phase voltages at the Emergency line terminals. Also, verify that the phase rotation of the Emergency source is the same as the phase rotation of the Normal source.

After the sources have been verified, shut down the engine generator, and put the generator starting control in the automatic position. Complete the visual inspection of the transfer switch, and close and lock the cabinet door.

Initiate the test by pressing the TEST button on the LCD keypad. The controller will then prompt for your access code. After entering the code, three test options will appear--**load, fast load and no load.**

Load test simulates Normal line failure, transferring the load to the Emergency source.

Fast load test presets all timer values to a maximum 30 seconds before transferring to the Emergency source. After completion of the test, all timers are reset to their original values.

No load test starts the generator but does not transfer the load to the Emergency source.

Press and hold the desired test option button until the switch transfers to the Emergency source (load test) or until the generator has been run for the desired amount of time (no load test). **Releasing the test button before transfer to Emergency will halt the test.**

When the test is initiated, the controller first starts the P timer. Upon completion of the P time delay, an engine start signal is sent. After the auxiliary source voltage and frequency have reached preset levels, the W timer begins its timing cycle. This timer is used to ensure the voltage and frequency of the auxiliary source has stabilized before transfer. If either the voltage or frequency

of the auxiliary source falls below preset limits the test will be terminated and the U timer (see below) will time out. If the voltage and frequency remain within preset limits for the duration of the W time delay, the transfer switch will open out of the Normal source to the Open position.

The switch will remain in the Open position for the duration of the DW timer. When the DW time has elapsed, the switch will complete its transfer by closing into the Emergency source.

Deactivating the test switch will initiate retransfer to the Normal source. After the time delay of the T timer the switch will open out of the Normal source to the Open position. The switch will remain in the Open position for the duration of the DT timer. After the time delay of the DT timer, the switch will complete its transfer by closing into the Normal source. Immediately after retransfer, the U timer begins its timing cycle. The U timer is the engine overrun timer which allows the engine generator to run unloaded for a preset cool down period.

NOTE: W and T timers are bypassed on the no load test.

For complete details of timer and voltage sensing operations, please refer to the MX200 Operation Manual (50R-2000)

⚠ NOTICE

A periodic test of the transfer switch under load conditions is recommended to insure proper operation. (See National Electric Code articles 700 and 70I.)

SECTION II - OPERATION AND FEATURES

Figure 4 is a typical schematic diagram of a Zenith transfer switch power panel. The information supplied with the transfer switch includes a schematic diagram and description of operation of all timers and settings.

System voltage is continuously monitored by the Zenith MX200 controller via the 10V secondary windings of transformers XN1 and XN2. Transfer of the load to the Emergency source begins automatically when the MX200 detects an out of range phase-to-phase voltage or a test sequence is begun (see Section I). Immediately the engine start timer P begins its timing cycle. The P time delay is provided to override momentary outages and to prevent nuisance starting of the engine generator (user set from 0-10 seconds). If the Normal source voltage returns to the correct range, the P timing cycle is reset, and the transfer sequence is stopped.

If the Normal source voltage does not restore above the pickup setting before the P time delay is completed, a starting signal is sent to the engine generator. The controller then senses the voltage and frequency of the Emergency source via the 10V secondary on transformer XE1 (and transformer XE2 if three phase Emergency sensing is supplied). When the voltage and frequency of the Emergency source reach preset values, timer W begins its timing cycle. The W time delay is used to ensure that the Emergency source has stabilized before beginning transfer to that source. After completion of the W timer, the switch will open out of the Normal source to the Open position. The DW timer then begins its timing cycle. This timer provides an adjustable transfer delay to the Emergency source as required (user set from 0-5 minutes).

When the DW time delay is completed, the CCE relay closes to energize the CE solenoid completing transfer of the load to the Emergency source.

The sequence for retransfer to the Normal source begins automatically when the controller detects that the voltage on all phases of the Normal source has been restored.

When the Normal source restores, retransfer is initiated by beginning the T timer. The T timer provides an adjustable delay to insure that the Normal source has stabilized before reconnection to the load (user set from 0-60 minutes). If the Normal source fails before the T time delay completes, the retransfer sequence is stopped.

After completion of the the T time delay, the switch will open out of the Emergency source to the Open position. In the Open position the DT timer begins its timing cycle. This timer provides an adjustable transfer delay to the Normal source as required (user set from 0-5 minutes). When the DT time delay is completed, the CCN relay closes to energize the CN solenoid completing transfer of the load to the Normal source. Also, the engine over-run timer U begins its timing cycle. This timer provides a period of time for the engine generator to run without load and cool down before shutdown (user set from 0-60 minutes).

For complete details of the timers and settings, please refer to the MX200 controller manual (50R-2000).

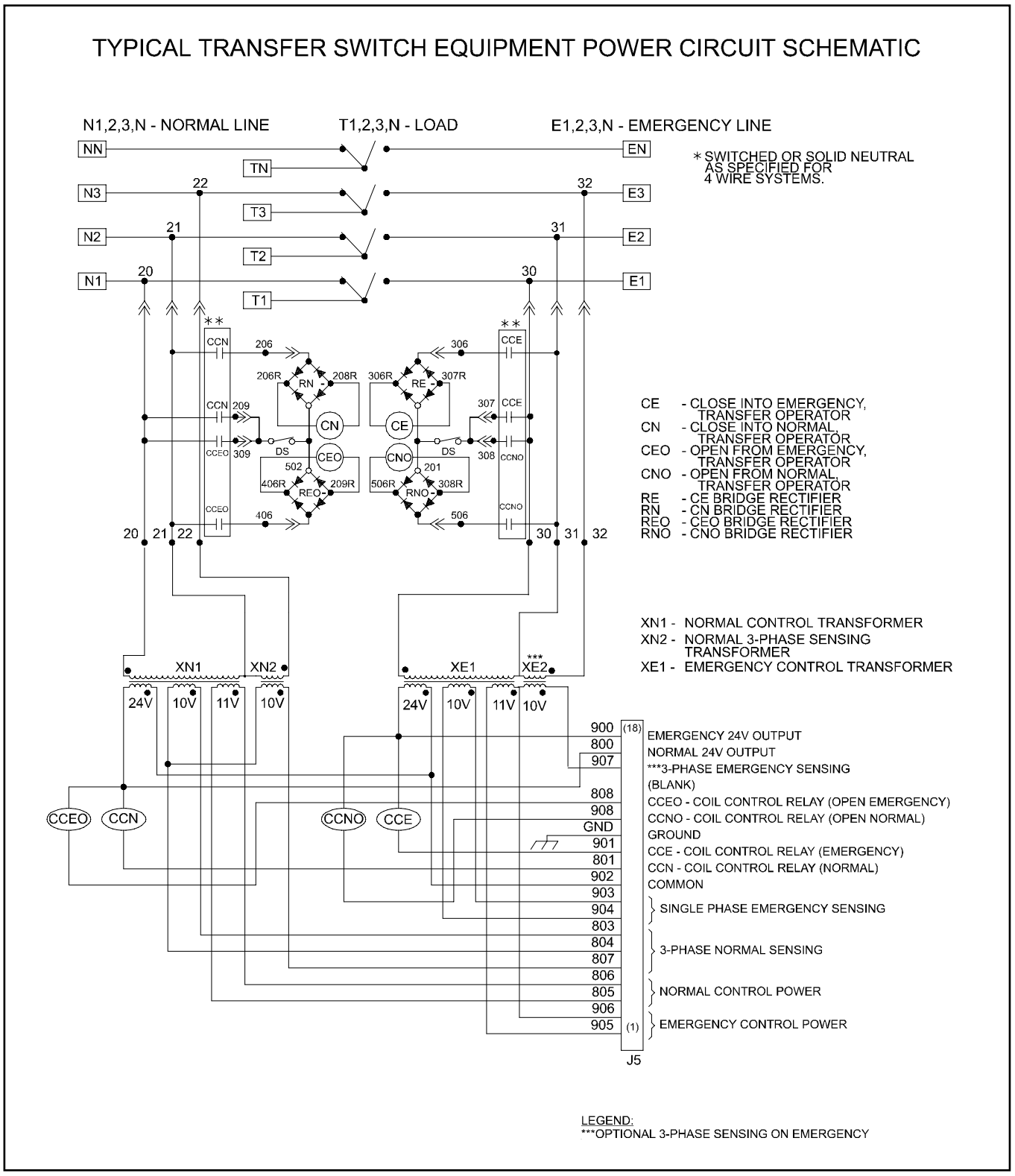

TYPICAL TRANSFER SWITCH EQUIPMENT POWER CIRCUIT SCHEMATIC
N1,2,3,N - NORMAL LINE
T1,2,3,N - LOAD
E1,2,3,N - EMERGENCY LINE
NN
TN
N3
T3
N2
T2
N1
T1
EN
E3
E2
E1
22
21
20
32
31
30
* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEMS.
CCN
CCEO
CCE
CCNO
206
306
206R
208R
306R
307R
RN
RE
CN
CE
CEO
CNO
209
309
307
308
DS
502
201
406R
209R
506R
308R
REO
RNO
406
506
CE - CLOSE INTO EMERGENCY, TRANSFER OPERATOR
CN - CLOSE INTO NORMAL, TRANSFER OPERATOR
CEO - OPEN FROM EMERGENCY, TRANSFER OPERATOR
CNO - OPEN FROM NORMAL, TRANSFER OPERATOR
RE - CE BRIDGE RECTIFIER
RN - CN BRIDGE RECTIFIER
REO - CEO BRIDGE RECTIFIER
RNO - CNO BRIDGE RECTIFIER
XN1
XN2
XE1
XE2
24V
10V
11V
10V
XN1 - NORMAL CONTROL TRANSFORMER
XN2 - NORMAL 3-PHASE SENSING TRANSFORMER
XE1 - EMERGENCY CONTROL TRANSFORMER
900
800
907
808
908
GND
901
801
902
903
904
803
804
807
806
805
906
905
(18)
(1)
J5
EMERGENCY 24V OUTPUT
NORMAL 24V OUTPUT
***3-PHASE EMERGENCY SENSING
(BLANK)
CCEO - COIL CONTROL RELAY (OPEN EMERGENCY)
CCNO - COIL CONTROL RELAY (OPEN NORMAL)
GROUND
CCE - COIL CONTROL RELAY (EMERGENCY)
CCN - COIL CONTROL RELAY (NORMAL)
COMMON
SINGLE PHASE EMERGENCY SENSING
3-PHASE NORMAL SENSING
NORMAL CONTROL POWER
EMERGENCY CONTROL POWER
LEGEND:
***OPTIONAL 3-PHASE SENSING ON EMERGENCY

Figure 4

SECTION III - MAINTENANCE AND TESTING

A preventive maintenance program will insure high reliability and long life for the transfer switch. The preventive maintenance program for the transfer switch should include the following items:

1. INSPECTION AND CLEANING

⚠ DANGER

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

De-energize all sources of power before doing any work on the transfer switch.

The switch should be inspected for any accumulation of dust, dirt, or moisture, and should be cleaned by vacuuming or wiping with a dry cloth or soft brush. DO NOT use a blower since debris may become lodged in the electrical and mechanical components and cause damage.

Remove the transfer switch barriers and check the condition of the contacts. Any surface deposits must be removed with a clean cloth (DO NOT USE EMERY CLOTH OR A FILE). If the contacts are pitted or worn excessively, they should be replaced. A general inspection of mechanical integrity should be made to include loose, broken or badly worn parts.

2. SERVICING

All worn or inoperative parts must be replaced using Zenith recommended replacement parts. Please refer to the Replacement Parts manual for specific part information and ordering procedures. Please contact the Zenith Technical Services Department for the Replacement Parts manual.

The operating mechanism of the transfer switch is lubricated with Lubriplate 105. The lubricant applied at the factory provides adequate lubrication for the lifetime of the switch. Should debris contaminate the mechanism, clean and apply additional Lubriplate.

Zenith can provide complete preventative maintenance services. Please contact the Zenith Technical Services Department for additional information.

3. TESTING

A manual operator handle is provided with the transfer switch for maintenance purposes only. Manual operation of the switch must be checked before it is operated electrically. Both power sources MUST be disconnected before manual operation of the switch. Insert the handle and operate the transfer switch between the Normal and Emergency positions. The transfer switch should operate smoothly without binding. Return the switch to the Normal position, remove the handle, and return it to the holder provided.

After completing the inspection, cleaning and servicing of the transfer switch, reinstall the switch cover, and close and lock the cabinet door. Reclose the circuit breakers feeding the utility and generator sources to the switch.

Complete testing as described on page 5 of this manual.

⚠ NOTICE

A periodic test of the transfer switch under load conditions is recommended to insure proper operation. (See National Electric Code articles 700 and 701.)

SECTION III - MAINTENANCE AND TESTING (Continued)

4. TROUBLESHOOTING

Before beginning any troubleshooting activity, refer to the information package supplied with the transfer switch and review the description and operation of all accessories supplied. Also refer to Section I of this manual, Installation.

a. Engine does Not START

Annunciation	Possible Cause	Corrective Action
EMERGENCY AVAILABLE LED off	Engine start wires not terminated properly	Check Engine Start Connections
	Generator in "off" position	Investigate why Engine Control Switch was turned off

b. Engine does Not STOP

Annunciation	Possible Cause	Corrective Action
LCD Display - "Delay to Engine Stop"	**U** timing cycle not complete	Check **U** Timer setting
NORMAL POSITION, and NORMAL and EMERGENCY AVAILABLE LEDs on, but U timer has timed out	Engine start wires not terminated correctly	Check Engine Start Connections
	Generator in "Manual"	Put generator in "Auto"

c. ATS Will Not Transfer To EMERGENCY

Annunciation	Possible Cause	Corrective Action
EMERGENCY AVAILABLE LED off	Emergency voltage or frequency not within acceptable parameters	Check Engine Start Connections, Generator Breaker, Generator output, and Engine Control Switch
None	Power supply connector unplugged	Plug in connector
LCD Display - "Mechanical Failure"	Limit switch or RT box connector unplugged	Plug in connector
LCD Display - "Delay to Emergency"	**DW** timing cycle not complete	Check **DW** Timer setting
LCD Display - "Delay to Open"	**W** timing cycle not complete	Check **W** Timer setting

d. ATS Will Not Transfer To NORMAL

Annunciation	Possible Cause	Corrective Action
NORMAL AVAILABLE LED off	Normal voltage or frequency not within acceptable parameters.	Check utility and utility breakers
None	Power supply connector unplugged	Plug in connector
LCD Display - "Mechanical Failure"	Limit switches or RT box connector unplugged	Plug in connector
LCD Display - "Delay to Normal"	**DT** timing cycle not complete	Check **DT** Timer setting
LCD Display - "Delay to Open"	**T** timing cycle not complete	Check **T** Timer setting

FIELD NOTES

Model Number _____

Serial Number _____

Date Shipped _____

Start-Up Date _____

Drawings Supplied _____

Test and Maintenance Notes			
Date	**Tested**	**Observations**	**Notes**

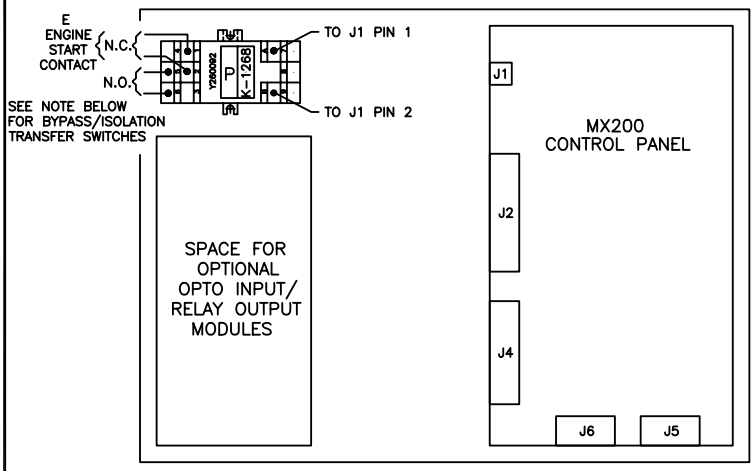


830 West 40th Street
Chicago, IL 60609 USA

Phone: 773 247-6400
FAX: 773 247-7805
www.zenithcontrols.com
E-Mail: zenith@zenithcontrols.com

© 1998 Zenith Controls, Inc.

INSIDE VIEW OF CABINET DOOR



PILOT DEVICES

AUXILIARY CONTROL PANEL*

(12" X 18")
(305mm X 457mm)

NOTE: J2,J4 TERMINALS FOR ADDED OPTIONAL ACCESSORIES ONLY.

INTERCONNECT PLUGS

J1

1	
A	
B	
2	

FROM MX250 CONTROL PANEL TO P RELAY

J5

1								9
905	906	805	806	807	804	803	904	903
902	801	901	GND	908 **	808 **	907 ***	800	900
10								18

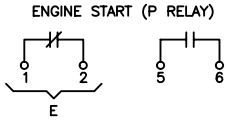
FROM MX150 CONTROL PANEL TO J5 PLUG ON RELAY/TRANSFORMER BOX

J6

1		3
26	36	35B **
25B **	25ZZ	25ZA
4		6

FROM MX150 CONTROL PANEL TO ATS POWER PANEL

CUSTOMER CONNECTIONS



RELAY	CONTACT	RATING
P	E	10 AMP @ 240 VAC 10 AMP @ 28 VDC
	A3, A4	20 AMP @ 125, 250 VAC

LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —○— WIRE ON TERMINAL BLOCK * OPTIONAL ** DELAY UNIT ONLY *** 3-PHASE SENSING ON EMERGENCY		FOR BYPASS/ISOLATION TRANSFER SWITCHES CONSULT STANDARD DIAGRAM FOR INTERCONNECTION OF ENGINE START P RELAY WITH TEST PLUG.

REVISIONS				
REV	ECN NO.	DATE	DFT	ENG
A	S-5757	ESTABLISH DWG.		
B	S-6612	11/04/96	SG	SB
C	S-6770	08/20/97	SG	SB

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION.
DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: MX200 INSIDE DOOR VIEW
JOB/MODEL: ZTS(D)L SERIES TRANSFER SWITCHES

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	-	50A-2000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SDW	JC	03/06/95	N/A	1 OF 1	C

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
G	s-7890 REVISED	09/16/02	GG KL

ZTSDL SERIES WITH MX200 MICROPROCESSOR-BASED CONTROL PANEL AUTOMATIC TRANSFER SWITCH (ATS) 40-4000 AMP

FOR USE ON EMERGENCY OR STANDBY SYSTEMS - RATED FOR TOTAL SYSTEM & MOTOR LOAD

A. LEGEND

MX Series Microprocessor-Based Control Panel Standard Features:

- DS ..... Disconnect Switch
- DT..... Time Delay to Normal
- DW..... Time Delay to Emergency
- L1..... Emergency Position Light
- L2..... Normal Position Light
- L3..... Normal Available Light
- L4..... Emergency Available Light

Relay/Transformer Box

- CCE.....CE/O Control Relay, Emergency
- CCEO.....CE/O Control Relay, Open Emergency
- CCN.....CN/O Control Relay, Normal
- CCNO.....CN/O Control Relay, Open Normal
- XE1, (XE2)... Control Transformer, Emergency
- XN1,XN2 ..... Control Transformer, Normal

Power Panel

- N1,2,3,(N) .... Normal Line _____
- E1,2,3,(N) .... Emergency Line _____
- T1,2,3,(N) .... Load Connections
- CE ..... Emergency Transfer Operator (600-4000 Amp)
- CE2 ..... Emergency Transfer Operator (4000 Amp)
- CEO ..... Transfer Operator, Open Emergency (600 - 4000 Amp)
- CEO2 ..... Transfer Operator, Open Emergency (4000 Amp)
- CE/O ..... Transfer Operator, Emergency (400 Amp)
- CN ..... Normal Transfer Operator (600-4000 Amp)
- CN2 ..... Normal Transfer Operator (4000 Amp)
- CNO ..... Transfer Operator, Open Normal (600 - 4000 Amp)
- CNO2 ..... Transfer Operator, Open Normal (4000 Amp)
- CN/CE ..... Transfer Operator, (40 - 260 Amp)
- CN/O ..... Transfer Operator, Normal (400 Amp)
- CN/CEO ..... Transfer Operator, Open Emergency (100-400 Amp)
- CE/CNO ..... Transfer Operator, Open Normal (100-400 Amp)
- GND ..... Ground
- NB ..... Neutral Bar (if required)
- RE ..... Bridge Rectifier, CE (600-4000 Amp)
- REO ..... Bridge Rectifier, CEO (600-4000 Amp)
- RN ..... Bridge Rectifier, CN (600-4000 Amp)
- RNO..... Bridge Rectifier, CNO (600-4000 Amp)
- RTE ..... Bridge Rectifier, CE/O (400 Amp)
- RTN ..... Bridge Rectifier, CN/O (400 Amp)
- SCE,SCEO ..... Limit Switches, CE/O (400 Amp)
- SCN,SCNO ..... Limit Switches, CN/O (400 Amp)
- SE ..... Emergency Position
- SEO ..... Emergency Open Position
- SN ..... Normal Position
- SNO..... Normal Open Position

Interconnect Plugs

- J1, J2, J4, J5, J6, J7, and J8
- J9 and J10..... For Panel Mounted Optional Accessories

B. OPERATION

When Normal line drops below the preset dropout point, the Normal voltage sensing circuit initiates the engine start circuit.

When Emergency line voltage and frequency reach the preset pickup point, the MX control panel energizes the CCNO control relay to operate the transfer operator. The load is now transferred to open position. After the set time delay, the MX control panel energizes CCE control relay to operate the transfer operator. The load is now transferred to the Emergency line. The transfer switch is mechanically locked. SN limit switch awaits the next operation to Normal.

When the Normal line voltage reaches the preset pickup point, the MX control panel energizes the CCEO control relay to operate the transfer operator. The load is now transferred to open position. After the set time delay, the MX control panel energizes CCN control relay to operate the transfer operator. the load is now re-transferred back to the Normal line. The transfer switch is mechanically locked. SE limit switch awaits the next operation to Emergency.

Test Switch

The Test Switch simulates a normal line failure when activated. To test, activate the Test Switch allowing the transfer switch to transfer to the EMERGENCY position. De-activate the Test Switch. The transfer will reset to the NORMAL position. Testing at least once a month is recommended. For hospital emergency systems, test once a week.

Disconnect Switch

When the Disconnect Switch is placed in the INHIBIT position the MX control panel is disengaged and transfer cannot take place.

* Optional 3 Phase Sensing on Emergency for ZTSDL series only.

C. ACCESSORIES

Zenith Transfer Switch with MX200 microprocessor-based control panel has the capability for additional accessories. The following is a description of the optional accessories. Those options checked are supplied on this unit. See additional pages for complete legend and operation.

- ☐ A1 Auxiliary contact, S.P.D.T., operates on normal line failure.
- ☐ A1E Auxiliary contact, S.P.D.T., operates on emergency line failure.
- ☐ A3 Auxiliary Contact S.P.S.T. Emergency Position
- ☐ A4 Auxiliary Contact S.P.S.T. Normal Position.
- ☐ A6 Motor disconnect. To de-energize external motor control circuit 0-60 seconds (adjustable) prior to transfer in either direction.
- ☐ C Plant Exerciser. Automatically starts generator for selected time intervals.
- ☐ C/D Plant Exerciser. Automatically starts generator to run unloaded or simulate a power failure and starts generator to run under load.
- ☐ CTAP Chicago Transfer Alarm Panel.
- ☐ E Engine Start Contact.
- ☐ J1N Normal Under Frequency Sensing.
- ☐ J2E Emergency Over Frequency Sensing.
- ☐ J2N Normal Over Frequency Sensing.
- ☐ K Frequency Meter to indicate load frequency.
- ☐ M1 Ammeter. Single Phase.
- ☐ M2 Ammeter. Three Phase.
- ☐ M3 Voltmeter. Single Phase.
- ☐ M4 Voltmeter. Three Phase.
- ☐ N1 Running Time Meter.
- ☐ P Time Delay to Engine Start.
- ☐ Q2 Remote peak shave or area protection circuit. Energizing QR2 input will transfer to Emergency. Includes bypass for automatic return to Normal if Emergency line fails and Normal is present.
- ☐ Q3 Remote Inhibit transfer to Emergency Circuit. Energizing QR3 input allows transfer to Emergency.
- ☐ Q7 Remote Inhibit transfer to Normal Circuit. Energizing QR7 input prevents transfer to Normal.
- ☐ R1 Overvoltage sensing on normal single phase or three phase.
- ☐ R8 Three Phase Over Voltage Sensing on Emergency.
- ☐ R15D Load Shed. Should the Emergency source become overloaded, a signal will be given to switch to open position.
- ☐ R16 Phase sequence sensing.
- ☐ R17 Three Phase Under Voltage Sensing on Emergency.
- ☐ S1 Three Position Engine Control Selector Switch: "OFF" "AUTO" "START"
- ☐ S3 Prime Source Selector Switch. Allows choice of Source 1 or Source 2 as Primary Source.
- ☐ S5 Auto/Manual return to Normal selector switch. In AUTO position, re-transfer to Normal is automatic after T timer times out. In MANUAL position, re-transfer to Normal is upon depression of YN or if Emergency fails.
- ☐ S9 Remote Test Circuit. Energizing S9 input will perform a test operation. Includes bypass for automatic return to Normal if Emergency line fails and Normal is present.
- ☐ S12 Auto/manual-transfer selector switch. In AUTO position the transfer switch functions automatically as specified with drawing. In MANUAL position, the transfer switch will transfer by depression of YN (to Normal) or YE (to Emergency). Once transferred in MANUAL position, the transfer switch maintains the selected position, even if the selected source failed.
- ☐ S13 Commit/No-Commit Selector Switch. In "Commit" position, Transfer Switch will commit transfer to Emergency when normal fails. In "No-Commit" position, Transfer Switch will not transfer to Emergency should normal restore before time delay to Emergency times out.
- ☐ T Time Delay to Normal
- ☐ T3/W3 Presignal auxiliary Contact, S.P.S.T: Operates 0-60 seconds (adjustable) prior to transfer in either direction.
- ☐ U Time Delay to Engine Cool Down
- ☐ W Time Delay to Emergency
- ☐ YE Pushbutton transfer to Emergency. Provides manual control of transfer to Emergency source. If time delay accessory W is supplied pushbutton bypasses time delay for immediate transfer; otherwise, transfer to Emergency will be automatic after time delay.
- ☐ YN Pushbutton, Retransfer to Normal. Provides manual control of retransfer to Normal source. If time delay accessory T is supplied, pushbutton bypasses time delay for immediate retransfer; otherwise, retransfer to Normal will be automatic after time delay.
- ☐ ZNET Communications provisions.
- ☐ Other: _____

NOTES:

1. ⚠ CAUTION: In using a 3 phase, 4 wire delta or open delta power supply (usually 120/240 volts, sometimes listed as 120/208 volts) with one leg having a grounded center tap, one line will be 160 to 208 volts to ground. When such a system used it is necessary to connect the high leg to N2. DO NOT CONNECT 120 VOLT LOAD CIRCUIT TO THE HIGH LEG.
2. GROUNDING TERMINAL: A grounding terminal (GND) is provided. When installing open type switches connect this to the metal enclosure or conduit.
3. ⚠ WARNING - TO ENSURE AGAINST SHOCK OR ACCIDENT HAZARD, DISCONNECT ALL SOURCES OF SUPPLY BEFORE SERVICING.
4. ON SINGLE PHASE UNITS WHERE THE EMERGENCY SOURCE IS A UTILITY LINE, CONNECT EMERGENCY LINE SO THAT MINIMUM VOLTAGE IS MEASURED FROM N1 TO E1.
5. ON SINGLE PHASE (2 POLE) UNITS, CENTER POLE IS NOT SUPPLIED. RIGHT-HAND POLE IS NOT SUPPLIED ON 400 AMP UNITS.

GE PROPRIETARY AND CONFIDENTIAL INFORMATION
This document is the property of General Electric ("GE") and contains proprietary information of GE. This document is loaned on the express condition that neither it nor the information contained therein shall be disclosed to others without the express, written consent of GE Industrial Systems, and that the information shall be used by the recipient only as approved expressly by GE Industrial Systems. This document shall be returned to GE upon its request. This document may be subject to certain restrictions under U.S. export controls laws and regulations.

THIRD ANGLE PROJECTION

FOR ADDITIONAL INFO REFER TO
APPLIED PRACTICES
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
2 PL. DECIMALS ± .020
3 PL. DECIMALS ± .005
ANGLES ± 1°
FRACTIONS ± 1/64
FINISH

SIGNATURES		DATE
MODEL	SG	01/11/01
DETAIL		
CHECKED		
ENGRG	KL	
MFG		
QUALITY		
ISSUED		

DRAWING FILE: 53a-0900d-g-1.dwg
MODEL / ASSEMBLY FILE: ZTSDL4-400 (40-4000A)
AutoCad Generated
CTQs ⊖ CRITICAL TO QUALITY CHARACTERISTIC

GE Zenith Controls

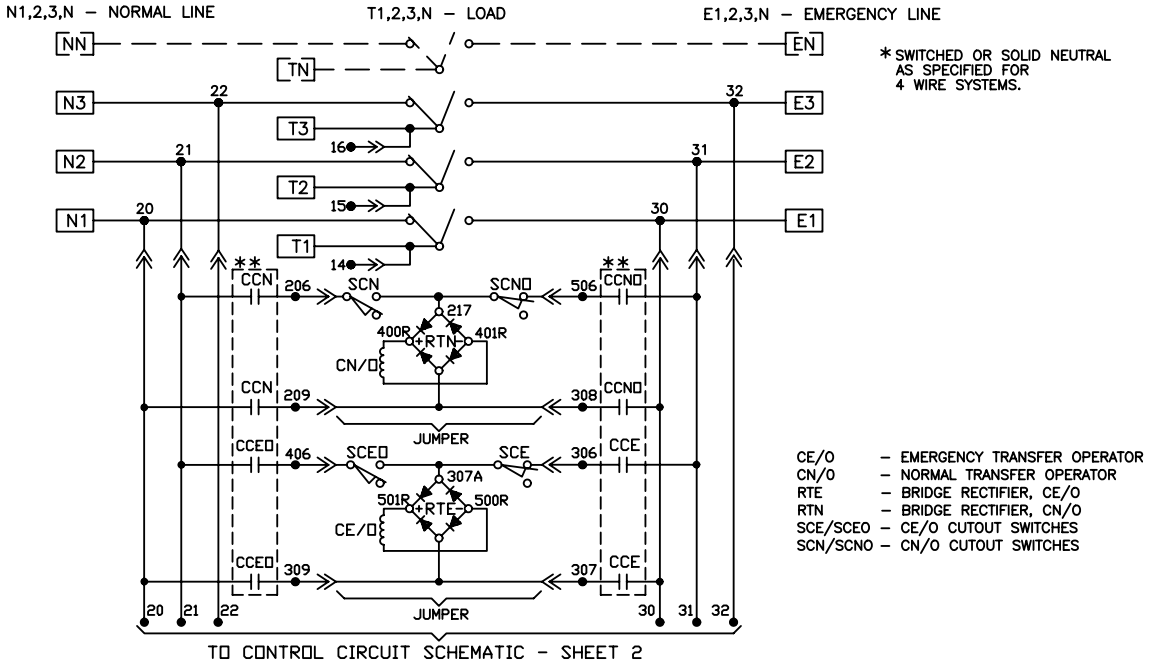
TITLE
LEGEND, OPERATION, AND ACCESSORIES

FIRST MADE FOR:

SIZE	CAGE CODE	DWG NO
B		53A-0900D

SCALE: - SHEET 1 OF 1

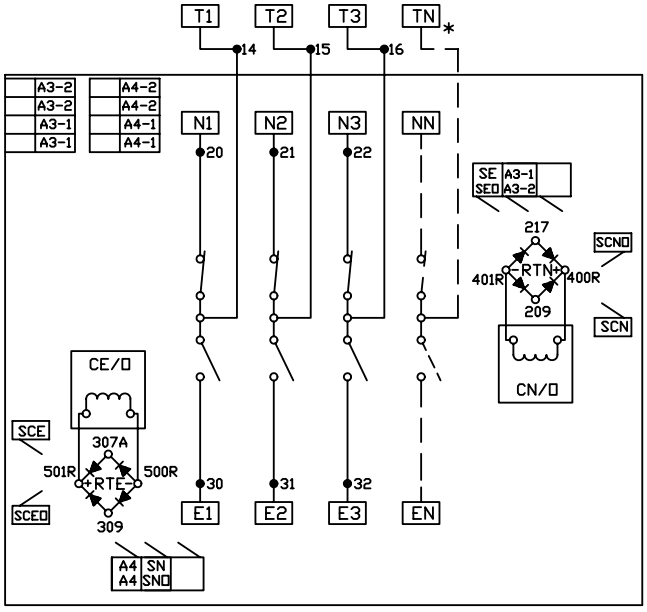
ATS POWER CIRCUIT SCHEMATIC



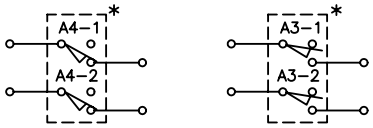
* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEMS.

CE/O – EMERGENCY TRANSFER OPERATOR
CN/O – NORMAL TRANSFER OPERATOR
RTE – BRIDGE RECTIFIER, CE/O
RTN – BRIDGE RECTIFIER, CN/O
SCE/SCEO – CE/O CUTOUT SWITCHES
SCN/SCNO – CN/O CUTOUT SWITCHES

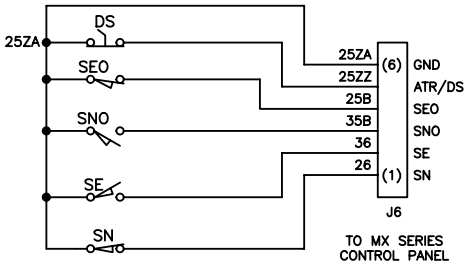
ATS POWER PANEL LAYOUT



AUXILIARY CONTACTS



LIMIT SWITCH SCHEMATIC



DS – DISCONNECT SWITCH ON MX200
SEO – EMERGENCY OPEN POSITION LIMIT SWITCH
SNO – NORMAL OPEN POSITION LIMIT SWITCH
SE – EMERGENCY POSITION LIMIT SWITCH
SN – NORMAL POSITION LIMIT SWITCH

LEGEND	REFERENCE	NOTES
●— WIRE CONNECTION o— WIRE ON TERMINAL BLOCK ≫ WIRE IN INTERCONNECT PLUG * OPTIONAL ** LOCATED ON RELAY/ TRANSFORMER BOX	LEGEND, OPERATION, AND ACCESSORIES: 53A–0900D FOR PRODUCTION ONLY: R/T BOX AND PLUG– SHEET 2 MX200 CONTROLLER– 50A–2000	ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S–5757	ESTABLISH DWG.		
B	S–5757–D	01/09/96	SDW	SB
C	S–6536	07/29/96	SG	SB
D	S–6849	02/05/98	RMC	SB
E	S–7179	06/25/99	DF	SB
F	S–7377	03/15/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

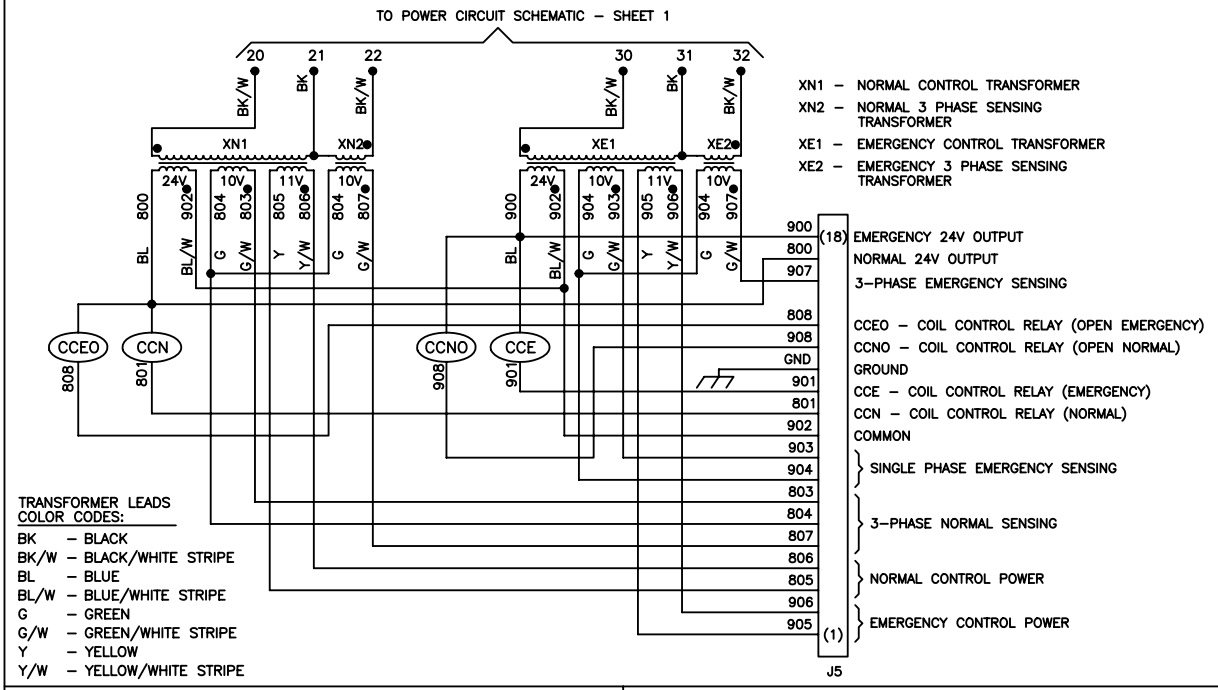
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: ATS POWER CIRCUIT & LIMIT SWITCHES
JOB/MODEL: ZTSDL40 (400 AMP)

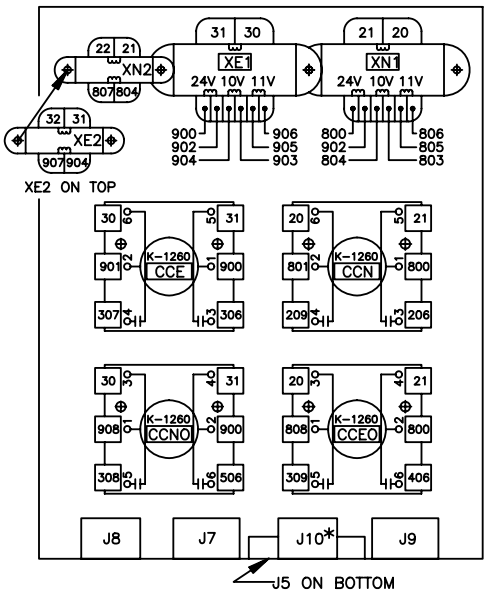
CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	53A–5000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
BRB	JC	05/29/95	–	1 OF 2	F

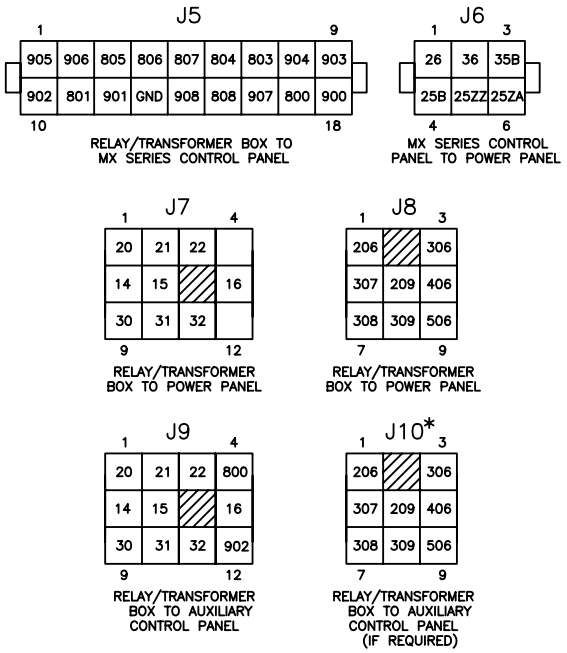
RELAY/TRANSFORMER BOX SCHEMATIC



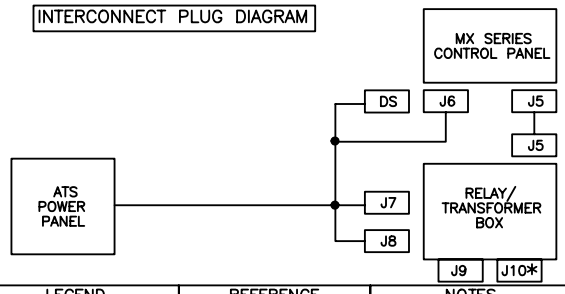
RELAY/TRANSFORMER BOX



INTERCONNECT PLUGS



INTERCONNECT PLUG DIAGRAM



LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION * OPTIONAL		

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S-5757	ESTABLISH DWG.		
B	S-5757-D	01/09/96	SDW	SB
C	S-6536	07/29/96	SG	SB
D	S-6849	02/05/98	RMC	SB
E	S-7179	06/25/99	DF	SB
F	S-7377	03/15/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

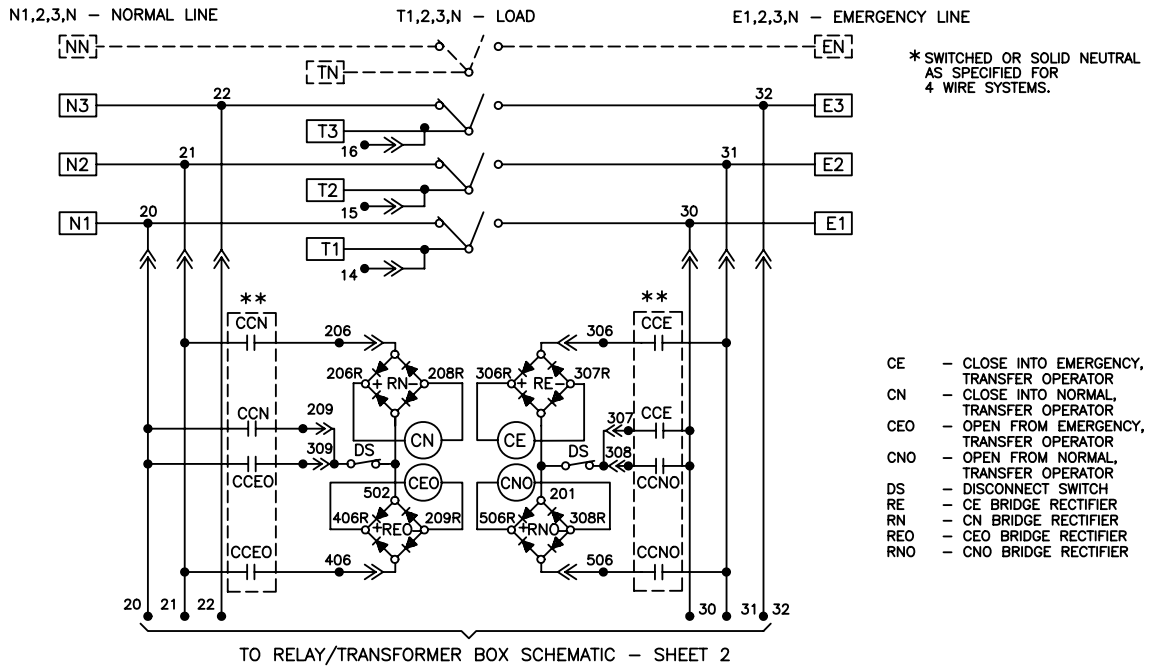
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: RELAY/XFR. BOX & INTERCONNECT PLUGS
JOB/MODEL: ZTSDL40 (400 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	53A–5000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
BRB	JC	05/29/95	–	2 OF 2	F

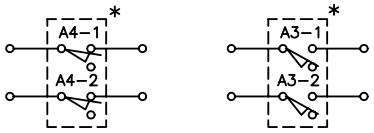
ATS POWER CIRCUIT SCHEMATIC



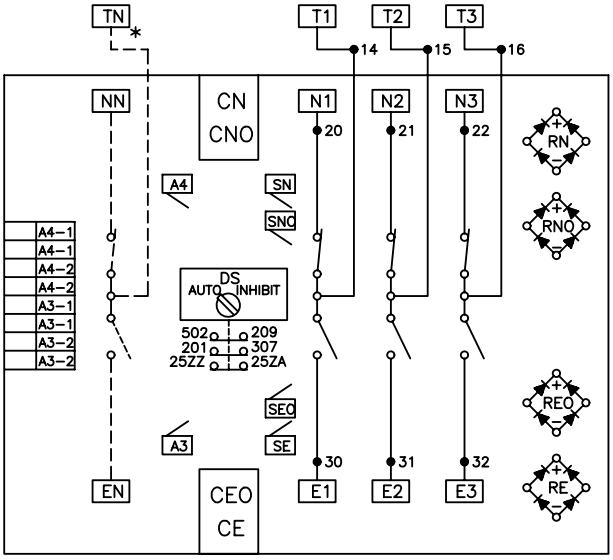
* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEMS.

CE – CLOSE INTO EMERGENCY, TRANSFER OPERATOR
CN – CLOSE INTO NORMAL, TRANSFER OPERATOR
CEO – OPEN FROM EMERGENCY, TRANSFER OPERATOR
CNO – OPEN FROM NORMAL, TRANSFER OPERATOR
DS – DISCONNECT SWITCH
RE – CE BRIDGE RECTIFIER
RN – CN BRIDGE RECTIFIER
REO – CEO BRIDGE RECTIFIER
RNO – CNO BRIDGE RECTIFIER

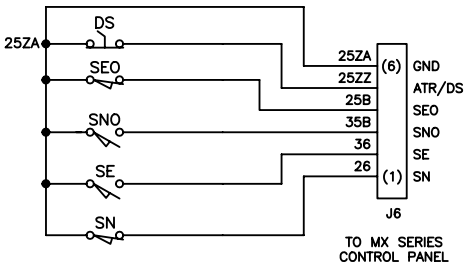
AUXILIARY CONTACTS



ATS POWER PANEL LAYOUT



LIMIT SWITCH SCHEMATIC



DS – DISCONNECT SWITCH
SEO – EMERGENCY OPEN POSITION LIMIT SWITCH
SNO – NORMAL OPEN POSITION LIMIT SWITCH
SE – EMERGENCY POSITION LIMIT SWITCH
SN – NORMAL POSITION LIMIT SWITCH

LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —○— WIRE ON TERMINAL BLOCK —≫— WIRE IN INTERCONNECT PLUG * OPTIONAL ** LOCATED ON RELAY/TRANSFORMER BOX	LEGEND, OPERATION, AND ACCESSORIES: 53A–0900D FOR PRODUCTION ONLY: R/T BOX AND PLUG–SHEET 2 MX200 CONTROLLER–50A–2000	ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS				
REV	ECN NO.	DATE	DFT	ENG
A	S–5757	ESTABLISH DWG.		
B	S–6536	07/29/96	SG	SB
C	S–6849	01/28/98	RMC	SB
D	S–7377	03/15/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

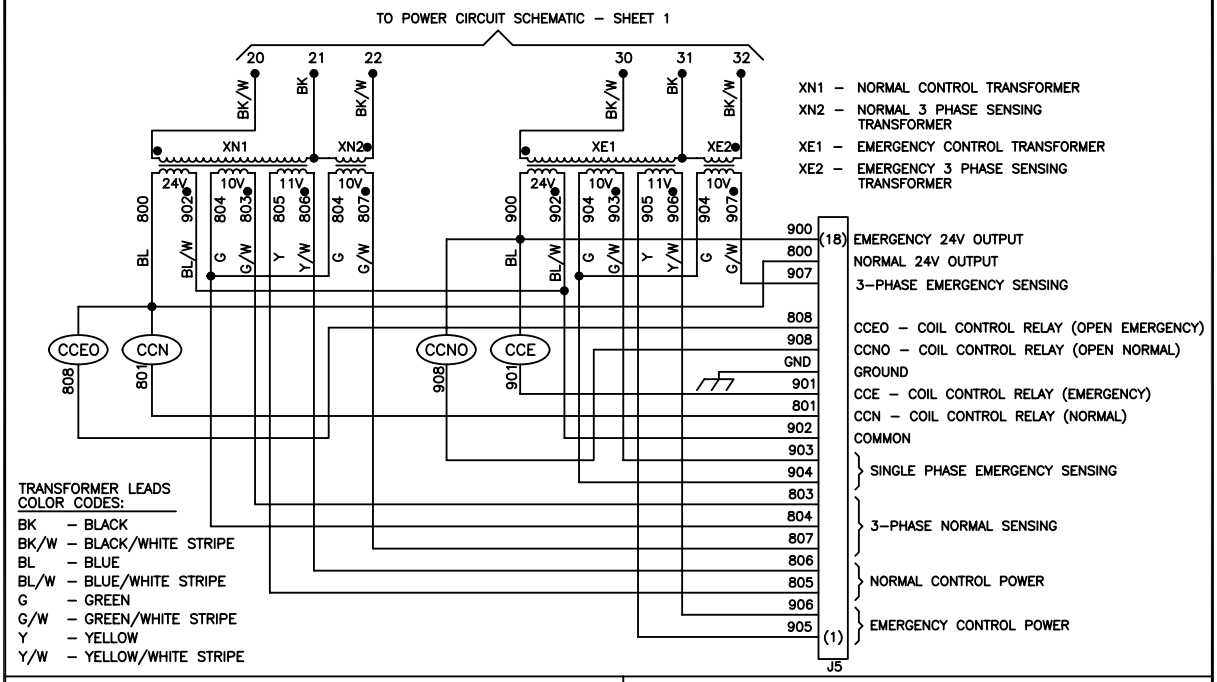
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: ATS POWER CIRCUIT & LIMIT SWITCHES
JOB/MODEL: ZTSDL60–300 (600–3000 AMP)

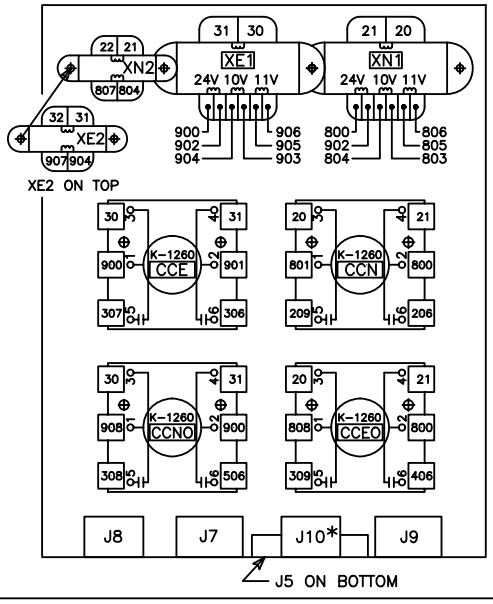
CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	53A–6000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
BRB	JC	05/30/95	–	1 OF 2	D

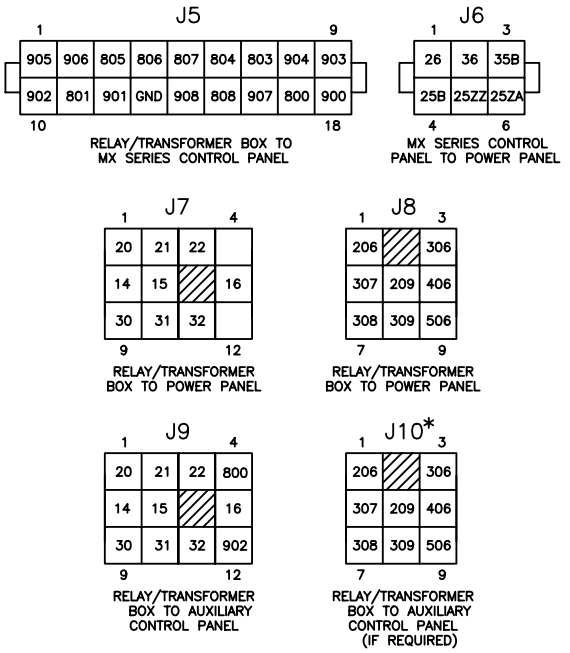
RELAY/TRANSFORMER BOX SCHEMATIC



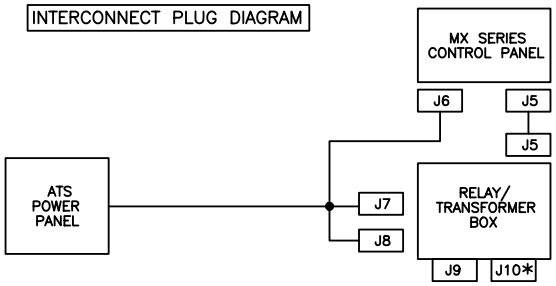
RELAY/TRANSFORMER BOX



INTERCONNECT PLUGS



INTERCONNECT PLUG DIAGRAM



LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION		
* OPTIONAL		

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S–5757	ESTABLISH DWG.		
B	S–6536	07/29/96	SG	SB
C	S–6849	01/28/98	RMC	SB
D	S–7377	03/15/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

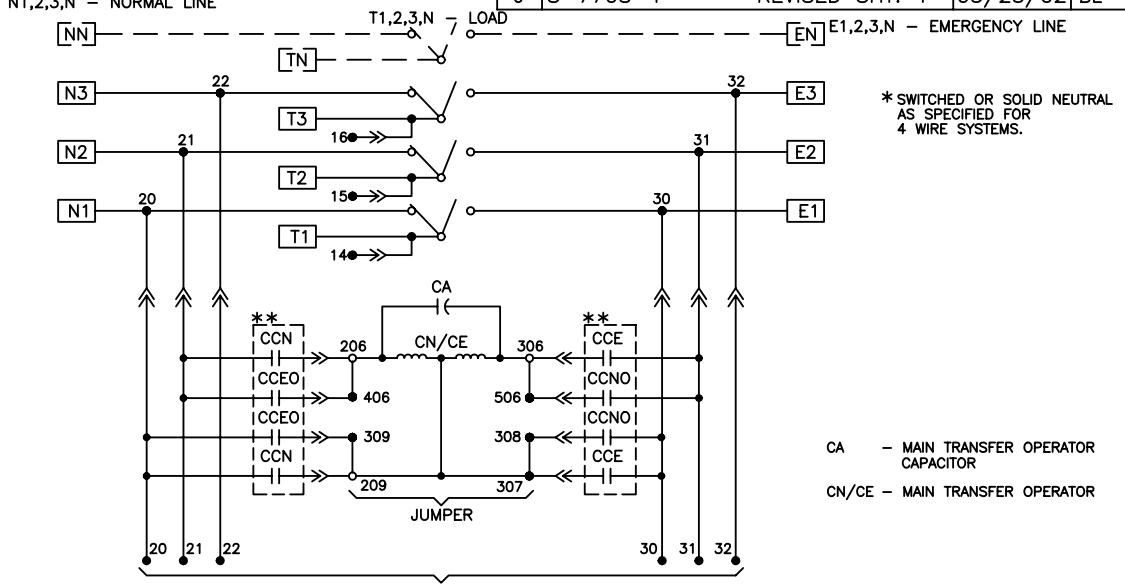
DWG TITLE: RELAY/XFR BOX & INTERCONNECT PLUGS
JOB/MODEL: ZTSDL60–300 (600–3000 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	53A–6000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
BRB	JC	05/30/95	–	2 OF 2	D

REVISIONS				
REV.	DESCRIPTION		DATE	APPROVED
J	S-7708-1	REVISED SHT. 1	03/25/02	BL BL

ATS POWER CIRCUIT SCHEMATIC

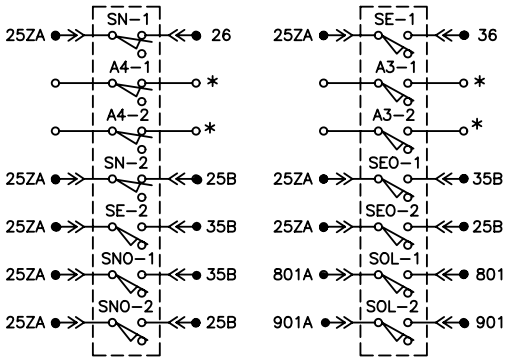


* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEMS.

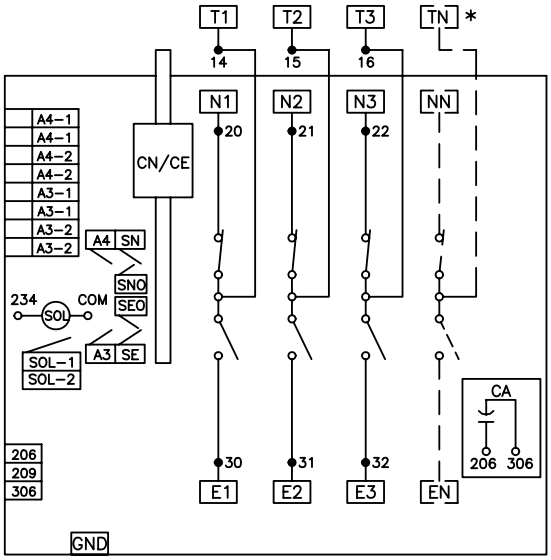
CA – MAIN TRANSFER OPERATOR CAPACITOR

CN/CE – MAIN TRANSFER OPERATOR

AUXILIARY CONTACTS



ATS POWER PANEL LAYOUT



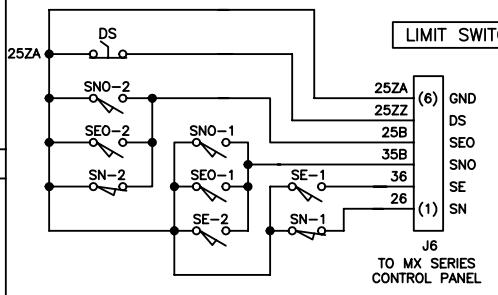
LEGEND

- WIRE CONNECTION
- WIRE ON TERMINAL BLOCK
- WIRE IN INTERCONNECT PLUG
- * OPTIONAL
- ** LOCATED ON RELAY/ TRANSFORMER BOX

NOTES

1. ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.
2. LEGEND, OPERATION, AND ACCESSORIES 53A-0900D

LIMIT SWITCH SCHEMATIC



DS – DISCONNECT SWITCH ON MX200

SE – EMERGENCY POSITION LIMIT SWITCH

SN – NORMAL POSITION LIMIT SWITCH

SEO – EMERGENCY OPEN POSITION LIMIT SWITCH

SNO – NORMAL OPEN POSITION LIMIT SWITCH

GE PROPRIETARY AND CONFIDENTIAL INFORMATION
This document is the property of General Electric ("GE") and contains proprietary information of GE. This document is loaned on the express condition that neither it nor the information contained therein shall be disclosed to others without the express, written consent of GE Industrial Systems, and that the information shall be used by the recipient only as approved expressly by GE Industrial Systems. This document shall be returned to GE upon its request. This document may be subject to certain restrictions under U.S. export controls laws and regulations.

THIRD ANGLE PROJECTION

FOR ADDITIONAL INFO REFER TO
APPLIED PRACTICES
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
2 PL. DECIMALS ± .020
3 PL. DECIMALS ± .005
ANGLES ± 1°
FRACTIONS ± 1/64
FINISH

SIGNATURES		DATE
MODEL	GG	07/25/01
DETAIL		
CHECKED		
ENGRG	SK	
MFG		
QUALITY		
ISSUED		

DRAWING FILE: 53a-7000-j-1.dwg
MODEL / ASSEMBLY FILE: ZTSDL4-26 (40-260 AMP)
CTQs ⊖ CRITICAL TO QUALITY CHARACTERISTIC
AutoCad Generated

GE Zenith Controls

TITLE
ATS POWER CIRCUIT & LIMIT SWITCHES

FIRST MADE FOR:

SIZE	CAGE CODE	DWG NO
B		53A-7000

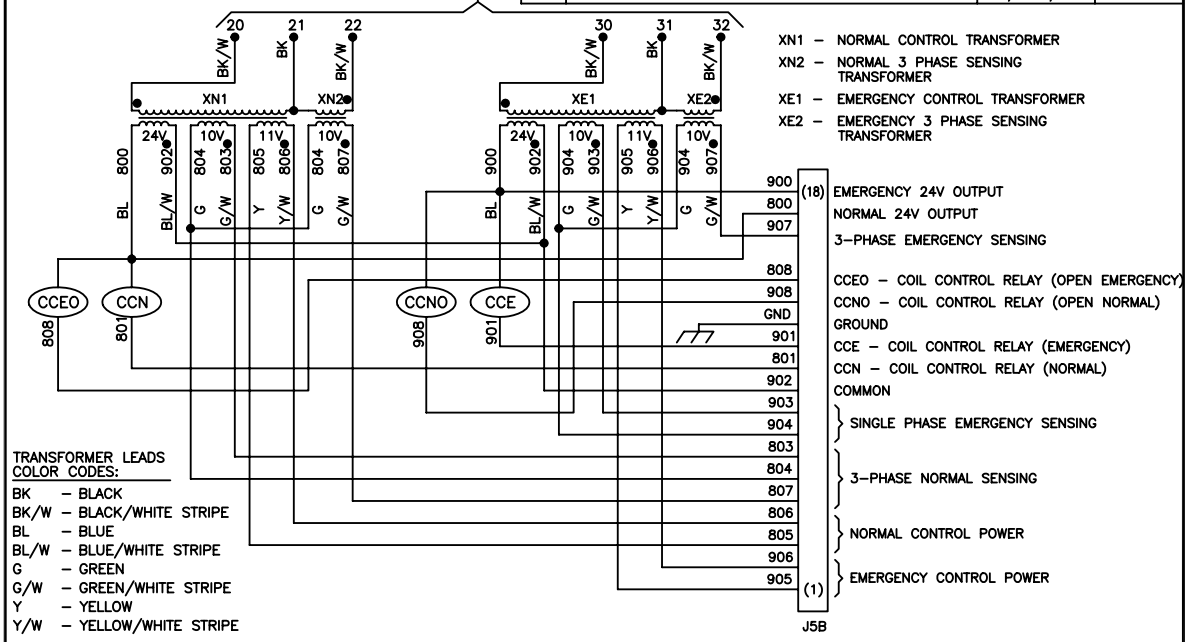
SCALE: NA

SHEET 1 OF 3

RELAY/TRANSFORMER BOX SCHEMATIC

TO POWER CIRCUIT SCHEMATIC – SHEET 1

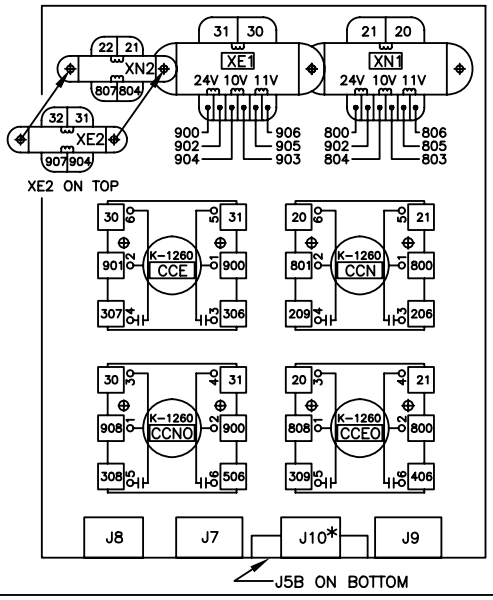
REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
J	S–7708–1 REVISED SHT. 1	03/25/02	BL BL



TRANSFORMER LEADS COLOR CODES:

BK – BLACK
BK/W – BLACK/WHITE STRIPE
BL – BLUE
BL/W – BLUE/WHITE STRIPE
G – GREEN
G/W – GREEN/WHITE STRIPE
Y – YELLOW
Y/W – YELLOW/WHITE STRIPE

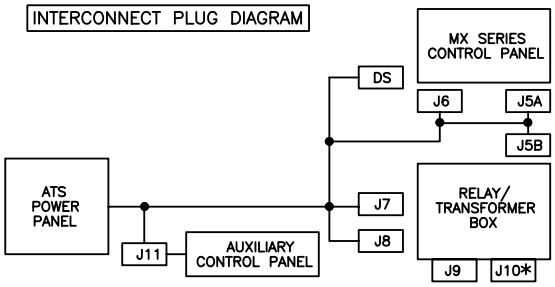
RELAY/TRANSFORMER BOX



XE2 ON TOP

J5B ON BOTTOM

INTERCONNECT PLUG DIAGRAM



INTERCONNECT PLUGS

J5B

1								9
905	906	805	806	807	804	803	904	903
902	801	901	GND	908	808	907	800	900
10								18

RELAY/TRANSFORMER BOX TO MX SERIES CONTROL PANEL PLUG J5A AND TO POWER PANEL

J6

1		3
26	36	35B
25B	25ZZ	25ZA
4		6

MX SERIES CONTROL PANEL TO POWER PANEL

J7

1			4
20	21	22	
14	15		16
30	31	32	
9			12

RELAY/TRANSFORMER BOX TO POWER PANEL

J8

1		3
206		306
307	209	406
308	309	506
7		9

RELAY/TRANSFORMER BOX TO POWER PANEL

J9

1			4
20	21	22	800
14	15		16
30	31	32	902
9			12

RELAY/TRANSFORMER BOX TO AUXILIARY CONTROL PANEL

J10*

1		3
206		306
307	209	406
308	309	506
7		9

RELAY/TRANSFORMER BOX TO AUXILIARY CONTROL PANEL (IF REQUIRED)

J11

1			4
20	21	800	800
234	COM	801A	901A
30	31	900	900
9			12

AUXILIARY CONTROL PANEL TO POWER PANEL

LEGEND

—●— WIRE CONNECTION
* OPTIONAL

GE PROPRIETARY AND CONFIDENTIAL INFORMATION
This document is the property of General Electric ("GE") and contains proprietary information of GE. This document is loaned on the express condition that neither it nor the information contained therein shall be disclosed to others without the express, written consent of GE Industrial Systems, and that the information shall be used by the recipient only as approved expressly by GE Industrial Systems. This document shall be returned to GE upon its request. This document may be subject to certain restrictions under U.S. export controls laws and regulations.

THIRD ANGLE PROJECTION

FOR ADDITIONAL INFO REFER TO
APPLIED PRACTICES
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
2 PL. DECIMALS ± .020
3 PL. DECIMALS ± .005
ANGLES ± 1°
FRACTIONS ± 1/64
FINISH

SIGNATURES		DATE
MODEL	GG	07/25/01
DETAIL		
CHECKED		
ENGRG	SK	
MFG		
QUALITY		
ISSUED		

DRAWING FILE: 53a-7000-j-2.dwg
MODEL / ASSEMBLY FILE: ZTSDL4-26 (40-260 AMP)
CTQs ⊖ CRITICAL TO QUALITY CHARACTERISTIC
AutoCad Generated

GE Zenith Controls

TITLE
RELAY/XFR. BOX & INTERCONNECT PLUGS

FIRST MADE FOR:

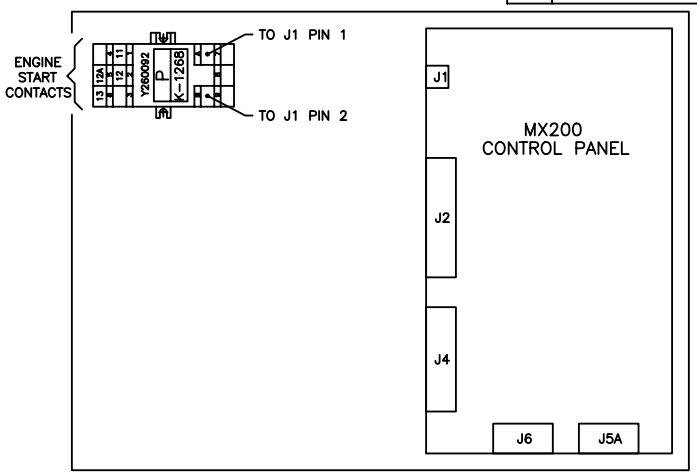
SIZE	CAGE CODE	DWG NO
B		53A–7000

SCALE: NA

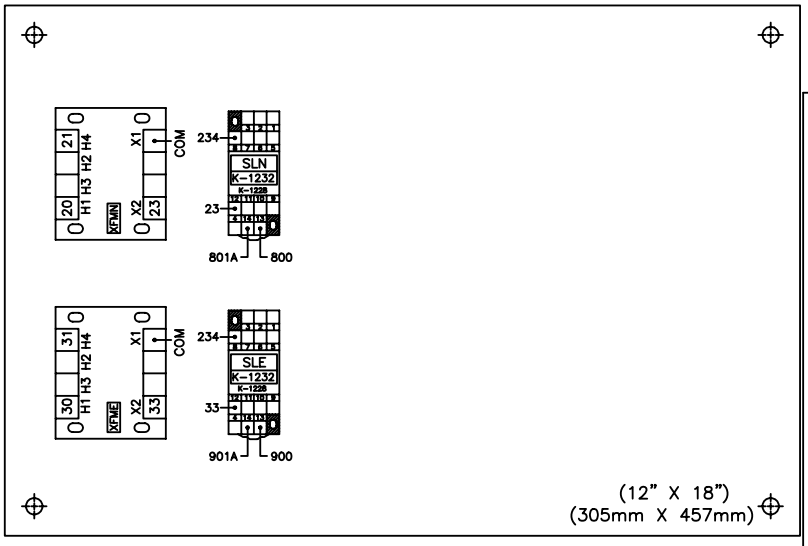
SHEET 2 OF 3

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
J	S-7708-1 REVISED SHT. 1	03/25/02	BL BL

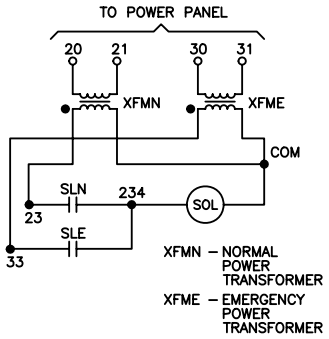
INSIDE VIEW OF CABINET DOOR



AUXILIARY CONTROL PANEL



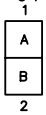
CONTROL CIRCUIT SCHEMATIC



INTERCONNECT PLUGS

NOTE: J2,J4 TERMINALS FOR ADDED OPTIONAL ACCESSORIES ONLY.

J1

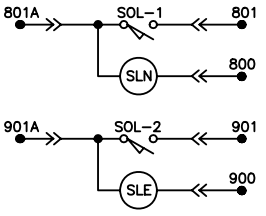


FROM MX200 CONTROL PANEL TO P RELAY

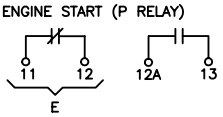
J5A

1								9
905	906	805	806	807	804	803	904	903
902	801A	901A	GND	908	808		800	900
10								18

FROM MX200 CONTROL PANEL TO J5B PLUG ON RELAY/TRANSFORMER BOX AND TO POWER PANEL



CUSTOMER CONNECTIONS



LEGEND

- WIRE CONNECTION
- WIRE IN INTERCONNECT PLUG

A3, A4
SEE POWER CIRCUIT SCHEMATIC & LAYOUT

RELAY	CONTACT	RATING
P	E	10 AMP @ 250 VAC 10 AMP @ 30 VDC
	A3, A4	20 AMP @ 125, 250 VAC

GE PROPRIETARY AND CONFIDENTIAL INFORMATION
This document is the property of General Electric ("GE") and contains proprietary information of GE. This document is loaned on the express condition that neither it nor the information contained therein shall be disclosed to others without the express, written consent of GE Industrial Systems, and that the information shall be used by the recipient only as approved expressly by GE Industrial Systems. This document shall be returned to GE upon its request. This document may be subject to certain restrictions under U.S. export controls laws and regulations.

THIRD ANGLE PROJECTION

FOR ADDITIONAL INFO REFER TO
APPLIED PRACTICES
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
2 PL. DECIMALS ± .020
3 PL. DECIMALS ± .005
ANGLES ± 1°
FRACTIONS ± 1/64
FINISH

SIGNATURES		DATE
MODEL	GG	07/25/01
DETAIL		
CHECKED		
ENGRG	SK	
MFG		
QUALITY		
ISSUED		

DRAWING FILE: 53a-7000-j-3.dwg
MODEL / ASSEMBLY FILE: ZTSDL4-26 (40-260 AMP)
CTQs
CRITICAL TO QUALITY CHARACTERISTIC
AutoCad Generated

GE Zenith Controls

TITLE
MX200 INSIDE DOOR VIEW & AUX. PANEL

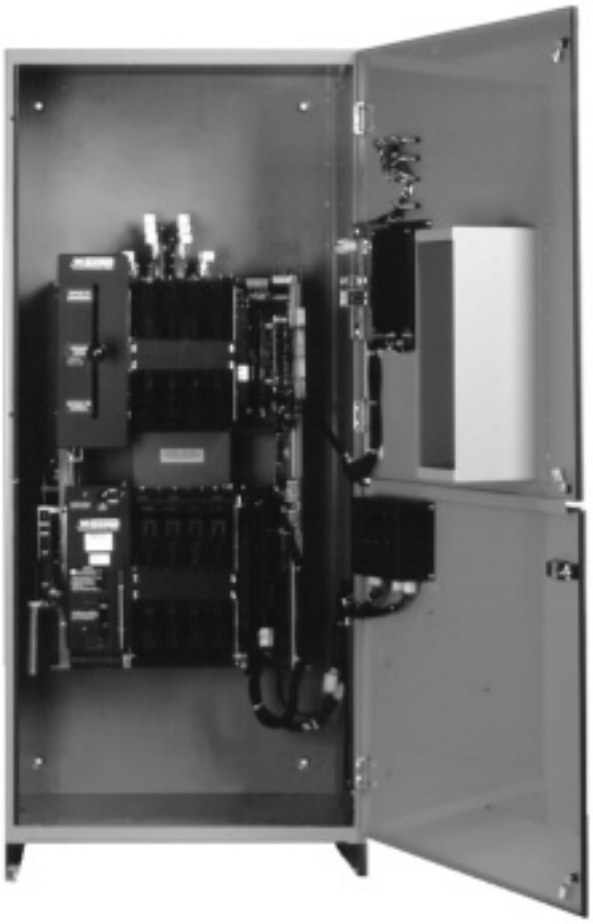
FIRST MADE FOR:

SIZE	CAGE CODE	DWG NO
B		53A-7000

SCALE: NA
SHEET 3 OF 3

ZBTS/ZBTSD Series Transfer Bypass Isolation Switches 100-4000 Amps

GE Zenith Controls





56R-1000D
8/02

Operation and Maintenance Manual

Authorized Service

For GE parts and service, call: 773 299-6600

Table of Contents

	Page
Introduction	ii
Safety	1
Equipment Inspection and Storage	1
Final Equipment Inspection	1
Mounting	1
Installation	2
Power Connections	2
Engine Start Control Connections	3
Functional Test	4
Initial Energization	5
Control Connections	6
Sequence of Operation — Standard Transition	6
Normal Power Failure	6
Restoration of Normal Power	7
Sequence of Operation — Delayed Transition	7
Power Failure Sequence of Operation	8
Maintenance and Testing	10
Inspection and Cleaning	10
Servicing	10
Testing	10
Operation & Features	11
Bypass-Isolation Operation	11
After the Isolated Operation	11
100-400 AMP	11
600-1200 AMP	12
1600-4000 AMP	13
Troubleshooting and Diagnostics	14
Appendix A — MX200	15
Operation & Maintenance	15
Option Connections	16
Programmable Options	19
User Settings - SET Menu	20
User Settings - CNFG Menu	21
User Settings - ALT Menu	22
Setting System Clock	23
Setting Plant Exerciser C/D	23
Exerciser Types	24
Timers	26
Timer Designations	27
Sensors	28
Optional Pilot Devices	29
Testing	31
Index of Terms	32
Appendix B — ZTSH	33
Installation	33
Operation & Features	34
Adjustments & Settings	35
Control Layout	37

Introduction

GE Zenith Transfer Switches are used to provide a continuous source of power for lighting and other critical loads by automatically transferring from the normal source of power to an emergency source of power in the event that the normal source voltage falls below preset limits.

Voltage sensing and system control is performed via a state-of-the-art microcontroller located on the cabinet door. It is designed to give highly accurate control of the transfer switch system.

All GE Zenith transfer switches are designed for use on emergency or standby systems, and are rated for total system or motor loads. Transfer switches are UL Listed under Standard 1008 and CSA Certified under Standard C22.2 No. 178 and IEC Listed under Standard 947.

NOTE: A protective device such as a molded care circuit breaker or fused disconnect switch MUST be installed on both sources of incoming power for circuit protection and as a disconnection device.

Safety

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

The safe operation of your switch is GE Zenith's focus. The proper storage, installation, operation and maintenance will help increase the life of the switch.

⚠ CAUTION ⚠

Due to hazardous voltage and current, GE Zenith recommends that a GE Zenith Certified technician or a qualified electrician must perform the installation and maintenance of the switch.

Equipment Inspection and Storage

Once you have received the transfer switch, inspect it for any damage. This includes damage to the enclosure, power panel, control panel and wiring harness. If any damage is found or suspected, file a claim as soon as possible with the carrier and notify the nearest GE Zenith representative.

Before installation, it is necessary to store the transfer switch in a clean dry place, protected from dirt and water. Provide ample air circulation and heat, if necessary, to prevent condensation.

Storage Temperature	Operating Temperature (Ambient):	Humidity
-30°C to +75°C (-22°F to +167°F)	**40-400 AMP** *(molded shell)* -20°C to +65°C (-4°F to +149°F) **40-4000 AMP** *(all other frame and panel types)* -20°C to +60°C (-4°F to +140°F)	5% to 95% (non-condensing)

Final Equipment Inspection

Prior to energizing the transfer switch:

1. Remove any debris incurred, with a vacuum, due to shipment or installation.

⚠ WARNING ⚠

Do not use a blower since debris may become lodged in the electrical and mechanical components and cause damage.

2. Verify that all cabled connections are correct and that phase rotation of both sources match.
3. Check engine start connections and verify the correct connection of all control wires.
4. Check settings of all timers and adjust as necessary. Also adjust any optional accessories as required.
5. Check the integrity of power connections by verifying actual lug torque values as specified in the power panel manual.
6. Make sure that all covers and barriers are installed and properly fastened.

NOTE: Power Panels ship from GE Zenith in the Normal Position.

Each GE Zenith transfer switch is factory wired and tested. A complete information package is furnished with each switch which includes:

a. Sequence of operation.
b. Description and operation of all accessories supplied.
c. Power panel connection diagram and schematic.
d. Description and identification of all customer field connections.

Installation of GE Zenith transfer switches includes:

a. Mounting the transfer switch cabinet.
b. Connection of all Normal, Emergency, and Load cables or bus bars.
c. Connection of external control circuits as required.

Mounting

Adequate lifting means must be used to mount the transfer switch into place. The recommended method for moving the transfer switch using the lifting eyes, where supplied, and a spreader bar is illustrated in *Figure 1.* Enough room should be allowed to open the cabinet doors fully for inspection and servicing of the switch per NEC and local codes.

⚠ CAUTION ⚠

Before drilling conduit entry holes or any accessory mounting holes, cover and protect the switch and control panel to prevent dirt and metal fragments from entering the mechanical and electrical components.

Failure to do so may result in damage and malfunction of the switch.

Installation

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Power Connections

GE Zenith transfer switches are supplied with UL listed solderless screw type terminals as standard for the Normal, Emergency and Load power connections. *Table 1* lists the number and sizes of cable lugs supplied as standard for each switch amp rating.

Connect the Normal, Emergency, and Load conductors to the clearly marked terminals on the transfer switch. Remove surface oxides from cables by cleaning with a wire brush. Verify that all connections are correct before tightening the lugs. All cable lug connections must be tightened to the proper torque values as shown in *Table 2*.

NOTE: Do not run cables or wiring behind front-connected transfer switches.

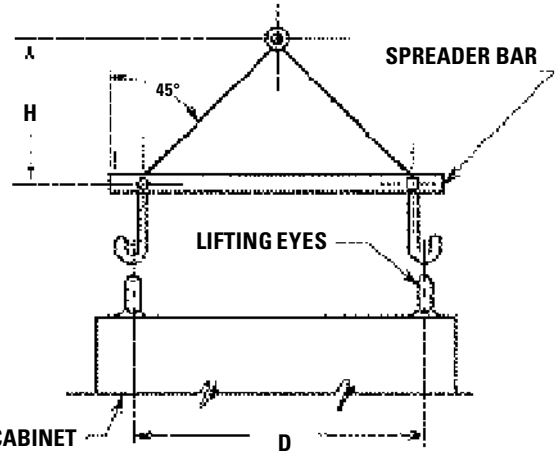


Figure 1

NOTE: When lifting the switch using a spreader bar, height H must be equal to half of distance D.

Screw Type Terminals for External Power Connections

Switch Size (Amps)	Normal, Emergency & Load Terminals		Neutral Bar (When Required)	
	Cable Per Pole	Range of Wire Sizes	No. of Cables	Range of Wire Sizes
100	1	#8 to 1/0 AWG	3	#8 to 1/0 AWG
150	1	#8 to 3/0 AWG	3	#8 AWG to 300 MCM
200, 225, 250*	1	#6 AWG to 250 MCM	3	#6 AWG to 300 MCM
260, 300*, 400	1	#4 AWG to 600 MCM	3	#4 AWG to 300 MCM
600	2	#2 AWG to 600 MCM	8	#2 AWG to 600 MCM
800, 1000, 1200	4	#2 AWG to 600 MCM	12	#2 AWG to 600 MCM
1600, 2000 2600, 3000, 4000	Line, load and neutral terminals are located in the rear of the switch and arranged for bus bar locations			

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Engine Start Control Connections

Engine-start control wires connect to control terminals on the bypass switch. Engine start terminals are indicated by a schematic symbol (the symbol indicates the contact state for a de-energized Normal source). *Figure 2* shows the engine-start contacts.

Make all other necessary control connections to the control panel terminal blocks per the schematics supplied with the ATS.

NOTE: All control wires (18-12 AWG) must be torqued to 19 in/lbs.

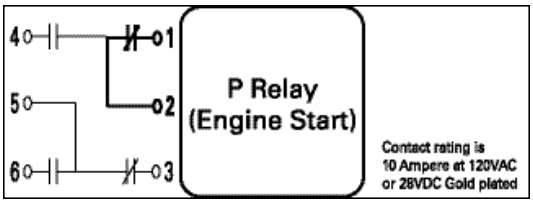


Figure 2

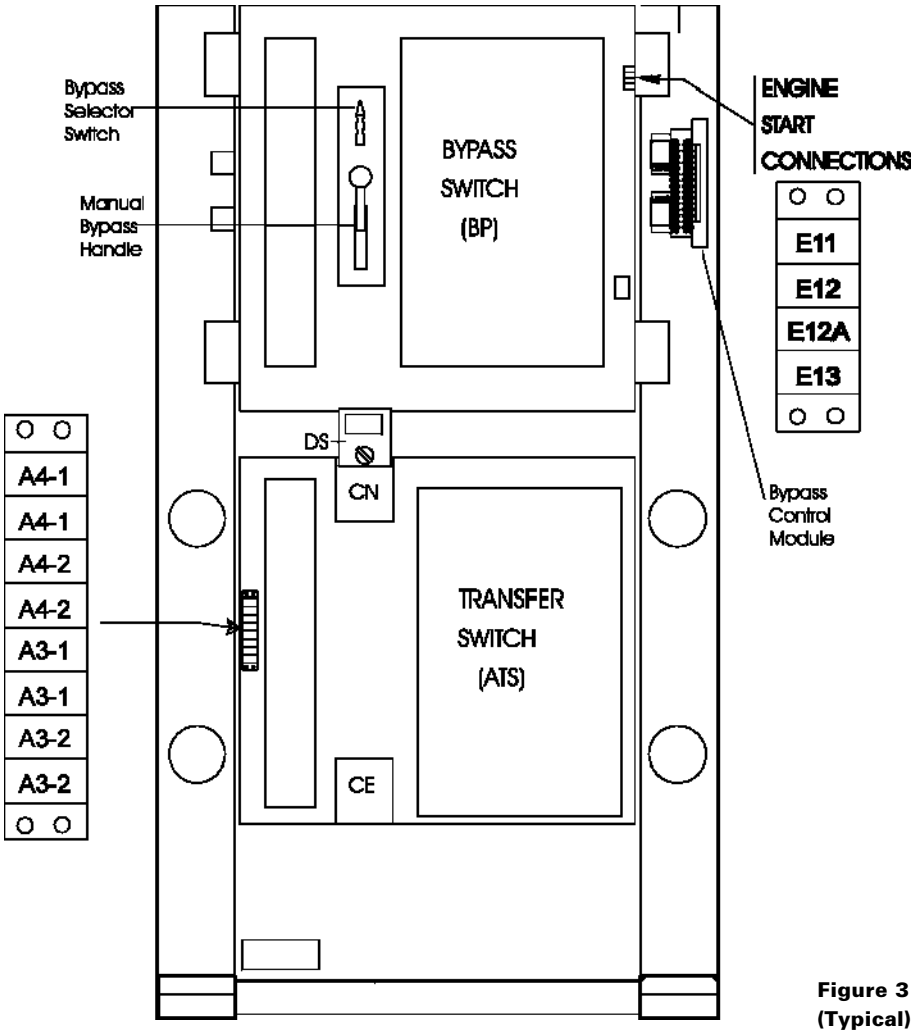


Figure 3 (Typical)

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Tightening Torque for Lugs		
Socket Size Across Flats	Torque	
	Lb. - In.	Lb. - Ft.
1/8	45	4
5/32	100	8
3/16	120	10
7/32	150	12
1/4	200	17
5/16	275	23
3/8	375	31
1/2	500	42
9/16	600	50

Table 2

The engine-start terminals are clearly identified by a label on the microcontroller backplate. In the case of manual transfer switches, or in other applications not requiring the microprocessor, clearly marked terminal blocks are provided in the upper left corner of the control panel for the engine start control wires.

Terminals for field connections to the A3 Emergency auxiliary contacts and the A4 Normal auxiliary contacts are also provided. These terminals are clearly marked and appear on the side of the power panel

Functional Test

Functional testing of the ATS consists of electrical tests described in this section. Before proceeding, refer to the information package supplied with the ATS and read and understand the information on all accessories provided.

⚠ CAUTION ⚠

Certain accessories, per specific schematics, can inhibit automatic transfer.

1. Unlock the enclosure.
2. Open the enclosure.
3. Verify the correct system voltage.

NOTE: The equipment rating nameplate on the transfer switch lists the voltage. See *Figure 3*.

4. Close the Normal source circuit. breaker.

NOTE: The controller will illuminate the Normal Available LED if proper voltage is sensed.

5. Verify the phase to phase voltages at the Normal line terminals.
6. Close the Emergency source circuit breaker.
7. Start the generator's engine.

NOTE: The controller will illuminate the Emergency Available LED when preset voltage and frequency levels are reached.

8. Verify the phase to phase voltages at the Emergency line terminals.
9. Verify that the phase rotation of the Emergency source is the same as the phase rotation of the Normal source.
10. Shut down the generator's engine.
11. Place the starting control in the Automatic position.
12. Complete the visual inspection of the transfer switch.
13. Close the enclosure.
14. Lock the enclosure.



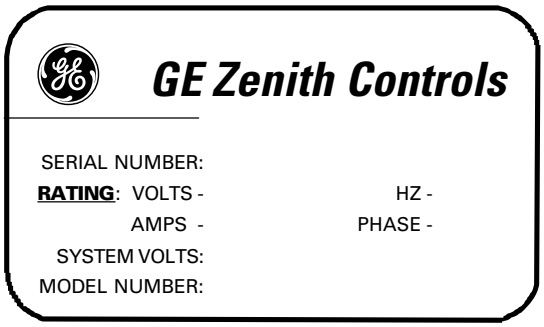


Figure 3

⚠ CAUTION ⚠

Engine Gen-Set could start when engine control wires are attached.

Initial Energization

After all options and accessories are checked and verified, follow these steps to set up the ATS. Refer to MX200 display *Figure 4*. The annunciation LEDs illuminate to indicate (1) source availability, (2) ATS position, and (3) MX200 control functions.

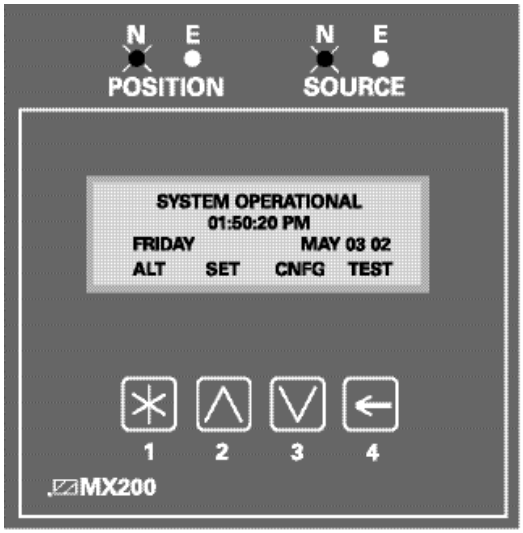


Figure 4 – Standard Transition Annunciation LEDs and Test Switch

NOTE: If a diagnostic message is visible, refer to Troubleshooting and Diagnostics.

1. Unlock the enclosure.
2. Open the enclosure.
3. Place the Disconnect Switch in the Inhibit.

   NOTE: This step is only performed if the "DS" Option was purchased.

4. Close the external (up-stream) Normal circuit breaker.

   NOTE: The normal Available and Normal Position LED's will illuminate.

   NOTE: If the Normal Available LED does not illuminate, verify that the Normal Source Voltage is above the preset pick-up value.

   NOTE: On the initial start-up, the Delay to Engine Stop Timer will display for the duration of its setting.

   NOTE: The Gen-Set will start and run while Delay to Engine Stop is timing.

5. Close the External (up-stream) Emergency line circuit breaker.
6. Start the engine generator in MANUAL mode.

   NOTE: When the voltage and frequency reach preset values, the Emergency Available LED will illuminate.

7. Verify the phase to phase voltages at the Emergency line terminals.
8. Verify that the phase rotation of the Emergency source is the same as the phase rotation of the Normal source.



9. Shut down the generator's engine. (Place in Automatic Mode.)

   NOTE: The Emergency Available LED will turn off.

   NOTE: The engine generator will continue to run if the Delay to Engine Stop Timer is displayed.

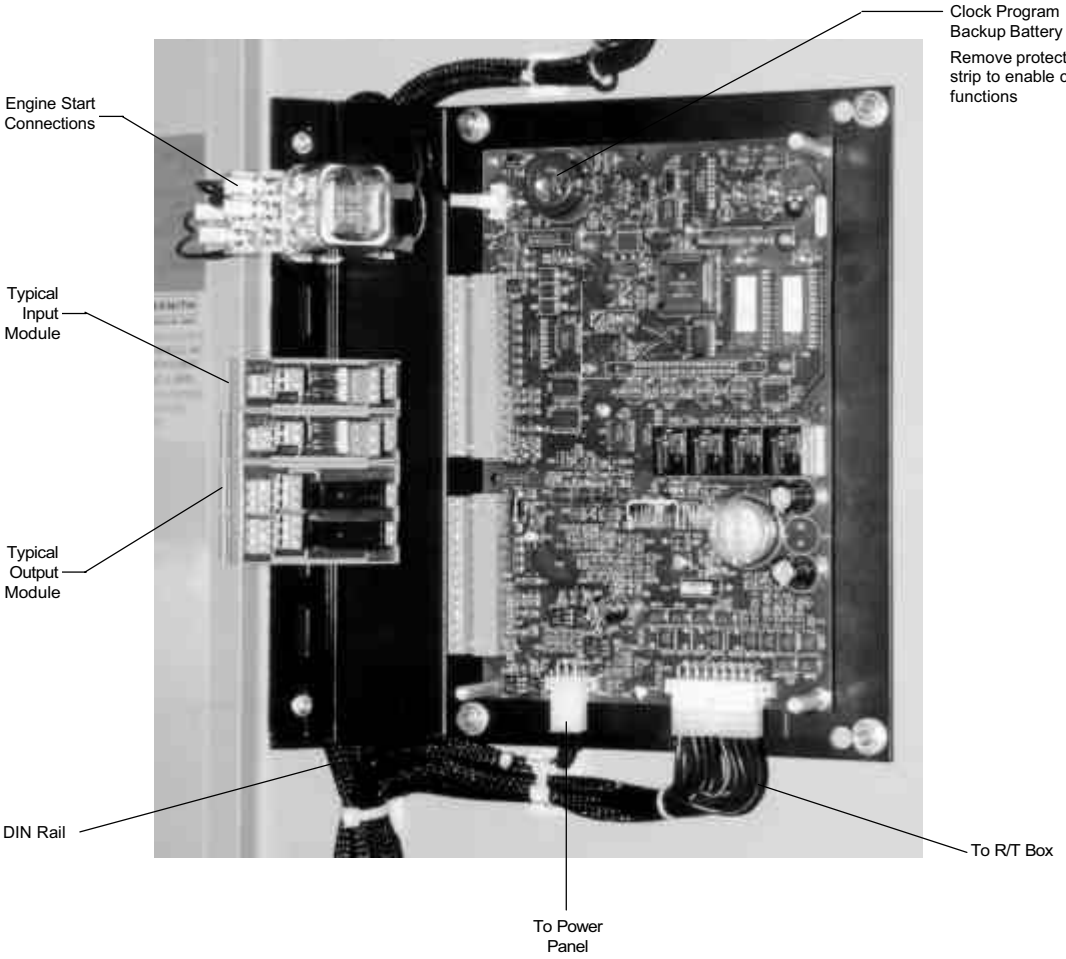
10. Place the disconnect switch to ENABLE.
11. Complete the visual inspection of the transfer switch.
12. Close the enclosure.
13. Lock the enclosure.

⚠ WARNING ⚠

When performing a hi-pot or dielectric test on the power section, DISCONNECT the control panel plugs from the microprocessor to avoid potential damage.

Installation *(cont'd)*

Control Connections



Sequence of Operation - Standard Transition

Normal Power Failure. When Normal voltage has fallen below the preset dropout value, the engine start (P) timer begins its timing cycle (factory set 3 seconds). The P timer allows for momentary undervoltage conditions in the Normal source without triggering the generator to start. If the Normal voltage remains below the dropout point throughout the P timing cycle, a generator start signal will be sent. The MX200 then monitors generator voltage and frequency to determine if they are within preset parameters. When the generator voltage and frequency reach acceptable limits the W timer begins its timing cycle. The W timer governs either the time delay for transfer to Emergency or to the open position (standard or delayed transition, respectively). The W timer (typically 1 second) assures that the generator voltage and frequency are stable before transfer.

The transfer to Emergency sequence is then completed as follows:

Standard Transition—after the W time delay, the ATS transfers to Emergency position and load power is supplied by the generator.

Standard Transition w/A6 or T3/W3—following the W time delay, the presignal is initiated. The TA6 timer is started. The TA6 time delay is typically set to 5 seconds. After the TA6, the ATS transfers to Emergency.

When the W time is completed, the CCE relay energizes the CE solenoid to close the transfer switch into the emergency source. The SE limit switch activates to de-energize the CCE relay.

Sequence of Operation - Standard Transition

Restoration of Normal Power. When Normal power reaches the preset pickup value, the T timer begins its timing cycle (factory set 30 minutes). The T timer is used to ensure that the Normal source has fully restored before retransfer. If Normal voltage remains above the pickup values for the duration of the T timer, transfer to Normal position is performed.

Retransfer is accomplished as follows:

Standard Transition—ATS transfers to the Normal position and the load power is supplied by utility.

Delayed Transition—the switch opens out of Emergency to the Open position. The DT timer activates, typically set to 5 seconds. After the DT time delay, the switch completes transfer to Normal.

Delayed Transition w/A6 or T3/W3—following the W time delay, the presignal is initiated. The TA6 timer is started. The TA6 time delay is typically set to 5 seconds. After the TA6, the ATS transfers to the open position. The DT timer activates, typically set to 5 seconds. After the DT time delay, the switch completes transfer to Normal.

When the T time delay is completed, the CCN relay energizes the CN solenoid to retransfer the switch into the normal source. The SN limit switch activates to de-energize the CCN relay. Simultaneously, the engine over-run timer U begins its timing cycle. This timer provides a period of time for the engine generator to run without load and cool down before shutdown.

Sequence of Operation - Delayed Transition

Transfer of the load to the Emergency source begins automatically when any phase of the Normal source falls below the preset dropout point and this undervoltage failure condition is detected by the MX200 microcontroller. The engine start timer P begins its timing cycle. The P time delay is provided to override momentary outages and to prevent nuisance starting of the engine generator. If the Normal source voltage returns above the pickup setting, the P timing cycle is reset, and the transfer sequence is stopped.

If the normal source voltage does not return before the P time delay is completed, the P timer drops out and sends a starting signal to the engine generator. The microcontroller senses the voltage and frequency of the Emergency source. When both the voltage and the frequency of the Emergency source reach the preset values timer W begins its timing cycle. The W timer provides an adjustable transfer delay to the Emergency source as required.

When the W time is completed, the CCNO relay energizes the CNO solenoid to open the transfer switch out of the Normal source. The switch is now in a neutral (both sources open) position. The switch remains in a neutral position for the duration of the DW time delay. DW is an adjustable time delay between the opening of the Normal source and closing into the Emergency source.

After the DW time delay has elapsed, the CCE relay energizes. The switch then completes transfer to the Emergency source by energizing the CE solenoid. The SE limit switch activates to de-energize the CCE relay. The sequence for retransfer to the Normal source begins automatically when the microcontroller detects that the voltage on all phases of the Normal source has been restored.

When the Normal source restores, switching to the Normal source is initiated by energizing timer T, beginning its timer cycle. The T timer provides an adjustable delay to insure that the Normal source has stabilized before reconnection to the load. If the Normal source fails before the T time delay completes, the retransfer sequence is stopped.

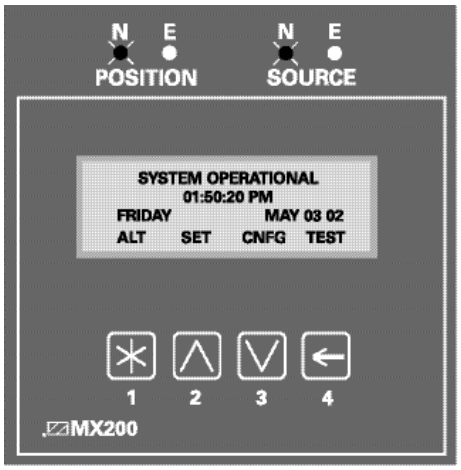
When the T time delay is completed, the CCEO relay energizes the CEO solenoid to open the switch out of Emergency and into a neutral position. The switch remains in neutral for the DT time delay. When the DT time delay has elapsed, the CCN relay energizes the CN solenoid to complete retransfer of the switch into the normal source. The SN limit switch activates to de-energize the CCN relay. Simultaneously, the engine overrun timer U begins its timing cycle. This timer provides a period of time for the engine generator to run without load and cool down before shutdown.

NOTE: If option A6 or T3/W3 are supplied, then time delay features activate prior to the transfer of this switch to the open position.

NOTE: For setup/operations of microprocessor see Appendix A

Power Failure Sequence of Operation

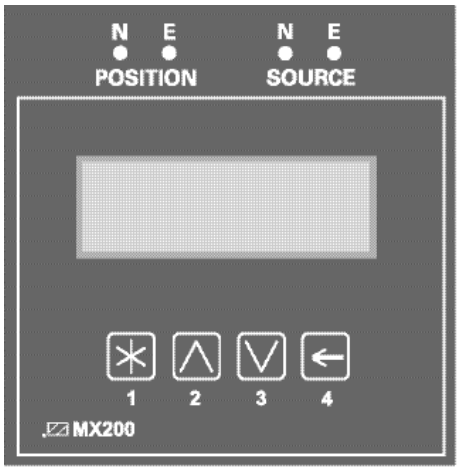
LEDs Green - Green



Normal Source Available

ATS Normal Position

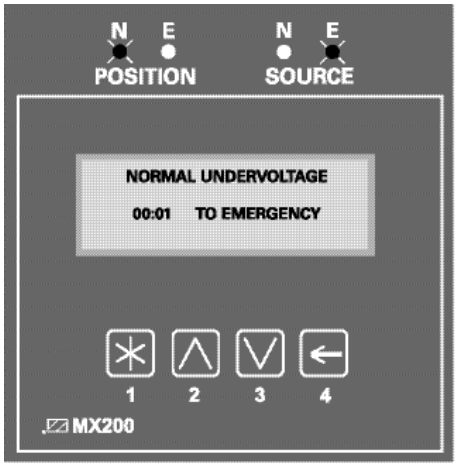
LEDs OFF



Normal Source Failed

Engine Starts After ENG START DELAY (P) (No Power Available)

LEDs Green - Red



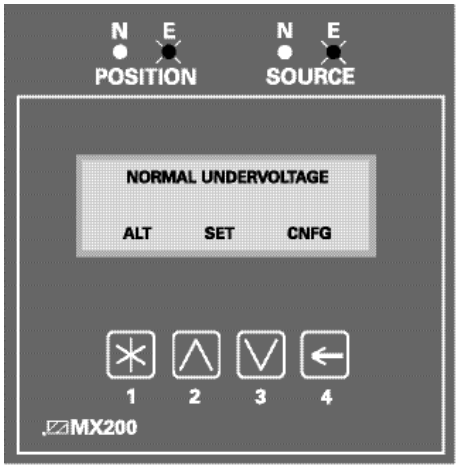
ENG START DELAY Lapsed

Emergency Source Available

Transfer TO EMERGENCY Timing (W)

Power Failure Sequence of Operation

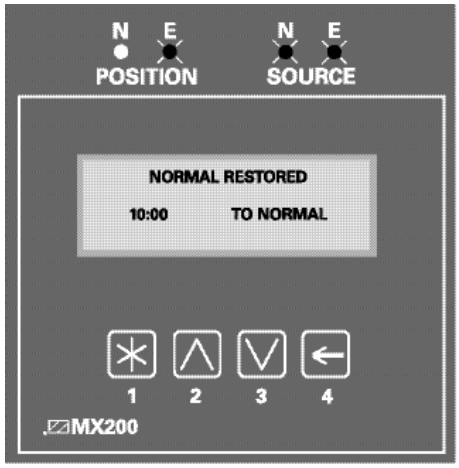
LEDs Red - Red



TO EMERGENCY
Lapsed (W)

ATS Transferred to
Emergency Position

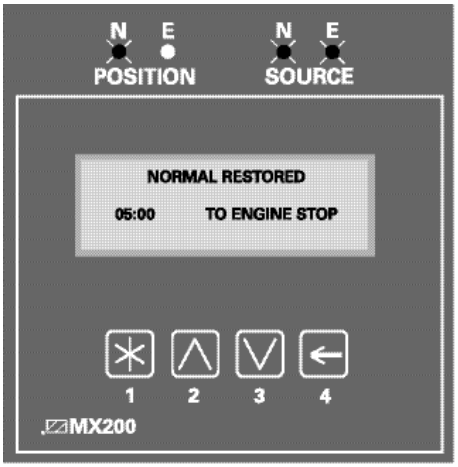
LEDs Red - Green - Red



Normal Source Returned

TO NORMAL Timing (T)

LEDs Green - Green - Red



Transfer TO NORMAL
Lapsed (T)

ATS Transferred to
Normal Position

Once ENGINE STOP
is complete,

Maintenance and Testing

⚠ CAUTION ⚠

Due to hazardous voltage and current, GE Zenith recommends that a GE Zenith Certified technician or a qualified electrician must perform the installation and maintenance of the switch.

⚠ WARNING ⚠

Both power sources must be disconnected before manual operation of the switch.

A preventive maintenance program will insure high reliability and long life for the transfer switch. The preventive maintenance program for the transfer switch should include the following items:

Inspection and Cleaning

The switch should be inspected for any accumulation of dust, dirt, or moisture, and should be cleaned by vacuuming or wiping with a dry cloth or soft brush. do not use a blower since debris may become lodged in the electrical and mechanical components and cause damage.

Remove the transfer switch barriers and check the condition of the contacts. Any surface deposits must be removed with a clean cloth (do not use emery cloth or a file). If the contacts are pitted or worn excessively, they should be replaced. A general inspection of mechanical integrity should be made to include loose, broken or badly worn parts.

Servicing

All worn or inoperative parts must be replaced using GE Zenith recommended replacement parts. Please refer to the Replacement Parts manual for specific part information and ordering procedures. Please contact the GE Zenith Technical Services Department for the Replacement Parts manual.

The operating mechanism of the transfer switch is lubricated with Lubriplate 105. The lubricant applied at the factory provides adequate lubrication for the lifetime of the switch. Should debris contaminate the mechanism, clean and apply additional Lubriplate.

GE Zenith can provide complete preventative maintenance services. Please contact the GE Zenith Technical Services Department for additional information.

Testing

A manual operator handle is provided with the transfer switch for maintenance purposes only. Manual operation of the switch must be checked before it is operated electrically. **Both power sources must be disconnected before manual operation of the switch.** Insert the handle and operate the transfer switch between the Normal and Emergency positions. The transfer switch should operate smoothly without binding. Return the switch to the Normal position, remove the handle, and return it to the holder provided.

After completing the inspection, cleaning and servicing of the transfer switch, reinstall the switch cover, and close and lock the cabinet door. Reclose the circuit breakers feeding the utility and generator sources to the switch.

Initiate the electrical transfer test by activating the test switch. P timer will time out and the microcontroller will send an engine start signal. When the W time has elapsed, the switch will complete its transfer by closing into the Emergency source.

Deactivating the test switch will start retransfer to the Normal source. The switch will complete its retransfer to Normal after the time delay of the T timer. The U engine overrun timer allows the engine generator to run unloaded for a preset cool down period.

Test Options

The ATS can be tested in either of two positions:

1) **"Auto Position"**
   Full Transfer Test - This test checks the complete operation of the ATS by transferring and interrupting the load's power source from 'Normal' to 'Emergency'.
2) **"Test Position"**
   This procedure is recommended for Preventive Maintenance (PM) of ATS without interrupting the Load thru the BYPASS/ISOLATION SWITCH.

NOTE: A periodic test of the transfer switch under load conditions is recommended to insure proper operation. (See National Electric Code articles 700 and 701).

⚠ WARNING ⚠

When performing a hi-pot or dielectric test on the power section, DISCONNECT the control panel plugs from the microprocessor to avoid potential damage.

Operation & Features

Bypass-Isolation Operation

An automatic transfer switch equipped with a bypass-isolation switch provides the ability to withdraw the ATS for testing and/or maintenance purposes without interrupting the served load.

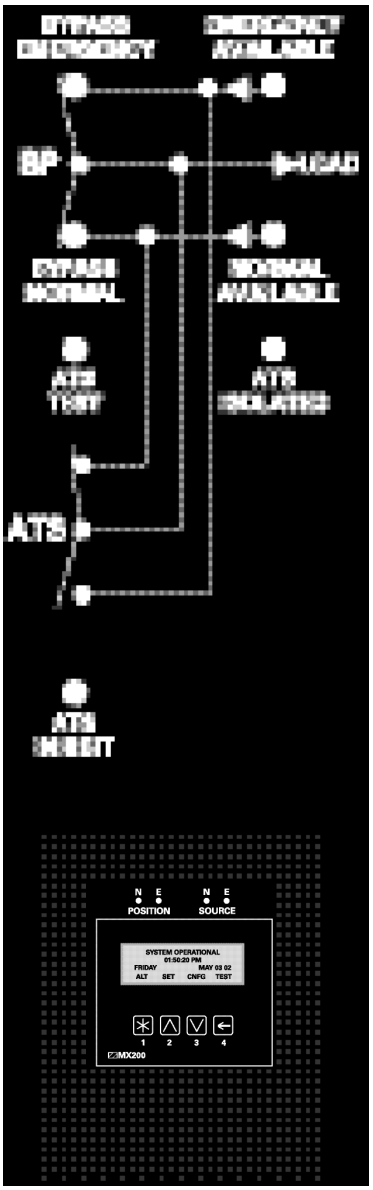
Operation of the unit is quick and convenient requiring only one operator and less than one minute to complete. Instructions are mounted on the front of each isolation switch door along with a mimic panel providing indication of power source availability and ATS/bypass switch positions.

The bypass switch is normally open on both sources with the ATS feeding the system load. During operation, the bypass is closed paralleling the ATS contacts which then allows withdrawal of the ATS to the "TEST" or "ISOLATE" positions. Mechanical and electrical interlocks are included to prevent cross-servicing or bypassing to a dead source.

In the "TEST" position, the ATS is disconnected from the load (now fed through the bypass) but control power is present to allow complete operational testing through the control panel of the transfer switch

In the "ISOLATE" position, the ATS is completely withdrawn and may be removed from the enclosure for maintenance if desired.

After the isolation operation, if the bypass is closed on the normal power source and if this source fails, an auxiliary contact on the bypass control will automatically start the engine-generator set. When the second source is available, the manual handle of the bypass may be operated to transfer the load to the available source. Interlocks prevent both this transfer, if the ATS is in the circuit and connected to the opposite source or reconnection of the ATS unless the positions match.



⚠ WARNING ⚠

While the bypass switch is out of the AUTO position/mode, the ATS is INHIBITED from automatic operation. Make certain the ATS is left in automatic after completion of any service.

Operation & Features *(cont'd)*

100-400 AMP

1) Automatic
- a) Manually operated Bypass Switch contacts (BN/BE) are open and ATS is supplying load.
- b) Disconnect Switch (DS) is in Auto.

2) To Bypass ATS
- a) Open bottom cabinet door and turn DS to Inhibit.
- b) Position manual bypass handle (MBH) to same power source as ATS.

3) To Test ATS
- a) Bypass per above instructions.
- b) Move ATS location handle (ALH) to Test location.
- c) Turn DS to Auto.
- d) Test Switch (TS) on bottom cabinet door will allow electrical operation of ATS.

4) To Isolate ATS
- a) Bypass per above instructions.
- b) Move ALH to Isolate location.

5) To Remove ATS
- a) Bypass and isolate per above instructions.
- b) Move ALH to Release location.
- c) Disconnect multipin plugs.
- d) Lift ATS out of drawer.

6) To Reconnect ATS
- a) Place ATS into drawer slots (front rollers first).
- b) Turn DS to Inhibit.
- c) Manually position ATS into same source as Bypass Switch.
- d) Reconnect multipin plugs and external connections to ATS.
- e) Push ATS inward to engage carriage.
- f) Move ALH to Test location (as indicated by light).
- g) Turn DS to Auto and use TS to electrically operate ATS.
- h) Turn DS to Inhibit.
- i) Move ALH to Auto location.
- j) Turn DS to Auto and open Bypass with MBH.
- k) ATS is now fully automatic.

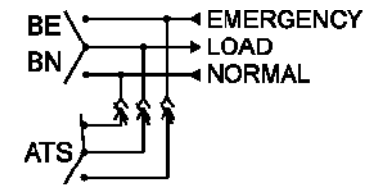


FIG. 1 BP IS OPEN WITH ATS IN NORMAL

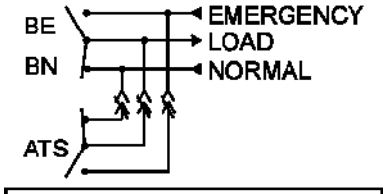


FIG. 2 BP IN NORMAL WITH ATS IN NORMAL

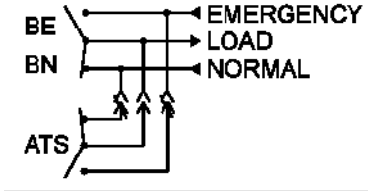


FIG. 3 BP IN NORMAL WITH ATS IN TEST (LOAD CONNECTIONS ARE OPEN)

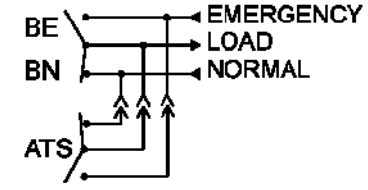


FIG. 4 BP IN NORMAL WITH ATS ISOLATED

Notes:
1. DS in Inhibit will prevent ATS electrical operation.
2. Do not use excessive force on mechanical handles.
3. Figures depict Bypass Normal. Sequence is the same for Bypass Emergency.
4. When ATS is in Test or Isolate, Bypass Switch is manual transfer switch to either available source (indicated on light panel).
5. To operate Bypass Switch when ATS is in Test or Isolate, position MBH to available power source.

Legend:
1. BP - Bypass switch (indicated by contacts BN/BE) is a three position switch.
2. ATS - Automatic Transfer Switch.

600-1200 AMP

1) Automatic
- a) Manually operated Bypass Switch contacts (BN/BE) are open and ATS is supplying load.
- b) Disconnect Switch (DS) is in Auto.

2) To Bypass ATS
- a) Open bottom cabinet door and turn DS to Inhibit.
- b) Turn Bypass Selector Switch (BSS) to same power source as ATS
- c) Position manual bypass handle (MBH) upward.

3) To Test ATS
- a) Bypass per above instructions.
- b) Rotate crank mechanism counter-clockwise until ATS test light is illuminated.
- c) Turn DS to Auto.
- d) Test Switch (TS) on bottom cabinet door will allow electrical operation of ATS.

4) To Isolate ATS
- a) Bypass per above instructions.
- b) Rotate cank mechanism counter-clockwise until ATS Isolated light is illuminated.

5) To Remove ATS
- a) Bypass and isolate per above instructions.
- b) Disconnect multipin plugs and external connections to ATS.
- c) Rotate four power panel latches to vertical position, slide ATS forward and lock mechanism in place.
- d) ATS can now be removed from cabinet.

6) To Reconnect ATS
- a) Place ATS in slide mechanism.
- b) Unlock slide mechanism. Slide ATS over power panel latches and rotate latches to horizontal position.
- c) Turn DS to Inhibit.
- d) Manually position ATS into same source as Bypass Switch.
- e) Reconnect multipin plugs and external connections to ATS.
- f) Rotate crank mechanism clockwise until ATS Test light is illuminated.
- g) Turn DS to Auto and use TS to electrically operate ATS.
- h) Turn DS to Inhibit.
- i) Move ALH to Auto location.
- j) Turn DS to Auto and open Bypass with MBH.
- k) ATS is now fully automatic.

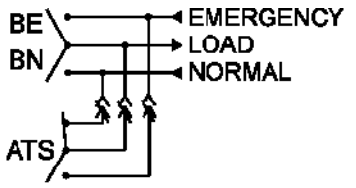


FIG. 1 BP IS OPEN WITH ATS IN NORMAL

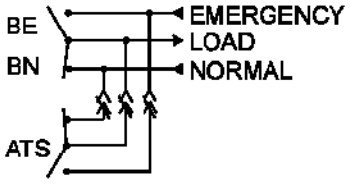


FIG. 2 BP IN NORMAL WITH ATS IN NORMAL

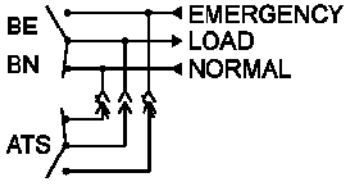


FIG. 3 BP IN NORMAL WITH ATS IN TEST (LOAD CONNECTIONS ARE OPEN)

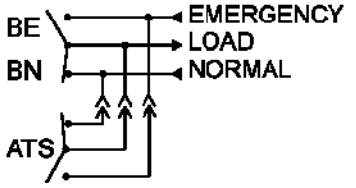


FIG. 4 BP IN NORMAL WITH ATS ISOLATED

Notes:
1. DS in Inhibit will prevent ATS electrical operation.
2. Do not use excessive force on mechanical handles.
3. Figures depict Bypass Normal. Sequence is the same for Bypass Emergency.
4. When ATS is in Test or Isolate, Bypass Switch is manual transfer switch to either available source (indicated on light panel).
5. To operate Bypass Switch when ATS is in Test or Isolate:
   a) Move MBH downward (to open Bypass Contacts BN/BE).
   b) Turn BSS to opposite power source.
   c) Move MBH upward to close into selected power source.

Legend:
1. BP - Bypass switch (indicated by contacts BN/BE) is a three position switch.
2. ATS - Automatic Transfer Switch.

Operation & Features *(cont'd)*

1600-4000 AMP

1) Automatic
- a) Manually operated Bypass Switch contacts (BN/BE) are open and ATS is supplying load.
- b) Disconnect Switch (DS) is in Auto.

2) To Bypass ATS
- a) Open bottom cabinet door and turn DS to Inhibit.
- b) Turn Bypass Selector Switch (BSS) to same power source as ATS
- c) Position manual bypass handle (MBH) upward.

3) To Test ATS
- a) Bypass per above instructions.
- b) Rotate crank mechanism counter-clockwise until ATS test light is illuminated.
- c) Turn DS to Auto.
- d) Test Switch (TS) on bottom cabinet door will allow electrical operation of ATS.

4) To Isolate ATS
- a) Bypass per above instructions.
- b) Rotate crank mechanism counter-clockwise until ATS Isolated light is illuminated.

5) To Remove ATS
- a) Bypass and isolate per above instructions.
- b) Disconnect multipin plugs and external connections to ATS.
- c) Slide four corner latches of ATS to innermost position.
- d) ATS can now be removed from cabinet.

6) To Reconnect ATS
- a) Roll cart back into cabinet.
- b) Slide four corner latches of ATS to outermost position.
- c) Turn DS to Inhibit.
- d) Manually position ATS into same source as Bypass Switch.
- e) Reconnect multipin plugs and external connections to ATS.
- f) Rotate crank mechanism clockwise until ATS Test light is illuminated.
- g) Turn DS to Auto and use TS to electrically operate ATS.
- h) Turn DS to Inhibit.
- i) Rotate crank mechanism clockwise until ATS location pointer is aligned with Auto mark on location indicator. (ATS must be in same source as Bypass.)
- j) Turn DS to Auto and open Bypass with MBH.
- k) ATS is now fully automatic.

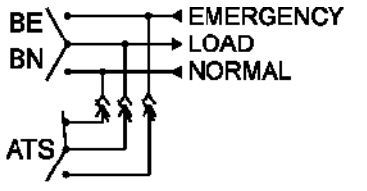


FIG. 1 BP IS OPEN WITH ATS IN NORMAL

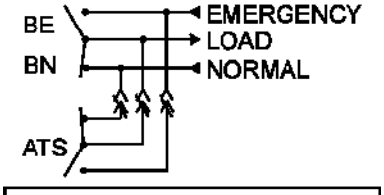


FIG. 2 BP IN NORMAL WITH ATS IN NORMAL

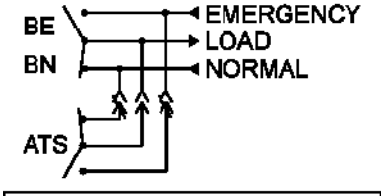


FIG. 3 BP IN NORMAL WITH ATS IN TEST (LOAD CONNECTIONS ARE OPEN)

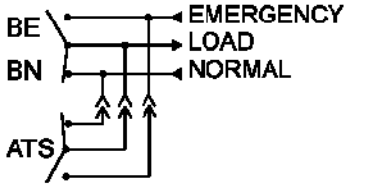


FIG. 4 BP IN NORMAL WITH ATS ISOLATED

Notes:
1. DS in Inhibit will prevent ATS electrical operation.
2. DO NOT use excessive force on mechanical handles.
3. Figures depict Bypass Normal. Sequence is the same for Bypass Emergency.
4. When ATS is in Test or Isolate, Bypass Switch is a manual transfer switch to either available source (indicated on light panel).
5. To operate Bypass Switch when ATS is in Test or Isolate:
   a) Move MBH downward (to open Bypass Contacts BN/BE)
   b) Turn BSS to opposite power source.
   c) Move MBH upward to close into selected power source.

Legend:
1. BP - Bypass switch (indicated by contacts BN/BE) is a three position switch.
2. ATS - Automatic Transfer Switch.

Troubleshooting and Diagnostics

⚠ DANGER ⚠

HAZARDOUS VOLTAGES CAN CAUSE SEVERE INJURY OR DEATH.
These charts may indicate problems that require authorized GE Zenith service personnel.
Hazardous voltages may exist on termination plugs other than those that go into the MX100.

General Troubleshooting

The following troubleshooting guide is used to recognize, and determine basic faults. When using this guide, it will ask several questions about the condition of the switch. This guide will then list an order of the possible faults. You will then look at the first suspected fault to determine if it is the problem. If it is not a fault, you go to the second suspected fault. If you go through all of the suspected faults, or the chart instructs you to, call a GE Zenith Representative for further assistance.

NOTE: When you use the troubleshooting charts, the Annunciation column refers to the LED's on the control panel.

Symptom	Annunciation	Possible Cause(s)	Corrective Action
Engine does not START	EMERGENCY AVAILABLE LED off	Engine start wires not terminated properly	Check engine start connections
		Generator is in OFF position	Investigate why Engine Control Switch was turned off
Engine does not stop	LCD Display - "Delay to Engine Stop"	U timing cycle not complete	Check U timer setting
	NORMAL POSITION, and NORMAL and EMERGENCY AVAILABLE LEDs on, but U timer has timed out	Engine start wires not terminated correctly	Check Engine Start Connections
		Generator in MANUAL	Place generator in AUTO
ATS will not transfer to EMERGENCY	EMERGENCY AVAILABLE LED off	Emergency voltage or frequency not within acceptable parameters	Check: Engine Start Connections, Generator Breaker, Generator Output, and Engine Control Switch
	None	Power supply connector unplugged	Plug in connector
	LCD Display - "Diagnostic Code 001"	Limit switch or RT box connector unplugged	Call Technical Services
	LCD Display - "Delay to Emergency"	**W** timing cycle not complete	Check **W** Timer setting
ZTSDL Series	LCD Display - "Delay to Emergency"	**DW** timing cycle not complete	Check **DW** Timer setting
ATS will not transfer to NORMAL	NORMAL AVAILABLE LED off	Normal voltage or frequency not within acceptable parameters	Check utility and utility breakers
	None	Power supply connector unplugged	Plug in connector
	LCD Display - "Diagnostic Code 001"	Limit switch or RT box connector unplugged	Call Technical Services
	LCD Display - "Delay to Normal"	**T** timing cycle not complete	Check **T** Timer setting
ZTSDL Series	LCD Display - "Delay to Emergency"	**DT** timing cycle not complete	Check **DT** Timer setting

Appendix A - MX200 Operation and Maintenance

The MX200 CONTROLLER consists of two major assemblies:

I. The **Microprocessor** contains the following:

A. Customer Input and Output (I/O) for system interface. Located on the left hand side of the back of the unit (see figure 1)

1. I/O accessories that can be found here are:
   a. Engine start relay P output
   b. Source Availability A1 and A1E output (optional)
   c. Pre-Signal to transfer T3, W3 and A6 output (optional)
   d. Transfer Inhibit Q3 and Q7 input (optional)
   e. Remote test Q2 input (optional)
   f. Load shed R15 input (optional)
   g. Network interface ZNET200 input/output (optional)

B. LCD and Keypad located on the exterior of the door (see figure 2)

1. User accessibility to the following:
   a. LED indication of source availability
   b. LED indication of transfer switch position
   c. LCD screen indicates:
      (1) timer count down (numeric)
      (2) event reporting (text)
   d. Keypad provides user interface to: *[in conjunction with LCD screen]*
      (1) Setting sensors and timers
      (2) Configuring logic accessories

II. The **R/T box** (relay transformer box) contains the following: (see figure 1)

A. Relays which are required for controller output to energize the transferring mechanism of the transfer switch at line voltage.

B. Transformers which drop line voltage to control level for controller input.

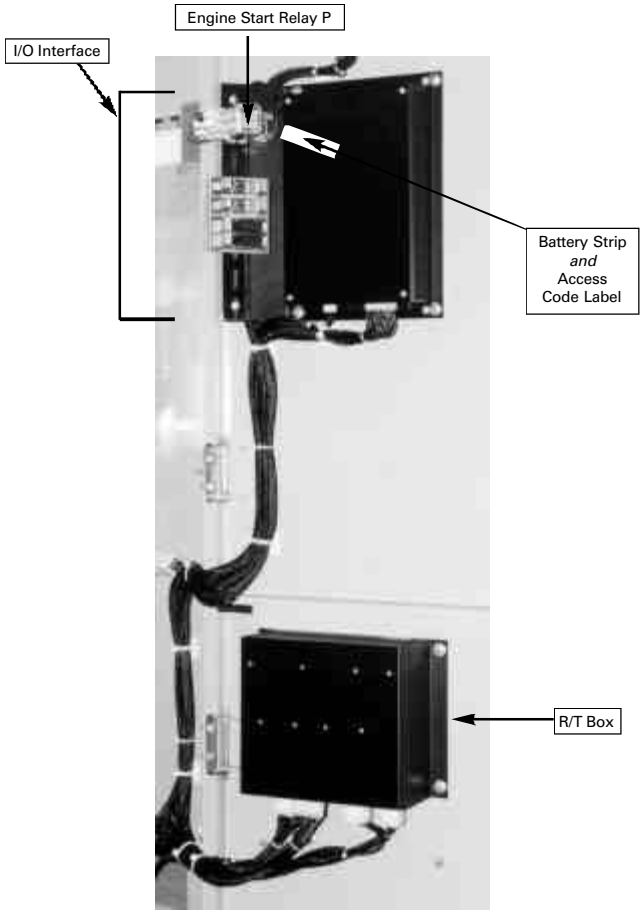


Figure 1

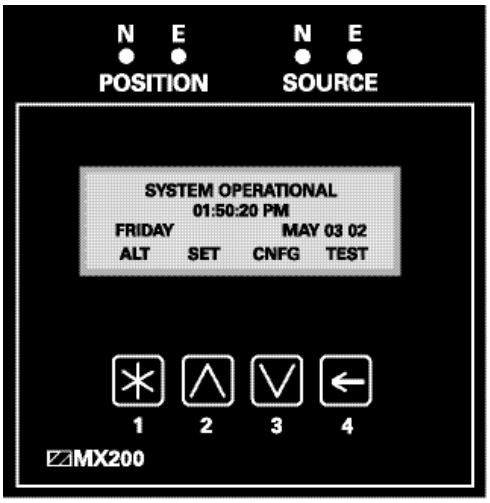


Figure 2

Appendix A - MX200 Operation and Maintenance

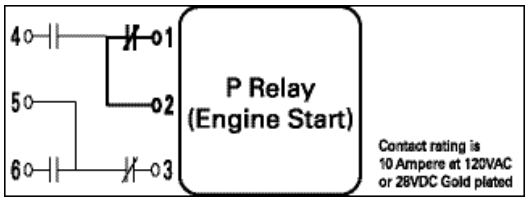
⚠ DANGER ⚠

HAZARDOUS VOLTAGES CAN CAUSE SEVERE INJURY OR DEATH.
Turn OFF all power installation, adjustment, or removal of transfer switch or any of its components.
Connecting Engine Start may cause Generator to start. Before connecting, turn Generator OFF.

Engine Control Connections (E contacts)

Connections for Engine Control are located on the upper left side of the unit (see figure 1). The P relay provides this output. This contact is controlled by the P timer. To change response time to Normal power outage (see page 7 and 8).

E



The above diagram represents a de-energized P relay (utility shown de-energized). The majority of generator manufacturers require a contact closure to start Engine. Use terminals #1 and #2.

Note 1: Bypass Isolation Transfer Switches have an auxiliary Engine Start feature. This provides an Engine Start even if the ATS and controls are isolated (*THIS IS A STANDARD FEATURE EXCLUSIVELY ON ZENITH BYPASS PRODUCTS*). The Customer connections on these products are located on the Power Panel, upper right-hand corner. Please refer to the Power Panel instruction manual for complete details.

Note 2: Products equipped with Engine control options such as S1, S2 or P2 provide customer connections on an auxiliary terminal block located on the MX200 DIN rail or auxiliary control panel. Please refer to corresponding option drawing.

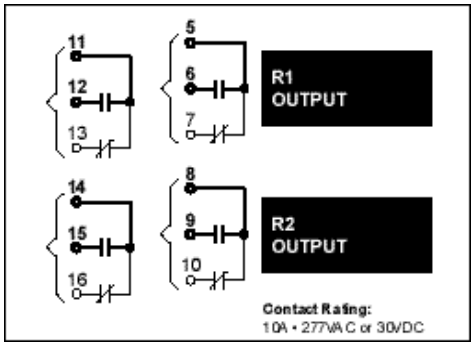
Generally the input and output options are located below the P relay on the same DIN rail (see figure 1). In some cases it may be necessary to mount additional accessories on an auxiliary panel.

Output Option Connections

Auxiliary contact(s) that operate(s) based on Normal source availability. Contacts located on R1 and/or R2. Refer to labeling.

Example: Terminal numbers 11 and 12 are closed when Normal source is acceptable (11 and 13 are open). When the Normal source is unacceptable, the opposite is true. Diagrams are shown with Normal unavailable.

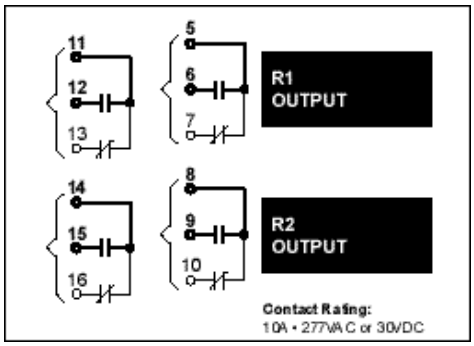
A1



Auxiliary contact(s) that operate(s) based on Emergency source availability. Contacts located on R1 and/or R2. Refer to labeling.

Example: Terminal numbers 11 and 12 are closed when Emergency source is acceptable (11 and 13 are open). When the Emergency source is unacceptable, the opposite is true. Diagrams are shown with Emergency unavailable.

A1E



Appendix A - MX200 Option Connections

⚠ DANGER ⚠

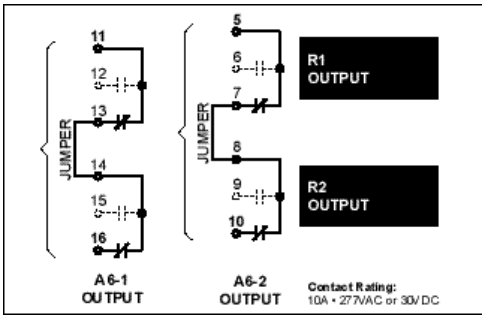
HAZARDOUS VOLTAGES CAN CAUSE SEVERE INJURY OR DEATH.
Turn OFF all power installation, adjustment, or removal of transfer switch or any of its components.

Output Option Connections (Cont.)

A3/A4

These connections are located on the Power Panel. Exact location depends upon which model is used. Refer to the Power Panel instruction manual for details. In all cases the A4 contact closes when the Transfer Switch is in the Normal position and the A3 contact closes when the Transfer Switch is in the Emergency position.

A6



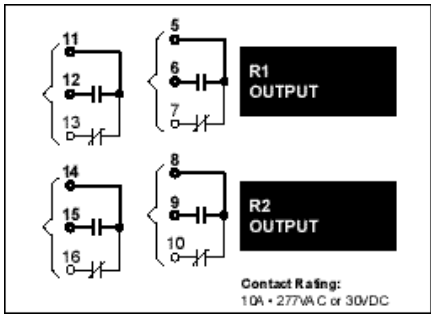
Auxiliary contact(s) that open prior to transfer in either direction.

Example: Terminals 11 to 16 will open five* seconds prior to transfer in either direction and close instantaneously after transfer.

* Pre-signal time is adjustable via T3/W3 timers (see page 11, 19 and 20)

For complete sequence of operation, see page ?

T3/W3

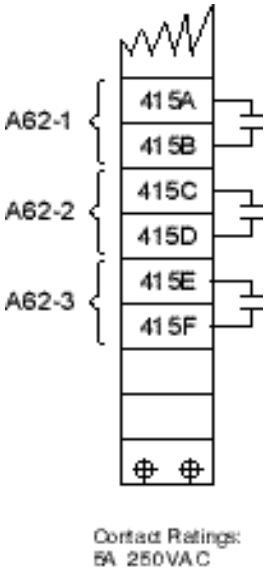


Auxiliary contacts that close five* seconds prior to transfer, and open instantaneously after transfer. Contacts located on R1 and/or R2. Refer to labeling.

- T3 is prior to transfer to Normal.
- W3 is prior to transfer to Emergency.
- T3/W3 is canceled when transfer is due to source outage.

*pre-signal time is adjustable (see page 11, 19 and 20)

A62



Auxiliary contact(s) that open prior* to transfer in either direction and close in sequence** after transfer.

All A62 contacts will open five* seconds prior to transfer in either direction. Contacts close after transfer when their corresponding timers have timed out.

- A62-1 contact sequence timer is T62-1
- A62-2 contact sequence timer is T62-2
- A62-3 contact sequence timer is T62-3

Example: When all three sequence timers are set for 5 seconds:

- A62-1 closes 5 seconds after transfer and starts T62-2 timer
- A62-2 will close 10 seconds after transfer and then start the T62-3 timer
- A62-3 will then close 15 seconds after transfer and so on.

* pre-signal time is adjustable via T3/W3 timers (see page 11, 19 and 20)
** sequence timers are adjustable and located on the auxiliary panel

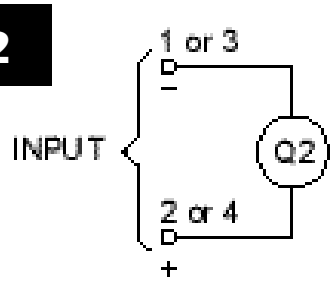
Appendix A - MX200 Options Connections

⚠ DANGER ⚠

HAZARDOUS VOLTAGES CAN CAUSE SEVERE INJURY OR DEATH.
Turn OFF all power installation, adjustment, or removal of transfer switch or any of its components.

Input Option Connections

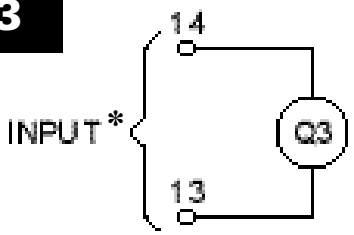
Q2



Remote Peak Shave or Area Protection Circuit
Energize Q2 input to simulate a Normal line failure causing the Generator to start and transfer the load to Emergency. Should Emergency fail during this operation, the Transfer Switch will retransfer back to Normal.

Q2 Input Modules:
120VAC INPUT (*Standard*)
24V (AC or DC) or 12VDC INPUT (*Optional*)

Q3

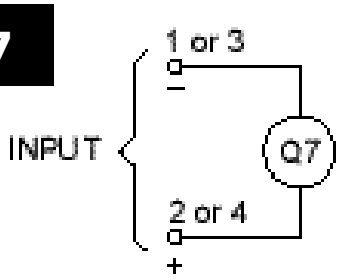


Remote Inhibit Transfer to Emergency Circuit
Voltage applied to Q3 input will allow transfer to Emergency. Conversely, no input on Q3 will inhibit transfer to Emergency.

* To enable Q3 option, engage Q3 jumper.

Q3 Relay:
120VAC *(Standard)*
24VAC; K-1242, 24VDC *(Optional)*

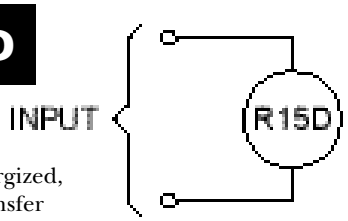
Q7



Remote Inhibit Transfer to Normal Circuit
Energize Q7 input to prevent transfer to Normal.

Q7 Input Modules:
120VAC INPUT (*Standard*)
24V (AC or DC) or 12VDC INPUT (*Optional*)

R15/R15D



Load Shed
Input, that when energized, causes the unit to transfer out of the Emergency position. The customer can use this to prevent generator overload.

On a ***Standard*** transfer switch, the R15 will transfer the unit to a dead Normal.

On a ***Delay*** transfer switch, the R15D will transfer the unit to a neutral (open) position. (Unit will transfer to Normal if acceptable)

Q3 is used to keep the unit from transferring back to Emergency.

R15/R15D Relay:
120VAC *(Standard)*
24VAC; K-1242, 24VDC *(Optional)*

Communication Connections

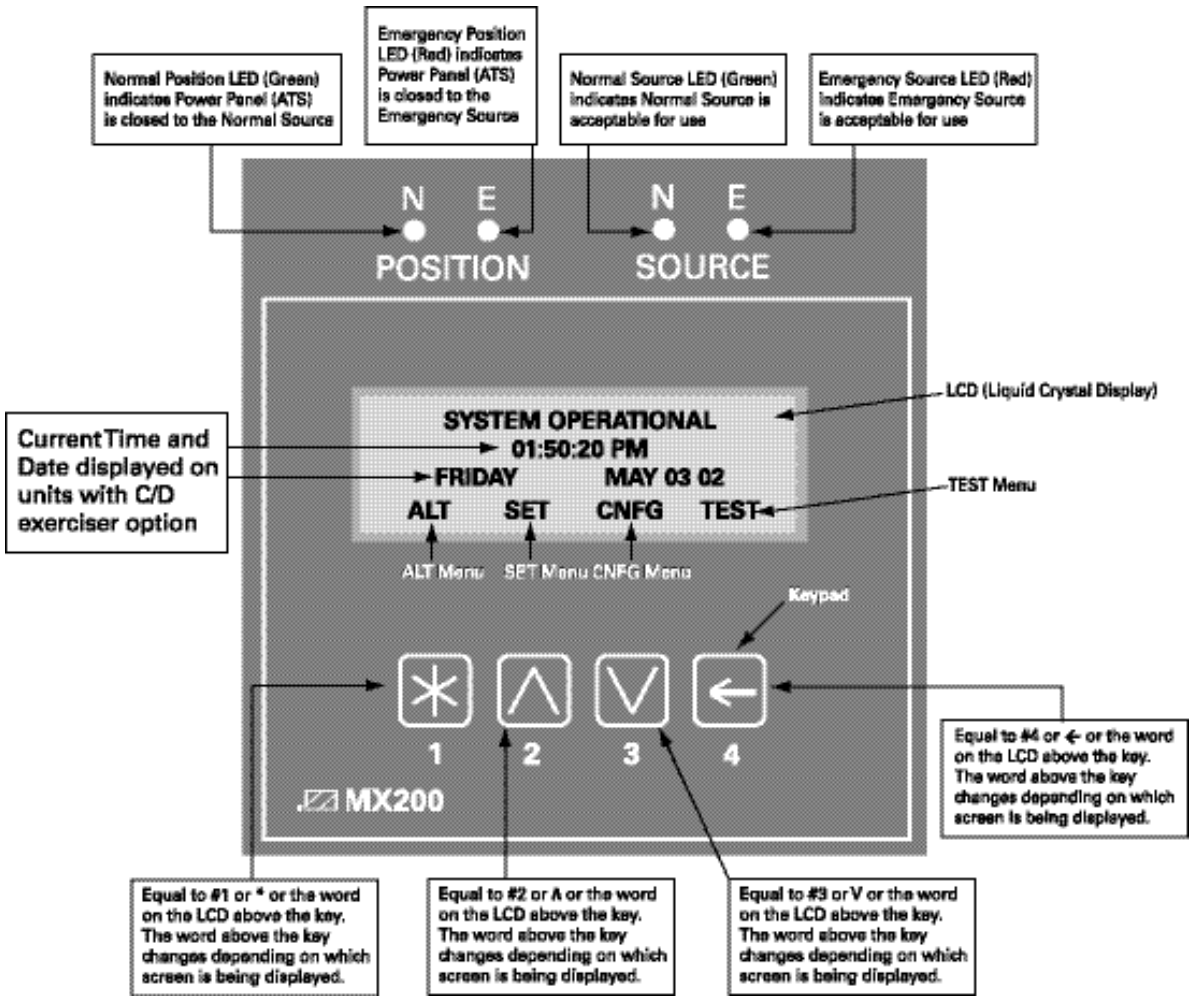
ZNET200

Network card allows communication of ATS position, available source, timers running, etc. to a remote annunciator panel, PC or PLC via one pair of twisted wires. Connections located below P relay. Refer to labeling. Network cable to be Belden 8471, 16AWG (unshielded two conductor twisted pair, not included).

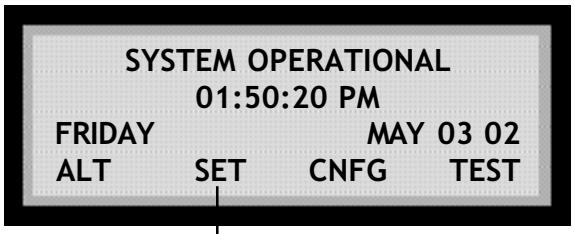
Appendix A - MX200 Programmable Options

These options are accessible through the LCD and keypad (see figure below). To become familiar with the options loaded into a particular unit, scrolling through the SET and CNFG menu will show the descriptions of the options (see page 11 and 12). These menus are the very same menus that are used to access the setting and/or configuration of these options. The SET (setting) menu is primarily used to show or change, time and voltage settings. The CNFG menu is primarily used to turn an option on or off. When scrolling through these menus, no changes can be made without entry of the access code. The factory set six-digit access code is located on a white label on the back of the unit (see figure 1).

The MX200 has many logic options. Each controller is downloaded with options at the time of manufacture. The collection of options that any one controller has is specified at the time of order placement. The following pages include all the options that can reside in the controller. Not all units include all options.



Appendix A - MX200 User Settings (SET Menu)



- * SYSTEM CLOCK (pg. 14)
- * EXERCISER EVENTS (pg. 15)
- N PICKUP VOLTAGE (pg. 22)
- N DROPOUT VOLTAGE (pg. 22)
- N PICKUP FREQ (pg. 22)
- E PICKUP VOLTAGE (pg. 23)
- E DROPOUT VOLTAGE (pg. 23)
- E PICKUP FREQ (pg. 23)
- ENG START DELAY (pg. 18)
- * DELAY TO EMERG PRE SIGNAL (pgs. 19-20)
- * EMERG PRE SIGNAL (pgs. 19-20)
- * DELAY TO OPEN NORMAL (pgs. 18 and 20)
- DELAY TO EMERG (pgs. 18 and 20)
- DELAY TO NORMAL (pgs. 18 and 20)
- * DELAY TO NORMAL PRE SIGNAL
- * NORMAL PRE SIGNAL (pgs. 19-20)
- * DELAY TO EMERG OPEN (pgs. 18-20)
- ENG STOP DELAY (pgs. 18 and 20)
- CALIBRATE NORMAL
- CALIBRATE EMERGENCY

Change adjustable values through keypad via SET menu.

Key stroke (SET ^ 2) (SELECT ^ v 2 3) scroll to accessory description to be changed, then (SET ← 4).

Enter six-digit access code (******) ♦

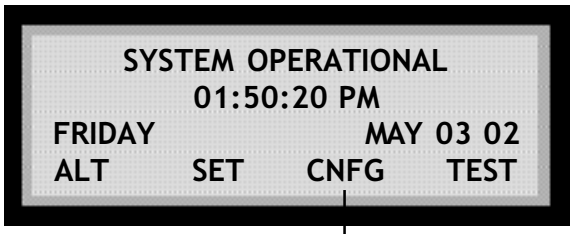
(SET ← 4) (SELECT ^ v 2 3) scroll to choose New Value

(STORE ← 4) this will be repeated for each digit to be set then (BACK * 1) to get out of SET screens and save your changes.

♦ The factory assigned six-digit access code is located on the white label on the back of the controller (see figure 1).

* optional

Appendix A - MX200 CNFG Menu



* N OVER VOLTAGE (pg. 22)

* N UNDER FREQ (pg. 22)

* N OVER FREQ (pg. 22)

* E OVER VOLTAGE (pg. 23)

* E OVER FREQ (pg. 23)

* IN PHASE MONITOR (pg. 21)

TRANSFER COMMIT (pg. 26)

* EXERCISER (pgs. 15-17)

TEST MENU KEY

DATE STYLE

* CONFIG NO TRANSFER (pg. 21)
(Phase Rotation)

* optional

Turn options ON or OFF via keypad through the CNFG menu.

Key stroke (CNFG ∨ 3) (SELECT ∧ 2 ∨ 3) scroll to accessory description then (CNFG ← 4)

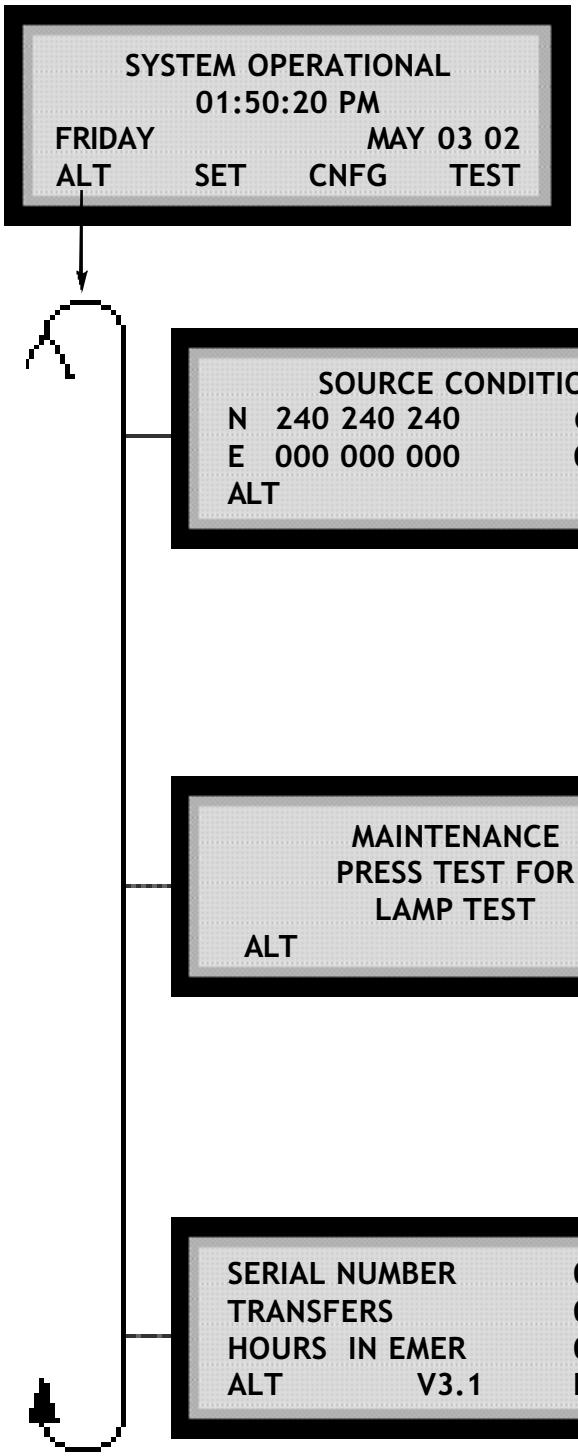
enter six-digit access code (******)♦

(CNFG ← 4) (∨ 3) scroll to ON or OFF

(STORE ← 4) (BACK * 1) to get out of CNFG screen and save changes.

♦ The factory assigned six-digit access code is located on the white label on the back of the controller (see figure 1).

Appendix A - MX200 ALT Menu



This screen displays line to line voltage values of both sources (A to B, B to C and A to C). Frequency of both sources is also displayed. Display will remain once selected, until transfer occurs. This is an alternate main screen.

This screen provides a lamp test.

Pressing 

key will test LEDs above screen. This display will revert back to SYSTEM OPERATIONAL after 5 seconds.

This screen provides:

SERIAL NUMBER of the transfer switch unique to each switch.
TRANSFERS is a count of how many times the unit has transferred to Emergency (Total).
HOURS IN EMER is a running total of hours the unit has provided Emergency to the load.
V# is the software version number.

Appendix A - MX200 Operation and Maintenance

How to Set the System Clock

Set **SYSTEM CLOCK**, time and date:

- Only controllers with the Plant exerciser (C/D) option will show a system clock.
- When the controller does not have this option, the second and third line of the display will be blank during **SYSTEM OPERATIONAL** screen.
- When the clock is present but not set, the display will show **SET SYSTEM CLOCK** on the second line of the **SYSTEM OPERATIONAL** screen.
- The **SYSTEM OPERATIONAL** screen will show time (hours, minutes and seconds) on the second line if the system clock has been set. (Date on third line)

Set the system clock via the SET menu:
(Start from **SYSTEM OPERATIONAL** screen)

1. Remove battery protective white plastic strip near P relay (see figure 1)*
2. Press **SET**
3. Scroll to **SET SYSTEM CLOCK** using the up and down keys (SELECT)
4. Press **SET**
5. **ENTER ACCESS CODE** located on the white label on the back of the controller (see figure 1)
6. Press **SET**
7. Use the up and down keys to change the hour value (AM or PM is also selected)
8. Press **STORE** (this will enter this value and move cursor to minutes)
9. Use the up and down keys to change the minutes
10. Press **STORE** (this will enter this value and move cursor to month)
11. Use the up and down keys to change the month
12. Press **STORE** (this will enter this value and move cursor to date)
13. Use the up and down keys to change the date
14. Press **STORE** (this will enter this value and move cursor to year)
15. Use the up and down keys to change year
16. Press **STORE** (this will enter this value and complete the clock setting)
17. To edit settings, press **SET** and repeat steps 6 - 16
18. If the setting is satisfactory, press BACK (unit then returns to the **SYSTEM OPERATIONAL** screen)

* *Replacement battery Part # K-4100*
Battery will last 5 years and provides power to retain clock function only (Controller functions without battery)

How to Set the Plant Exerciser C/D

- Units equipped with this option will display the time of day on second line of **SYSTEM OPERATIONAL** screen (if time is correct, go to step one; if not, see page 14 "How to Set the System Clock").
- When the second line displays **SET SYSTEM CLOCK** the unit is equipped with the exerciser option, but the **SYSTEM CLOCK** has not been set. **SYSTEM CLOCK** must be set before proceeding (see page 14 "How to Set the System Clock").
- When a unit is not equipped with this option, the second and third line of the **SYSTEM OPERATIONAL** screen will be blank (Plant Exerciser option is not installed).

Verify the Exerciser is on with the following:

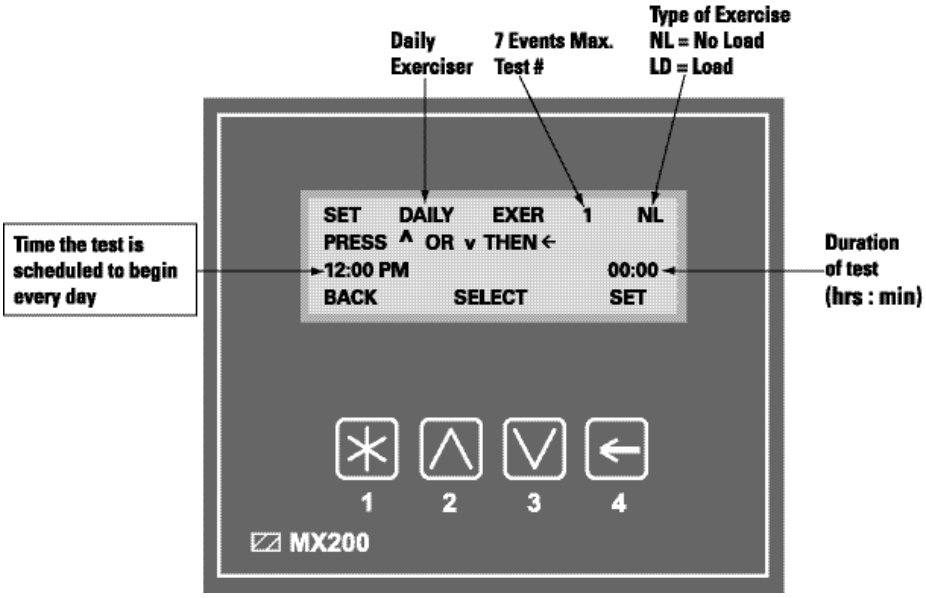
1. Beginning from the **SYSTEM OPERATIONAL** screen, press **CNFG**
2. Using up and down keys, scroll to **CONFIG EXERCISER** screen
3. The lower right-hand corner (above **CNFG**) will show on or off
4. If **on**: press **BACK** and skip to step 12
5. If **off**: continue
6. Press **CNFG**
7. Enter **ACCESS CODE** located on white label on the back of the controller (see figure 1)
8. Press **CNFG**
9. Select "**on**" using up and down keys
10. Press **STORE**
11. Press **BACK** to return the **SYSTEM OPERATIONAL** screen.

Set the **PLANT EXERCISER** via the **SET** menu after verifying the unit is equipped with this option and it is turned on as per above:

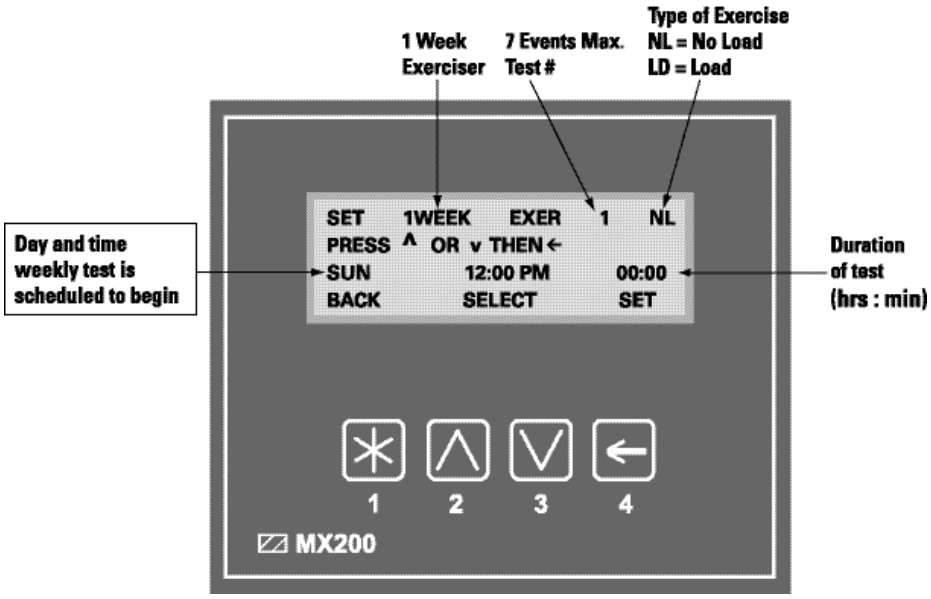
12. Beginning from the **SYSTEM OPERATIONAL** screen, press **SET**
13. Using up and down keys, scroll to **SET PLANT EXERCISER** screen (if this screen cannot be found begin at the top of the page)
14. Press **SET**
15. Enter **ACCESS CODE** located on white label on the back of the controller (see figure 1)
16. Press **SET**
17. The **SET 1WEEK EXER** screen is now displayed (refer to page 16 and 17 to verify type of exerciser installed; 1WEEK, 2WEEK, DAILY OR CLNDR)
18. Press **SET** again
19. Cursor is indicated as a line under character to be changed, move cursor via **STORE** key
20. Change values with up and down keys, press **STORE** after each entry (test duration is hours and minutes)
21. Press **STORE** when complete, until **SAVING RECORD** is displayed
22. Press **BACK** twice when done to return to the **SYSTEM OPERATIONAL** screen.

Appendix A - MX200 Exerciser Types

Daily Exerciser

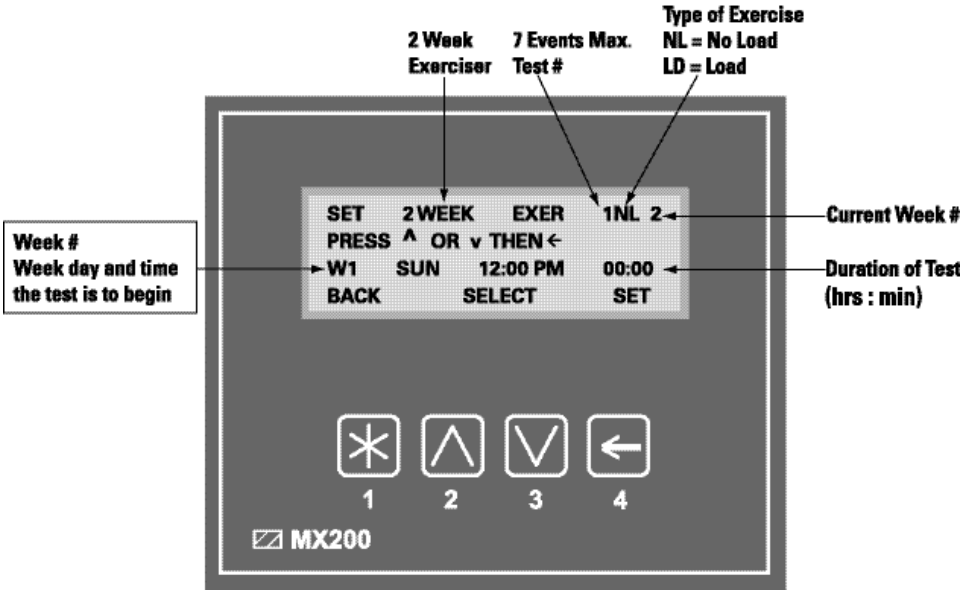


1 Week Exerciser

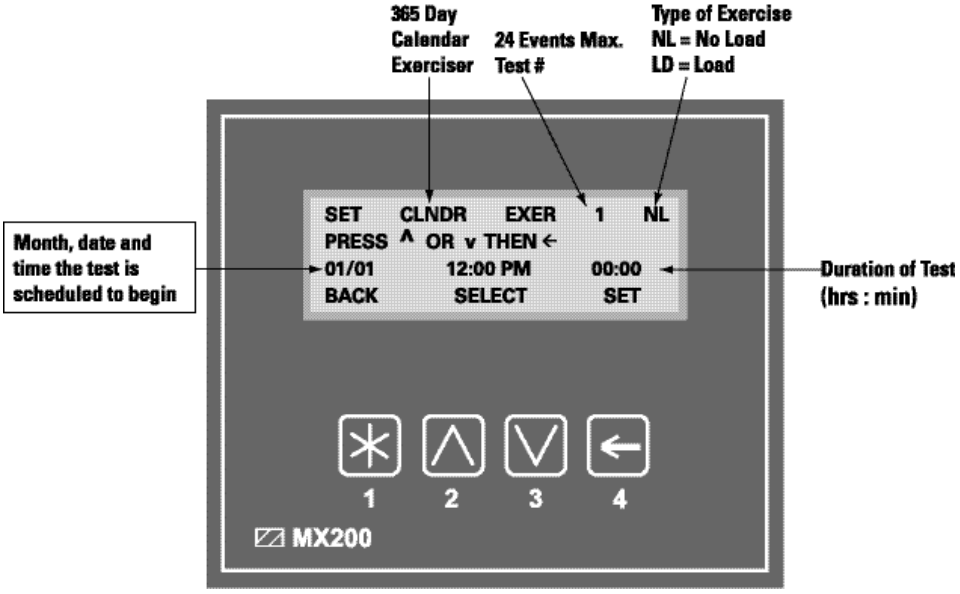


Appendix A - MX200 Exerciser Types

2 Week Exerciser



365 Day Calendar Exerciser



Appendix A - MX200 Timers

P (Engine Start Timer)

adjust via SET menu *(see page 11)* Factory default 3 seconds

- The purpose of this timer is to ensure that the transfer switch does not start the engine when the Normal power outage is very short.
- The P time range is 0 to 10 seconds in 1/10 of a second increments.
- Timer begins when the Normal fails to meet adjusted parameters.
- When the time setting has lapsed, P relay contacts will operate to start engine (DPDT).

W (Transfer to Emergency Timer)

adjust via SET menu *(see page 11)* Factory default 1 second

- The purpose of this timer is to ensure the Generator is stable before transfer.
- The W time range is 0 to 5 minutes in 1 second increments.
- Timer begins once the Generator output satisfies adjusted parameters.
- When time setting has lapsed, transfer to Generator will be initiated.

T (Transfer to Normal Timer)

adjust via SET menu *(see page 11)* Factory default 30 minutes

- The purpose of this timer is to verify that the Normal source has consistently met the sensor parameters for a minimum duration.
- The T time range is 0 to 60 minutes in 1 second increments.
- The T timer begins when Normal satisfies sensor parameters.
- When the timer setting has lapsed, retransfer back to Normal will be initiated. (Timer bypassed upon Emergency failure)

U (Engine Cool Down Timer)

adjust via SET menu *(see page 11)* Factory default 5 minutes

- The purpose of this timer is to run the Generator unloaded prior to stop.
- The time range is 0 to 60 minutes in 1 second increments.
- The timer begins once the transfer switch has transferred to Normal.
- When the timer setting has lapsed, the P relay will operate to stop engine.

DT/DW (Open Delay Timers)

adjust via SET menu *(see page 11)* Factory default 5 seconds

- Both DT and DW are center position timers for Delay style ATS Power Panels.
- The purpose of these timers is to control the center off position of delay power panels to allow the back EMF of the load to decay before re-energizing the load.
- These timers have a range of 0 to 10 minutes in increments of one second.
- DT controls how long the ATS stays open when transferring from Emergency to Normal.
- DW controls how long the ATS stays open when transferring from Normal to Emergency.

T3/W3, A6 and A62 (Pre-signal Timers)

adjust via SET menu *(see page 11)*

output connection *(see page 5-7)*

Factory default 20 seconds

- Both T3 and W3 are pre-signal timers.
- The purpose of these timers is to provide an output prior to transfer.
- These outputs are provided to coordinate building systems preparedness for the impending interruption that will occur when transferring from one live source to another.
- These timers have a range of 0 to 60 seconds in increments of one second.
- Output is relay contacts (DPDT).
- T3 takes place prior to transfer to Normal and W3 takes place prior to transfer to Emergency.
- These timers are bypassed when transferring from a dead source (power outage).
- Outputs from these timers are commonly used in conjunction with elevators and UPS systems.

Example: A five second T3 timer setting will give a relay output of a 5 second duration, during the last 5 seconds prior to transferring to the Normal source. Once the ATS is in the Normal position, the T3 signal is terminated.

Note: The operation of T3 time is added to the T time (T+T3 = transfer delay to Normal). Both T and T3 are canceled if the generator fails during transfer delay. The operation of W3 time is added to the W time (W+W3 = transfer delay to Emergency). W3 is canceled during Normal power loss transfer to Emergency. W3 is only active during testing. W timer is always used when transferring to Emergency.

- **A6** provides contact pre-signal in both directions and is normally closed.
- **A6** utilizes T3/W3 timers to provide pre-signal time setting. This option is configured without the dead source bypassing feature utilized on the standard T3/W3 operating scheme.
- **A62** option utilizes independent external timers to sequence contact outputs after transfer. These contacts are normally closed contacts that open prior to transfer in both directions (pre-signal duration determined by T3/W3 setting) and re-close in sequence after the transfer is complete (determined by the external timers designated T61, T62, T63…).
- **A62** option is commonly used to shed multiple motor loads prior to transfer and sequentially add these loads after transfer is complete. This option is configured without the bypassing feature utilized on the standard T3/W3 operating scheme.

* optional

Timer Designations as they appear in the SET menu

ATS Type	P	W	W3 (A6)	DW	T	T3 (A6)	DT	U
Standard ATS	ENG. START DELAY	TO EMERGENCY	→	→	TO NORMAL	→	→	ENG. STOP DELAY
Standard ATS with pre-signal option; T3/W3, A6 or A62	ENG. START DELAY	TO PRESIGNAL	EMERGENCY PRESIGNAL	→	TO N-PRE	NORMAL PRESIGNAL	→	ENG. STOP DELAY
Delay ATS	ENG. START DELAY	TO OPEN N	→	TO EMERGENCY	TO OPEN E	→	TO NORMAL	ENG. STOP DELAY
Delay ATS with pre-signal option; T3/W3, A6 or A62	ENG. START DELAY	TO E-PRE	TO OPEN N	TO EMERGENCY	TO N-PRE	TO OPEN E	TO NORMAL	ENG. STOP DELAY

NORMAL FAILS → TRANSFER TO EMERGENCY → NORMAL RETURNS → TRANSFER TO NORMAL → ENGINE COOLDOWN →

Appendix A - MX200 Sensors / Normal Sensors

*R50 (In Phase Monitor)

can be turned on or off via CNFG menu *(see page 12)*
Factory default off

- This feature restricts ***live source to live source transfers*** to occur only when sources are within 7 electrical degrees or less of each other (***Live source to live source transfers*** usually occur during transfer back to Normal or testing).
- R50 does not change the operation of the ATS in a power failure mode.
- R50 operation occurs after all timer functions have lapsed.
- Once the transfer timers have lapsed, the CHECKING FOR SOURCE SYNCHRONISM will be displayed.
- Transfer will then take place once the sources come into sync.
- In the event that the sources do not come within 7 electrical degrees of each other, within 60 seconds the unit will display the message: SYNCH CHECKING PRESS ← TO BYPASS.
- If ← is pressed at this point, the following will be displayed: WARNING PRESSING ← MAY CAUSE DAMAGE TO LOAD DUE TO OUT OF PHASE TRANSFER. Pressing ← again will then actually bypass the R50.
- Since this is a passive device the amount of time that it takes to sync is dependent on the frequency difference between the two sources.
- The Normal source is usually a utility and the frequency is not within the control of the consumer. The Emergency source needs to be adjusted to create an adequate difference in order for the transfer to happen in a timely fashion.

Note: **For optimum performance the generator should be adjusted maximum 2 Hertz above or below the utility frequency, minimum .1 Hertz different (58 to 59.9) or (60.1 to 62) Hertz** *(adjustment of generator to 60.0 hz will cause lengthy transfer delay).*

*R16(Phase Sequencing/Rotation)

can be turned on or off via CNFG menu *(see page 12)*

Factory default on this feature prevents ***live source to live source transfers*** from occurring between dissimilar phase sequences. This condition is primarily caused by an installation error. Connections from the Normal and Emergency need to be verified, compared and corrected to remedy the inconsistent phase rotation between the two sources.

WARNING: Turning off this option can cause severe damage to loads.

Pick Up Voltage

Factory Default: 90%
This adjustment determines the minimum acceptable voltage required to transfer to Normal. Adjust via the SET menu. Range is 85 to 100% in 1% increments *(see page 11)*. Once satisfied, the T timer will begin timing to transfer to Normal.

Pick Up Frequency

Factory Default: 95%
This adjustment determines the minimum acceptable frequency required to transfer to Normal. Adjust via the SET menu. Range is 90 to 100% in 1% increments *(see page 11)*. Once satisfied, the T timer will begin timing to transfer to Normal.

Drop Out Voltage

Factory Default: 80%
This adjustment determines the low voltage threshold. Adjust via the SET menu. Range is 75 to 98% in 1% increments *(see page 11)*. Drop out must be a minimum of 2% below pickup setting. Once voltage falls below threshold, P timer begins timing to signal generator to start.

Over Voltage (R1)

This feature, when on, provides a maximum voltage threshold at 110% of nominal system voltage. Turn on or off via CNFG menu *(see page 12)*. Once threshold is exceeded, P timer begins timing to signal generator to start.

Under Frequency (J1N)

This feature, when on, provides a minimum frequency threshold at 2Hz below pick up frequency. Turn on or off via the CNFG menu *(see page 12)*. Once the frequency drops below this threshold for more than 5 seconds, the P timer will begin timing to signal the generator to start.

Over Frequency (J2N)

This feature, when on, provides a maximum frequency threshold of 2 Hz above nominal frequency. Turn on or off via CNFG menu *(see page 12)*. Once frequency exceeds threshold, P timer begins timing to signal generator to start.

* optional

Appendix A - MX200 Emergency Sensors / Optional Pilot Devices

Pick Up Voltage

Factory Default: 90%

This adjustment determines the minimum acceptable voltage. Adjust via the SET menu. Range is 85 to 100% in 1% increments *(see page 11)*. Once satisfied, the W timer will begin timing to transfer to Emergency.

Pick Up Frequency

Factory Default: 95%

This adjustment determines the minimum acceptable frequency. Adjust via the SET menu. Range is 90 to 100% in 1% increments *(see page 11)*. Once satisfied, the W timer will begin timing to transfer to Normal.

Drop Out Voltage

Factory Default: 80%

This adjustment determines the low voltage threshold. Adjust via the SET menu. Range is 75 to 98% in 1% increments *(see page 11)*. Drop out must be a minimum of 2% below pickup setting. Once voltage falls below threshold, the T timer will be bypassed to expedite the transfer to Normal.

*Over Voltage (R8)

This feature, when on, provides a maximum voltage threshold at 110% of nominal voltage. Turn on or off via CNFG menu *(see page 12)*. Once this threshold is exceeded, the T timer will be bypassed to expedite the transfer to Normal.

*Over Frequency (J2E)

This feature, when on, provides a maximum frequency threshold of 2Hz above of nominal frequency. Turn on or off via the CNFG menu *(see page 12)*. Once the frequency exceeds this threshold, the T timer will be bypassed to expedite the transfer to Normal.

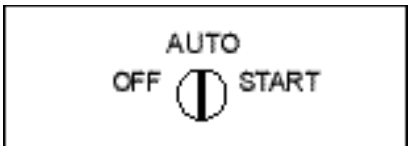
Over Frequency

This feature provides a minimum frequency threshold at 2 Hz below pick up frequency. Once the frequency drops below this threshold, if sustained for more than 5 seconds, the T timer will be bypassed to expedite the transfer to Normal.

Door Mounted Options

The S options are usually options related to a manually operated switch mounted on the door of the enclosure, which provides access to a feature or function.

S1



Selector Switch

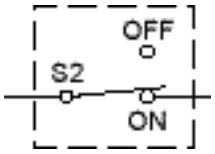
Provides start-stop control of the engine from the transfer switch panel.

AUTO Position provides Normal operation of the transfer switch and the engine.

OFF Position disconnects the transfer switch start contact from the engine. Then engine can only be started manually in this position.

START Position closes the circuit to the engine, causing it to start and run until the switch is moved from the start position.

S2



Engine Disconnect Switch

Interrupts the engine start circuit when in the "OFF" position.

* optional

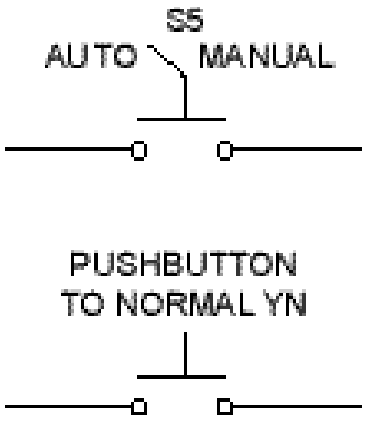
Appendix A - MX200 Optional Pilot Devices

Auto/Manual Retransfer Selector Switch

In **AUTO**, retransfer to Normal is Automatic after T timer times out. T time delay is bypassed if Emergency fails.

In **MANUAL**, retransfer to Normal occurs upon manual depression of YN or if Emergency fails.

S5



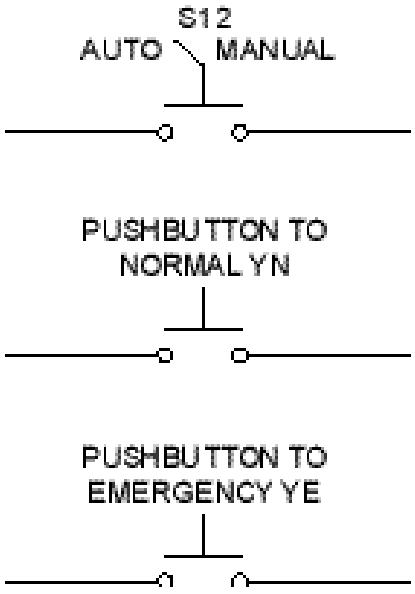
Auto/Manual Selector Switch

When the S12 is in the AUTO position, the Automatic Transfer Switch functions automatically as specified with the switch drawing.

When the S12 Switch is in the MANUAL position, the Automatic Transfer Switch will transfer either direction only by depression of Normal (YN) or Emergency (YE) Pushbutton.

NOTE: When in MANUAL, the switch maintains position, even if the selected power fails.

S12



Transfer Commit

can be turned on or off via CNFG menu
(this feature is standard)(see page 12)

When the Transfer commit is set to the Y (Yes) position

- The ATS is committed to transfer to the Emergency position once the W timer has begun timing, even if Normal returns before the transfer to Emergency occurs.
- This is to ensure that the transfer takes place, because one outage is often followed by another.

When the transfer commit is set to N (No) position
(factory default)

- The ATS is not committed to transfer unless the outage duration is longer than the timers that precede the transfer to the Emergency position.
- This assumes that the outage will be an isolated event.

S13

Test Switch, Three Position, Key Operated (Spring Return to Center)

Holding the Selector Switch in **TEST** will transfer the ATS to Emergency. Releasing the switch (to **AUTO** position) will return the ATS to Normal through the **T** timer function.

Holding the Selector Switch in **YN** Normal position will bypass the **T** timer and immediately transfer the ATS back to Normal. Releasing the Selector Switch allows the Selector Switch to return to **AUTO** position.

S14

Appendix A - MX200 Testing

⚠ NOTICE ⚠

A periodic test of the transfer switch under load conditions is recommended to insure proper operation. (See National Electric Code articles 700 and 701)

Start generator and verify proper voltage, frequency and phase sequence (match to Normal). Shut down gen set and place in Auto. Complete the visual inspection of the transfer switch, and close the cabinet door.

Initiate the test by pressing the TEST button on the LCD keypad. The controller will then prompt for your access code (as shown on Figure 1). After entering the code, three test options will appear—STD LOAD, FAST LOAD and NO LOAD (See Figure 3).

- **STD LOAD** test starts the generator and using the current timer settings, transfers the load to the Emergency source.
- **FAST LOAD** test presets timer values to a maximum 30 seconds during the test. After completion of the test, all timers are reset to their original values. (T3, W3, DT and DW remain)
- **NO LOAD** test starts the generator but does not transfer the load to the Emergency source. Press and hold the desired test option button until the switch transfers to the Emergency source (load test) or until the generator has been run for the desired amount of time (no load test). Releasing the test button before W timer timeout will abort the test (Exception: see transfer commit option, page 26).

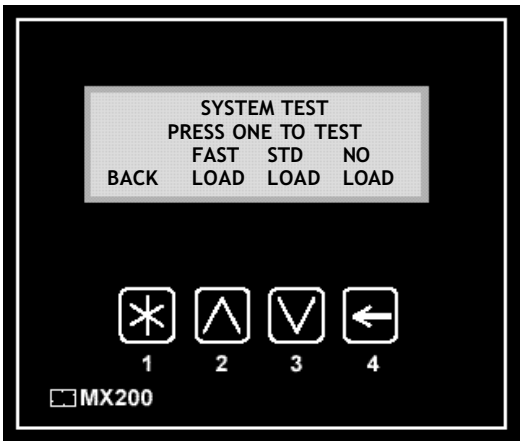


Figure 3

When the test is initiated, the controller first starts the P timer. Upon completion of the P time delay, an engine start signal is sent. After Emergency has reached preset levels, the W timer begins its timing cycle. This timer is used to ensure the voltage and frequency of Emergency has stabilized before transfer. If either the voltage or frequency of Emergency fall below preset limits the test will be terminated, and the U timer will time out. If the voltage and frequency remain within preset limits for the duration of the W time delay, the transfer switch will close into the Emergency source.

Deactivating the test switch initiates retransfer to the Normal source. The switch will retransfer after the time delay of the T timer. This timer is used to ensure that the Normal source is stable before retransfer. Immediately after retransfer, the U timer begins its timing cycle. The U timer is the engine cool down timer which allows the engine generator to run unloaded.

NOTE: Only the P timer is used during the no load test.

Appendix A - MX200 Index of Terms

Term	Definition	Page
A1	Normal Availability output relay contact	11
A1E	Emergency Availability output relay contact	11
A3	Emergency position output contact	13
A4	Normal position output contact	13
A6	Pre-signal contact either direction	13
A62	A6 with sequential pick up after transfer	13
Access Code	Six numeric digit required for program changes	15
ALT	Alternate Main Screen	15
ATS	Automatic Transfer Switch	23
Aux. Panel	Auxiliary Control Panel	
Battery	Clock Battery K-4100	19
CNFG	Menu for configure parameters	11
D Type Switch	Transfer switch with an off position (3 position)	22
DS	Disconnect Switch (located on Power Panel)	22
DT	Delay Timer from open to Normal (D Type Switch)	22
DW	Delay Timer from open to Emergency (D Type Switch)	22
E	Emergency	
E-Contact	Engine Start output relay contact	12
Emergency	Alternate Power Plant / Engine Generator Set	
Exerciser Clock	Time clock for automatic generator test	20
Input	Voltage applied from a remote source	
J1N	Normal Under Frequency Sensor	24
J2E	Emergency Over Frequency Sensor	25
J2N	Normal Over Frequency Sensor	24
Keypad	User interface keys	11
LCD	Liquid Crystal Display	11
LED	Light Emitting Diode	15
MX200	Micro processor based controller	
N	Normal	
Normal	Utility power (preferred source)	
Output	Indication via dry contacts	11-13
P	Delay timer to Engine Start	11
P2	Extended time range P	
Pre-Signal	Signal prior to transfer	11
Power Panel	Structure that transfers load between two sources of power	
Q2	Input for Remote Peak Shave/Test	11
Q3	Input to inhibit transfer to Emergency	11
Q7	Input to inhibit transfer to Normal	11
R1	Normal Over Voltage Sensor	24
R8	Emergency Over Voltage Sensor	
R15 (load shed)	Input to transfer off Emergency to dead Normal	14
R15D (load shed)	Input to transfer off Emergency to open position (D Type Switch)	14
R16	Phase sequence sensor	
R50	In phase monitor	
Retransfer	Transfer back to Normal source	
RT box	Relay Transformer Box	11
S1	Selector; Engine (OFF-AUTO-START)	25
S12	Selector; Automatic or Manual ATS	26
S13	Transfer Commit	26
S14	Selector; Test-Auto-YN	26
S2	Selector; Engine (OFF-ON)	25
S5	Selector; Auto or Manual retransfer	26
SET	Menu for Setting parameters	15
T	Delay timer to transfer to Normal	22
T3	Pre-signal to Normal transfer timer	13
Test	Simulated utility power outage	
Test Switch	Simulates utility power outage	
U	Engine cool down timer	22
UPS	Uninterruptable Power Source	
W	Delay timer to transfer to Emergency	22
W3	Pre-signal to Emergency transfer timer	22
YE	Push button to Emergency	
YN	Push button to Normal	
ZNET200	Network communication card	14
ZTS	Zenith Transfer Switch	

Appendix B - ZTSH Installation

Control Connections

A complete information package is furnished with each transfer switch including a complete connection diagram and schematic which details all necessary control circuit field connections.

The engine start control wires connect to the terminals specified in the upper left corner of the control panel. *Figure 2* shows the location of these terminals on the standard SSRCP printed circuit board mounted on the steel backplate. These terminals are clearly identified by a pre-printed label attached to the steel control panel. In the case of manual transfer switches, or in other applications not requiring the standard control panel, clearly marked terminal blocks are provided in the upper left corner of the control panel for the engine start control wires.

Terminals for field connections to the A3 Emergency auxiliary contacts and the A4 Normal auxiliary contacts are also provided. These terminals are clearly marked and appear on the side of the power panel. On 400 amp units these terminals appear on the disconnect switch bracket above the operator handle, and are marked as illustrated in *Figure 3*.

Make all other necessary external control connections to the appropriate terminal blocks located on the control panel. Insure that all connections are tightened to the torque specified in *Figure 1*.

Control Wire Connections	
Wire Size (AWG)	**Torque Lb. - In.**
18-16	19
14-8	19
6-4	36

Figure 1

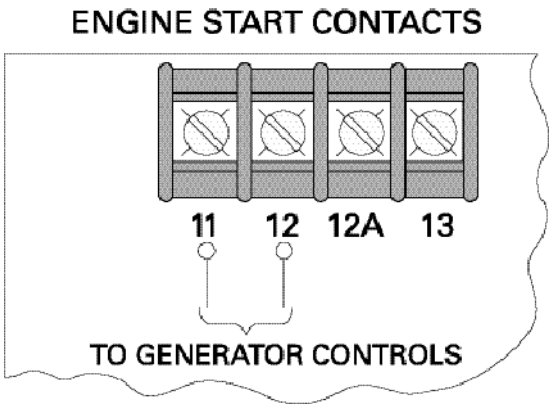


Figure 2

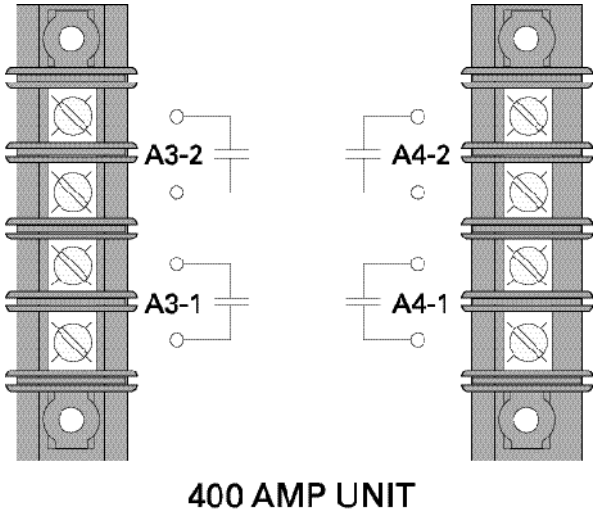


Figure 3

Appendix B - ZTSH Operation and Features

Sequence of Operation

The information package supplied with the transfer switch includes a schematic diagram and description of operation of all accessories provided.

The sequence for load transfer to the Emergency source begins automatically when any phase of the Normal source falls below the preset dropout point and this undervoltage failure condition is detected by the solid state phase relays B1, B2, B3.

The phase relays drop out, de-energizing the normal control relay CR, and engine start timer P1 begins its timing cycle. The P1 time delay is provided to override momentary outages and to prevent nuisance starting of the engine generator. If the Normal source voltage returns above the pickup setting of the phase relays, the P1 timing cycle is reset to zero by the re-energization of the CR relay.

If the normal source voltage does not return before the P1 time delay is completed, the P1 timer drops out and sends a starting signal to the engine generator. An emergency voltage and frequency sensing relay VFSM monitors the voltage and frequency of the Emergency source. When both the voltage and the frequency of the Emergency source reach the preset pickup points, the VFSM relay initiates the transfer to the Emergency source and timer W begins its timing cycle. The W timer provides an adjustable transfer delay to the Emergency source as required.

When the W time delay is completed, the Emergency control relay RT energizes and picks up the power relay, CE1 or CCE. The power relay connects voltage from the Emergency source to the Emergency switch operating circuit caaausing the switch to transfer its main contacts to the Emergency source. The switch is mechanically locked in the Emergency position. The power relay and Emergency operator are de-energized when the SE limit switch is activated by the operator. The SN limit switch is deactivated at the same time, readying the Normal control circuit for retransfer when the Normal source is restored.

The sequence for retransfer to the Normal source begins automatically when the voltage on all phases of the Normal source reach the preset pickup point and this condition is detected by the solid state phase relays.

When the Normal source restores, the solid state phase relays B1, B2, B3 pick up and initiate retransfer of the switch to the Normal source by energizing timer T and beginning its timing cycle. The T timer provides an adjustable delay to ensure that the Normal source has stabilized before reconnection to the load. If the Normal source fails before the T time delay is completed, the phase relays drop out and the T timing cycle is reset to zero.

When the T time delay is completed, the Normal control relay CR energizes and picks up the power relay, CN1 or CNN. The power relay connects voltage from the normal source to the Normal switch operating circuit causing the retransfer of the main switch contacts to the normal source. The switch is mechanically locked in the Normal position. The power relay and the Normal operator are de-energized when the SN limit switch is activated by the operator. The SN limit switch also energizes the engine over-run timer U and begins its timing cycle. The timer provides a period of timefor the engine generator to run without load and cooldown before shutdown. After the U time delay is completed, the P1 timer is energized and the engine generator is shutdown.

Appendix B - ZTSH Adjustments and Settings

Solid State Timers

Solid state timers are adjustable from 0.1 second to 100 hours. The red timing indicator in the upper left corner flashes as the timer progresses through the timing cycle. When the timing cycle is completed, the indicator remains illuminated. A flathead screwdriver is required to change the setting, as shown in *Figure 7*.

The time unit is selected by turning the rotary switch at the lower right of the timer. Four selections are available: "Seconds", "Minutes", "Hours", "10 Hours". The time unit selected is displayed in the window below the time setting dial.

The time range is selected by turning the rotary switch at the lower left of the timer. Four ranges are available: "0-0.5", "0-1.0", "0-5.0", "0-10.0". The dial digits appear in the windows around the time setting knob.

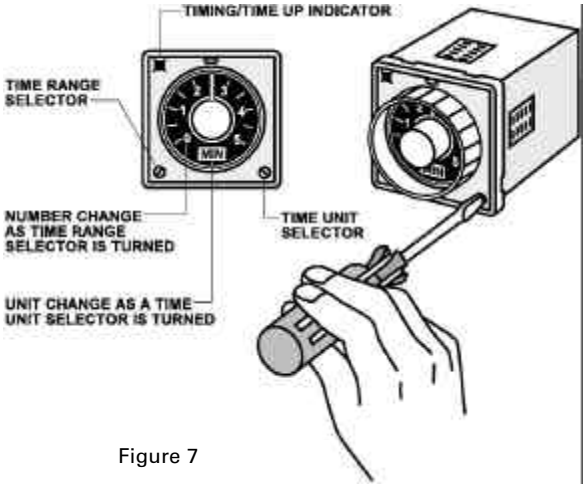


Figure 7

⚠ CAUTION ⚠

Do NOT change the setting while the timer is energized. Timer malfunction or damage may occur.

The factory setting of the solid state timers used in the Zenith standard package are shown in *Table 4*.

Timer	Factory Setting
T	30 minutes
U	5 minutes
W	1 second

Table 4

Voltage/Frequency Sensor (VSFM)

The pickup point may be adjusted by rotating the adjustment screw as shown in *Figure 8*. Counter-clockwise rotation increases the pickup voltage.

Pickup Voltage (at 100% Frequency)
Adjustable: 80% to 95%
Factory Set: 90%
Pickup Frequency
Adjustable: 80% to 100%
Factory Set: 95%

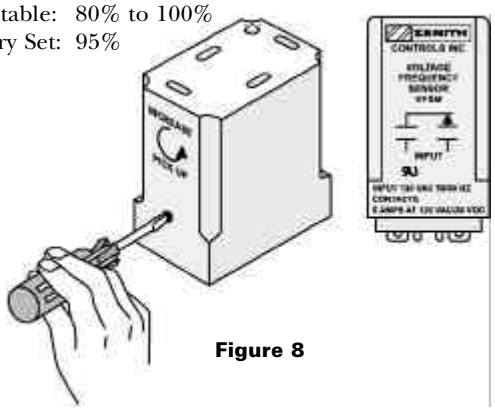


Figure 8

Solid State Phase Relay (ARSM)

The pickup and dropout points may be adjusted by using the following procedure. Use of a variable voltage supply (Variac) is required. The relay is illustrated in *Figure 9*.

1. Turn the pickup adjustment fully clockwise.
2. Turn the dropout adjustment fully counter-clockwise.
3. Set Variac to the desired pickup voltage.
4. Rotate the pickup adjustment counterclockwise very slowly until the relay picks up. The LED will illuminate.
5. Set Variac to the desired dropout voltage.
6. Rotate the dropout adjustment clockwise very slowly until the relay drops out. The LED will go out.
7. Verify the setting by raising the voltage until the relay picks up and lowering the voltage until the relay drops out.

Pickup Voltage:
75% to 115% of Nominal
Factory Set:
90% of Nominal

Dropout Voltage:
55% to 105% of Nominal
Factory Set:
80% of Nominal

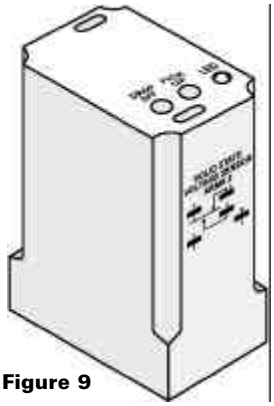


Figure 9

Appendix B - ZTSH Adjustments and Settings

C OR D CLOCK ACCESSORIES

OPERATION The "C" plant exercisor starts the engine (No Load Test) by closing the engine start circuit. The "D" plant exercisor simulates normal line failure, starts the generator, and transfers the load to emergency at selected time intervals.

NOTE Total GENERATOR running time = clock ON time + "U" timer ON time (if U is used)

CAUTION ⚠ Before changing the time setting, turn Disconnect Switch (DS) to "OFF" position; after desired selection has been made, return DS to "ON" position.

Digi 20 PROGRAMMING INSTRUCTIONS

The circular keypads are positioned to provide a sequential path for programming. Starting with Prog. to select a program, clockwise to ⛱ to select ON or OFF. Then h for hour, m for minute, and finally Day to select day or days of the week. If an input is missing or incomplete, the missing segments will flash when the ◷ or program key is depressed. (For example, if no ON or OFF is selected, the ON symbol will flash). The missing entry must be completed before programming can resume. While programming, pressing the h, m or Day key longer then 2 seconds will cause a rapid roll of the parameter. A program consists of: 1. ON or OFF command, 2. Hour and minute, and 3. Day or multiple days on which it is to occur.
Note: A flashing display indicates either incomplete data entry or the battery is low. Check to see if days and ON or OFF times are entered, and check the power supply to the time control.

IMPORTANT: Depress reset key (Res.) before beginning to set time and program

SETTING TIME AND DAY OF CLOCK

1. Select military (24:00 hr.) or AMPM (12:00 hr.) time mode by depressing and holding h key while pressing ±1h key to toggle between military and AM/PM. (AM appears in display when in AM/PM mode).
2. Press and hold down ◷ key.
3. If setting the time when daylight savings time is in effect, press ±1h key once (±1h will appear in display).
4. Set hour with h key. If AM or PM does not appear in display, the unit is in Military time see note above to change display.
5. Set minutes with m key.
6. Press Day key repeatedly to the day of the week (1 is Monday, 7 is Sunday).
7. Release ◷ key, colon will begin flashing. If the days are flashing, the day of the week was not entered. (See step 6).

PROGRAMMING

1. Press Prog.key will appear in display. (Pressing Prog. key again, display will show the number of free programs: Fr 20). Press again to advance to 1st program.
2. Press ⛱ key, ⦿ ON symbol will appear. Pressing the key again will toggle to OFF ◠ . Select ON or OFF for the program with the ⛱ key.
3. Press h to select hour for switching time.
4. Press m to select minute for switching time.
5. If the program is to occur every day of the week, (24 hour time control) ignore Day key and press Prog. key to advance to next program.
6. If 7 day time control is desired, press Day key. 1 2 3 4 5 6 (Mon. thru Sat.) block of days appears in Day key again, 1 2 3 4 5 (Mon. thru Fri.) appears in display. Pressing Day key again, 6, 7 (Sat. & Sun.) appears in display. Pressing Day key again, 1 (Mon.) appears in display. Repeated presses will cycle through all days of the week and back to 1 thru 7 (Mon. thru Sun.). Select day or block of days desired with the Day key.

7. Press Prog. key and repeat steps 2 thru 6 to enter additional programs of ON and OFF times. Note that more than and Prog. Press OFF times. Note that more than one OFF time program may be entered, enabling automatic control of manual overrides.

8. Press ◷ key to enter run mode.

IMPORTANT: THE OUTPUT RELAYS WILL SWITCH ON (OR OFF) ONLY AT THE PROGRAMMED TIMES, AFTER PROGRAMMING IS COMPLETED. IF A CHANNEL SHOULD BE ON, IT MUST BE MANUALLY TURNED ON WITH THE KEY. FOR EXAMPLE: PROGRAMMING IS COMPLETED AT 2PM AND CH1 WAS PROGRAMMED TO BE ON AT 8AM AND OFF AT 5PM. AFTER PRESSING THE ◷ KEY, CH1 WILL BE OFF; PRESS TO TURN IT ON. IT WILL ASSUME AUTOMATIC OPERATION AT THE 5PM OFF TIME.

REVIEW AND CHANGE OF PROGRAMS

1. To review a program at any time press Prog. key. Programs will be displayed in the sequence they were entered with repeated presses of Prog. key.
2. To change a program, select the program to be changed with Prog. key and enter the new time of day and/or days of week just as in the programming steps shown above. The old program is overwritten with the new selections. Press Prog. to store the new program.
3. To delete on individual program, select the program as in step 1 and press the m key and then the h key until "--:--" appears in display. Press either Prog. or ◷ key until "--:--" flashes. The program is deleted after a few seconds.

MANUAL OVERRIDE

While in Run mode, (◷ symbol is in display), pressing the key will reverse the load status (switch load OFF if it is ON, or switch ON if it is OFF) a symbol appears in display to indicate the override is active. At the next scheduled time, automatic time control will resume, eliminating the override.

Pressing the key a second time ⦿ appears in the display indicating the load is switched permanently ON
Pressing the key a third time ◯ appears in the display indicating the load is switched permanently OFF.
Pressing the key a fourth time returns to automatic, ◷ appears in the display.

C/D ACCESSORY

OPERATION — The "C" plant exerciser starts the engine (No Load Test) by closing the engine start circuit. The "D" plant exerciser simulates normal line failure, starts the generator, and transfers the load to emergency at selected time intervals.

NOTE — Total GENERATOR running time = clock ON time + "U" timer ON time (if U is used)

CAUTION — ⚠ Before changing the time setting, turn Disconnect Switch (DS) to "OFF" position; after desired selection has been made, return DS to "ON" position.

Digi 42/2 PROGRAMMING INSTRUCTIONS

The circular keypads are positioned to provide a sequential path for programming. Starting with Prog. to select a program, clockwise to to select ON or OFF. Then h for hour, m for minute, and finally Day to select day or days of the week. If an input is missing or incomplete, the missing segments will flash when the ◷ or program key is depressed. (For example, if no ON or OFF is selected, the ON symbol will flash). The missing entry must be completed before programming can resume. While programming, pressing the h, m or Day key longer then 2 seconds will cause a rapid roll of the parameter. A program consists of: 1. ON or OFF command, 2. Hour and minute, and 3. Day or multiple days on which it is to occur.
Note: A flashing display indicates either incomplete data entry or the battery is low. Check to see if days and ON or OFF times are entered, and check the power supply to the time control.

IMPORTANT: Depress reset key (Res.) before beginning to set time and program

Appendix B - ZTSH Adjustments and Settings

MANUAL OR AUTOMATIC DAYLIGHT TIME CHANGEOVER

For areas where Daylight Savings time is not observed, please ignore this section. The Digi 42/2 offers the option of manual or completely automatic Daylight Savings time chageover in the spring and fall. For manual changeover, depressing the ±1h key sets clock time up or down 1 hour to change the time twice a year. For automatic changeover, perform the following programming, which only needs to be done during initial installation, or if the reset key is depressed at any time. When programmed for auto changeover, the time switch will automatically change the time at 2 AM on the first Sunday of April and the last Sunday of October until the year 2079.

1. Select military (24:00 hr.) or AM/PM (12:00 hr.) time mode by simultaneously depressing the ±1h key and h keys. (AM appears in display when in AM/PM mode).
2. Enter the Daylight Savings Time Program by pressing the ±1h and Day once simultaneously. A "1" will appear uner "Mo" in display. Then set the current (today's) date with the m key and the month with the h key. (If military time, set the date with h key and month with m key). For example: Feb 15 would appear as 02:15 if in AM/PM or as 15:02 if military time.
3. Press ±1h key once. A "12" will appear under "Tu" in display. Then enter the current year with the m key. If you overshoot the current year, hold down the m key and the years will scroll to 2079 and back to 1995, 1996, 1997, etc.
4. Press ±1h key once. A "3" will appear under "We" in display, and "AU" (for preset European dates). If European dates are desired, press key to enter the data and exit Daylight Time programming mode.
5. Press m key onc. "cHA" will appear in display (for entering North American dates).

   NOTE: If the m key is inadvertantly pressed two times and "HA" appears in display, press the m key two more times, until display shows "cHA". ("HA" for specific dates is not used at present).
6. Press ±1h key once. A "4" will appear under "Th" in display. Enter the date for changeover to Summer Daylight Savings Time for the current year (see chart below for dates) by entering the date with the m key and the month with the h key) (If in Military Time, set date with h month with m key). For example: April 7 would appear as 04:07 if in AM/PM time, 07:04 if in military time.
7. Press ±1h key once. A "5" will appear under "Fr" in display. Enter the date changeover to Winter Time for the current year (see chart below for dates) by entering date with the m key and the month with the h key. (If in Military Time, set date with h key and the month with m key).
8. Press key to enter the data and exit the Daylight Savings Time programming mode.

Daylight Savings Time Changeover Dates

2002.....April 07.....October 27	2005.....April 03.....October 30
2003.....April 06.....October 26	2006.....April 02.....October 29
2004.....April 04.....October 31	2007.....April 01.....October 28

SETTING TIME AND DAY OF CLOCK

1. Select military (24:00 hr.) or AM/PM (12:00 hr.) time mode by depressing and holding h key while pressing ±1h key to toggle between military and AM/PM. (AM appears in display when in AM/PM mode).
2. Press and hold down ◷ key.
3. If Automatic Daylight Savings Time Changeover is not programmed, press ±1h key once if setting the timer when Daylight Savings time is in effect (±1h appears in display).
4. Set hour with h key. If AM or PM does not appear in display, the unit is in Military Time (see note above to change display).
5. Set minutes with m key.
6. Press Day key repeatedly until the day of the week is displayed (1 is Monday, 7 is Sunday).
7. Release key, colon will begin flashing. If the days are flashing, the day of the week was not entered. (See step 6).

Appendix B - ZTSH Adjustments and Settings

PROGRAMMING

1. Press Prog. key [PROG/SET] will appear in display. (Pressing Prog. key again, display will show the number of free programs: Fr 42) press again to advance to 1st program.

2. Press 1 key or 2 key. ON symbol will appear below CH 1 or CH2. Pressing the key again will toggle to OFF . Pressing a third time clears the ON/OFF for the channel from the program. Pressing again returns to ON. Select ON or OFF for the program with the key. Note: ON or OFF con be selected for BOTH CHANNELS. (Both channels con switch ON at the some time, or one con switch ON and the other OFF from the some program).
3. Press h to select hour for switching time.
4. Press m to select minute for switching time.
5. If the program is to occur every day of the week. (24 hour time control) ignore Day key and press Prog. key to advance to next program.
6. If 7 day time control is desired, press Day key, a flashing underline appears below day 1. Pressing the Day key a second time advances the underline to day 2, etc. Use the Day key to advance to a day of the week to be omitted from the program and press the Sel. (select) key, the day will flash. Continue pressing Day and Sel. keys to omit days until only the desired days remain and ore not flashing.
7. Press Prog. key and repeat steps 2 thru 6 to enter additional programs of ON and OFF times. Note that more than one OFF time program may be entered, enabling automatic control of manual overrides.
8. Press key to enter run mode.

8th DAY (HOLIDAY OR VACATION) PROGRAM
Multiple programs (more than one ON and OFF time) may be entered to be implemented on holidays or vacation periods. (A typical program is: OFF, 12:01Am to hove the loads) OFF during the holiday).

1. Press Prog. key, select ON or OFF, h and m as with normal programming. but do not select or omit any days.
2. Press key. will appear in the display, indicating 8th day holiday/vacation program.
3. Press key to enter run mode. Time switch is now permanently preset for the ON/OFF schedule to be implemented on holiday or extended vacation period in the Future as described below.
   HOLIDAY PROGRAM: Pre-select Day or Series of Days for 8th day Program to Occur.
   The holiday program may be implemented at any time up to 6 days in advance of the holiday(s) or vacation period. It may also be activated on the holiday or first day of the vacation period.
1. While in Run mode, press key. "--Ho" appears in display.
2. Press Day key to select the day of week Holiday program is to begin.
3. Press Sel. key to select the number of days Holiday program is to run. Up to 99 days. If Sel. key is held down. numbers roll up rapidly to 99 then to 01)
4. Press key to store, holiday symbol appears in display.
5. To review or change the Holiday Program, press key. To cancel Holiday Program, press key.

   On the day that the Holiday Program is selected to begin, the 8th day program will be implemented at 1 2:00AU Midnight and hove priority over the regular doily programs. The display will show the holiday symbol and the number of days the program is to run, which will count down each day and revert to the normal display, when all days of the holiday/vacation period hove expired. To cancel holiday program, press key.

IMPORTANT: THE OUTPUT RELAYS WILL SWITCH ON (OR OFF) ONLY AT THE PROGRAMMED TIMES, AFTER PROGRAMMING IS COMPLETE. If A CHANNEL SHOULD BE ON, It MUST BE MANUALLY TURNED ON WITH THE KEY. FOR EXAMPLE: PROGRAMMING IS COMPLETE AT 2PM AND CH1 WAS PROGRAMMED TO BE ON AT 8AM AND OFF AT 5PM. AFTER PRESSING THE KEY, CH1 WILL BE OFF; PRESS TO TURN IT ON. IT WILL ASSUME AUTOMATIC OPERATION AT THE 5PM OFF TIME.

REVIEW AND CHANGE OF PROGRAMS

1. To review a program at any time press Prog. key. Programs will be displayed in the sequence they were entered with repeated presses of Prog. key.

2. To change a program, select the program to be changed with Prog. key and enter the new time of day and/or days of week just as in the programming steps shown above. The old program is overwritten with the new selections. Press Prog. to store the new program.
3. To delete on individual program, select the program as in step 1 and press the m key and then the h key until "--:--" appears in display. Press either Prog. or ◷ key until "--:--" flashes. The program is deleted after a few seconds.

MANUAL OVERRIDE

While in Run mode, (◷ symbol is in display), pressing the key will reverse the load status (switch load OFF if it is ON, or switch ON if it is OFF) a symbol appears in display to indicate the override is active. At the next scheduled time, automatic time control will resume, eliminating the override.

Pressing the key a second time ⦿ appears in the display indicating the load is switched permanently ON
Pressing the key a third time ◯ appears in the display indicating the load is switched permanently OFF.
Pressing the key a fourth time returns to automatic, ◷ appears in the display.

C/D WITH 365 DAY CLOCK

LEGEND

C/D.... Exercise clock, 365 day pogrom.
See sheets 2, 3 & 4 for programming instructions.

OPERATION

C-MODE: The "C" plant exercisor starts the engine (No Load Test) by closing the Engine Start circuit.
D-MODE: The "D" plant execisor simulates normal line failure, starts generator, and transfers load to emergency at the selected time intervals.

NOTES

1. Total GENERATOR running time = "C" ON time + "U" timer ON time (if U is used).

CAUTION

⚠ Before changing the time setting, turn Disconnect Switch (DS) to "INHIBIT" position; after desired selection has been mode, return DS to AUTO position

DIGI 322 - 45/2 Y—24

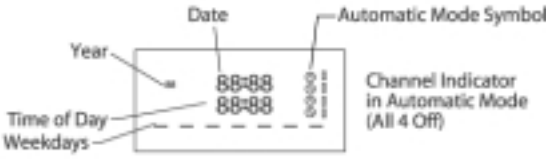
KEYPAD DESCRIPTION

Mo-Su - Day selector
✱Reset - Clears all programs and actual time
✱S/W - Switch for daylight savings time functions
Prior - Sets priorities
Year - Sets year when setting actual time
CL - To cancel on individual pogrom step
R - Used to review the pogrom
1X - Used to enter a one time schedule
N - Used to enter on intermediate step in a pogrom block
◷ - Recalls actual time (Time of Day)
S - Used to store the final step in a pogrom block
⎍ - Sets the momentary contact (IMP)
⊣⊢ - Used to set the end of a multiday holiday period
Day - Used to set the day of the month
Month - Used to set the month
h+ - Hour advance
h- - Hour reverse
m+ - Minute advance
m- - Minute reverse
I/O - Sets ON(1), OFF(0) command for each channel
- Manual override for each channel
✱ - Recessed buttons - use a long pen point

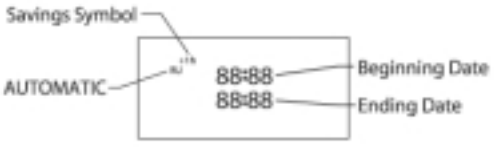
LCD DISPLAY ELEMENTS

The LCD incorporates a number of different elements to display various data and information.

1. Example: Actual dote and time of day

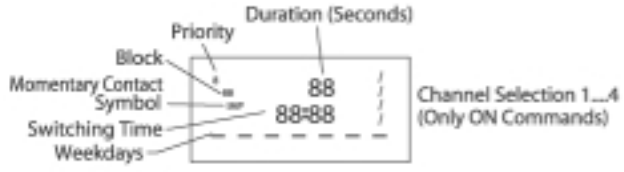


2. Example: Daylight savings time



Appendix B - ZTSH Adjustments and Settings

3. Example: Momentary Contact



4. Example: Other displays



BLOCK FORMATION

The purpose of the blocks is to simplify the programming, i.e. switching times that are repeated for different holidays or periods need not be repeated. Likewise, when programming ON and OFF times the date need only be entered once.

The time switch assigns a block number to each program or date block entered from 00 to 99. All programs withour a date (7-day prograns) automatically receive the block number 00.

Programs with dates - individual days or period of days - are assigned an ascending block number (01, 02.....99). All programs within a block are stored by pressing "N". The last program or portion of a program within a block is entered by pressing "S", thus closing the block.

EXECUTION OF PROGRAMS

At beginning of each day the microprocessor determines which of the stored programs for that day have the highest priority. Only the highest priority program(s) will be

Once the digi 322 is programmed, it will automatically "look back" and assume the correct ON or OFF switch position.

PRIORITY

The microprosessor automatically assigns the lowest priority - "0" - to standard 7-day programs. Holiday programs with a duration of more than one day automatically receive priority "1". Holiday programs for one day only automatically receive priority "2". A higher priority can be manually assigned to any holiday program by using the "Prior." key.

PROGRAM STORAGE CAPACITY

The digi 322 can store up to 322 programs. These 322 programs can be freely assigned to different dates or periods, switching times or channels.

A storage position is used each time the button "N" or "S" is pressed. If all storage positions are used up, four 8's will be shown in the display.

If a program step is not complete and storage is attempted with the "N" or "S" button, the missing components will blink in the LCD.

SETTING THE TIME

[Example: 8:15 AM, July 10, 1991]
Press "Reset" to clear the time and all programs.
While holding ◷ :

Press "Year"	to 91
Press "Month"	to 7 (July)
Press "Day"	to 10
Press "h+"	to 8 (AM)
Press "m+"	to 15

Release the ◷. The current date and time will be displayed, as will the day of the week; the time colon will blink. Channel setting and override status will be indicated on the right and the +1h indicates that Daylight Saving Time is in effect, if appropriate.

DAYLIGHT SAVINGS TIME (DST) FUNCTIONS

The digi 322 is pre-programmed for DST to begin on the last Sunday in March and to end on the last Sunday in September every year. You can program a different DST as follows:

To cancel pre-programmed DST:

Press "S/W"	(dates will appear)
Press "CL"	to cancel - (zeros will appear)
Press "S"	to store
Press ◷	to display the time of day

To program different dates for DST:

[Example: For 1991, April until October 27]

Press "S/W"	the dates 03:31 to 09:29 are displayed
Press "CL"	the display shows zeros

Appendix B - ZTSH Adjustments and Settings

Press "Month"	to 4 (April)
Press "Day"	to 7
Press →|	to set the ending date
Press "Mounth"	to 10 (Ocober)
Press "Day"	to 27
Press "S"	to store
Press ◷	to display the time of day

PROGRAMMING 7-DAY SCHEDULES

NOTE: The actual time of day must be set prior to programming. Check DST. We recommend that all programs be first written out on the enclosed program worksheets.

[Example: Channel 1 on at 7 AM and off at 6 PM, Monday thru Friday]

Press "h+"	to 7 AM (press 9 times)
Press "m+"	to 00 (once)
Press "Sa"	to omit Saturday
Press "Su"	to omit Sunday
Press "I/O"	(for channel 1) to 1 (ON)
Press "N"	to store
Press "h+"	to 6 PM
Press "m+"	to 00 (once)
Press "Sa"	to omit Saturday
Press "Su"	to omit Sunday
Press "I/O"	(for channel 1) twice to 0 (OFF)
Press "S"	to store

Weekly program steps are automatically assigned to block "00" and priority "0".

PROGRAMMING INDIVIDUAL HOLIDAYS

[Example: July 4th - fixed date holiday; Labor Day (September 2, 1991) - 1-time schedule; Channel 1 off at 12:01 AM]

NOTE: Fixed day holidays will stay in the program until the year 2079 when the internal clock stops. As one time holiday commands are executed the month and day go to zero (visible if you review the program). The month and day for the next year can be substituted for the zeros. For example: If you have a holiday program for Thanksgiving 1991 it is executed on November 28. If you review the program on November 29th you will see 00.00 not 11.28; you can enter 11.26, and press the "N" key to program Thanksgiving for 1992.

Press "Month"	to 07 (July)
Press "Day"	to 04
Press "N"	to store
Press "Month"	to 09 (September)
Press "Day"	to 02
Press "1X"	1-time schedule only
Press "N"	to store
Press "h+"	to 12 AM
Press "m+"	to 01
Press "I/O"	(for channel 1) twice to 0 (OFF)
Press "S"	to store this and close the block

Individual Holiday programs are automatically assigned priority 2.

NOTE: Ignore the days of the week indicator.

PROGRAMMING MULTIDAY HOLIDAY PERIODS

[Example: Channel 1 off (we will use an OFF command at 12:01 AM) each day from June 22, 1991 until September 3, 1991 inclusive]. The daily program will resume September 4. As this "School Summer Vacation" will be different in 1992 this becomes a 1X (one time) schedule.

Press "Month"	to 06 (June)
Press "Day"	to 22
Press →|	to set the end date
Press "Month"	to 09 (September)
Press "Day"	to 03
Press "1X"	to set one time
Press "N"	to store
Press "h+"	to 12 AM
Press "m+"	to 01
Press I/O"	(for channel 1) twice to 0 (OFF)
Press "S"	to store this and close the block

Multiday holiday program are automatically assigned priority 1. These periods can be programmed with a 7-day schedule that is different than the standard 7-day schedule. Simply follow the above procedure and add the respective Monday thru Sunday keys for the desired days of the week before selecting the hours.

If no ON or OFF times are programmed for some or all days of the week during a multiday holiday period, the standard 7-day schedule will be executed.

REPEAT CHANNEL SELECTION

The control of loads is not restricted to a single channel. All loads can be turned on or off at the same time. For example, load 1 can be turned OFF simultaneous to load 2 being turned ON.

SPECIAL PROGRAM FUNCTIONS

MOMENTARY CONTACT PROGRAM

Short duration programs in 1-second intervals up to 59 seconds can be programmed for loads such as bells.

Appendix B - ZTSH Adjustments and Settings

[Example: A noon whistle (channel 2) for six seconds Monday through Friday]

Press "h+"	to 12 PM - noon
Press "m+"	once to 00
Press "I/O"	(channel 2) once to 1
Press "Pulse"	to 6 (seconds)
Press "Sa, Su"	to eliminate Saturday & Sunday
Press "S"	to store

NOTE: This can only be used for ON commands.

PRIORITIES

Pressing the "Prior." key after entering the date for a holiday program permits the assignment of a higher priority (the highest is 9). This allows that standard holiday programs with priority 1 or 2 are overridden with special programs.

MANUAL OVERRIDE

The digi 322 provides temporary and fixed overrides. Each channel has an elongated button below the . Pressing this button will change the status of a channel, i.e. ON to OFF or OFF to ON. The small in the display will change to indicating an override condition. This is a temporary override which will in turn be overridden by the next program change.
For example, if lights are programmed to turn off at 4 PM and they are turned on manually at 2 PM, they will turn off at 4 PM.
Pushing the button again will give a FIX 1 (ON) and pushing it another time will give a FIX 0 (OFF). These are permanent ON or OFF commands which will not be overridden by the program. Pushing the elongated button one more time will return to automatic operation.

PROGRAM REVIEW

The program can be reviewed by pushing the "R" key successively. Block 00 is reviewed first and each weekly ON/OFF command will be displayed on successive screens. A blank screen indicates the end of block 00. Block 01 is reviewed next. The first screens show the holidays followed by a blank screen.
The ON/OFF commands for those days are next followed by another blank screen which indicates the end of block 01. Block 02 and any additional blocks are reviewed in the same manner. Press the turn to the TOD display anytime.

CANCELLING PROGRAMS

Use the "R" key to find the program step to be cancelled. Pressing the "CL" key will cancel that step and it is deleted from memory. To delete holidays from the program you must clear both the date and the time/on/off positions. The reset key will cancel all program steps and also the current time of day, date etc.

EDITING PROGRAMS

Use the "R" key to find the program step to be corrected. Make the changes as in normal programming and then use the "N" key to store the change.

BATTERY-POWERED RESERVE

In case of power failure, the built-in nickel-cadmium battery maintains the time of day, program storage and the LCD display of 150 hours (6+ days). During this time, all programmed switching events will be carried out but the relays will not operate. The battery reserve operates to its full capacity only if the digi 322 has been connected to electrical power for at least 140 hours.

NOTES:

1. When power is restored after a power failure, the digi 322 "looks back" and assumes the correct ON or OFF switch position.

2. After entering a time of day and pressing N or S, the display may still show the hour that was entered.

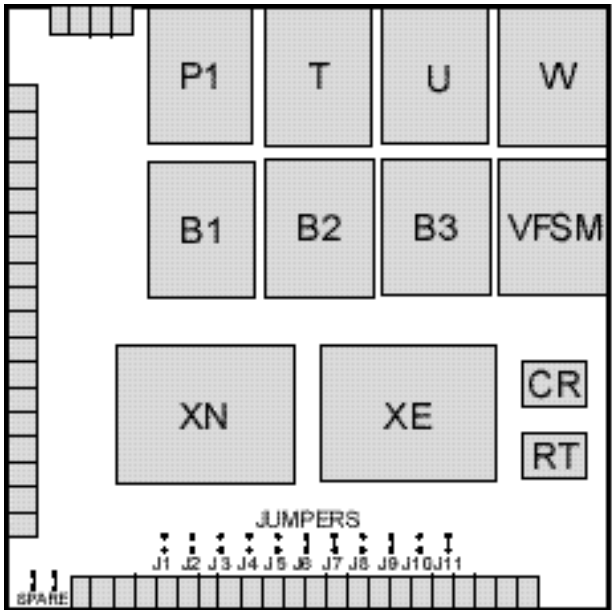
   For example: if 2:00 PM had been entered, the display may show "PM 02:--" after pressing N or S.

   To enter the next time of day program, it is necessary to change the hour with the h+ or h- key even if the next time of day program is to be the same hour as previously entered. If the hour is not changed, the Digi322 will not accept the next program.

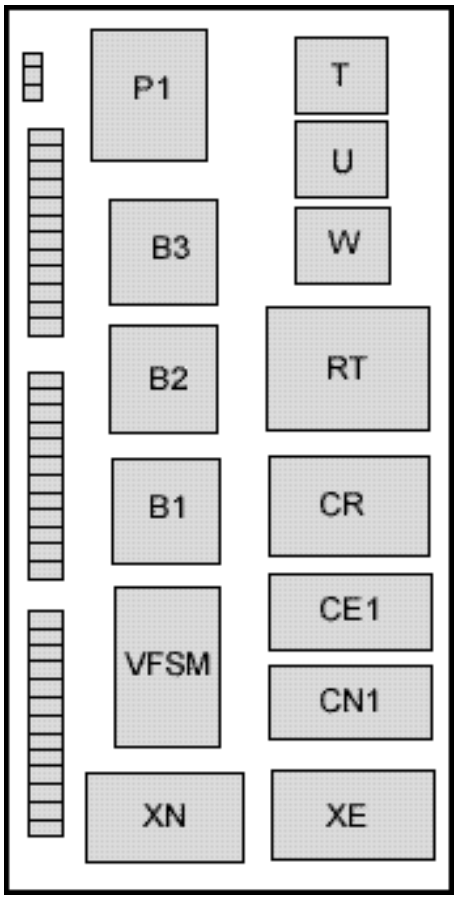
   For example: After entering a 2:00 PM program, if the next time of day program is to be 2:30 PM, press the h+ key to 3 PM, and then the h-key back to 2 PM, and then press the m+ key to :30.

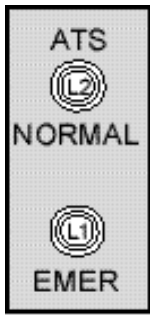
Appendix B - ZTSH Control Layout

Standard Control Panel (SSRCP)



JUMPER	CONNECTS POINTS	REMOVE WHEN ACCESSORIES USED
J1	23, 23A	B1
J2	23A, 23B	B2
J3	23B, 23C	B3
J4	23C, 23Z	JIN, TS, C/D
J5	23Z, 27	T, YN
J6	25, 25Z	T3, R4
J7	28, 28Z	S1, C, C/D
J8	28Z, 29	P1 & U
J9	33A, 33Y	ER1, 2, 3, J1E
J10	33Z, 37	W
J11	35, 35Z	R4, W3







TAG	DESCRIPTION
L1 L2	ATS Emergency Position Indicator ATS Normal Position Indicator Lens (Normal) Lens (Emergency) Bulb Socket Emergency Bulb Normal Bulb
TS	Test Switch Operator, Momentary Contact Block N.C. Contact Mounting Base



GE Zenith Controls

GE Industrial Systems – Power Equipment Business
General Electric Company
830 West 40th Street, Chicago, IL 60609 USA
773 299-6600, Fax: 773 247-7805
www.zenithcontrols.com

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
F	S-7598 ADD R1 & R16	01/11/01	SB

ZBTSL SERIES WITH MX200 MICROPROCESSOR–BASED CONTROL PANEL BYPASS/ISOLATION TRANSFER SWITCH 100–4000 AMP

FOR USE ON EMERGENCY OR STANDBY SYSTEMS – RATED FOR TOTAL SYSTEM & MOTOR LOAD

A. LEGEND

MX200 Series Microprocessor–Based Control Panel

Standard Features:

L1..... Emergency Position Light
L2..... Normal Position Light
L3..... Normal Available Light
L4..... Emergency Available Light

Relay/Transformer Box

CCE..... Control Relay, Close Emergency
CCN..... Control Relay, Close Normal
XE1, (XE2) Control Transformer, Emergency
XN1,XN2 ..... Control Transformer, Normal

Power Panel

N1,2,3,(N) .... Normal Line _____
E1,2,3,(N) .... Emergency Line _____
T1,2,3,(N) .... Load Connections
BR ..... Bridge Rectifier (100–400 Amp)
CE ..... Emergency Transfer Operator (600–4000 Amp)
CE2..... Emergency Transfer Operator (4000 Amp)
CN ..... Normal Transfer Operator (600–4000 Amp)
CN2..... Normal Transfer Operator (4000 Amp)
CNE ..... Main Transfer Operator (100–400 Amp)
DS ..... Disconnect Switch
GND ..... Ground
NB ..... Neutral Bar (if required)
RE ..... Bridge Rectifier, CE (1600–4000 Amp)
RN ..... Bridge Rectifier, CN (1600–4000 Amp)
SCE,SCN ..... CNE Limit Switches (100–400 Amp)
SE ..... Emergency Position
SN ..... Normal Position

Interconnect Plugs

J1, J2, J4, J5, J6, J7, J8, PA3, PC, PD1, PD2, TP
J9 and J10..... For Panel Mounted Optional Accessories

B. OPERATION

When Normal line drops below the preset dropout point, the Normal voltage sensing circuit initiates the engine start circuit.

When Emergency line voltage and frequency reach the preset pickup point, the MX control panel energizes the CCE control relay to operate the main transfer operator. The load is now transferred to the Emergency line. The transfer switch is mechanically locked. SN limit switch awaits the next operation to Normal.

When Normal line voltage reaches the preset pickup point, the MX control panel energizes the CCN control relay to operate the main transfer operator. The load is now re–transferred back to the Normal line. The transfer switch is mechanically locked. SE limit switch awaits the next operation to Emergency.

Test Switch

The Test Switch simulates a normal line failure when activated.
To test, activate the Test Switch allowing the transfer switch to transfer to the EMERGENCY position. De–activate the Test Switch. The transfer switch will reset to the NORMAL position. Testing at least once a month is recommended. For hospital emergency systems, test once a week.

Disconnect Switch

When the Disconnect Switch is placed in the INHIBIT position the circuit to the main transfer operator is opened and transfer cannot take place.

× Optional 3 Phase Sensing on Emergency for ZBTSL series only.

C. ACCESSORIES

Zenith Transfer Switch with MX200 microprocessor–based control panel has the capability for additional accessories. The following is a description of the optional accessories. Those options checked are supplied on this unit. See additional pages for complete legend and operation.

- ☐ A1 Auxiliary contact, S.P.D.T., operates on normal line failure.
- ☐ A1E Auxiliary contact, S.P.D.T., operates on emergency line failure.
- ☐ A3 Auxiliary Contact S.P.S.T. Emergency Position
- ☐ A4 Auxiliary Contact S.P.S.T. Normal Position
- ☐ A6 Motor Disconnect. To de–energize external motor control circuit 0–60 seconds (adjustable) prior to transfer in either direction.
- ☐ C Plant Exerciser. Automatically starts generator for selected time intervals.
- ☐ C/D Plant Exerciser. Automatically starts generator to run unloaded or simulate a power failure and starts generator to run under load.
- ☐ CTAP Chicago Transfer Alarm Panel.
- ☐ E Engine Start Contact
- ☐ J1N Normal Under Frequency Sensing.
- ☐ J2E Emergency Over Frequency Sensing.
- ☐ J2N Normal Over Frequency Sensing.
- ☐ K Frequency Meter to indicate load frequency.
- ☐ M1 Ammeter. Single Phase.
- ☐ M2 Ammeter. Three Phase.
- ☐ M3 Voltmeter. Single Phase.
- ☐ M4 Voltmeter. Three Phase.
- ☐ N1 Running Time Meter
- ☐ P Time Delay to Engine Start
- ☐ Q2 Remote peak shave or area protection circuit. Energizing QR2 input will transfer to Emergency. Includes bypass for automatic return to Normal if Emergency line fails and Normal is present.
- ☐ Q3 Remote Inhibit transfer to Emergency Circuit. Energizing QR3 input allows transfer to Emergency.
- ☐ Q7 Remote Inhibit transfer to Normal Circuit. Energizing QR7 input prevents transfer to Normal.
- ☐ R1 Overvoltage sensing on normal single phase or three phase.
- ☐ R8 Three Phase Over Voltage Sensing on Emergency.
- ☐ R15 Load Shed. Should the Emergency source become overloaded, a signal will be given to open out of Emergency position.
- ☐ R16 Phase sequence sensing.
- ☐ R17 Three Phase Under Voltage Sensing on Emergency.
- ☐ R50 In–phase monitor. Prevents transfer until two sources are in–phase.
- ☐ S1 Three Position Engine Control Selector Switch: "OFF" "AUTO" "START"
- ☐ S3 Prime Source Selector Switch. Allows choice of Source 1 or Source 2 as Primary Source.
- ☐ S5 Auto/Manual return to Normal selector switch. In AUTO position, re–transfer to Normal is automatic after T timer times out. In MANUAL position, re–transfer to Normal is upon depression of YN or if Emergency fails.
- ☐ S9 Remote Test Circuit. Energizing S9 input will perform a test operation. Includes bypass for automatic return to Normal if Emergency line fails and Normal is present.
- ☐ S12 Auto/manual–transfer selector switch. In AUTO position the transfer switch functions automatically as specified with drawing. In MANUAL position, the transfer switch will transfer by depression of YN (to Normal) or YE (to Emergency). Once transferred in MANUAL position, the transfer switch maintains the selected position, even if the selected source failed.
- ☐ S13 Commit/No–Commit Selector Switch. In "Commit" position, Transfer Switch will commit transfer to Emergency when normal fails. In "No–Commit" position, Transfer Switch will not transfer to Emergency should normal restore before time delay to Emergency times out.
- ☐ T Time Delay to Normal
- ☐ T3/W3 Presignal auxiliary Contact, S.P.S.T: Operates 0–60 seconds (adjustable) prior to transfer in either direction.
- ☐ U Time Delay to Engine Cool Down
- ☐ W Time Delay to Emergency
- ☐ YE Pushbutton transfer to Emergency. Provides manual control of transfer to Emergency source. If time delay accessory W is supplied pushbutton bypasses time delay for immediate transfer; otherwise, transfer to Emergency will be automatic after time delay.
- ☐ YN Pushbutton, Retransfer to Normal. Provides manual control of retransfer to Normal source. If time delay accessory T is supplied, pushbutton bypasses time delay for immediate retransfer; otherwise, retransfer to Normal will be automatic after time delay.
- ☐ ZNET Communications provisions.
- ☐ Other: _____

NOTES:

1. ⚠ CAUTION: In using a 3 phase, 4 wire delta or open delta power supply (usually 120/240 volts, sometimes listed as 120/208 volts) with one leg having a grounded center tap, one line will be 160 to 208 volts to ground. When such a system is used it is necessary to connect the high leg to N2DO NOT CONNECT 120 VOLT LOAD CIRCUIT TO THE HIGH LEG.
2. GROUNDING TERMINAL: A grounding terminal (GND) is provided. When installing open type switches connect this to the metal enclosure or conduit.
3. ⚠ WARNING – TO ENSURE AGAINST SHOCK OR ACCIDENT HAZARD, DISCONNECT ALL SOURCES OF SUPPLY BEFORE SERVICING.
4. ON SINGLE PHASE UNITS WHERE THE EMERGENCY SOURCE IS A UTILITY LINE, CONNECT EMERGENCY LINE SO THAT MINIMUM VOLTAGE IS MEASURED FROM N1 TO E1.
5. ON SINGLE PHASE (2 POLE) UNITS, CENTER POLE IS NOT SUPPLIED. RIGHT–HAND POLE IS NOT SUPPLIED ON 100–400 AMP UNITS.

GE PROPRIETARY AND CONFIDENTIAL INFORMATION
This document is the property of General Electric ("GE") and contains proprietary information of GE. This document is loaned on the express condition that neither it nor the information contained therein shall be disclosed to others without the express written consent of GE Industrial Systems, and that the information shall be used by the recipient only as approved expressly by GE Industrial Systems. This document shall be returned to GE upon its request. This document may be subject to certain restrictions under U.S. export controls laws and regulations.

THIRD ANGLE PROJECTION

FOR ADDITIONAL INFO REFER TO
APPLIED PRACTICES
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
2 PL. DECIMALS ± .020
3 PL. DECIMALS ± .005
ANGLES ± 1°
FRACTIONS ± 1/64
FINISH ✓
AutoCad Generated

SIGNATURES		DATE
MODEL	SG	01/11/01
DETAIL		
CHECKED		
ENGRG	SB	01/11/01
MFG		
QUALITY		
ISSUED		

DRAWING FILE: 56A-0900-F-1.DWG
MODEL / ASSEMBLY FILE: ZBTSL10-400 (100-4000A)
CTQs ⊖ CRITICAL TO QUALITY CHARACTERISTIC

GE Zenith Controls

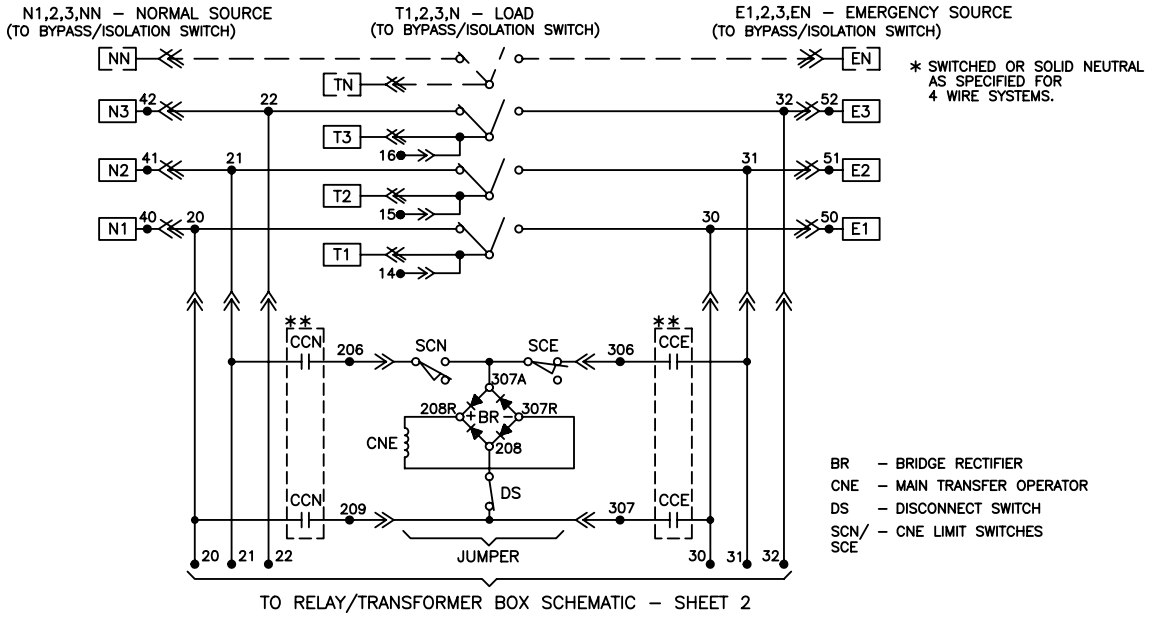
TITLE
LEGEND, OPERATION, AND ACCESSORIES

FIRST MADE FOR:

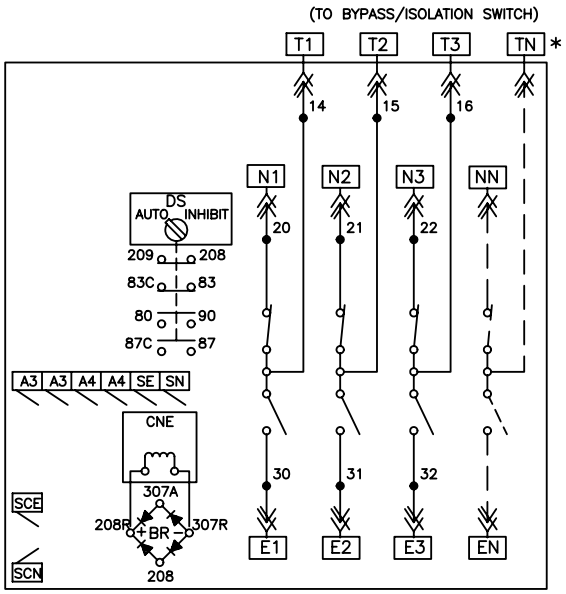
SIZE	CAGE CODE	DWG NO
B		56A-0900

SCALE: – SHEET 1 OF 1

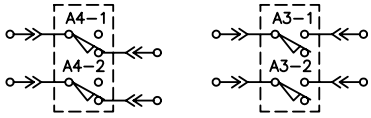
ATS POWER CIRCUIT SCHEMATIC



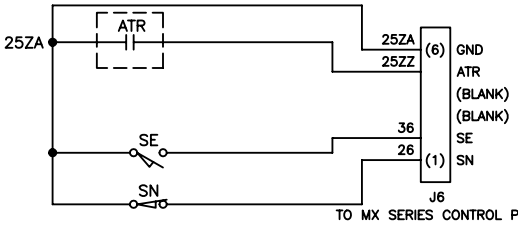
ATS POWER PANEL LAYOUT



AUXILIARY CONTACTS



LIMIT SWITCH SCHEMATIC



ATR – AUTO/TEST RELAY CONTACT (LOCATED ON BYPASS SUB PANEL)
SE – EMERGENCY POSITION LIMIT SWITCH
SN – NORMAL POSITION LIMIT SWITCH

LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —○— WIRE ON TERMINAL BLOCK —≫— WIRE IN INTERCONNECT PLUG * OPTIONAL ** LOCATED ON RELAY/TRANSFORMER BOX	LEGEND, OPERATION, AND ACCESSORIES: 56A–0900. MX200 CONTROLLER–50A–2000.	ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S–5757	ESTABLISH DWG.		
B	S–6536	07/30/96	SG	SB
C	S–6612	11/05/96	SG	SB
D	S–6849	01/28/98	RMC	SB
E	S–7377	05/19/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

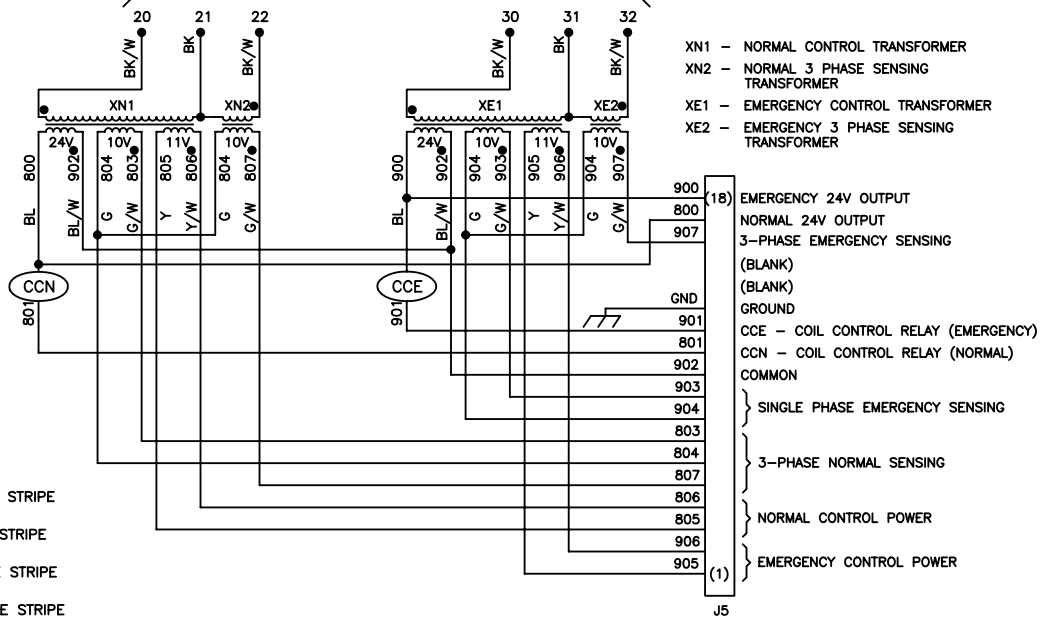
DWG TITLE: ATS POWER CIRCUIT & LIMIT SWITCHES
JOB/MODEL: ZBTSL10–40 (100–400 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	56A–1000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SDW	SB	12/13/95	–	1 OF 5	E

RELAY/TRANSFORMER BOX SCHEMATIC

TO POWER CIRCUIT SCHEMATIC – SHEET 1

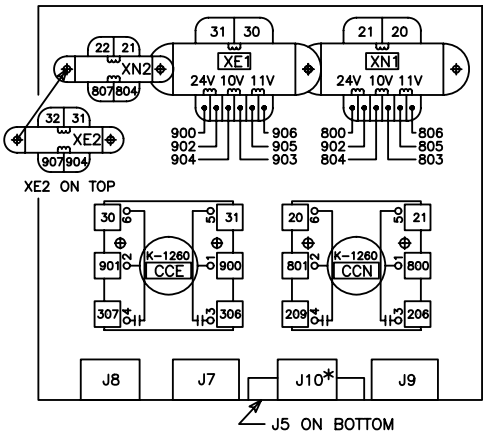


XN1 – NORMAL CONTROL TRANSFORMER
XN2 – NORMAL 3 PHASE SENSING TRANSFORMER
XE1 – EMERGENCY CONTROL TRANSFORMER
XE2 – EMERGENCY 3 PHASE SENSING TRANSFORMER

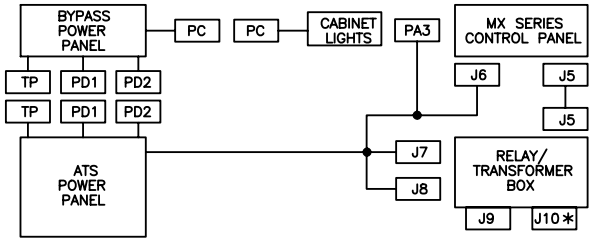
TRANSFORMER LEADS COLOR CODES:

BK – BLACK
BK/W – BLACK/WHITE STRIPE
BL – BLUE
BL/W – BLUE/WHITE STRIPE
G – GREEN
G/W – GREEN/WHITE STRIPE
Y – YELLOW
Y/W – YELLOW/WHITE STRIPE

RELAY/TRANSFORMER BOX

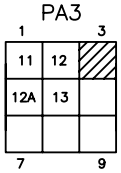


INTERCONNECTION PLUG DIAGRAM



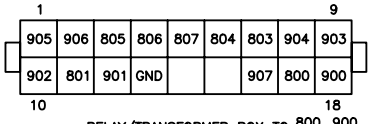
INTERCONNECT PLUGS

PA3



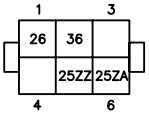
MX SERIES CONTROL PANEL TO POWER PANEL

J5



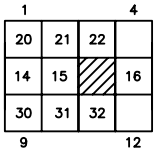
RELAY/TRANSFORMER BOX TO 800 900 MX SERIES CONTROL PANEL

J6



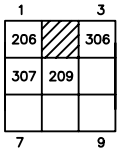
MX SERIES CONTROL PANEL TO POWER PANEL

J7



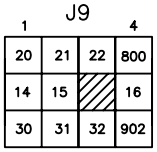
RELAY/TRANSFORMER BOX TO POWER PANEL

J8



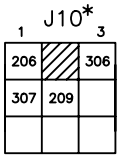
RELAY/TRANSFORMER BOX TO POWER PANEL

J9



RELAY/TRANSFORMER BOX TO AUXILIARY CONTROL PANEL

J10*



RELAY/TRANSFORMER BOX TO AUXILIARY CONTROL PANEL (IF REQUIRED)

LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION		
* OPTIONAL		

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S–5757	ESTABLISH DWG.		
B	S–6536	07/30/96	SG	SB
C	S–6612	11/05/96	SG	SB
D	S–6849	01/28/98	RMC	SB
E	S–7377	01/28/98	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: RELAY/XFR BOX & INTERCONNECT PLUGS
JOB/MODEL: ZBTSL10–40 (100–400 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	56A–1000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SDW	SB	12/14/95	–	2 OF 5	E

OPERATION: BYPASS/ISOLATION SWITCH

AUTOMATIC

1. Manually operated Bypass Switch contact (BN/BE) are open and ATS is supplying load
2. Disconnect Switch (DS) is in "AUTO".

TO BYPASS ATS

1. Open bottom cabinet door & turn DS to "INHIBIT".
2. Position manual bypass handle (MBH) to same power source as ATS.

TO TEST ATS

1. Bypass per above instructions.
2. Move ATS location handle (ALH) to "TEST" location.
3. Turn DS to "AUTO".
4. Test Switch (TS) on bottom cabinet door will allow electrical operation of ATS.

TO ISOLATE ATS

1. Bypass per above instructions.
2. Move ALH to "ISOLATE" location.

TO REMOVE ATS

1. Bypass and Isolate per above instructions.
2. Move ALH to "RELEASE" location.
3. Disconnect multipin plugs.
4. Lift ATS out of drawer.

TO RECONNECT ATS

1. Place ATS into drawer slots (front rollers first).
2. Turn DS to "INHIBIT".
3. Manually position ATS into same source as Bypass Switch.
4. Reconnect multipin plugs and external connections to ATS.
5. Push ATS inward to engage carriage.
6. Move ALH to "TEST" location (as indicated by light)
7. Turn DS to "AUTO" and use TS to electrically operate ATS.
8. Turn DS to "INHIBIT".
9. Move ALH to "AUTO" location.
10. Turn DS to "AUTO" & open Bypass with MBH.
11. ATS is now fully automatic (Fig.1).

NOTES:

1. DS in "INHIBIT" will prevent ATS electrical operation.
2. Do not use excessive force on mechanical handles.
3. Above Figures depict Bypass NORMAL. Sequence is same for Bypass EMERGENCY.
4. When ATS is in TEST or ISOLATE, Bypass Switch is manual transfer switch to either available source (indicated on light panel).
5. To operate Bypass Switch when ATS is in TEST or ISOLATE, position MBH to available power source.

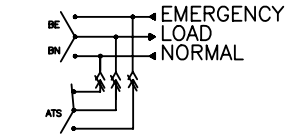


FIG. 1 BP IS OPEN WITH ATS IN NORMAL

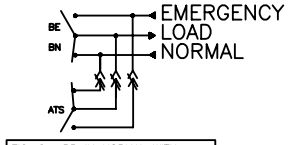


FIG. 2 BP IN NORMAL WITH ATS IN NORMAL

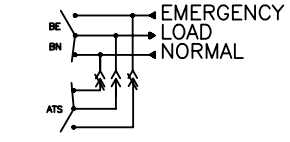


FIG. 3 BP IN NORMAL WITH ATS IN TEST (LOAD CONNECTIONS ARE OPEN)

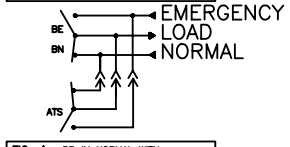


FIG. 4 BP IN NORMAL WITH ATS ISOLATED

NOTES:
1. BP–Bypass switch (indicated by contacts BN/BE) is a 3 position switch.
2. ATS–Automatic Transfer Switch

LEGEND: BYPASS/ISOLATION SWITCH (BP)

I. (BP) BYPASS/ISOLATION SWITCH: MECHANICAL COMPONENTS

N1,2,3,(N)..... Normal Line connections
E1,2,3,(N).....Emergency Line connections
T1,2,3,(N).....Load Line connections
BE.....Bypass Emergency contacts
BN.....Bypass Normal contacts
MBH.....Manual Bypass Handle
ALH.....ATS Location Handle

II. (BP) BYPASS/ISOLATION: ELECTRICAL COMPONENTS

AA–1,2.....Limit switch held actuated in Auto location of ATS, Non–actuated Test and Isolated locations.
AB3–1,2,3,4.....Limit switch, actuated in Bypass Emergency position
AB4–1,2.....Limit switch, actuated in Bypass Normal position
ABE.....Auxiliary Bypass contact (Emergency)
ABN.....Auxiliary Bypass contact (Normal)
AE–1,2.....Limit switch, switches Engine Start from ATS control to bypass control during ATS Isolate
AI.....Limit switch, actuated in Isolate location
ALL.....Limit switch, ATS lock location
AT–1,2.....Limit switch, actuated in Test location
ATR.....Auto/Test Relay. Energized in AUTO and TEST locations
BLL.....Limit switch, Bypass lock location
BPS.....Bypass Solenoid
BR–1,2,3.....Bridge Rectifier
BTE.....Limit switch, Bypass Transfer Emergency (actuates during MBH movement to Emergency)
BTN.....Limit switch, Bypass Transfer Normal (actuates during MBH movement to Normal)
C.....Capacitor: RNH
D1.....Diode
EA–3.....Limit switch, ATS in Emergency
NA–4.....Limit switch, ATS in Normal
PLS–1,2.....Permissive limit switches
R1.....Resistor: RNH
RNH.....Relay normally held, 24 VDC coil, 3PDT
TRS.....Transfer Release Solenoid
TSE.....Limit switch. Transfer switch engaged non–activated in remove position
XBE.....Emergency line control transformer
XBN.....Normal line control transformer

III. (BP) BYPASS/ISOLATION SWITCH: INDICATOR LIGHTS

LNA..... Normal available
LEA.....Emergency available
LBN (NOTE 1).....Bypass Normal (BN closed)
LBE (NOTE 1).....Bypass Emergency (BE closed)
LAT (NOTE 1)..... ATS in Test location
LAI (NOTE 1)..... ATS in Isolate location
LIT (NOTE 1)..... ATS Inhibit
LDS (NOTE 1).....ATS DS switch in INHIBIT position

NOTES:
1. Indicator off during automatic operation of ATS.
2. Four pole includes neutral lugs.

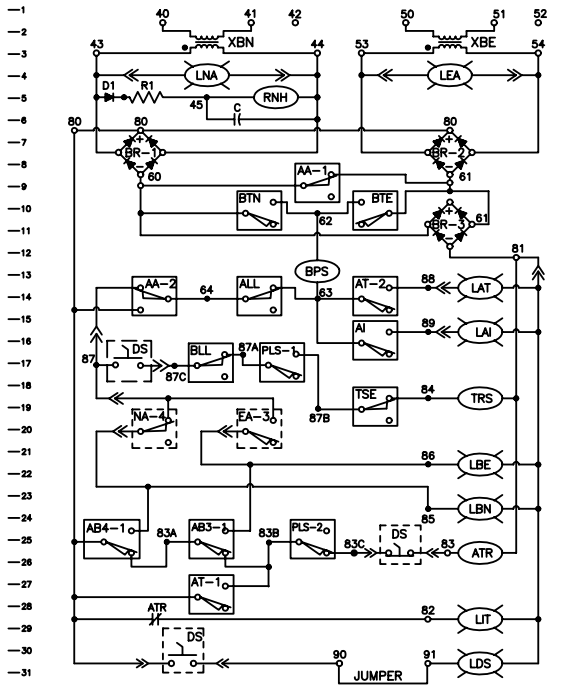
REVISIONS				
REV	ECN NO.	DATE	DFT	ENG
A	–	ESTABLISH DWG.		
B	S–6536	07/30/96	SG	SB
C	S–6612	11/05/96	SG	SB
D	S–6849	02/04/98	RMC	SB
–	–	05/27/99	RMC	MW
E	S–7377	04/24/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE:	BP/ISOLATION SW.: LEGEND & OPERATION							
JOB/MODEL:	ZBTSL10–40 (100–400 AMP)							
CHKD:	APPD:	CADD:	ORDER NUMBER:		DRAWING NUMBER:			
		ACAD	–		56A–1000			
		DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:	
		SG	SB	07/30/96	–	3 OF 5	E	

BYPASS/ISOLATION SCHEMATIC



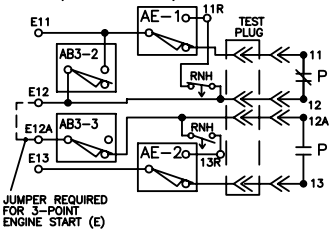
XBN – BYPASS NORMAL CONTROL TRANSFORMER
XBE – BYPASS EMERGENCY CONTROL TRANSFORMER
LNA – NORMAL AVAILABLE LIGHT
LEA – EMERGENCY AVAILABLE LIGHT
RNH – NORMALLY HELD RELAY
D1 – DIODE
R1 – RESISTOR, RNH
C – CAPACITOR, RNH
BR-1,2,3 – BRIDGE RECTIFIER
AA-1 – LIMIT SWITCH, ATS AUTO LOCATION
BTN – LIMIT SWITCH, BYPASS TRANSFER NORMAL (MBH MOVEMENT TO NORMAL)
BTE – LIMIT SWITCH, BYPASS TRANSFER EMERG. (MBH MOVEMENT TO EMERGENCY)
BPS – BYPASS SOLENOID
AA-2 – LIMIT SWITCH, ATS AUTO LOCATION
ALL – LIMIT SWITCH, ATS LOCK LOCATION
AT-2 – LIMIT SWITCH, ATS TEST LOCATION
LAT – LIGHT, ATS TEST LOCATION
AI – LIMIT SWITCH, ATS ISOLATE LOCATION
LAI – LIGHT, ATS ISOLATE LOCATION
BLL – LIMIT SWITCH, BYPASS LOCK LOCATION
PLS-1 – PERMISSIVE LIMIT SWITCH
TSE – LIMIT SWITCH, TRANSFER SWITCH ENGAGED
TRS – SOLENOID, TRANSFER RELEASE
NA-4 – LIMIT SWITCH, ATS IN NORMAL
EA-3 – LIMIT SWITCH, ATS IN EMERGENCY
LBE – LIGHT, BYPASS EMERGENCY
LBN – LIGHT, BYPASS NORMAL
AB4-1 – LIMIT SWITCH, BYPASS NORMAL
AB3-1 – LIMIT SWITCH, BYPASS EMERGENCY
PLS-2 – PERMISSIVE LIMIT SWITCH
ATR – AUTO/TEST RELAY
AT-1 – LIMIT SWITCH, ATS TEST LOCATION

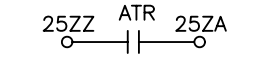
LIT – LIGHT, ATS INHIBIT
DS – ATS DISCONNECT SWITCH
LDS – LIGHT, DISCONNECT SWITCH INHIBIT POSITION
ALH – ATS LOCATION HANDLE
MBH – MANUAL BYPASS HANDLE

[LOCATED ON ATS] [LOCATED ON BYPASS]

ENGINE START SCHEMATIC

AE-1,2 – LIMIT SWITCH, ENGINE START TRANSFER
AB3-2,3- LIMIT SWITCH, BYPASS EMERGENCY



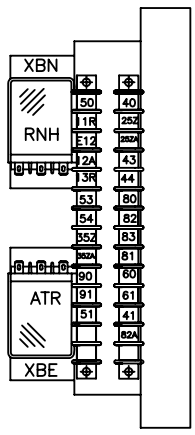


NORMAL/EMERGENCY TRANSFER PERMIT CIRCUIT. (ALH IN AUTO AND TEST LOCATION WITH DS IN AUTO POSITION)

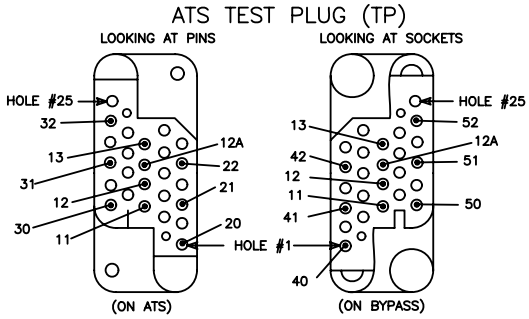
LIMIT SWITCH CHART

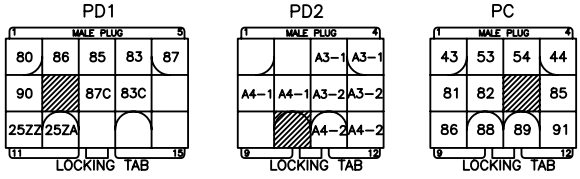
X = ACTUATED	ATS LOCATION				ATS MODE		BYPASS MODE		
	AUTO	TEST	ISO	REMOVE	NORM	EMERG.	NORM	EMERG.	OPEN
AA	X								
AT		X							
AI			X	X					
ALL	X	X	X	X					
TSE	X	X	X						
AE			X	X					
NA					X				
EA						X			
AB4							X		
AB3								X	
BLL							X	X	X
PLS	ACTIVATED WHEN ALH IS OPERATED								

BYPASS SUBPANEL



ATS TEST PLUG (TP)





REFER TO SHEET 2 FOR INTERCONNECT PLUG DIAGRAM

LEGEND	REFERENCE
WIRE CONNECTION	
WIRE ON TERMINAL BLOCK	
WIRE IN INTERCONNECT PLUG	

NOTES

ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S-5757	ESTABLISH DWG.		
B	S-6536	07/30/96	SG	SB
C	S-6612	11/05/96	SG	SB
D	S-6849	02/04/98	RMC	SB
E	S-7377	04/24/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

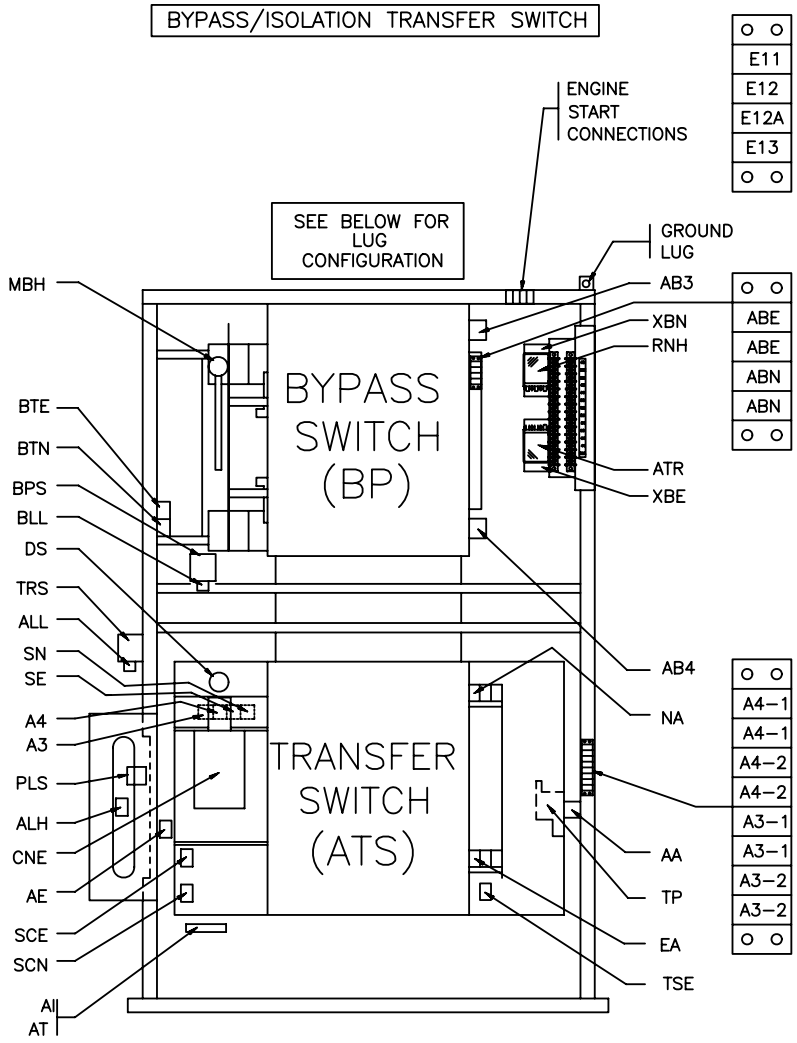
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: BYPASS/ISOLATION SCHEMATIC & PLUGS
JOB/MODEL: ZBTSL10-40 (100-400 AMP)

CHKD	APPD	CADD: ACAD	ORDER NUMBER: -	DRAWING NUMBER: 56A-1000
		DRWN: SDW	ENGR: SB	DATE: 12/14/95

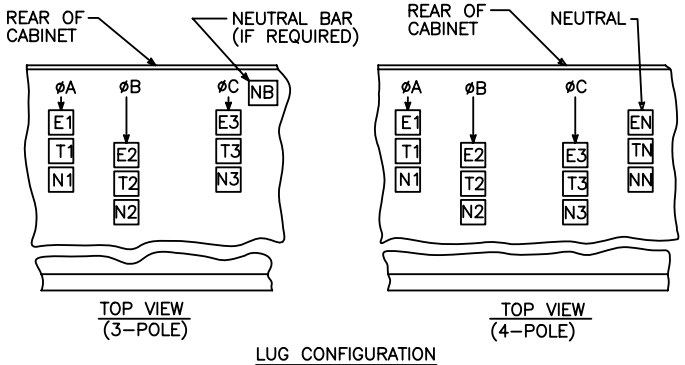
SCALE: - SHEET: 4 OF 5 REV: E

BYPASS/ISOLATION TRANSFER SWITCH



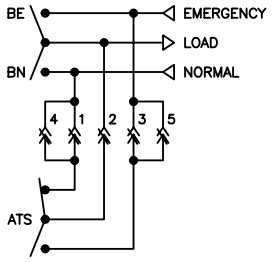
WIRE NUMBERING CHART

LIMIT SWITCHES	C	NC	NO
AA-1	60		61
AA-2	64	80	87
AB3-1	83A	83B	86
AB3-2	E12		E11
AB3-3	E12A	12A	
AB3-4	ABE		ABE
AB4-1	80	83A	85
AB4-2	ABN		ABN
AE-1	E11	11	11R
AE-2	E13	13	13R
AI	63		89
ALL	64		63
AT-1	80		83B
AT-2	63		88
BLL	87C		87A
BTE	61		62
BTN	60		62
EA-3	86		87
NA-4	85		87
PLS-1	87A		87B
PLS-2	83B	83C	
TSE	87B		84



LUG CONFIGURATION

BYPASS/ISOLATION DIAGRAM



ATS LOCATION	LOAD CARRYING CONTACTS			ATS TEST PLUG (TP)	
	1	2	3	4	5
AUTO	X	X	X	X	X
TEST	O	O	O	X	X
ISOLATE	O	O	O	O	O

X = CLOSED
O = OPEN

LEGEND	REFERENCE	NOTES
		ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S-5757	ESTABLISH DWG.		
B	S-6536	07/30/96	SG	SB
C	S-6612	11/05/96	SG	SB
D	S-6849	02/04/98	RMC	SB
E	S-7377	04/24/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

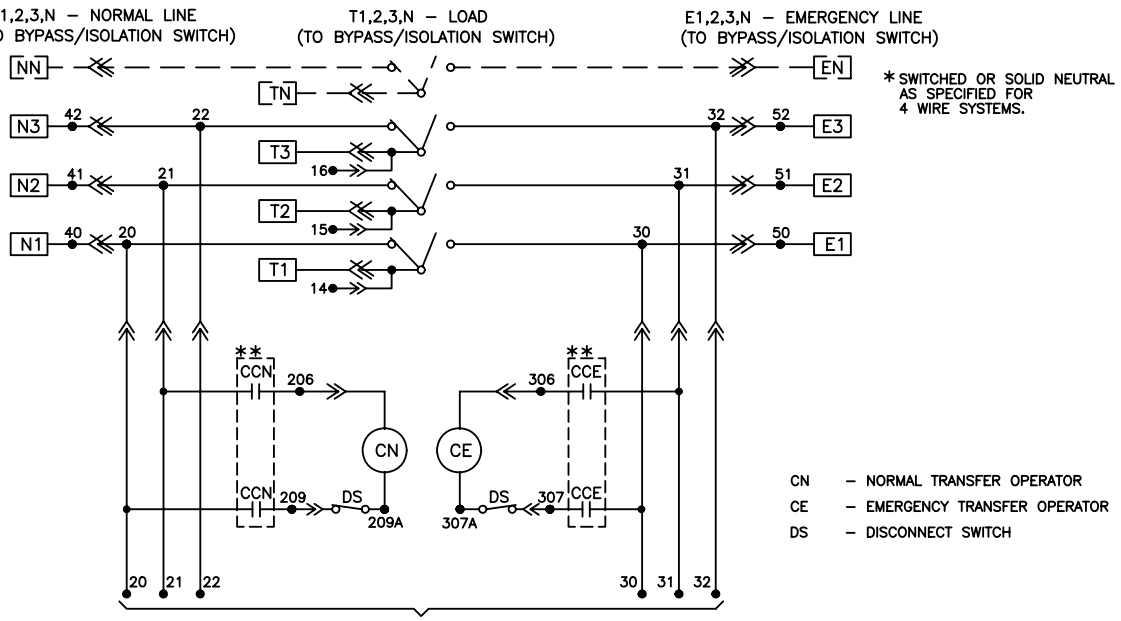
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: BYPASS/ISOLATION TRANSFER SWITCH
JOB/MODEL: ZBTSL10-40 (100-400 AMP)

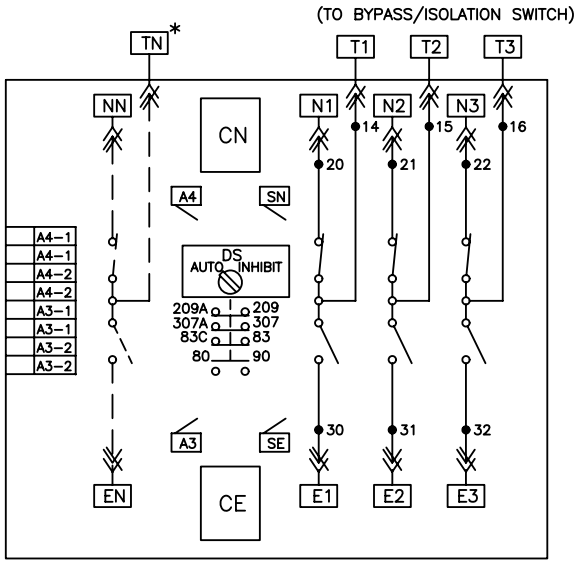
CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	-	56A-1000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SDW	SB	12/14/95	-	5 OF 5	E

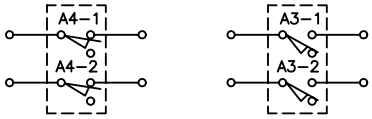
ATS POWER CIRCUIT SCHEMATIC



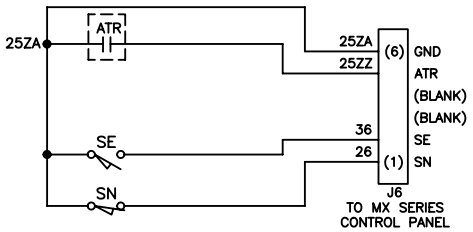
ATS POWER PANEL LAYOUT



AUXILIARY CONTACTS



LIMIT SWITCH SCHEMATIC



ATR – AUTO/TEST RELAY CONTACT
SE – EMERGENCY POSITION LIMIT SWITCH
SN – NORMAL POSITION LIMIT SWITCH

LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —○— WIRE ON TERMINAL BLOCK —≫— WIRE IN INTERCONNECT PLUG * OPTIONAL ** LOCATED ON RELAY/ TRANSFORMER BOX	LEGEND, OPERATION, AND ACCESSORIES: 56A–0900. MX200 CONTROLLER– 50A–2000.	ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

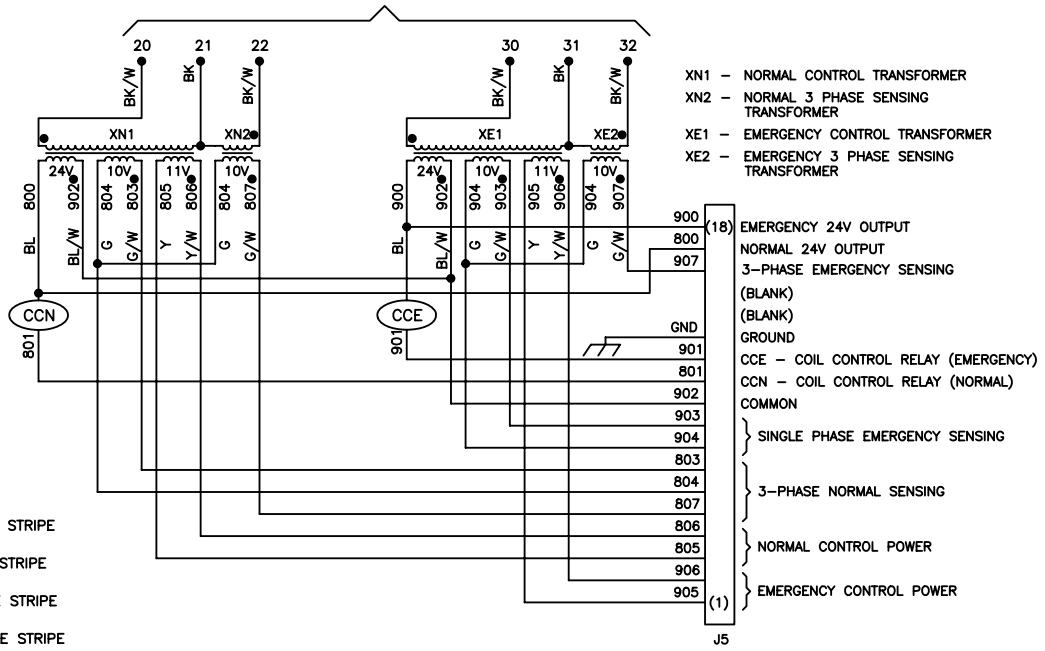
REVISIONS				
REV	ECN NO.	DATE	DFT	ENG
A	S–5757	ESTABLISH DWG.		
B	S–6536	07/30/96	SG	SB
C	S–6612	11/05/96	SG	SB
D	S–6849	02/04/98	RMC	SB
E	S–7377	05/19/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE:	ATS POWER CIRCUIT & LIMIT SWITCHES					
JOB/MODEL:	ZBTSL60–120 (600–1200 AMP)					
CHKD:	APPD:	CADD: ACAD	ORDER NUMBER: –	DRAWING NUMBER: 56A–2000		
		DRWN: SDW	ENGR: SB	DATE: 12/13/95	SCALE: –	SHEET: 1 OF 5	REV: E

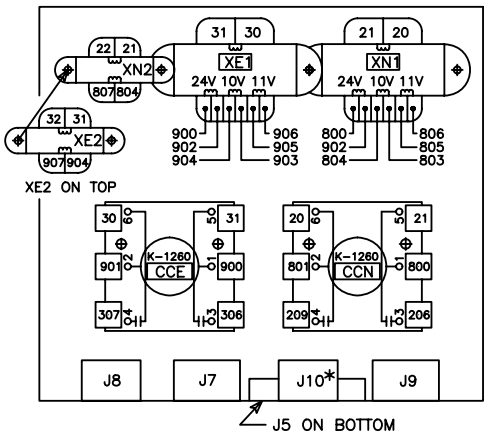
RELAY/TRANSFORMER BOX SCHEMATIC



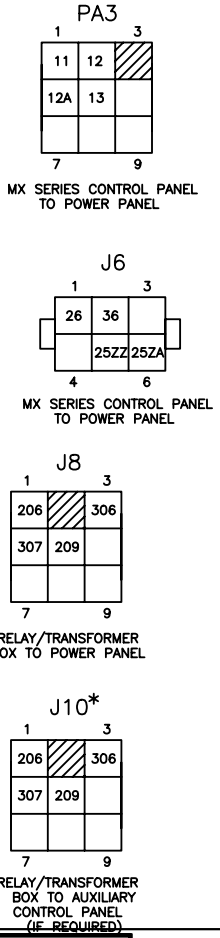
TRANSFORMER LEADS COLOR CODES:

BK	– BLACK
BK/W	– BLACK/WHITE STRIPE
BL	– BLUE
BL/W	– BLUE/WHITE STRIPE
G	– GREEN
G/W	– GREEN/WHITE STRIPE
Y	– YELLOW
Y/W	– YELLOW/WHITE STRIPE

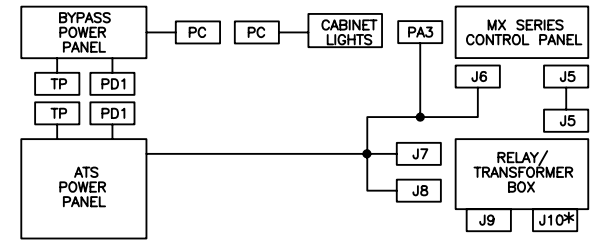
RELAY/TRANSFORMER BOX



INTERCONNECT PLUGS



INTERCONNECTION PLUG DIAGRAM



LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION		
* OPTIONAL		

REVISIONS				
REV	ECN NO.	DATE	DFT	ENG
A	S–5757	ESTABLISH DWG.		
B	S–6536	07/30/96	SG	SB
C	S–6612	11/05/96	SG	SB
D	S–6849	02/04/98	RMC	SB
E	S–7377	04/25/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE:	RELAY/XFR BOX & INTERCONNECT PLUGS					
JOB/MODEL:	ZBTSL60–120 (600–1200 AMP)					
CHKD:	APPD:	CADD: ACAD	ORDER NUMBER: –	DRAWING NUMBER: 56A–2000		
		DRWN: SDW	ENGR: SB	DATE: 12/14/95	SCALE: –	SHEET: 2 OF 5
						REV: E

OPERATION: BYPASS/ISOLATION SWITCH

AUTOMATIC

1. Manually operated Bypass Switch contacts (BN/BE) are open and ATS is supplying load.
2. Disconnect Switch (DS) is in "AUTO".

TO BYPASS ATS

1. Open bottom cabinet door and turn DS to "INHIBIT".
2. Turn Bypass Selector Switch (BSS) to same power source as ATS.
3. Move the Manual Bypass Handle (MBH) upward.

TO TEST ATS

1. Bypass per above instructions.
2. Rotate crank mechanism counterclockwise until ATS TEST light is illuminated.
3. Turn DS to "AUTO".
4. Test Switch (TS) on bottom cabinet door will allow electrical operation of ATS.

TO ISOLATE ATS

1. Bypass per above instructions.
2. Rotate crank mechanism counterclockwise until ATS ISOLATED light is illuminated.

TO REMOVE ATS

1. Bypass and Isolate per above instructions.
2. Disconnect multipin plugs and external connections to ATS.
3. Rotate four power panel latches to vertical position, slide ATS forward & lock mechanism in place.
4. ATS can now be removed from cabinet.

TO RECONNECT ATS

1. Place ATS in slide mechanism.
2. Unlock slide mechanism. Slide ATS over power panel latches and rotate latches to horizontal position.
3. Turn DS Switch to "INHIBIT".
4. Manually position ATS into same source as Bypass Switch.
5. Reconnect multipin plugs and external connections to ATS.
6. Rotate crank mechanism clockwise until ATS TEST light is illuminated.
7. Turn DS Switch to "AUTO" and use TS to electrically operate ATS.
8. Turn DS to "INHIBIT".
9. Rotate crank mechanism clockwise until ATS location pointer is aligned with "AUTO" mark on location indicator. (ATS must be in same source as Bypass).
10. Turn DS to "AUTO" and open Bypass with MBH.
11. ATS is now fully automatic (Figure 1).

NOTES:

1. DS in "INHIBIT" will prevent ATS electrical operation.
2. DO NOT use excessive force on mechanical handles.
3. Above Figures depict Bypass NORMAL. Sequence is same for Bypass EMERGENCY.
4. When ATS is in TEST or ISOLATE, Bypass Switch is a manual transfer switch to either available source. (Indicated on light panel).
5. To operate Bypass Switch when ATS is in TEST or ISOLATE:
   a) Move MBH downward (to open Bypass Contacts BN/BE).
   b) Turn BSS to opposite power source.
   c) Move MBH upward to close into selected power source.

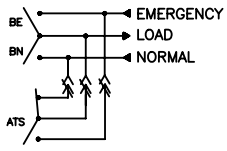


FIG. 1 BP IS OPEN WITH ATS IN NORMAL

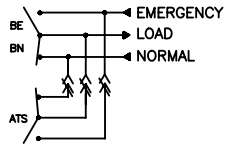


FIG. 2 BP IN NORMAL WITH ATS IN NORMAL

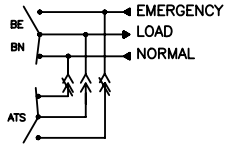


FIG. 3 BP IN NORMAL WITH ATS IN TEST (LOAD CONNECTIONS ARE OPEN)

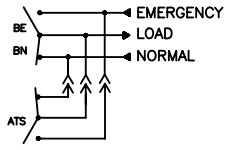


FIG. 4 BP IN NORMAL WITH ATS ISOLATED

NOTES:

1. BP–Bypass switch (indicated by contacts BN/BE) is a 3 position switch.
2. ATS–Automatic Transfer Switch

LEGEND: BYPASS/ISOLATION SWITCH (BP)

I. (BP) BYPASS/ISOLATION SWITCH: MECHANICAL COMPONENTS

N1,2,3,(N)..... Normal Line connections
E1,2,3,(N)..... Emergency Line connections
T1,2,3,(N)..... Load Line connections
BE..... Bypass Emergency contacts
BN..... Bypass Normal contacts
BSS..... Bypass Selector Switch
MBH..... Manual Bypass Handle

II. (BP) BYPASS/ISOLATION: ELECTRICAL COMPONENTS

AA–1,2,3..... Limit switch held actuated in Auto location of ATS, Non–actuated Test and Isolated locations.
AB3–1,2,3,4..... Limit switch, actuated in Bypass Emergency position
AB4–1,2..... Limit switch, actuated in Bypass Normal position
ACU/ACD..... Limit Switch, actuated when crankhandle is engaged
AE–1,2..... Limit switch, switches Engine Start from ATS control to bypass control during ATS Isolate
AI–1,2,3..... Limit switch, actuated in Isolate location
AT–1,2..... Limit switch, actuated in Test location
ATR..... Auto/Test Relay. Energized in AUTO and TEST locations
BR–1,2,3..... Bridge Rectifier
C..... Capacitor: RNH
CBC..... Crank Solenoid
CBE..... Emergency Bypass Permissive Solenoid
CBN..... Normal Bypass Permissive Solenoid
D1..... Diode
RNH..... Relay normally held, 24 VDC coil, 3PDT
R1..... Resistor: RNH
XBE..... Emergency line control transformer
XBN..... Normal line control transformer

III. (BP) BYPASS/ISOLATION SWITCH: INDICATOR LIGHTS

LNA..... Normal available
LEA..... Emergency available
LBN (NOTE 1)..... Bypass Normal (BN closed)
LBE (NOTE 1)..... Bypass Emergency (BE closed)
LAT (NOTE 1)..... ATS in Test location
LAI (NOTE 1)..... ATS in Isolate location
LIT (NOTE 1)..... ATS Inhibit
LDS (NOTE 1)..... ATS DS switch in INHIBIT position

NOTES:

1. Indicator off during automatic operation of ATS.
2. Four pole includes neutral lugs.

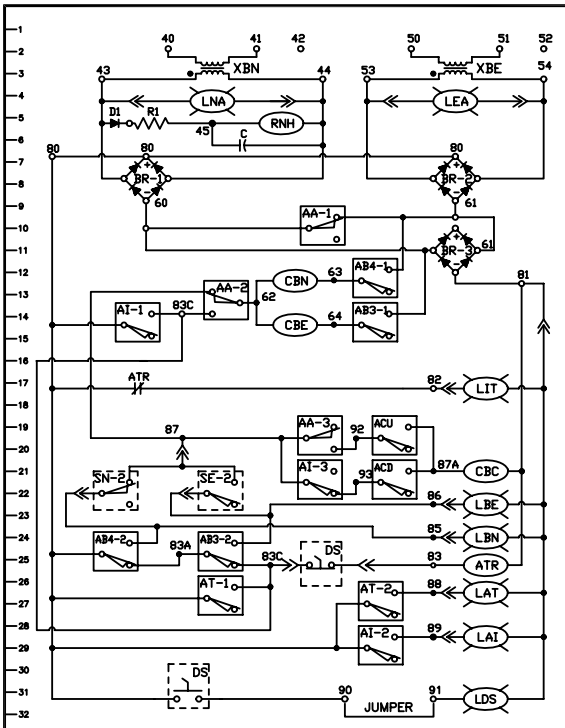
REVISIONS				
REV	ECN NO.	DATE	DFT	ENG
A	S–5757	ESTABLISH DWG.		
B	S–6536	07/30/96	SG	SB
C	S–6612	11/05/96	SG	SB
D	S–6849	02/05/98	RMC	SB
E	S–7377	04/25/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE:	BP/ISOLATION SWITCH: LEGEND & OPERATION				
JOB/MODEL:	ZBTSL60–120 (600–1200 AMP)				
CHKD:	APPD:	CADD: ACAD	ORDER NUMBER: –	DRAWING NUMBER: 56A–2000	
		DRWN: SG	ENGR: SB	DATE: 07/30/96	SCALE: –
					SHEET: 3 OF 5
					REV: E

BYPASS/ISOLATION SCHEMATIC



XBN – BYPASS NORMAL CONTROL TRANSFORMER
XBE – BYPASS EMERGENCY CONTROL TRANSFORMER
LNA – NORMAL AVAILABLE LIGHT
LEA – EMERGENCY AVAILABLE LIGHT
RNH – NORMALLY HELD RELAY
D1 – DIODE
R1 – RESISTOR, RNH
C – CAPACITOR, RNH
BR-1,2,3 – BRIDGE RECTIFIER
AA-1 – LIMIT SWITCH, ATS AUTO LOCATION

AB4-1 – LIMIT SWITCH, BYPASS NORMAL
CBN – NORMAL TRANSFER OPERATOR
AA-2 – LIMIT SWITCH, ATS IN AUTO
AB3-1 – LIMIT SWITCH, BYPASS EMERGENCY
CBE – EMERGENCY TRANSFER OPERATOR

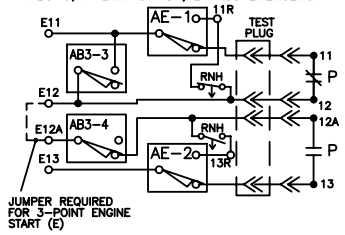
LIT – ATS INHIBIT LIGHT
AI-1 – LIMIT SWITCH, ATS IN ISOLATE
AA-3 – LIMIT SWITCH, ATS IN AUTO
ACD – LIMIT SWITCH, CRANK HANDLE
ACU – ENGAGED
AI-3 – LIMIT SWITCH, ATS IN ISOLATE
CBC – CRANK SOLENOID
LBE – LIGHT, BYPASS EMERGENCY
LBN – LIGHT, BYPASS NORMAL
AB4-2 – LIMIT SWITCH, BYPASS NORMAL
AB3-2 – LIMIT SWITCH, BYPASS EMERGENCY
ATR – AUTO/TEST RELAY
AT-1 – LIMIT SWITCH, ATS TEST LOCATION
LAT – ATS TEST LOCATION
AT-2 – LIMIT SWITCH, ATS IN TEST
LAI – ATS ISOLATE LIGHT
AI-2 – LIMIT SWITCH, ATS IN ISOLATE

DS – ATS DISCONNECT SWITCH
LDS – DISCONNECT SWITCH, INHIBIT POSITION LIGHT
MBH – MANUAL BYPASS HANDLE

LOCATED ON ATS
LOCATED ON BYPASS

ENGINE START SCHEMATIC

AE-1,2 – LIMIT SWITCH, ENGINE START TRANSFER
AB3-3,4– LIMIT SWITCH, BYPASS EMERGENCY



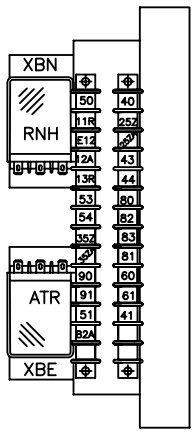
25ZZ — ATR — 25ZA

NORMAL/EMERGENCY TRANSFER PERMIT CIRCUIT. (ALH IN AUTO AND TEST LOCATION WITH DS IN AUTO POSITION)

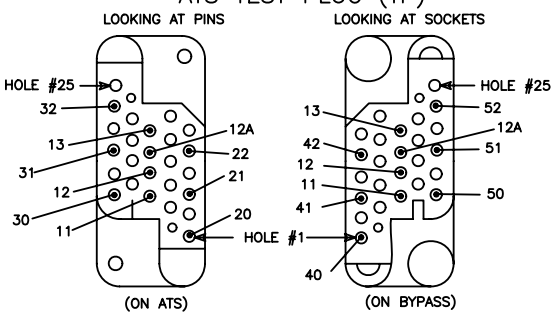
LIMIT SWITCH CHART

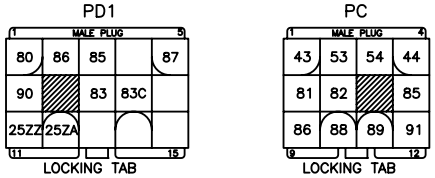
X = ACTUATED	ATS LOCATION				ATS MODE		BYPASS MODE	
	AUTO	TEST	ISO	REMOVE	NORM	EMERG.	NORM	EMERG.	OPEN
AA	X								
AT		X							
AI			X	X					
AE			X	X					
SN					X				
SE						X			
AB4							X		
AB3								X	

BYPASS SUBPANEL



ATS TEST PLUG (TP)





REFER TO SHEET 2 FOR INTERCONNECT PLUG DIAGRAM

LEGEND	REFERENCE	NOTES
WIRE CONNECTION WIRE ON TERMINAL BLOCK WIRE IN INTERCONNECT PLUG		ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S-5757	ESTABLISH DWG.		
B	S-6536	07/30/96	SG	SB
C	S-6612	11/05/96	SG	SB
D	S-6849	02/05/98	RMC	SB
E	S-7377	04/27/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

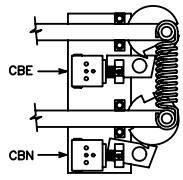
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: BYPASS/ISOLATION SCHEMATIC AND PLUGS
JOB/MODEL: ZBTSL60-120 (600-1200 AMP)

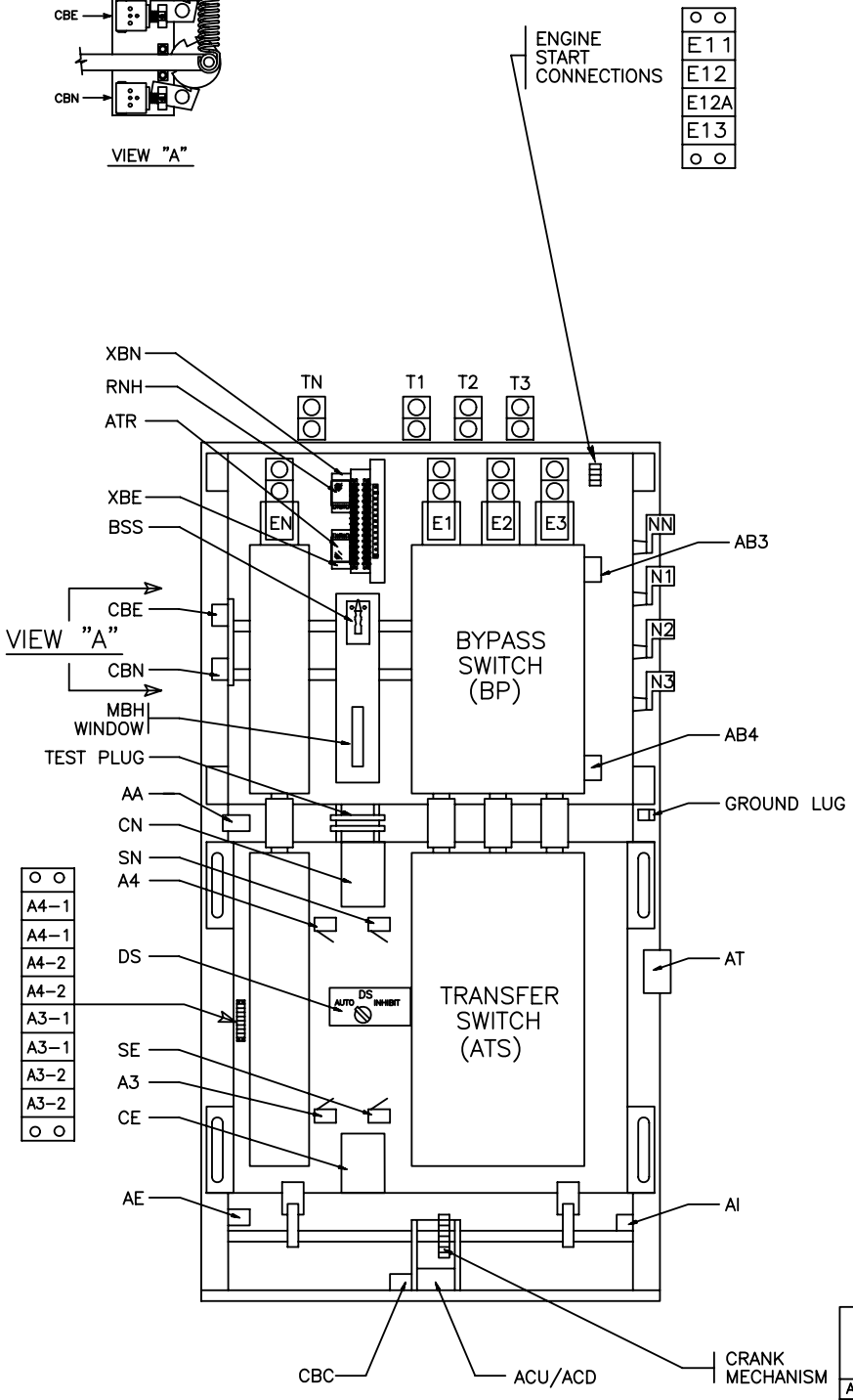
CHKD	APPD	CADD	ORDER NUMBER	DRAWING NUMBER
		ACAD	-	56A-2000

DRWN	ENGR	DATE	SCALE	SHEET	REV
SDW	SB	12/14/95	-	4 OF 5	E

BYPASS/ISOLATION TRANSFER SWITCH



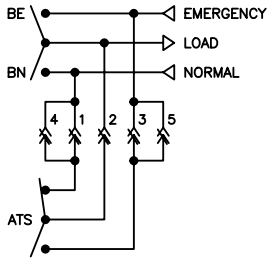
VIEW "A"



WIRE NUMBERING CHART

LIMIT SWITCHES	C	NC	NO
AA–1	60		61
AA–2	62	83C	87
AA–3	87	92	
AB3–1	64		60
AB3–2	83A	83C	86
AB3–3	E12		E11
AB3–4	E12A	12A	
AB4–1	63		61
AB4–2	80	83A	85
ACD	93		87A
ACU	92		87A
AE–1	E11	11	11R
AE–2	E13	13	13R
AI–1	80		83C
AI–2	80		89
AI–3	87	93	
AT–1	80		83C
AT–2	80		88
SE–2	86		87
SN–2	85		87

BYPASS/ISOLATION DIAGRAM



ATS LOCATION	LOAD CARRYING CONTACTS			ATS TEST PLUG (TP)	
	1	2	3	4	5
AUTO	X	X	X	X	X
TEST	O	O	O	X	X
ISOLATE	O	O	O	O	O

X = CLOSED
O = OPEN

LEGEND	REFERENCE	NOTES
		ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS				
REV	ECN NO.	DATE	DFT	ENG
A	S–5757	ESTABLISH DWG.		
B	S–6536	07/30/96	SG	SB
C	S–6612	11/05/96	SG	SB
D	S–6849	02/05/98	RMC	SB
E	S–7377	04/25/00	SG	MES

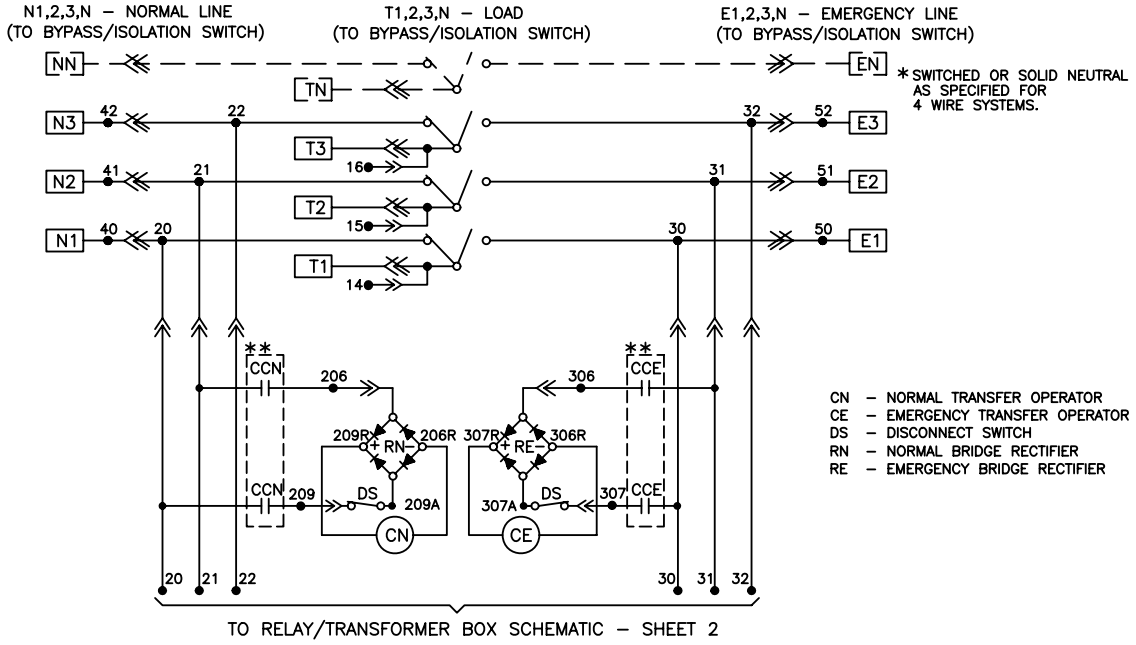
ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

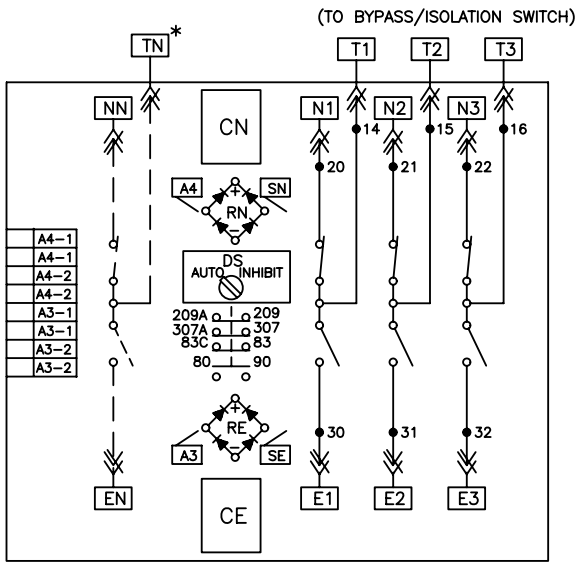
DWG TITLE: BYPASS/ISOLATION TRANSFER SWITCH
JOB/MODEL: ZBTSL60–120 (600–1200 AMP)

CHKD:	APPD:	CADD: ACAD	ORDER NUMBER: –	DRAWING NUMBER: 56A–2000		
		DRWN: SDW	ENGR: SB	DATE: 12/14/95	SCALE: –	SHEET: 5 OF 5	REV: E

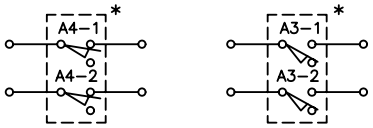
ATS POWER CIRCUIT SCHEMATIC



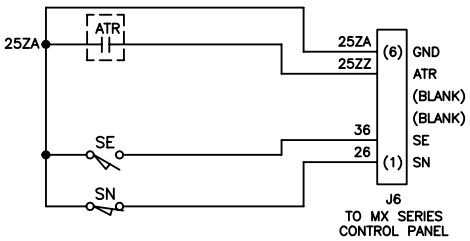
ATS POWER PANEL LAYOUT



AUXILIARY CONTACTS



LIMIT SWITCH SCHEMATIC



ATR – AUTO/TEST RELAY CONTACT (LOCATED ON BYPASS SUB PANEL)

SE – EMERGENCY POSITION LIMIT SWITCH

SN – NORMAL POSITION LIMIT SWITCH

LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —○— WIRE ON TERMINAL BLOCK —≫— WIRE IN INTERCONNECT PLUG * OPTIONAL ** LOCATED ON RELAY/ TRANSFORMER BOX	LEGEND, OPERATION, AND ACCESSORIES: 56A–0900. MX200 CONTROLLER– 50A–2000.	ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS				
REV	ECN NO.	DATE	DFT	ENG
A	S–5757	ESTABLISH DWG.		
B	S–6536	07/30/96	SG	SB
C	S–6612	11/05/96	SG	SB
D	S–6849	02/05/98	RMC	SB
E	S–7269	10/28/99	SG	MES
F	S–7377	05/19/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

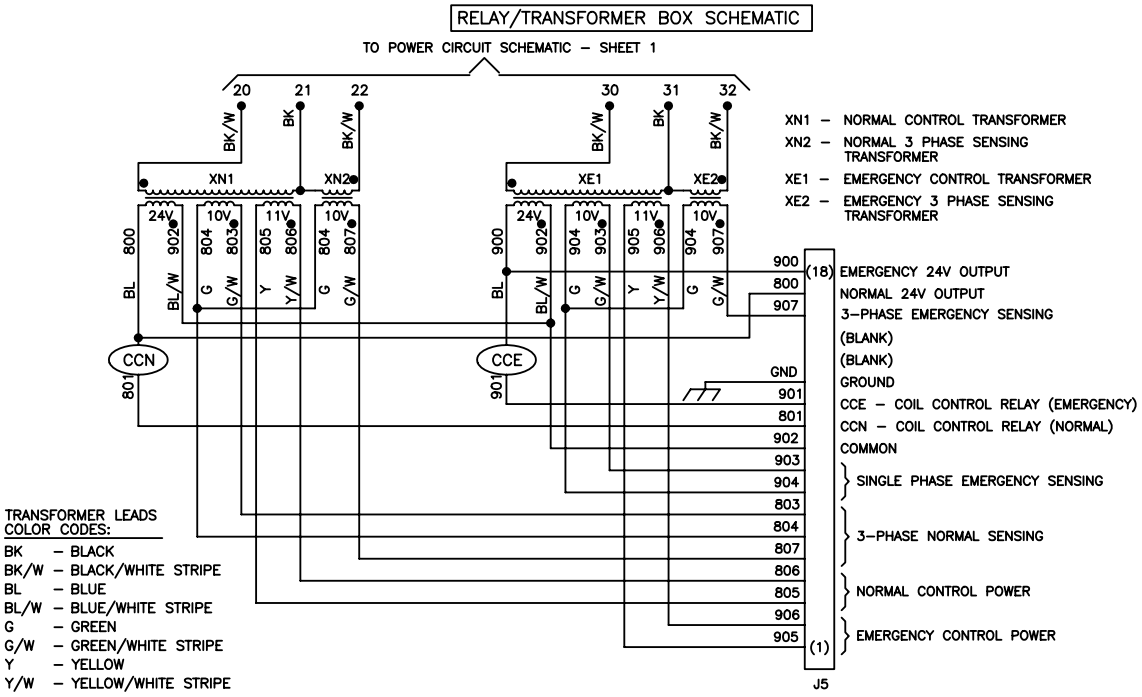
DWG TITLE: ATS POWER CIRCUIT & LIMIT SWITCHES

JOB/MODEL: ZBTSL160–300 (1600–3000 AMP)

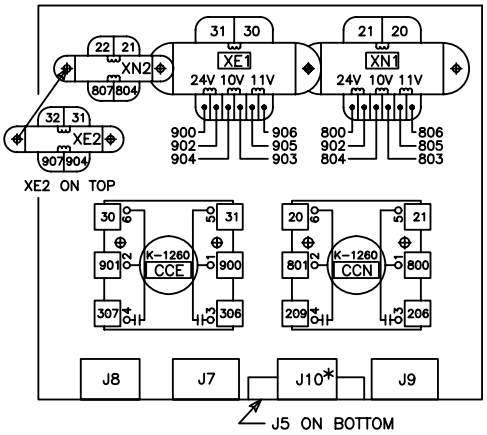
CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	56A–3000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SDW	SB	12/13/95	–	1 OF 5	F

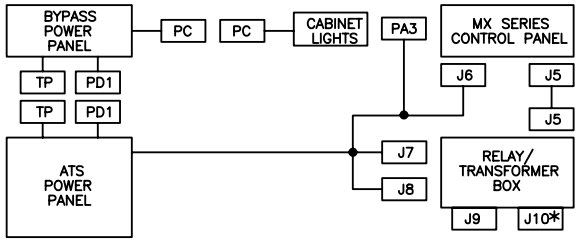
RELAY/TRANSFORMER BOX SCHEMATIC



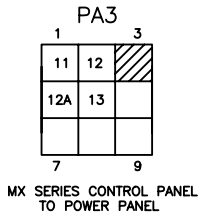
RELAY/TRANSFORMER BOX



INTERCONNECTION PLUG DIAGRAM



INTERCONNECT PLUGS



LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION		
* OPTIONAL		

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S–5757	ESTABLISH DWG.		
B	S–6536	07/30/96	SG	SB
C	S–6612	11/05/96	SG	SB
D	S–6849	02/05/98	RMC	SB
E	S–7269	10/28/99	SG	MES
F	S–7377	03/16/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: RELAY/XFR BOX & INTERCONNECT PLUGS
JOB/MODEL: ZBTSL160–300 (1600–3000 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	56A–3000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SDW	SB	12/14/95	–	2 OF 5	F

OPERATION: BYPASS/ISOLATION SWITCH

AUTOMATIC

1. Manually operated Bypass Switch contacts (BN/BE) are open and ATS is supplying load.
2. Disconnect Switch (DS) is in "AUTO".

TO BYPASS ATS

1. Open bottom cabinet door and turn DS to "INHIBIT".
2. Turn Bypass Selector Switch (BSS) to same power source as ATS.
3. Move the Manual Bypass Handle (MBH) upward.

TO TEST ATS

1. Bypass per above instructions.
2. Rotate crank mechanism counterclockwise until ATS TEST light is illuminated.
3. Turn DS to "AUTO".
4. Test Switch (TS) on bottom cabinet door will allow electrical operation of ATS.

TO ISOLATE ATS

1. Bypass per above instructions.
2. Rotate crank mechanism counterclockwise until ATS ISOLATED light is illuminated.

TO REMOVE ATS

1. Bypass and Isolate per above instructions.
2. Disconnect multipin plugs and external connections to ATS.
3. Slide four corner latches of ATS to innermost position.
4. ATS can now be removed from cabinet.

TO RECONNECT ATS

1. Roll cart back into cabinet.
2. Slide four corner latches of ATS to outermost position.
3. Turn DS Switch to "INHIBIT".
4. Manually position ATS into same source as Bypass Switch.
5. Reconnect multipin plugs and external connections to ATS.
6. Rotate crank mechanism clockwise until ATS TEST light is illuminated.
7. Turn DS Switch to "AUTO" and use TS to electrically operate ATS.
8. Turn DS to "INHIBIT".
9. Rotate crank mechanism clockwise until ATS location pointer is aligned with "AUTO" mark on location indicator. (ATS must be in same source as Bypass).
10. Turn DS to "AUTO" and open Bypass with MBH.
11. ATS is now fully automatic (Figure 1).

NOTES:

1. DS in "INHIBIT" will prevent ATS electrical operation.
2. DO NOT use excessive force on mechanical handles.
3. Above Figures depict Bypass NORMAL. Sequence is same for Bypass EMERGENCY.
4. When ATS is in TEST or ISOLATE, Bypass Switch is a manual transfer switch to either available source. (Indicated on light panel).
5. To operate Bypass Switch when ATS is in TEST or ISOLATE:
   a) Move MBH downward (to open Bypass Contacts BN/BE).
   b) Turn BSS to opposite power source.
   c) Move MBH upward to close into selected power source.

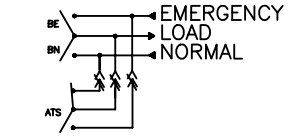


FIG. 1 BP IS OPEN WITH ATS IN NORMAL

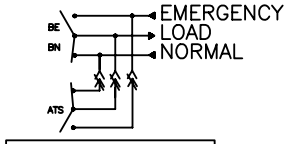


FIG. 2 BP IN NORMAL WITH ATS IN NORMAL

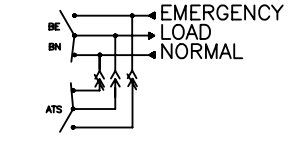


FIG. 3 BP IN NORMAL WITH ATS IN TEST (LOAD CONNECTIONS ARE OPEN)

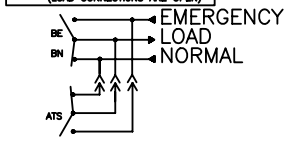


FIG. 4 BP IN NORMAL WITH ATS ISOLATED

NOTES:

1. BP–Bypass switch (indicated by contacts BN/BE) is a 3 position switch.
2. ATS–Automatic Transfer Switch

LEGEND: BYPASS/ISOLATION SWITCH (BP)

I. (BP) BYPASS/ISOLATION SWITCH: MECHANICAL COMPONENTS

N1,2,3,(N)	Normal Line connections
E1,2,3,(N)	Emergency Line connections
T1,2,3,(N)	Load Line connections
BE	Bypass Emergency contacts
BN	Bypass Normal contacts
BSS	Bypass Selector Switch
MBH	Manual Bypass Handle

II. (BP) BYPASS/ISOLATION: ELECTRICAL COMPONENTS

AA–1,2	Limit switch held actuated in Auto location of ATS, Non–actuated Test and Isolated locations.
AB3,–1,2,3,4	Limit switch, actuated in Bypass Emergency position
AB4–1,2	Limit switch, actuated in Bypass Normal position
AE–1,2	Limit switch, switches Engine Start from ATS control to bypass control during ATS Isolate
AI–1,2	Limit switch, actuated in Isolate location
AT–1,2	Limit switch, actuated in Test location
ATR	Auto/Test Relay. Energized in AUTO and TEST locations
BR	Bridge Rectifier
C	Capacitor: RNH
CBC	Crank Solenoid
CBE	Emergency Bypass Permissive Solenoid
CBN	Normal Bypass Permissive Solenoid
CH–1	Limit switch actuated when crank handle is engaged
D1	Diode
RNH	Relay normally held, 24 VDC coil, 3PDT
R1	Resistor: RNH
XBE	Emergency line control transformer
XBN	Normal line control transformer

III. (BP) BYPASS/ISOLATION SWITCH: INDICATOR LIGHTS

LNA	Normal available
LEA	Emergency available
LBN NOTE 1)	Bypass Normal (BN closed)
LBE (NOTE 1)	Bypass Emergency (BE closed)
LAT (NOTE 1)	ATS in Test location
LAI (NOTE 1)	ATS in Isolate location
LIT (NOTE 1)	ATS Inhibit
LDS (NOTE 1)	ATS DS switch in INHIBIT position

NOTES:

1. Indicator off during automatic operation of ATS.
2. Four pole includes neutral lugs.

LEGEND	REFERENCE	NOTES

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S–5757	ESTABLISH DWG.		
B	S–6536	07/30/96	SG	SB
C	S–6612	11/05/96	SG	SB
D	S–6849	02/05/98	RMC	SB
E	S–7269	10/28/99	SG	MES
F	S–7377	03/16/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

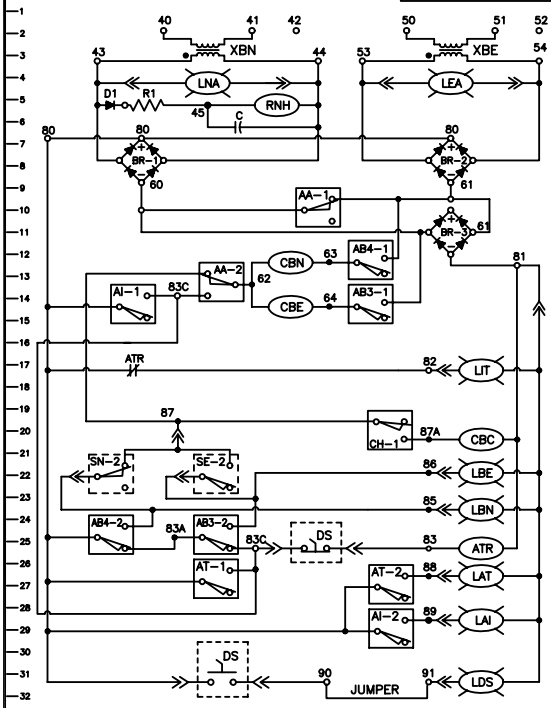
DWG TITLE: BP/ISOLATION SWITCH, LEGEND & OPERATION

JOB/MODEL: ZBTSL160–300 (1600–3000 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	56A–3000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SDW	SB	12/13/95	–	3 OF 5	F

BYPASS/ISOLATION SCHEMATIC



XBN – BYPASS NORMAL CONTROL TRANSFORMER
XBE – BYPASS EMERGENCY CONTROL TRANSFORMER
LNA – NORMAL AVAILABLE LIGHT
LEA – EMERGENCY AVAILABLE LIGHT
RNH – NORMAL VOLTAGE RELAY
D1 – DIODE
R1 – RESISTOR, RNA
BR-1,-2,3 – BRIDGE RECTIFIER
C – CAPACITOR, RNA
AA-1 – LIMIT SWITCH, ATS AUTO LOCATION

AB4-1 – LIMIT SWITCH, BYPASS NORMAL
CBN – NORMAL TRANSFER OPERATOR
AA-2 – LIMIT SWITCH, ATS IN AUTO
CBE – EMERGENCY TRANSFER OPERATOR
AB3-1 – LIMIT SWITCH, BYPASS EMERGENCY
AI-1 – LIMIT SWITCH, ATS IN ISOLATE

LIT – ATS INHIBIT LIGHT
DS – DISCONNECT SWITCH

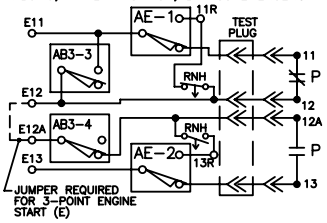
CBC – CRANK SOLENOID
CH-1 – LIMIT SWITCH
LBE – BYPASS EMERGENCY
AB4-2 – LIMIT SWITCH, BYPASS NORMAL
LBN – BYPASS NORMAL LIGHT
AB3-2 – LIMIT SWITCH, BYPASS EMERGENCY
ATR – AUTO/TEST RELAY
AT-1 – LIMIT SWITCH, ATS TEST LOCATION
LAT – ATS TEST LOCATION LIGHT
AT-2 – LIMIT SWITCH, ATS TEST LOCATION
LAI – ATS ISOLATE LIGHT
AI-2 – LIMIT SWITCH, ATS IN ISOLATE

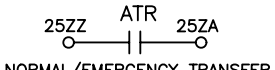
LDS – DISCONNECT SWITCH LIGHT

LOCATED ON ATS
LOCATED ON BYPASS

ENGINE START SCHEMATIC

AE-1,2 – LIMIT SWITCH, ENGINE START TRANSFER
AB3-3,4 – LIMIT SWITCH, BYPASS EMERGENCY



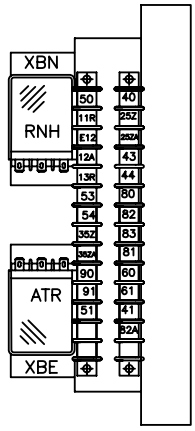


NORMAL/EMERGENCY TRANSFER PERMIT CIRCUIT. (ALH IN AUTO AND TEST LOCATION WITH DS IN AUTO POSITION)

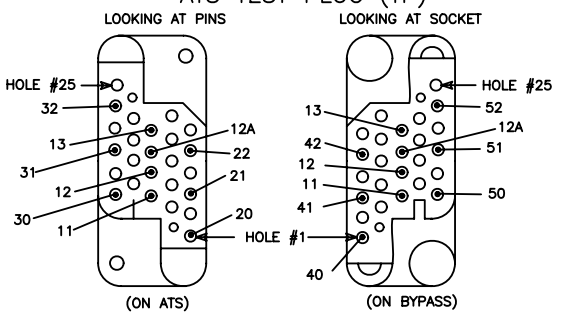
LIMIT SWITCH CHART

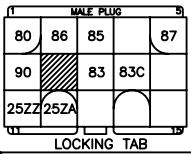
X = ACTUATED	ATS LOCATION				ATS MODE		BYPASS MODE	
	AUTO	TEST	ISO	REMOVE	NORM	EMERG.	NORM	EMERG.	OPEN
AA	X								
AT		X							
AI			X	X					
AE			X	X					
SN					X				
SE						X			
AB4							X		
AB3								X	

BYPASS SUBPANEL



ATS TEST PLUG (TP)







INTERCONNECTION PLUG DIAGRAM – SEE SHEET 2.

LEGEND	REFERENCE	NOTES
WIRE CONNECTION WIRE ON TERMINAL BLOCK WIRE IN INTERCONNECT PLUG		ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S-5757	ESTABLISH DWG.		
B	S-6536	07/30/96	SG	SB
C	S-6612	11/05/96	SG	SB
D	S-6849	02/05/98	RMC	SB
E	S-7269	10/28/99	SG	MES
F	S-7377	03/16/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

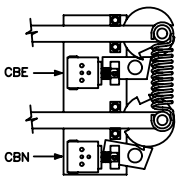
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: BYPASS/ISOLATION SCHEMATIC & PLUGS
JOB/MODEL: ZBTSL160-300 (1600-3000 AMP)

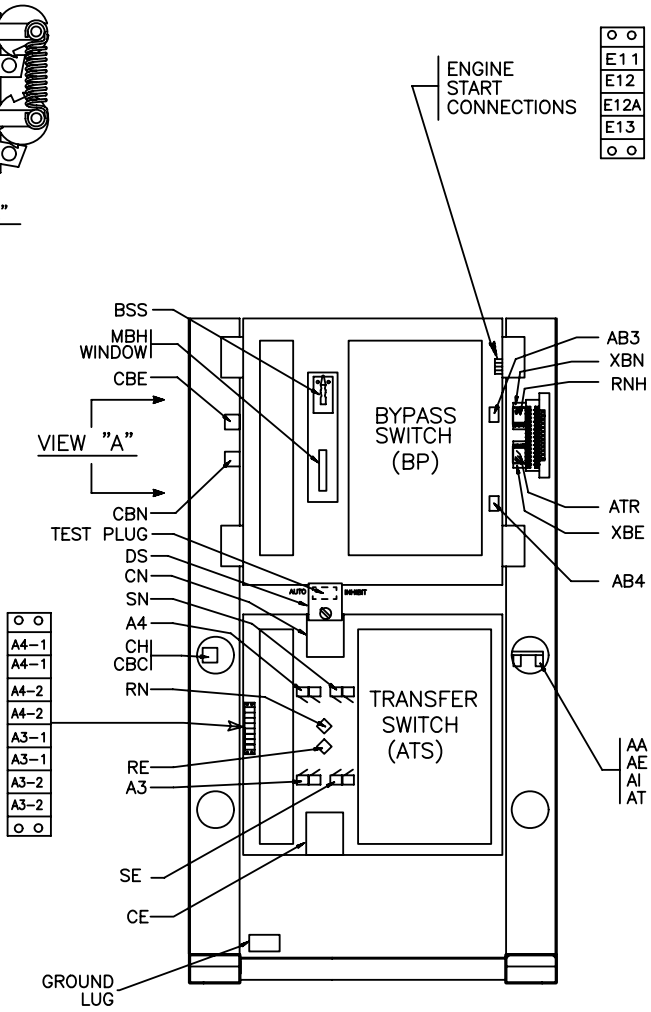
CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	56A-3000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SDW	SB	12/14/95	–	4 OF 5	F

BYPASS/ISOLATION TRANSFER SWITCH



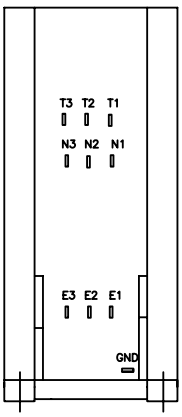
VIEW "A"



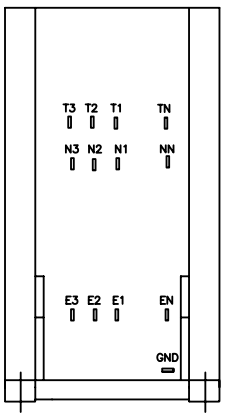
WIRE NUMBERING CHART

LIMIT SWITCHES	C	NC	NO
AA–1	60		61
AA–2	62	83C	87
AB3–1	64		60
AB3–2	83A	83C	86
AB3–3	E12		E11
AB3–4	E12A	12A	
AB4–1	63		61
AB4–2	80	83A	85
AE–1	E11	11	11R
AE–2	E13	13	13R
AI–1	80		83C
AI–2	80		89
AT–1	80		83C
AT–2	80		88
CH–1	87	87A	
SE–2	86		87
SN–2	85		87

STANDARD LUG CONFIGURATION
(CONSULT FACTORY FOR OPTIONAL CONFIGURATIONS)
REAR VIEW OF ENCLOSURE

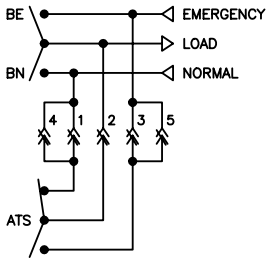


2/3–POLE SWITCH



4–POLE SWITCH

BYPASS/ISOLATION DIAGRAM



ATS LOCATION	LOAD CARRYING CONTACTS			ATS TEST PLUG (TP)	
	1	2	3	4	5
AUTO	X	X	X	X	X
TEST	O	O	O	X	X
ISOLATE	O	O	O	O	O

X = CLOSED
O = OPEN

LEGEND	REFERENCE	NOTES
		ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS				
REV	ECN NO.	DATE	DFT	ENG
A	S–5757	ESTABLISH DWG.		
B	S–6536	07/30/96	SG	SB
C	S–6612	11/05/96	SG	SB
D	S–6849	02/05/98	RMC	SB
E	S–7269	10/28/99	SG	MES
F	S–7377	03/16/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: BYPASS/ISOLATION TRANSFER SWITCH
JOB/MODEL: ZBTSL160–300 (1600–3000 AMP)

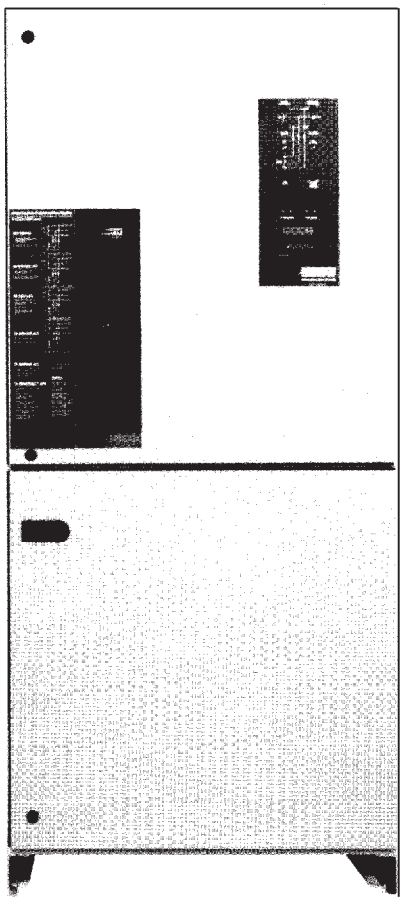
CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	56A–3000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SDW	SB	12/14/95	–	5 OF 5	F

ZENITH CONTROLS, INC.

ZENITH CONTROLS, INC.

OPERATION AND MAINTENANCE MANUAL
ZBTSDL SERIES POWER PANEL
100 - 4000 AMPS



ISO 9001

56R-1001B
7/97

INTRODUCTION

Zenith *Bypass-Isolation Delayed Transition Transfer Switches* are used to provide a continuous source of power to critical loads. This switch is designed to provide continuous power to the load even while maintenance is being performed on the switch.

Under normal operation, the switch acts as an automatic transfer switch, which transfers between a primary source and a secondary source of power in the event that the primary source voltage falls below preset limits. Voltage sensing and the transfer operation are performed by a state-of-the-art microcontroller located on the cabinet door.

Additionally, the Bypass-Isolation Transfer Switch includes a bypass switch which acts as a "second transfer switch" to supply power to the load. When in the bypass mode, the automatic transfer switch is no longer under power and can receive maintenance without disturbing power to the load. When in isolation mode, the automatic transfer switch is fully disconnected from the bypass switch, and can be removed from the cabinet. The bypass switch is manually operated via a handle through the cabinet door.

Zenith Delayed Transition Transfer Switches provide a set time delay between the opening of one source and closing into another. This time delay can be useful in many applications, such as allowing motor loads to de-energize prior to transfer.

All Zenith transfer switches are designed for use on emergency or standby systems, and are rated for total system or motor loads. Transfer switches are UL Listed under Standard 1008 and CSA Certified under Standard C22.2 No. 178.

This manual provides information on the installation, operation and maintenance of the switch. In addition, a complete information package is supplied with each transfer switch which details the features and accessories provided on that switch. The information package should be kept in a readily accessible location to provide complete reference information on this critically important piece of equipment.

A complete information package includes the following:

- Operation and Maintenance Manual for Power Panel (this manual)
- Operation and Maintenance Manual for Control Panel*
- Specific schematics for each transfer switch*

* Supplied with the transfer switch

TABLE OF CONTENTS

Section I **INSTALLATION** **2**
1. Equipment Inspection & Storage 2
2. Mounting 2
3. Power Connections 2
4. Control Connections 3
5. Final Equipment Inspection 5
6. Functional Test 5

Section II **OPERATION AND FEATURES** **7**

Section III **MAINTENANCE AND TESTING** **15**
1. Inspection and Cleaning 15
2. Servicing 15
3. Testing 15
4. Troubleshooting 16

SECTION I - INSTALLATION

⚠ DANGER

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Each Zenith transfer switch is factory wired and tested. A complete information package is furnished with each switch which includes:

a. Sequence of operation.
b. Description and operation of all accessories supplied.
c. Power panel connection diagram and schematic.
d. Description and identification of all customer field connections.

Installation of Zenith transfer switches includes:

a. Mounting the transfer switch cabinet.
b. Connection of all Normal, Emergency, and Load cables or bus bars.
c. Connection of external control circuits as required.

1. EQUIPMENT INSPECTION & STORAGE

Immediately inspect the transfer switch when received to detect any damage which may have occurred during transit. If damage is found or suspected, file claims as soon as possible with the carrier and notify the nearest Zenith representative.

Before installation, it is necessary to store the transfer switch in a clean dry place, protected from dirt and water. Provide ample air circulation and heat, if necessary, to prevent condensation.

Storage Temperature:
-30 C to + 65 C (-22 F to +149 F)

Operating Temperature (Ambient):
-20 C to +75 C (-4 F to +167 F) [40-260 Amps]
-20 C to +40 C (-4 F to +104 F) [400-4000 Amps]

Humidity:
5% to 95% (non-condensing)

2. MOUNTING

Adequate lifting means must be used to mount the transfer switch into place. The recommended method for moving the transfer switch using the lifting eyes and a spreader bar is illustrated in *Figure 1.* Enough room should be allowed to open the cabinet doors fully for inspection and servicing of the switch per NEC and local codes.

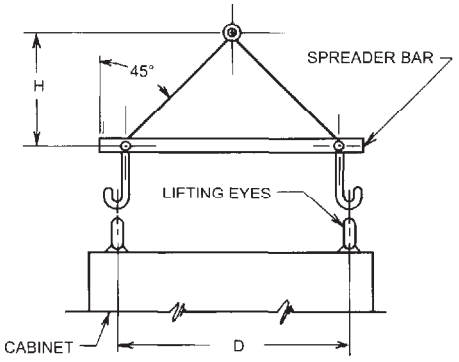


Figure 1

⚠ NOTICE

When lifting the switch using a spreader bar, height H must be equal to half of distance D.

Before drilling conduit entry holes or any accessory mounting holes, cover and protect the switch and control panel to prevent dirt and metal fragments from entering the mechanical and electrical components. Failure to do so may result in damage and malfunction of the switch.

3. POWER CONNECTIONS

Zenith transfer switches are supplied with UL listed solderless screw type terminals as standard for the Normal, Emergency and Load power connections. *Table 1* lists the number and sizes of cable lugs supplied as standard for each switch amp rating.

Connect the Normal, Emergency, and Load conductors to the clearly marked terminals on the transfer switch. Remove surface oxides from cables by cleaning with a wire brush. Verify that all connections are correct before tightening the lugs. All cable lug connections must be tightened to the proper torque values as shown in *Table 2.*

Do not run cables or wiring behind front-connected transfer switches.

In cases where the Normal, Emergency and Load connections are made to a rear connected bus bar, a compression washer, flat washer, and a minimum grade 5 bolt must be used and torqued to the values in *Table 3.*

SECTION I - INSTALLATION (Continued)

Screw Type Terminals for External Power Connections				
Switch Size	Normal, Emergency & Load Terminals		Fully Rated Neutral Bar (When Required)	
(Amps)	Cable Per Pole	Range of Wire Sizes	Number of Cables	Range of Wire Sizes
100	1	#14 to 1/0 AWG	3	#14 to 1/0 AWG
150	1	#8 to 3/0 AWG	3	#6 AWG to 300 MCM
225	1	#6 AWG to 250 MCM	3	#6 AWG to 300 MCM
260	1	#6 AWG to 350 MCM	3	#6 AWG to 300 MCM
400	1	#4 AWG to 600 MCM	4	#2 AWG to 600 MCM
600	2	#2 AWG to 600 MCM	8	#2 AWG to 600 MCM
800	4	#2 AWG to 600 MCM	12	#2 AWG to 600 MCM
1000	4	#2 AWG to 600 MCM	12	#2 AWG to 600 MCM
1200	4	#2 AWG to 600 MCM	12	#2 AWG to 600 MCM
1600 2000 3000 4000	Line and load terminals are located in rear and arranged for bus bar connection.		12	3/0 AWG to 750 MCM

Table 1

Tightening Torque for Lugs		
Socket Size	**Torque**	
Across Flats	**Lb.-In.**	**Lb.-Ft.**
1/8	45	4
5/32	100	8
3/16	120	10
7/32	150	12
1/4	200	17
5/16	275	23
3/8	375	31
1/2	500	42
9/16	600	50

Table 2

Tightening Torque for Bus Bars		
Bolt Size	**Torque Bolt (Grade 5)**	
	Lb.-In.	**Lb.-Ft.**
1/4-20	72	6
5/16-18	132	11
3/8-16	300	25
1/2-13	720	60

4. CONTROL CONNECTIONS

A complete information package is furnished with each transfer switch including a complete connection diagram and schematic which details all necessary control circuit field connections.

The engine start control wires connect to the terminals specified in the upper right corner of the bypass cabinet. Terminals for field connections to the A3 Emergency auxiliary contacts and the A4 Normal auxiliary contacts are also provided. These terminals are clearly marked and appear on the left side of the ATS power panel. *Figure 2* shows the location of these terminals.

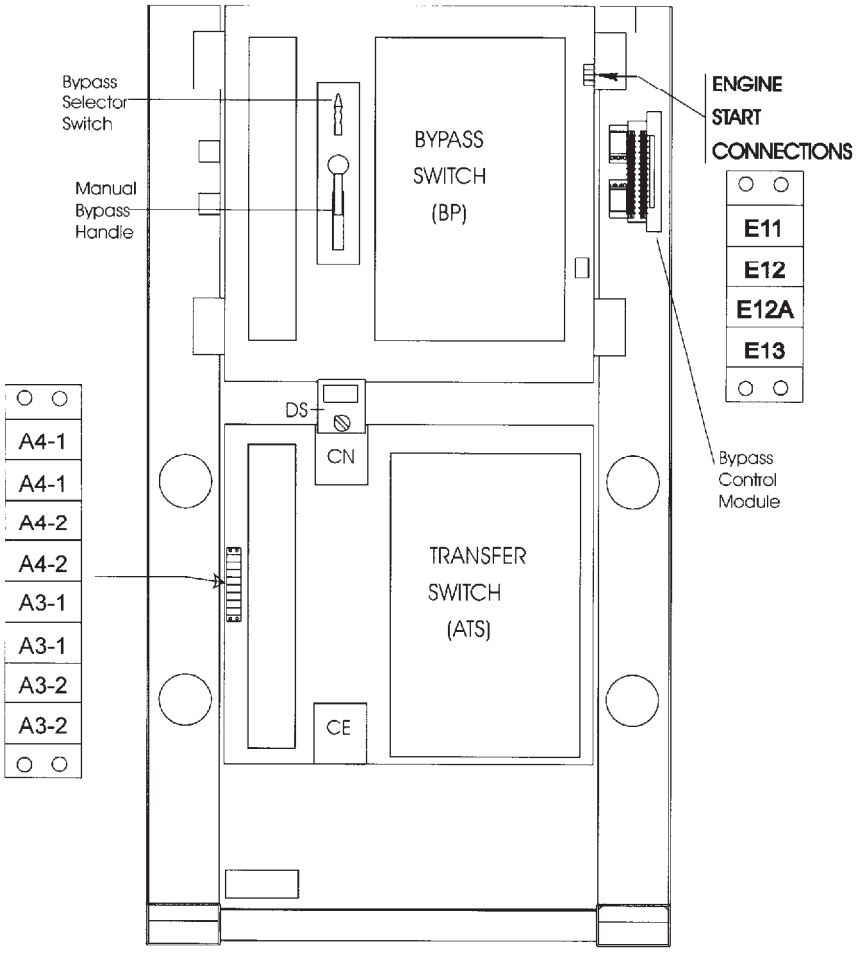
SECTION I - INSTALLATION (Continued)

4. CONTROL CONNECTIONS (Continued)

All other optional inputs and outputs are made via optoisolator terminals located on the left side of the microprocessor control panel (see *Figure 3*). Please refer to the MX-200 manual (50R-2000) and/or your specific switch drawings for complete option descriptions. Make necessary external control connections to the appropriate optoisolator terminals. Ensure that all connections are tightened to the torque specified in *Table 4*.

Control Wire Connections	
Wire Size (AWG)	**Torque Lb.-In.**
18 - 16	19
14 - 8	19
6 - 4	36

Table 4



SECTION I - INSTALLATION (Continued)

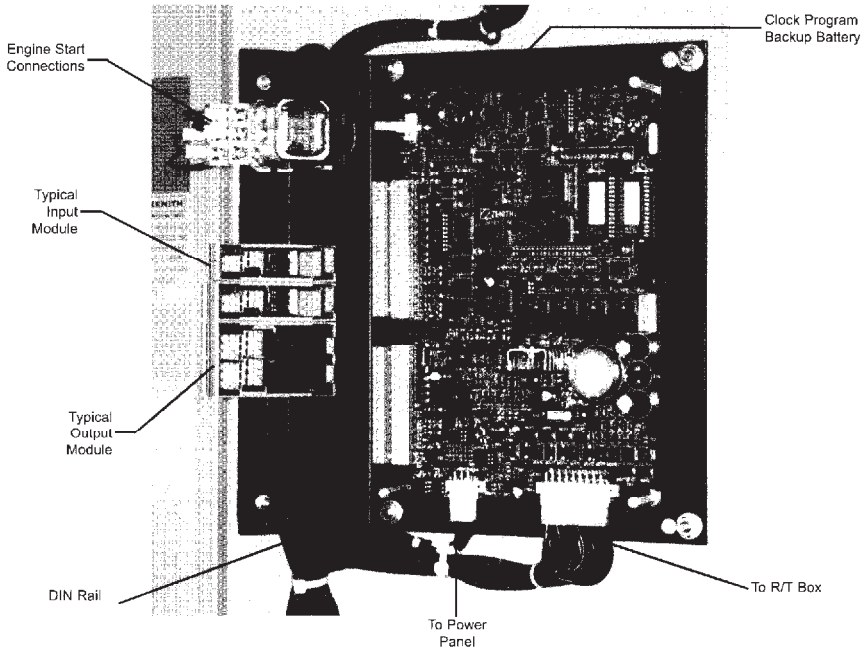


Figure 3

5. FINAL EQUIPMENT INSPECTION

Prior to energizing the transfer switch:

a. Remove any debris incurred due to shipment or installation. DO NOT use a blower since debris may become lodged in the electrical and mechanical components and cause damage. Use of a vacuum is recommended.
b. Verify that all cabled connections are correct and that phase rotation of both sources match.
c. Check engine start connections and verify the correct connection of all control wires.
d. Check settings of all timers and adjust as necessary. Also adjust any optional accessories as required. [See MX200 manual (50R-2000) for instructions on timer and option adjustments.]
e. Check the integrity of power connections by verifying actual lug torque values as specified in this manual.
f. Make sure that all covers and barriers are installed and properly fastened.

6. FUNCTIONAL TEST

The functional testing of the transfer switch consists of electrical tests described in this section. Before proceeding, refer to the information package supplied with the transfer switch. Read and understand all instructions and review the operation of all accessories provided. Before starting the operation test, check the equipment rating nameplate on the transfer switch to verify the correct system voltage. An example of the equipment rating nameplate is shown in *Figure 4.*

ZENITH CONTROLS, INC.

SERIAL NUMBER:
RATING: VOLTS - HZ -
AMPS - PHASE -
SYSTEM VOLTS:
MODEL NUMBER:

SECTION I - INSTALLATION (Continued)

To begin the test, close the Normal source circuit breaker. The controller will illuminate the Normal Available LED if proper voltage is sensed. Verify the phase to phase voltages at the Normal line terminals.

Next, close the Emergency source breaker and start the engine generator. The Emergency Available LED indicator will illuminate when preset voltage and frequency levels are reached. Check the phase to phase voltages at the Emergency line terminals. Also, verify that the phase rotation of the Emergency source is the same as the phase rotation of the Normal source.

After the sources have been verified, shut down the engine generator, and put the generator starting control in the automatic position. Complete the visual inspection of the transfer switch, and close and lock the cabinet door.

Initiate the test by pressing the TEST button on the LCD keypad. The controller will then prompt for your access code. After entering the code, three test options will appear--**load, fast load and no load.**

Load test simulates Normal line failure, transferring the load to the Emergency source.
Fast load test presets all timer values to a maximum 30 seconds before transferring to the Emergency source. After completion of the test, all timers are reset to their original values.
No load test starts the generator but does not transfer the load to the Emergency source.

Press and hold the desired test option button until the switch transfers to the Emergency source (load test) or until the generator has been run for the desired amount of time (no load test). **Releasing the test button before transfer to Emergency will halt the test.**

When the test is initiated, the controller first starts the P timer. Upon completion of the P time delay, an engine start signal is sent. As soon as the auxiliary source reaches preset levels, the W timer begins its timing cycle. This timer is used to ensure the voltage and frequency of the auxiliary source has stabilized before transfer. If the voltage and frequency of the auxiliary source falls below preset limits the test will be terminated and the U timer (below) will time out. If the voltage and frequency remain within preset limits for the duration of the W time delay, the transfer switch will open out of the Normal source to the Open position.

The switch will remain in the Open position for the duration of the DW timer. When the DW time has elapsed, the switch will complete its transfer by closing into the Emergency source.

Deactivating the test switch will start retransfer to the Normal source. After the time delay of the T timer the switch will open out of the Normal source to the Open position. The switch will remain in the Open position for the duration of the DT timer. After the time delay of the DT timer, the switch will complete its transfer by closing into the Normal source. Immediately after retransfer, the U timer begins its timing cycle. The U timer is the engine overrun timer which allows the engine generator to run unloaded for a preset cool down period.

NOTE: W and T timers are bypassed on the no load test.

For complete details of timer and voltage sensing operations, please refer to the MX200 Operation Manual (50R-2000)

⚠ NOTICE

A periodic test of the transfer switch under load conditions is recommended to insure proper operation. (See National Electric Code articles 700 and 701.)

SECTION II - OPERATION AND FEATURES

Zenith Bypass-Isolation Transfer Switches offer the benefits of combining an automatic transfer switch with a manual bypass switch. They are designed to provide continuous power to a load even while performing maintenance to the automatic transfer switch. The automatic transfer switch can be placed in any one of three modes: 1) standard automatic mode. 2) isolation from all power supplies, and 3) full removal from the unit. The following sections describe the operation of Zenith Bypass-Isolation Transfer Switches.

1. AUTOMATIC MODE OPERATION

Figure 5 is a typical schematic diagram of a Zenith transfer switch power panel. The information supplied with the transfer switch includes a schematic diagram and description of operation of all timers and settings.

System voltage is continuously monitored by the Zenith MX200 controller via the 10V secondary windings of transformers XN1 and XN2. Transfer of the load to the Emergency source begins automatically whenever the MX200 detects an out of range phase-to-phase voltage. Immediately the engine start timer P begins its timing cycle. The P time delay is provided to override momentary outages and to prevent nuisance starting of the engine generator (user set from 0-10 seconds). If the Normal source voltage returns to the correct range, the P timing cycle is reset, and the transfer sequence is stopped.

If the Normal source voltage is not restored before the P time delay is completed, a start signal is sent to the engine generator. The controller then senses the voltage and frequency of the Emergency source via the 10V secondary on transformer XE1 (and XE2 if three-phase voltage on Emergency is supplied). When the voltage and frequency of the Emergency source reach preset values, timer W begins its timing cycle. The W timer provides an adjustable delay before opening out of the Normal source (user set from 0-5 minutes) to ensure that the Emergency source has stabilized.

When the W time is completed, the CCNO relay energizes the CNO solenoid to open the transfer switch out of the Normal source. The switch is now in a neutral (both sources open) position. The switch remains in a neutral position for the duration of the DW time delay. DW is an adjustable time delay between the opening of the Normal source and closing into the Emergency source.

When the DW time delay is completed, the CCE relay closes to energize the CE solenoid completing transfer of the load to the Emergency source.

The sequence for retransfer to the Normal source begins automatically when the controller detects that the voltage on all phases of the Normal source has been restored.

When the Normal source restores, retransfer is initiated by beginning the T timer. The T timer provides an adjustable delay to ensure that the Normal source has stabilized before opening out of the Emergency source (user set from 0-60 minutes). If the Normal source fails before the T time delay completes, the retransfer sequence is stopped.

When the T time delay is completed, the CCEO relay energizes the CEO solenoid to open the switch out of Emergency and into a neutral position. The switch remains in neutral for the DT time delay. When the DT time delay has elapsed, the CCN relay energizes the CN solenoid to complete retransfer of the switch into the normal source. Simultaneously, the engine over-run timer U begins its timing cycle. This timer provides a period of time for the engine generator to run without load and cool down before shutdown (user set from 0-60 minutes).

For complete details of the timers and settings, please refer to the MX200 controller manual (50R-2000).

SECTION II - OPERATION AND FEATURES (Continued)

TYPICAL TRANSFER SWITCH EQUIPMENT POWER CIRCUIT SCHEMATIC

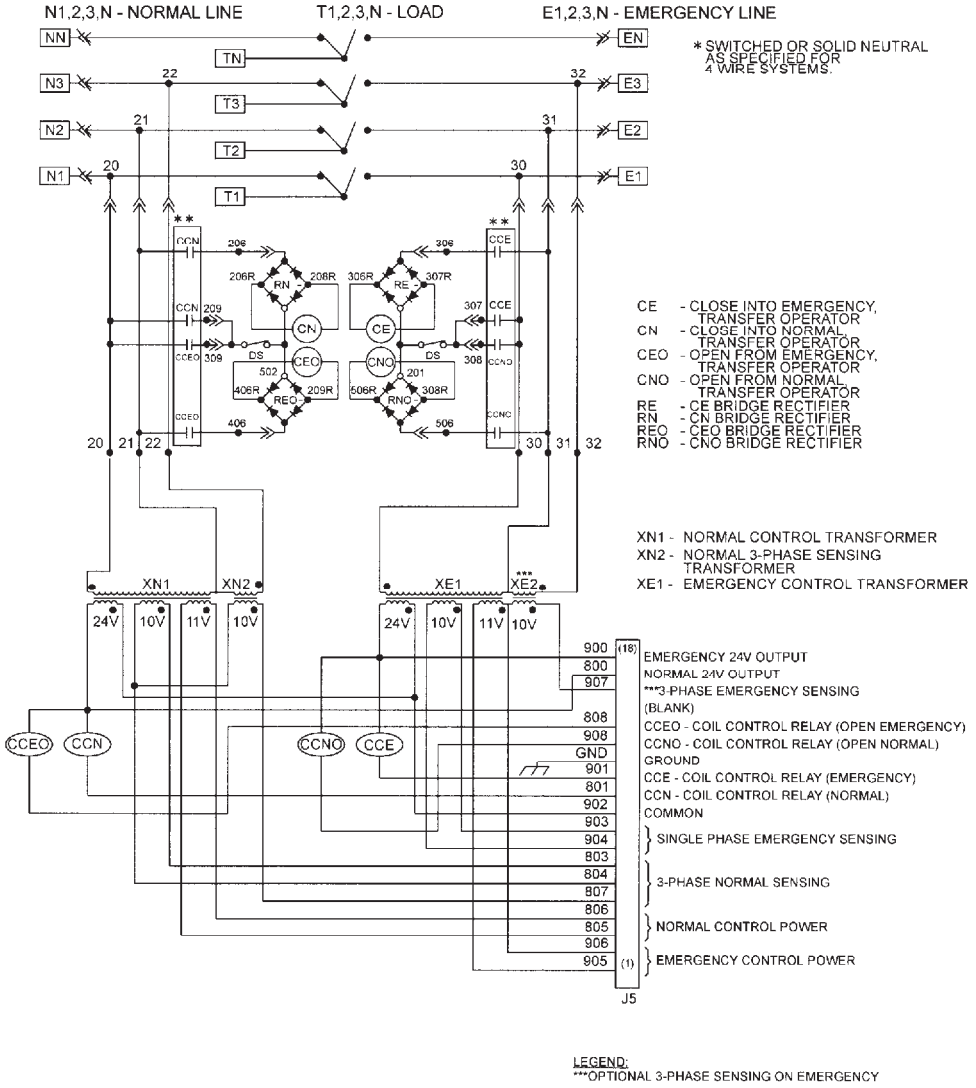
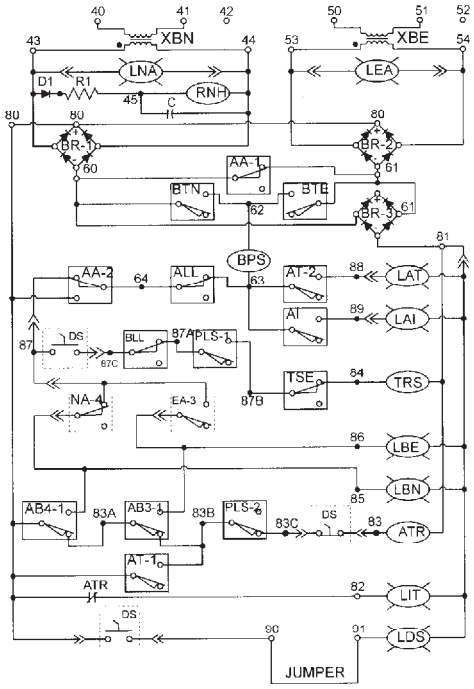


Figure 5

SECTION II - OPERATION AND FEATURES (Continued)

Bypass / Isolation Schematic (100-400 Amp)



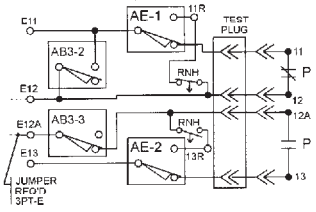
XBN	-	BYPASS NORMAL CONTROL TRANSFORMER
XBE	-	BYPASS EMERGENCY CONTROL TRANSFORMER
LNA	-	NORMAL AVAILABLE LIGHT
LEA	-	EMERGENCY AVAILABLE LIGHT
RNH	-	NORMALLY HELD RELAY
D1	-	DIODE
R1	-	RESISTOR, RNH
C	-	CAPACITOR RNH
BR-1,2,3	-	BRIDGE RECTIFIER
AA-1	-	LIMIT SWITCH, ATS AUTO LOCATION
BTN	-	LIMIT SWITCH, BYPASS TRANSFER NORMAL (MBH MOVEMENT TO NORMAL)
BTE	-	LIMIT SWITCH, BYPASS TRANSFER EMERG. (MBH MOVEMENT TO EMERGENCY)
BPS	-	BYPASS SOLENOID
AA-2	-	LIMIT SWITCH, ATS AUTO LOCATION
ALL	-	LIMIT SWITCH, ATS LOCK LOCATION
AT-2	-	LIMIT SWITCH, ATS TEST LOCATION
LAT	-	LIGHT, ATS TEST LOCATION
AI	-	LIMIT SWITCH, ATS ISOLATE LOCATION
LAI	-	LIGHT, ATS ISOLATE LOCATION
BLL	-	LIMIT SWITCH, BYPASS LOCK LOCATION
PLS-1	-	PERMISSIVE LIMIT SWITCH
TSE	-	LIMIT SWITCH, TRANSFER SWITCH ENGAGED
TRS	-	SOLENOID, TRANSFER RELEASE
NA-4	-	LIMIT SWITCH, ATS IN NORMAL
EA-3	-	LIMIT SWITCH, ATS IN EMERGENCY
LBE	-	LIGHT, BYPASS EMERGENCY
LBN	-	LIGHT, BYPASS NORMAL
AB4-1	-	LIMIT SWITCH, BYPASS NORMAL
AB3-1	-	LIMIT SWITCH, BYPASS EMERGENCY
PLS-2	-	PERMISSIVE LIMIT SWITCH
ATR	-	AUTO/TEST RELAY
AT-1	-	LIMIT SWITCH, ATS TEST LOCATION
LIT	-	LIGHT, ATS INHIBIT
DS	-	ATS DISCONNECT SWITCH
LDS	-	LIGHT, DISCONNECT SWITCH INHIBIT POSITION
ALH	-	ATS LOCATION HANDLE
MBH	-	MANUAL BYPASS HANDLE

LOCATED ON ATS

LOCATED ON BYPASS

ENGINE START SCHEMATIC

AE-1,2 - LIMIT SWITCH, ENGINE START TRANSFER
AB3-2,3- LIMIT SWITCH, BYPASS EMERGENCY





NORMAL/EMERGENCY TRANSFER PERMIT CIRCUIT. (ALH IN AUTO AND TEST LOCATION WITH DS IN AUTO POSITION)

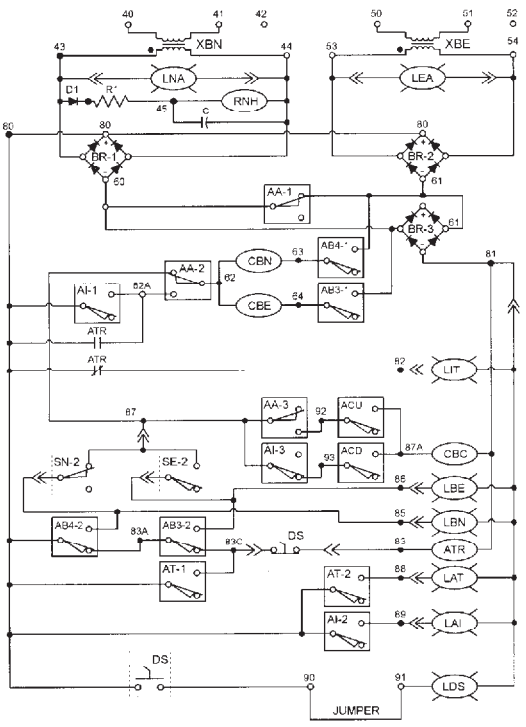
LIMIT SWITCH CHART

X = ACTUATED	ATS LOCATION				ATS MODE		BYPASS MODE		
	AUTO	TEST	ISO	REMOVE	NORM	EMERG	NORM	EMERG	OPEN
AA	X								
AT		X							
AI			X	X					
ALL	X	X	X	X					
TSE	X	X	X						
AI-			X	X					
NA					X				
EA						X			
AB4							X		
AB3								X	
BLL							X	X	X
PLS	ACTIVATED WHEN ALH IS OPERATED								

Figure 6

SECTION II - OPERATION AND FEATURES (Continued)

Bypass / Isolation Schematic (600-1200 Amp)

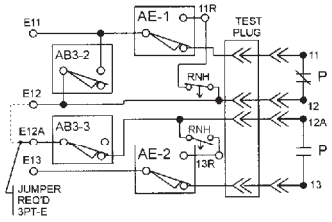


XBN - BYPASS NORMAL CONTROL TRANSFORMER
XBE - BYPASS EMERGENCY CONTROL TRANSFORMER
LNA - NORMAL AVAILABLE LIGHT
LEA - EMERGENCY AVAILABLE LIGHT
RNH - NORMALLY HELD RELAY
D1 - DIODE
R1 - RESISTOR, RNH
C - CAPACITOR, RNH
BR-1,2,3 - BRIDGE RECTIFIER
AA-1 - LIMIT SWITCH, ATS AUTO LOCATION
AB4-1 - LIMIT SWITCH, BYPASS NORMAL
CBN - NORMAL TRANSFER OPERATOR
AA-2 - LIMIT SWITCH, ATS IN AUTO
AB3-1 - LIMIT SWITCH, BYPASS EMERGENCY
CBE - EMERGENCY TRANSFER OPERATOR
LIT - ATS INHIBIT LIGHT
AI-1 - LIMIT SWITCH, ATS IN ISOLATE
AA-3 - LIMIT SWITCH, ATS IN AUTO
ACD - LIMIT SWITCH, CRANK HANDLE
ACU - ENGAGED
AI-3 - LIMIT SWITCH, ATS IN ISOLATE
CBC - CRANK SOLENOID
LBE - LIGHT, BYPASS EMERGENCY
LBN - LIGHT, BYPASS NORMAL
AB4-2 - LIMIT SWITCH, BYPASS NORMAL
AB3-2 - LIMIT SWITCH, BYPASS EMERGENCY
ATR - AUTO/TEST RELAY
AT-1 - LIMIT SWITCH, ATS TEST LOCATION
LAT - ATS TEST LOCATION
AT-2 - LIMIT SWITCH, ATS IN TEST
LAI - ATS ISOLATE LIGHT
AI-2 - LIMIT SWITCH, ATS IN ISOLATE
DS - ATS DISCONNECT SWITCH
LDS - DISCONNECT SWITCH, INHIBIT POSITION LIGHT
MBH - MANUAL BYPASS HANDLE

LOCATED ON ATS | LOCATED ON BYPASS

ENGINE START SCHEMATIC

AE-1,2 - LIMIT SWITCH, ENGINE START TRANSFER
AB3-2,3 - LIMIT SWITCH, BYPASS EMERGENCY





NORMAL/EMERGENCY TRANSFER PERMIT CIRCUIT (ALH IN AUTO AND TEST LOCATION WITH DS IN AUTO POSITION)

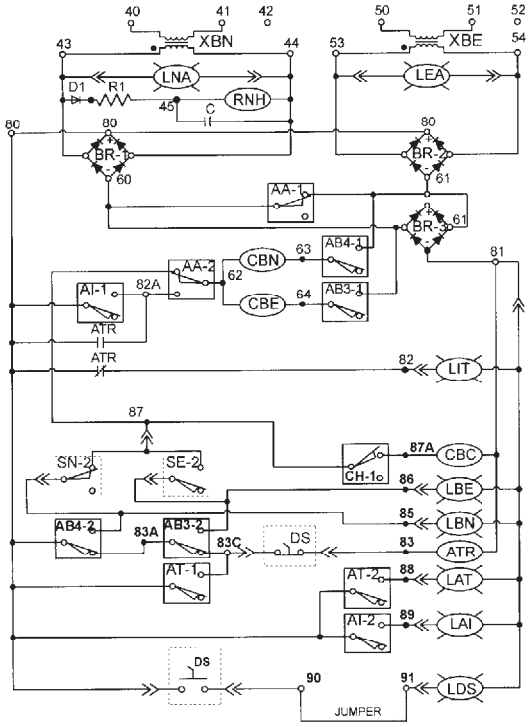
LIMIT SWITCH CHART

X = ACTUATED	ATS LOCATION				ATS MODE		BYPASS MODE	
	AUTO	TEST	ISO	REMOVE	NORM	EMERG	NORM	EMERG	OPEN
AA	X								
AT		X							
AI			X	X					
ALL	X	X	X	X					
TSE	X	X	X						
AE			X	X					
NA					X				
EA						X			
AB4							X		
AB3								X	
BLL							X	X	X
PLS	ACTIVATED WHEN ALH IS OPERATED								

Figure 7

SECTION II - OPERATION AND FEATURES (Continued)

Bypass / Isolation Schematic (1600-4000 Amp)



XBN - BYPASS NORMAL CONTROL TRANSFORMER
XBE - BYPASS EMERGENCY CONTROL TRANSFORMER
LNA - NORMAL AVAILABLE LIGHT
LEA - EMERGENCY AVAILABLE LIGHT
RNH - NORMAL VOLTAGE RELAY
D1 - DIODE
R1 - RESISTOR, RNA
BR-1,- BRIDGE RECTIFIER
2,3
C - CAPACITOR, RNA
AA-1 - LIMIT SWITCH, ATS AUTO LOCATION

AB4-1- LIMIT SWITCH, BYPASS NORMAL
CBN - NORMAL TRANSFER OPERATOR
AA-2 - LIMIT SWITCH, ATS IN AUTO
CBE - EMERGENCY TRANSFER OPERATOR
AB3-1- LIMIT SWITCH, BYPASS EMERGENCY
AI-1 - LIMIT SWITCH, ATS IN ISOLATE

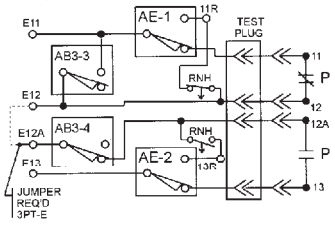
LIT - ATS INHIBIT LIGHT
DS - DISCONNECT SWITCH

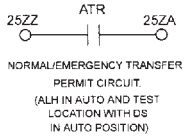
CBC - CRANK SOLENOID
CH-1 - LIMIT SWITCH
LBE - BYPASS EMERGENCY
AB4-2- LIMIT SWITCH, BYPASS NORMAL
LBN - BYPASS NORMAL LIGHT
AB3-2- LIMIT SWITCH, BYPASS EMERGENCY
ATR - AUTO/TEST RELAY
AT-1 - LIMIT SWITCH, ATS TEST LOCATION
LAT - ATS TEST LOCATION LIGHT
AT-2 - LIMIT SWITCH, ATS TEST LOCATION
LAI - ATS ISOLATE LIGHT
AI-2 - LIMIT SWITCH, ATS IN ISOLATE
LDS - DISCONNECT SWITCH LIGHT

LOCATED ON ATS | LOCATED ON BYPASS

ENGINE START SCHEMATIC

AE-1,2 - LIMIT SWITCH, ENGINE START TRANSFER
AB3-3,4 - LIMIT SWITCH, BYPASS EMERGENCY





NORMAL/EMERGENCY TRANSFER PERMIT CIRCUIT. (ALH IN AUTO AND TEST LOCATION WITH DS IN AUTO POSITION)

LIMIT SWITCH CHART

X = ACTUATED	ATS LOCATION				ATS MODE		BYPASS MODE		
	AUTO	TEST	ISO	REMOVE	NORM	EMERG.	NORM	EMERG.	OPEN
AA	X								
AT		X							
AI			X	X					
AE			X	X					
SN					X				
SE						X			
AB4							X		
AB3								X	

Figure 8

SECTION II - OPERATION AND FEATURES (Continued)

2. BYPASS/ISOLATION OPERATION

a. 100-400 AMP

1) Automatic
   a) Manually operated Bypass Switch contacts (BN/BE) are open and ATS is supplying load.
   b) Disconnect Switch (DS) is in Auto.

2) To Bypass ATS
   a) Open bottom cabinet door and turn DS to Inhibit.
   b) Position manual bypass handle (MBH) to same power source as ATS.

3) To Test ATS
   a) Bypass per above instructions.
   b) Move ATS location handle (ALH) to Test location.
   c) Turn DS to Auto.
   d) Test Switch (TS) on bottom cabinet door will allow electrical operation of ATS.

4) To Isolate ATS
   a) Bypass per above instructions.
   b) Move ALH to Isolate location.

5) To Remove ATS
   a) Bypass and isolate per above instructions.
   b) Move ALH to Release location.
   c) Disconnect multipin plugs.
   d) Lift ATS out of drawer.

6) To Reconnect ATS
   a) Place ATS into drawer slots (front rollers first).
   b) Turn DS to Inhibit.
   c) Manually position ATS into same source as Bypass Switch.
   d) Reconnect multipin plugs and external connections to ATS.
   e) Push ATS inward to engage carriage.
   f) Move ALH to Test location (as indicated by light).
   g) Turn DS to Auto and use TS to electrically operate ATS.
   h) Turn DS to Inhibit.
   i) Move ALH to Auto location.
   j) Turn DS to Auto and open Bypass with MBH.
   k) ATS is now fully automatic.

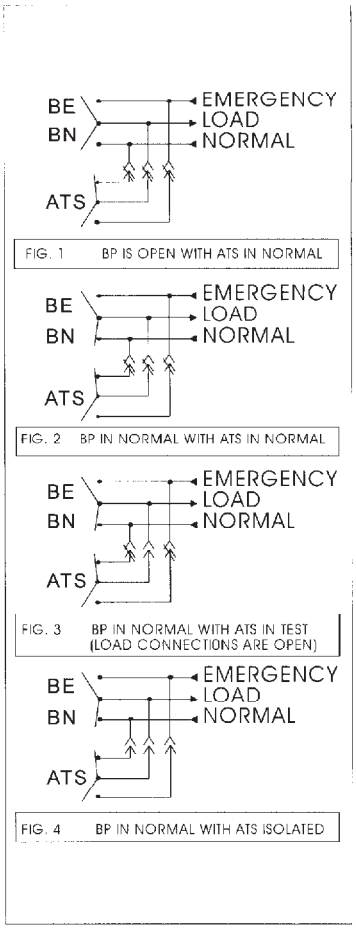


FIG. 1 BP IS OPEN WITH ATS IN NORMAL

FIG. 2 BP IN NORMAL WITH ATS IN NORMAL

FIG. 3 BP IN NORMAL WITH ATS IN TEST (LOAD CONNECTIONS ARE OPEN)

FIG. 4 BP IN NORMAL WITH ATS ISOLATED

Notes:
1. DS in Inhibit will prevent ATS electrical operation.
2. Do not use excessive force on mechanical handles.
3. Figures depict Bypass Normal. Sequence is the same for Bypass Emergency.
4. When ATS is in Test or Isolate, Bypass Switch is manual transfer switch to either available source (indicated on light panel).
5. To operate Bypass Switch when ATS is in Test or Isolate, position MBH to available power source.

Legend:
1. BP - Bypass switch (indicated by contacts BN/BE) is a three position switch.
2. ATS - Automatic Transfer Switch.

SECTION II - OPERATION AND FEATURES (Continued)

2. BYPASS/ISOLATION OPERATION (Continued)

b. 600-1200 AMP

1) Automatic
   a) Manually operated Bypass Switch contacts (BN/BE) are open and ATS is supplying load.
   b) Disconnect Switch (DS) is in Auto.

2) To Bypass ATS
   a) Open bottom cabinet door and turn DS to Inhibit.
   b) Turn Bypass Selector Switch (BSS) to same power source as ATS.
   c) Move the manual bypass handle (MBH) upward.

3) To Test ATS
   a) Bypass per above instructions.
   b) Rotate crank mechanism counterclockwise until ATS Test light is illuminated.
   c) Turn DS to Auto.
   d) Test Switch (TS) on bottom cabinet door will allow electrical operation of ATS.

4) To Isolate ATS
   a) Bypass per above instructions.
   b) Rotate crank mechanism counterclockwise until ATS Isolated light is illuminated.

5) To Remove ATS
   a) Bypass and isolate per above instructions.
   b) Disconnect multipin plugs and external connections to ATS.
   c) Rotate four power panel latches to vertical position, slide ATS forward and lock mechanism in place.
   d) ATS can now be removed from cabinet.

6) To Reconnect ATS
   a) Place ATS in slide mechanism.
   b) Unlock slide mechanism. Slide ATS over power panel latches and rotate latches to horizontal position.
   c) Turn DS to Inhibit.
   d) Manually position ATS into same source as Bypass Switch.
   e) Reconnect multipin plugs and external connections to ATS.
   f) Rotate crank mechanism clockwise until ATS Test light is illuminated.
   g) Turn DS to Auto and use TS to electrically operate ATS.
   h) Turn DS to Inhibit.
   i) Move ALH to Auto location.
   j) Turn DS to Auto and open Bypass with MBH.
   k) ATS is now fully automatic.

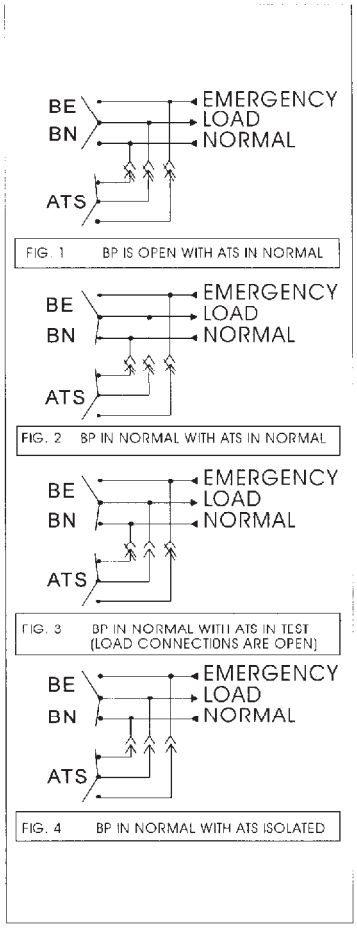


FIG. 1 BP IS OPEN WITH ATS IN NORMAL

FIG. 2 BP IN NORMAL WITH ATS IN NORMAL

FIG. 3 BP IN NORMAL WITH ATS IN TEST (LOAD CONNECTIONS ARE OPEN)

FIG. 4 BP IN NORMAL WITH ATS ISOLATED

Notes:
1. DS in Inhibit will prevent ATS electrical operation.
2. Do not use excessive force on mechanical handles.
3. Figures depict Bypass Normal. Sequence is the same for Bypass Emergency.
4. When ATS is in Test or Isolate, Bypass Switch is manual transfer switch to either available source (indicated on light panel).
5. To operate Bypass Switch when ATS is in Test or Isolate:
   a) Move MBH downward (to open Bypass Contacts BN/BE).
   b) Turn BSS to opposite power source.
   c) Move MBH upward to close into selected power source.

Legend:
1. BP - Bypass switch (indicated by contacts BN/BE) is a three position switch.
2. ATS - Automatic Transfer Switch.

SECTION II - OPERATION AND FEATURES (Continued)

2. BYPASS/ISOLATION OPERATION (Continued)

c. 1600-4000 AMP

1) Automatic
 a) Manually operated Bypass Switch contacts (BN/BE) are open and ATS is supplying load.
 b) Disconnect Switch (DS) is in Auto.

2) To Bypass ATS
 a) Open bottom cabinet door and turn DS to Inhibit.
 b) Turn Bypass Selector Switch (BSS) to same power source as ATS.
 c) Move the manual bypass handle (MBH) upward.

3) To Test ATS
 a) Bypass per above instructions.
 b) Rotate crank mechanism counterclockwise until ATS Test light is illuminated.
 c) Turn DS to Auto.
 d) Test Switch (TS) on bottom cabinet door will allow electrical operation of ATS.

4) To Isolate ATS
 a) Bypass per above instructions.
 b) Rotate crank mechanism counterclockwise until ATS Isolated light is illuminated.

5) To Remove ATS
 a) Bypass and isolate per above instructions.
 b) Disconnect multipin plugs and external connections to ATS.
 c) Slide four corner latches of ATS to innermost position.
 d) ATS can now be removed from cabinet.

6) To Reconnect ATS
 a) Roll cart back into cabinet.
 b) Slide four corner latches of ATS to outermost position.
 c) Turn DS to Inhibit.
 d) Manually position ATS into same source as Bypass Switch.
 e) Reconnect multipin plugs and external connections to ATS.
 f) Rotate crank mechanism clockwise until ATS Test light is illuminated.
 g) Turn DS to Auto and use TS to electrically operate ATS.
 h) Turn DS to Inhibit.
 i) Rotate crank mechanism clockwise until ATS location pointer is aligned with Auto mark on location indicator. (ATS must be in same source as Bypass).
 j) Turn DS to Auto and open Bypass with MBH.
 k) ATS is now fully automatic.

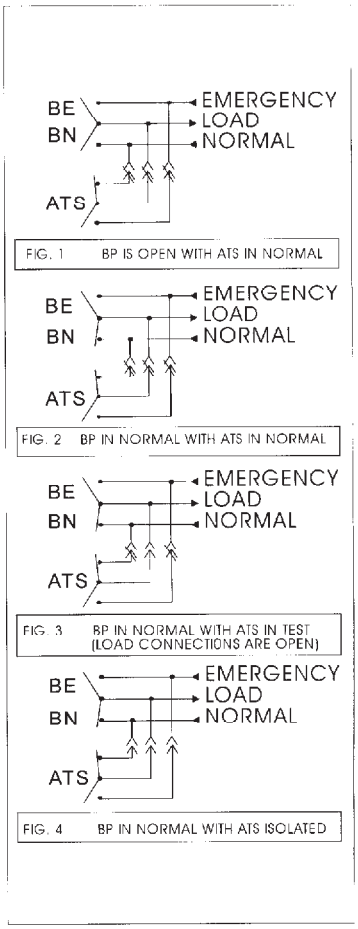


FIG. 1 BP IS OPEN WITH ATS IN NORMAL

FIG. 2 BP IN NORMAL WITH ATS IN NORMAL

FIG. 3 BP IN NORMAL WITH ATS IN TEST (LOAD CONNECTIONS ARE OPEN)

FIG. 4 BP IN NORMAL WITH ATS ISOLATED

Notes:
1. DS in Inhibit will prevent ATS electrical operation.
2. DO NOT use excessive force on mechanical handles.
3. Figures depict Bypass Normal. Sequence is the same for Bypass Emergency.
4. When ATS is in Test or Isolate, Bypass Switch is a manual transfer switch to either available source (indicated on light panel).
5. To operate Bypass Switch when ATS is in Test or Isolate:
 a) Move MBH downward (to open Bypass Contacts BN/BE)
 b) Turn BSS to opposite power source.
 c) Move MBH upward to close into selected power source.

Legend:
1. BP - Bypass switch (indicated by contacts BN/BE) is a three position switch.
2. ATS - Automatic Transfer Switch.

SECTION III - MAINTENANCE AND TESTING

A preventive maintenance program will insure high reliability and long life for the transfer switch. The preventive maintenance program for the transfer switch should include the following items:

1. INSPECTION AND CLEANING

⚠ DANGER

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

De-energize all sources of power before doing any work on the transfer switch.

The switch should be inspected for any accumulation of dust, dirt, or moisture, and should be cleaned by vacuuming or wiping with a dry cloth or soft brush. DO NOT use a blower since debris may become lodged in the electrical and mechanical components and cause damage.

Remove the transfer switch barriers and check the condition of the contacts. Any surface deposits must be removed with a clean cloth (DO NOT USE EMERY CLOTH OR A FILE). If the contacts are pitted or worn excessively, they should be replaced. A general inspection of mechanical integrity should be made to include loose, broken or badly worn parts.

2. SERVICING

All worn or inoperative parts must be replaced using Zenith recommended replacement parts. Please refer to the Replacement Parts manual for specific part information and ordering procedures. Please contact the Zenith Technical Services Department for the Replacement Parts manual.

The operating mechanism of the transfer switch is lubricated with Lubriplate 105. The lubricant applied at the factory provides adequate lubrication for the lifetime of the switch. Should debris contaminate the mechanism, clean and apply additional Lubriplate.

Zenith can provide complete preventative maintenance services. Please contact the Zenith Technical Services Department for additional information.

3. TESTING

A manual operator handle is provided with the transfer switch for maintenance purposes only. Manual operation of the switch must be checked before it is operated electrically. Both power sources MUST be disconnected before manual operation of the switch. Insert the handle and operate the transfer switch between the Normal and Emergency positions. The transfer switch should operate smoothly without binding. Return the switch to the Normal position, remove the handle, and return it to the holder provided.

After completing the inspection, cleaning and servicing of the transfer switch, reinstall the switch cover, and close and lock the cabinet door. Reclose the circuit breakers feeding the utility and generator sources to the switch.

Complete testing as described on page 5 of this manual.

⚠ NOTICE

A periodic test of the transfer switch under load conditions is recommended to insure proper operation.
(See National Electric Code articles 700 and 701.)

SECTION III - MAINTENANCE AND TESTING (Continued)

4. TROUBLESHOOTING

Before beginning any troubleshooting activity, refer to the information package supplied with the transfer switch and review the description and operation of all accessories supplied. Also refer to Section I of this manual, Installation.

a. Engine does Not START

Annunciation	Possible Cause	Corrective Action
EMERGENCY AVAILABLE LED off	Engine start wires not terminated properly	Check Engine Start Connections
	Generator in "off" position	Investigate why Engine Control Switch was turned off

b. Engine does Not STOP

Annunciation	Possible Cause	Corrective Action
LCD Display - "Delay to Engine Stop"	**U** timing cycle not complete	Check **U** Timer setting
NORMAL POSITION, and NORMAL and EMERGENCY AVAILABLE LEDs on, but U timer has timed out	Engine start wires not terminated correctly	Check Engine Start Connections
	Generator in "Manual"	Put generator in "Auto"

c. ATS Will Not Transfer To EMERGENCY

Annunciation	Possible Cause	Corrective Action
EMERGENCY AVAILABLE LED off	Emergency voltage or frequency not within acceptable parameters	Check Engine Start Connections, Generator Breaker, Generator output, and Engine Control Switch
None	Power supply connector unplugged	Plug in connector
LCD Display - "Mechanical Failure"	Limit switch or RT box connector unplugged	Plug in connector
LCD Display - "Delay to Emergency"	**DW** timing cycle not complete	Check **DW** Timer setting
LCD Display - "Delay to Open"	**W** timing cycle not complete	Check **W** Timer setting

d. ATS Will Not Transfer To NORMAL

Annunciation	Possible Cause	Corrective Action
NORMAL AVAILABLE LED off	Normal voltage or frequency not within acceptable parameters	Check utility and utility breakers
None	Power supply connector unplugged	Plug in connector
LCD Display - "Mechanical Failure"	Limit switches or RT box connector unplugged	Plug in connector
LCD Display - "Delay to Normal"	**DT** timing cycle not complete	Check **DT** Timer setting
LCD Display - "Delay to Open"	**T** timing cycle not complete	Check **T** Timer setting

SECTION III - MAINTENANCE AND TESTING (Continued)

FIELD NOTES

Model Number _____

Serial Number _____

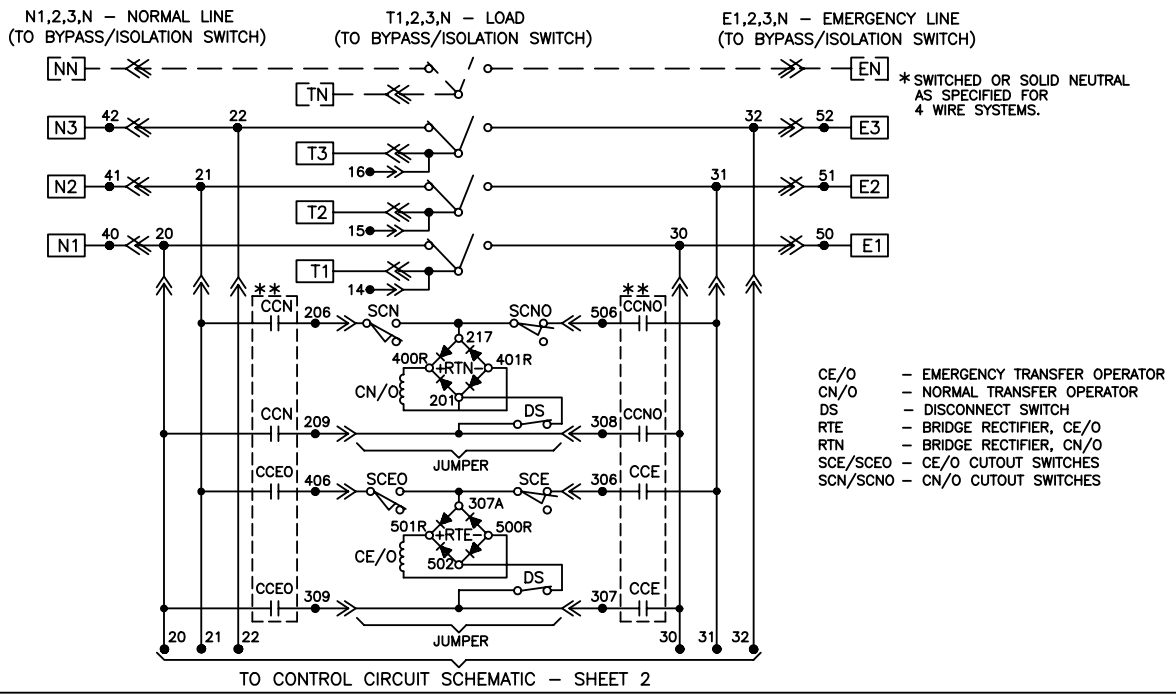
Date Shipped _____

Start-Up Date _____

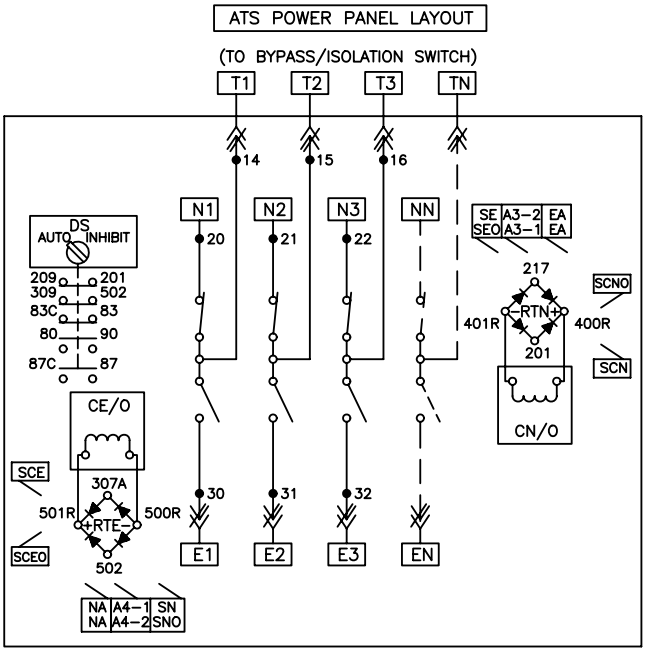
Drawings Supplied _____

Test and Maintenance Notes			
Date	**Tested**	**Observations**	**Notes**

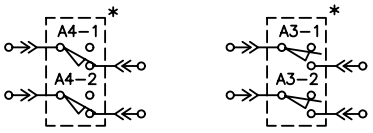
ATS POWER CIRCUIT SCHEMATIC



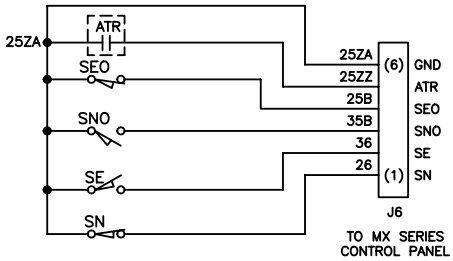
ATS POWER PANEL LAYOUT



AUXILIARY CONTACTS



LIMIT SWITCH SCHEMATIC



ATR – AUTO/TEST RELAY CONTACT (LOCATED ON BYPASS SUB PANEL)
SEO – EMERGENCY OPEN POSITION LIMIT SWITCH
SNO – NORMAL OPEN POSITION LIMIT SWITCH
SE – EMERGENCY POSITION LIMIT SWITCH
SN – NORMAL POSITION LIMIT SWITCH

LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —○— WIRE ON TERMINAL BLOCK —≫— WIRE IN INTERCONNECT PLUG * OPTIONAL ** LOCATED ON RELAY/ TRANSFORMER BOX	LEGEND, OPERATION, AND ACCESSORIES: 56A–0900D. MX200 CONTROLLER– 50A–2000.	ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S–5757	ESTABLISH DWG.		
B	S–6536	07/30/96	SG	SB
C	S–6612	11/05/96	SG	SB
D	S–6849	02/05/98	RMC	SB
E	S–7021	10/28/98	SG	PS
F	S–7377	05/19/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

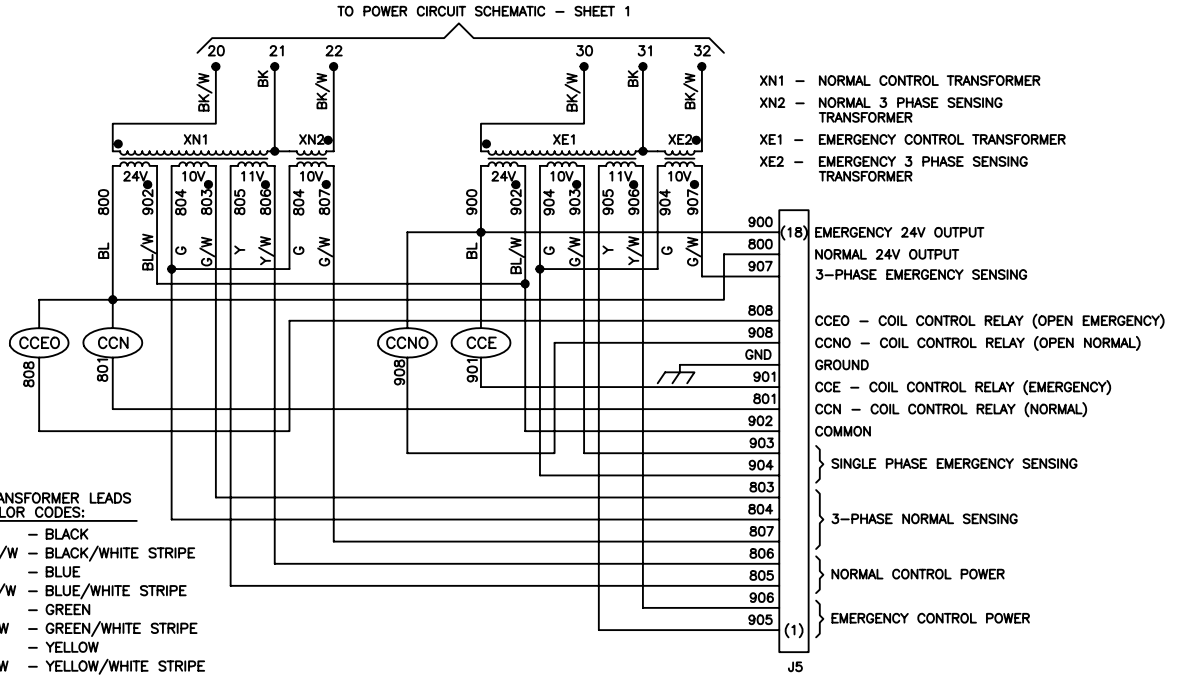
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: ATS POWER CIRCUIT & LIMIT SWITCHES
JOB/MODEL: ZBTSDL10–40 (100–400 AMP)

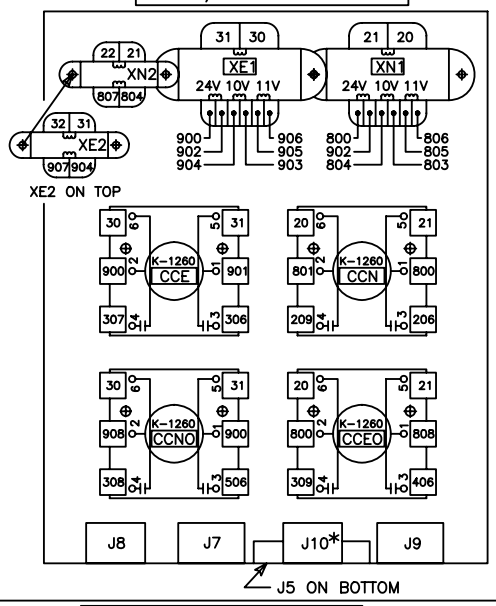
CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	56A–4000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SDW	SB	12/14/95	–	1 OF 5	F

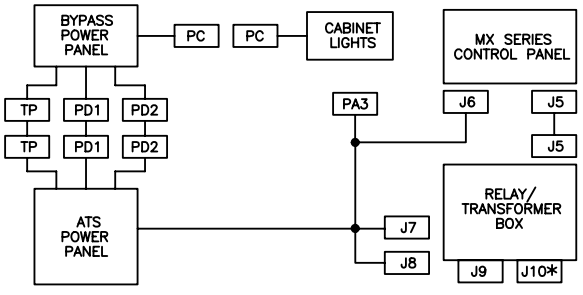
RELAY/TRANSFORMER BOX SCHEMATIC



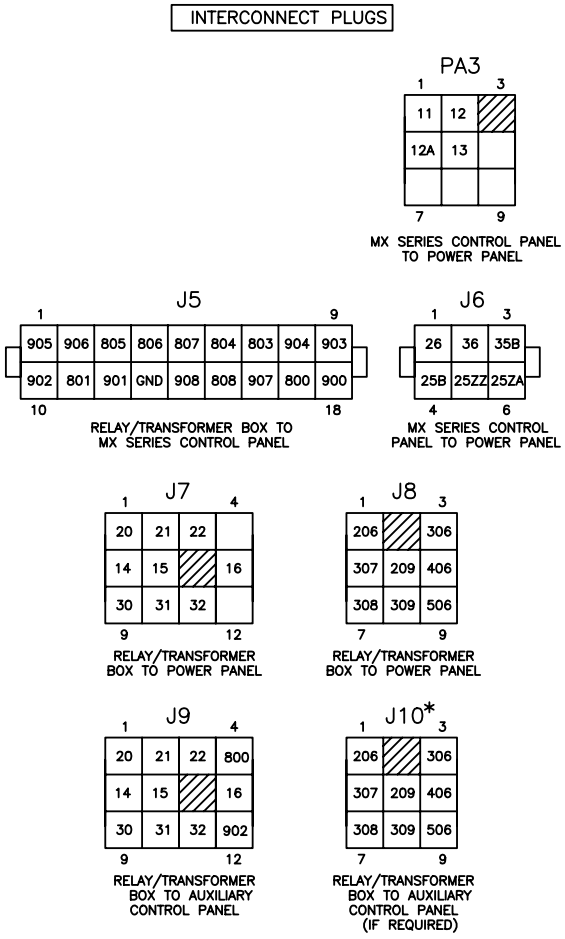
RELAY/TRANSFORMER BOX



INTERCONNECT PLUG DIAGRAM



INTERCONNECT PLUGS



LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION		
✱ OPTIONAL		

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S–5757	ESTABLISH DWG.		
–	–	10/02/95	RMC	SB
B	S–6536	07/30/96	SG	SB
C	S–6612	11/05/96	SG	SB
D	S–6849	02/05/98	RMC	SB
E	S–7021	10/28/98	SG	PS
F	S–7377	03/17/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: RELAY/XFR BOX & INTERCONNECT PLUGS

JOB/MODEL: ZBTSDL10–40 (100–400 AMP)

CHKD: APPD: CADD: ACAD | ORDER NUMBER: – | DRAWING NUMBER: 56A–4000

DRWN: SDW | ENGR: SB | DATE: 12/14/95 | SCALE: – | SHEET: 2 OF 5 | REV: F

OPERATION: BYPASS/ISOLATION SWITCH

AUTOMATIC

1. Manually operated Bypass Switch contacts (BN/BE) are open and ATS is supplying load
2. Disconnect Switch (DS) is in "AUTO".

TO BYPASS ATS

1. Open bottom cabinet door & turn DS to "INHIBIT".
2. Position manual bypass handle (MBH) to same power source as ATS.

TO TEST ATS

1. Bypass per above instructions.
2. Move ATS location handle (ALH) to "TEST" location.
3. Turn DS to "AUTO".
4. Test Switch (TS) on bottom cabinet door will allow electrical operation of ATS.

TO ISOLATE ATS

1. Bypass per above instructions.
2. Move ALH to "ISOLATE" location.

TO REMOVE ATS

1. Bypass and Isolate per above instructions.
2. Move ALH to "RELEASE" location.
3. Disconnect multipin plugs.
4. Lift ATS out of drawer.

TO RECONNECT ATS

1. Place ATS into drawer slots (front rollers first).
2. Turn DS to "INHIBIT".
3. Manually position ATS into same source as Bypass Switch.
4. Reconnect multipin plugs and external connections to ATS.
5. Push ATS inward to engage carriage.
6. Move ALH to "TEST" location (as indicated by light)
7. Turn DS to "AUTO" and use TS to electrically operate ATS.
8. Turn DS to "INHIBIT".
9. Move ALH to "AUTO" location.
10. Turn DS to "AUTO" & open Bypass with MBH.
11. ATS is now fully automatic (Fig.1).

NOTES:

1. DS in "INHIBIT" will prevent ATS electrical operation.
2. Do not use excessive force on mechanical handles.
3. Above Figures depict Bypass NORMAL. Sequence is same for Bypass EMERGENCY.
4. When ATS is in TEST or ISOLATE, Bypass Switch is manual transfer switch to either available source (indicated on light panel).
5. To operate Bypass Switch when ATS is in TEST or ISOLATE, position MBH to available power source.

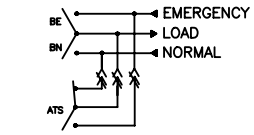


FIG. 1 BP IS OPEN WITH ATS IN NORMAL

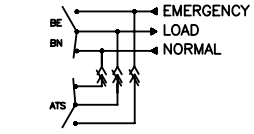


FIG. 2 BP IN NORMAL WITH ATS IN NORMAL

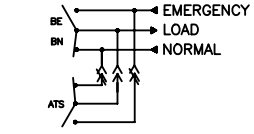


FIG. 3 BP IN NORMAL WITH ATS IN TEST (LOAD CONNECTIONS ARE OPEN)

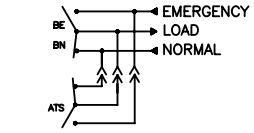


FIG. 4 BP IN NORMAL WITH ATS ISOLATED

NOTES:

1. BP–Bypass switch (indicated by contacts BN/BE) is a 3 position switch.
2. ATS–Automatic Transfer Switch

LEGEND: BYPASS/ISOLATION SWITCH (BP)

I. (BP) BYPASS/ISOLATION SWITCH: MECHANICAL COMPONENTS

N1,2,3(N)..... Normal Line connections_____
E1,2,3(N)..... Emergency Line connections_____
T1,2,3(N)..... Load Line connections_____
BE..... Bypass Emergency contacts
BN..... Bypass Normal contacts
MBH..... Manual Bypass Handle
ALH..... ATS Location Handle

II. (BP) BYPASS/ISOLATION: ELECTRICAL COMPONENTS

AA–1,2..... Limit switch held actuated in Auto location of ATS, Non–actuated Test and Isolated locations.
AB3–1,2,3,4..... Limit switch, actuated in Bypass Emergency position
AB4–1,2..... Limit switch, actuated in Bypass Normal position
ABE..... Auxiliary Bypass contact (Emergency)
ABN..... Auxiliary Bypass contact (Normal)
AE–1,2..... Limit switch, switches Engine Start from ATS control to bypass control during ATS Isolate
AI..... Limit switch, actuated in Isolate location
ALL..... Limit switch, ATS lock location
AT–1,2..... Limit switch, actuated in Test location
ATR..... Auto/Test Relay. Energized in AUTO and TEST locations
BLL..... Limit switch, Bypass lock location
BPS..... Bypass Solenoid
BR–1,2,3..... Bridge Rectifier
BTE..... Limit switch, Bypass Transfer Emergency (actuates during MBH movement to Emergency)
BTN..... Limit switch, Bypass Transfer Normal (actuates during MBH movement to Normal)
C..... Capacitor: RNH
D1..... Diode
EA–3..... Limit switch, ATS in Emergency
NA–4..... Limit switch, ATS in Normal
PLS–1,2..... Permissive limit switches
R1..... Resistor: RNH
RNH..... Relay normally held, 24 VDC coil, 3PDT
TRS..... Transfer Release Solenoid
TSE..... Limit switch. Transfer switch engaged non–activated in remove position
XBE..... Emergency line control transformer
XBN..... Normal line control transformer

III. (BP) BYPASS/ISOLATION SWITCH: INDICATOR LIGHTS

LNA..... Normal available
LEA..... Emergency available
LBN (NOTE 1)..... Bypass Normal (BN closed)
LBE (NOTE 1)..... Bypass Emergency (BE closed)
LAT (NOTE 1)..... ATS in Test location
LAI (NOTE 1)..... ATS in Isolate location
LIT (NOTE 1)..... ATS Inhibit
LDS (NOTE 1)..... ATS DS switch in INHIBIT position

NOTES:

1. Indicator off during automatic operation of ATS.
2. Four pole includes neutral lugs.

REVISIONS				
REV	ECN NO.	DATE	DFT	ENG
A	S–5757	ESTABLISH DWG.		
B	S–6536	07/30/96	SG	SB
C	S–6612	11/05/96	SG	SB
D	S–6849	02/05/98	RMC	SB
E	S–7021	10/28/98	SG	PS
F	S–7377	03/17/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

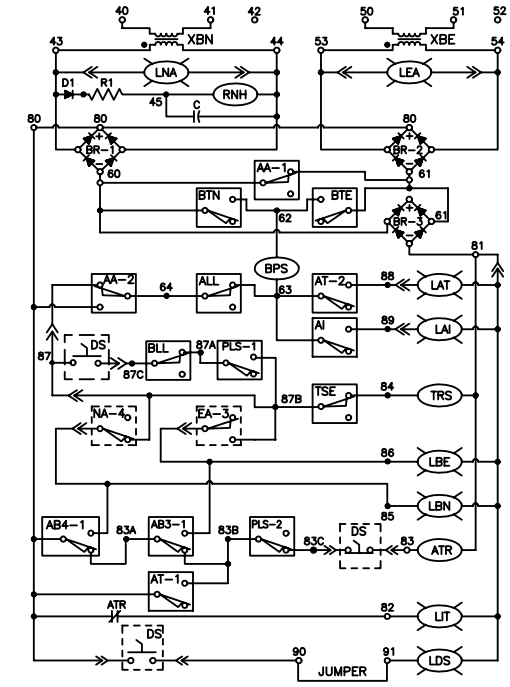
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: BP/ISOLATION SW., LEGEND & OPERATION
JOB/MODEL: ZBTSDL10–40 (100–400 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	56A–4000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SDW	SB	12/14/95	–	3 OF 5	F

BYPASS/ISOLATION SCHEMATIC

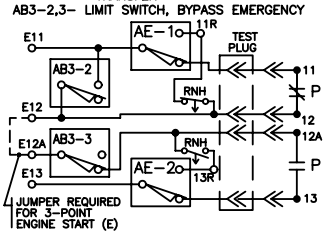


XBN – BYPASS NORMAL CONTROL TRANSFORMER
XBE – BYPASS EMERGENCY CONTROL TRANSFORMER
LNA – NORMAL AVAILABLE LIGHT
LEA – EMERGENCY AVAILABLE LIGHT
RNH – NORMALLY HELD RELAY
D1 – DIODE
R1 – RESISTOR, RNH
C – CAPACITOR, RNH
BR-1,2,3 – BRIDGE RECTIFIER
AA-1 – LIMIT SWITCH, ATS AUTO LOCATION
BTN – LIMIT SWITCH, BYPASS TRANSFER NORMAL (MBH MOVEMENT TO NORMAL)
BTE – LIMIT SWITCH, BYPASS TRANSFER EMERG. (MBH MOVEMENT TO EMERGENCY)
BPS – BYPASS SOLENOID
AA-2 – LIMIT SWITCH, ATS AUTO LOCATION
ALL – LIMIT SWITCH, ATS LOCK LOCATION
AT-2 – LIMIT SWITCH, ATS TEST LOCATION
LAT – LIGHT, ATS TEST LOCATION
AI – LIMIT SWITCH, ATS ISOLATE LOCATION
LAI – LIGHT, ATS ISOLATE LOCATION
BLL – LIMIT SWITCH, BYPASS LOCK LOCATION
PLS-1 – PERMISSIVE LIMIT SWITCH
TSE – LIMIT SWITCH, TRANSFER SWITCH ENGAGED
TRS – SOLENOID, TRANSFER RELEASE
NA-4 – LIMIT SWITCH, ATS IN NORMAL
EA-3 – LIMIT SWITCH, ATS IN EMERGENCY
LBE – LIGHT, BYPASS EMERGENCY
LBN – LIGHT, BYPASS NORMAL
AB4-1 – LIMIT SWITCH, BYPASS NORMAL
AB3-1 – LIMIT SWITCH, BYPASS EMERGENCY
PLS-2 – PERMISSIVE LIMIT SWITCH
ATR – AUTO/TEST RELAY
AT-1 – LIMIT SWITCH, ATS TEST LOCATION
LIT – LIGHT, ATS INHIBIT
DS – ATS DISCONNECT SWITCH
LDS – LIGHT, DISCONNECT SWITCH INHIBIT POSITION
ALH – ATS LOCATION HANDLE
MBH – MANUAL BYPASS HANDLE

LOCATED ON ATS
LOCATED ON BYPASS

ENGINE START SCHEMATIC

AE-1,2 – LIMIT SWITCH, ENGINE START TRANSFER
AB3-2,3– LIMIT SWITCH, BYPASS EMERGENCY



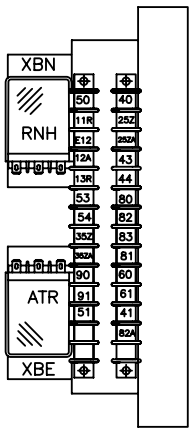
25ZZ — ATR — 25ZA

NORMAL/EMERGENCY TRANSFER PERMIT CIRCUIT. (ALH IN AUTO AND TEST LOCATION WITH DS IN AUTO POSITION)

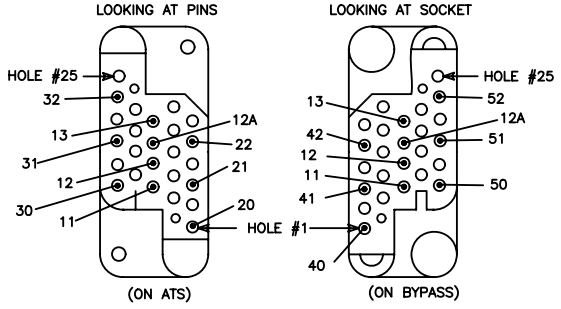
LIMIT SWITCH CHART

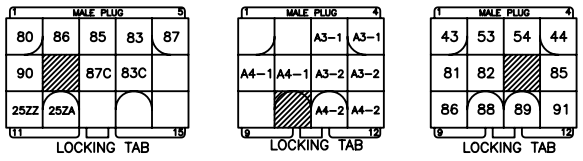
X = ACTUATED	ATS LOCATION				ATS MODE		BYPASS MODE		
	AUTO	TEST	ISO	REMOVE	NORM	EMERG.	NORM	EMERG.	OPEN
AA	X								
AT		X							
AI			X	X					
ALL	X	X	X						
TSE	X	X	X						
AE			X	X					
NA					X				
EA						X			
AB4							X		
AB3								X	
BLL							X	X	X
PLS	ACTIVATED WHEN ALH IS OPERATED								

BYPASS SUBPANEL



ATS TEST PLUG (TP)





REFER TO SHEET 2 FOR INTERCONNECT PLUG DIAGRAM

LEGEND	REFERENCE	NOTES
WIRE CONNECTION WIRE ON TERMINAL BLOCK WIRE IN INTERCONNECT PLUG		ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S-5757	ESTABLISH DWG.		
B	S-6536	07/30/96	SG	SB
C	S-6612	11/05/96	SG	SB
D	S-6849	02/05/98	RMC	SB
E	S-7021	10/28/98	SG	PS
F	S-7377	03/17/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

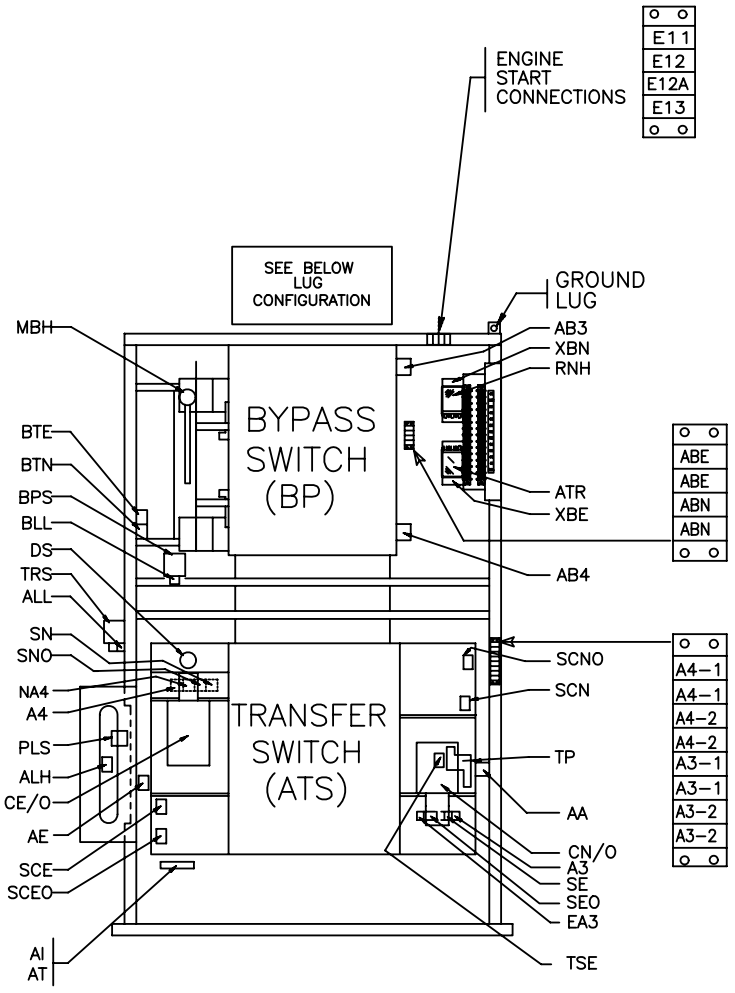
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: BYPASS/ISOLATION SCHEMATIC & PLUGS
JOB/MODEL: ZBTSDL10-40 (100-400 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	56A-4000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SDW	SB	12/14/95	–	4 OF 5	F

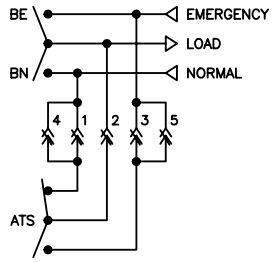
BYPASS/ISOLATION TRANSFER SWITCH

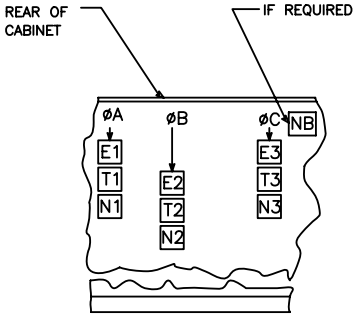


WIRE NUMBERING CHART

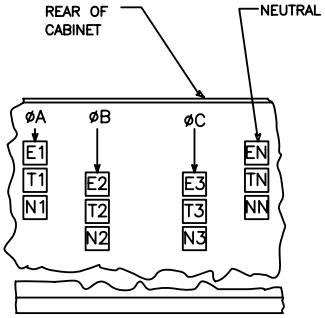
LIMIT SWITCHES	C	NC	NO
AA-1	60		61
AA-2	64	80	87
AB3-1	83A	83B	86
AB3-2	E12		E11
AB3-3	E12A	12A	
AB3-4	ABE		ABE
AB4-1	80	83A	85
AB4-2	ABN		ABN
AE-1	E11	11	11R
AE-2	E13	13	13R
AI	63		89
ALL	64		63
AT-1	80		83B
AT-2	63		88
BLL	87C		87A
BTE	61		62
BTN	60		62
EA-3	86	87	
NA-4	85	87	
PLS-1	87A		87B
PLS-2	83B	83C	
TSE	87B		84

BYPASS/ISOLATION DIAGRAM





TOP VIEW (3-POLE)



TOP VIEW (4-POLE)

ATS LOCATION	LOAD CARRYING CONTACTS			ATS TEST PLUG (TP)	
	1	2	3	4	5
AUTO	X	X	X	X	X
TEST	O	O	O	X	X
ISOLATE	O	O	O	O	O

X = CLOSED
O = OPEN

LUG CONFIGURATION

LEGEND	REFERENCE	NOTES
		ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S-5757	ESTABLISH DWG.		
B	S-6536	07/30/96	SG	SB
C	S-6612	11/05/96	SG	SB
D	S-6849	02/05/98	RMC	SB
E	S-7021	10/28/98	SG	PS
F	S-7377	03/17/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

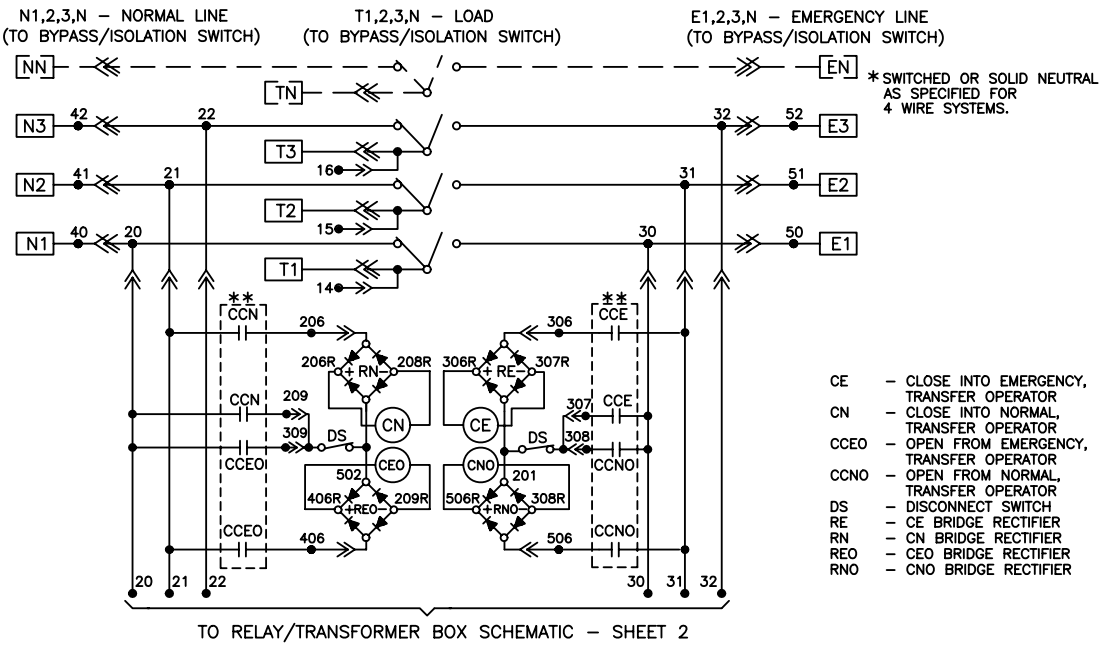
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: BYPASS/ISOLATION TRANSFER SWITCH
JOB/MODEL: ZBTSDL10-40 (100-400 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	-	56A-4000

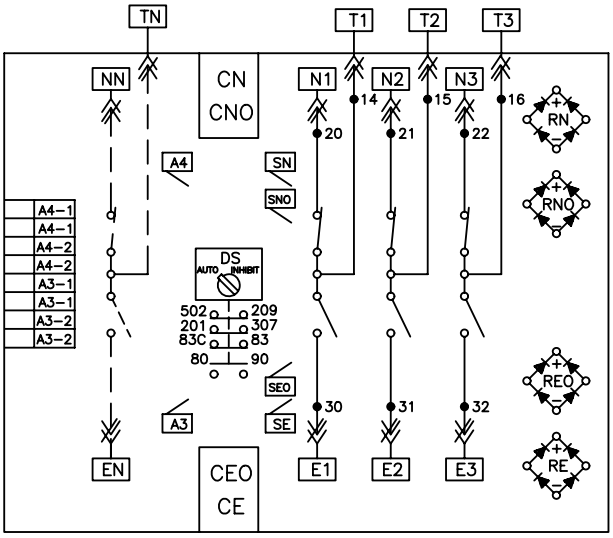
DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SDW	SB	12/14/95	-	5 OF 5	F

ATS POWER CIRCUIT SCHEMATIC

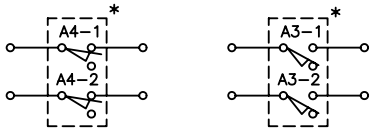


CE – CLOSE INTO EMERGENCY, TRANSFER OPERATOR
CN – CLOSE INTO NORMAL, TRANSFER OPERATOR
CCEO – OPEN FROM EMERGENCY, TRANSFER OPERATOR
CCNO – OPEN FROM NORMAL, TRANSFER OPERATOR
DS – DISCONNECT SWITCH
RE – CE BRIDGE RECTIFIER
RN – CN BRIDGE RECTIFIER
REO – CEO BRIDGE RECTIFIER
RNO – CNO BRIDGE RECTIFIER

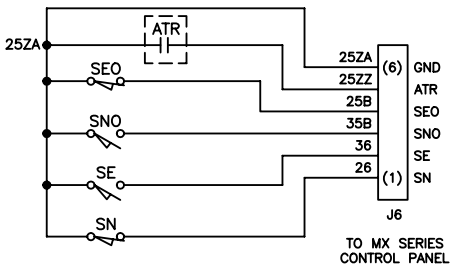
ATS POWER PANEL LAYOUT



AUXILIARY CONTACTS



LIMIT SWITCH SCHEMATIC



ATR – AUTO/TEST RELAY CONTACT (LOCATED ON BYPASS SUB PANEL)
SEO – EMERGENCY OPEN POSITION LIMIT SWITCH
SNO – NORMAL OPEN POSITION LIMIT SWITCH
SE – EMERGENCY POSITION LIMIT SWITCH
SN – NORMAL POSITION LIMIT SWITCH

LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —○— WIRE ON TERMINAL BLOCK —≫— WIRE IN INTERCONNECT PLUG * OPTIONAL ** LOCATED ON RELAY/ TRANSFORMER BOX	LEGEND, OPERATION, AND ACCESSORIES: 56A–0900D. MX200 CONTROLLER– 50A–2000.	ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS				
REV	ECN NO.	DATE	DFT	ENG
E	S–7123	03/30/99	SG	KK
F	S–7377	05/19/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

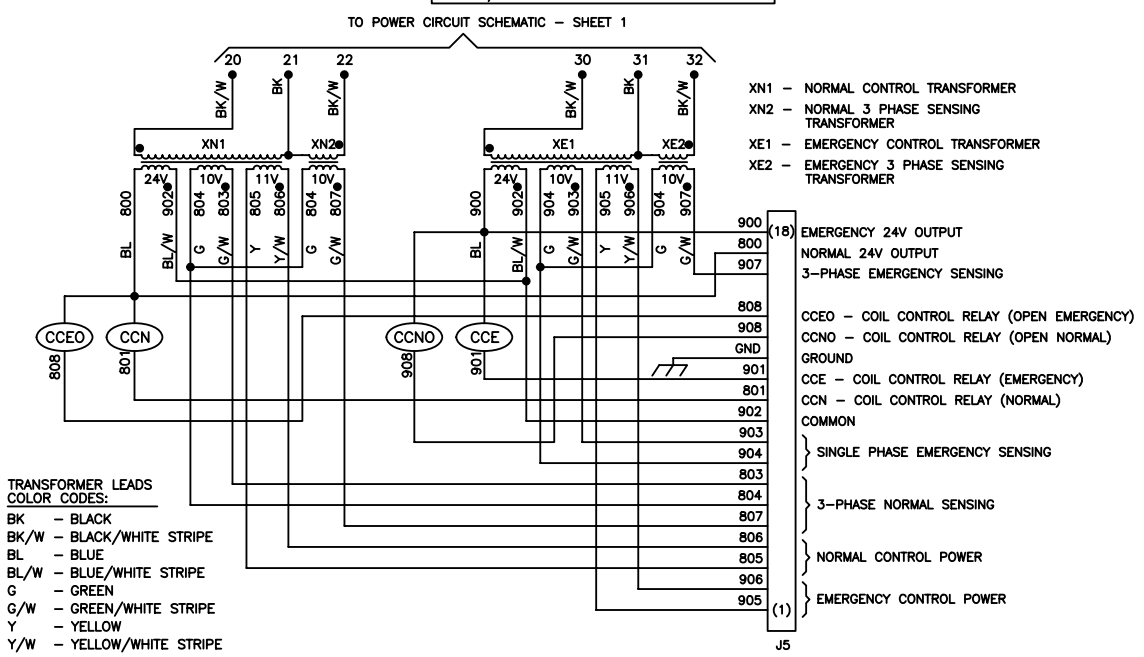
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: BYPASS/ISOLATION TRANSFER SWITCH
JOB/MODEL: ZBTSDL60–120 (600–1200 AMP)

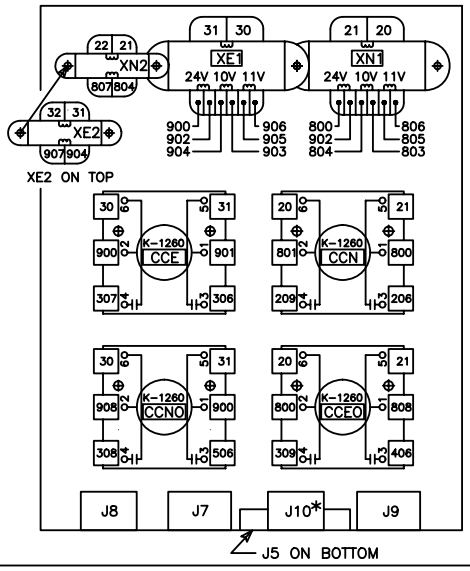
CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	56A–5000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SDW	SB	12/14/95	–	1 OF 5	F

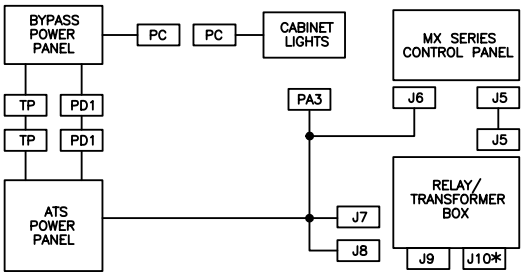
RELAY/TRANSFORMER BOX SCHEMATIC



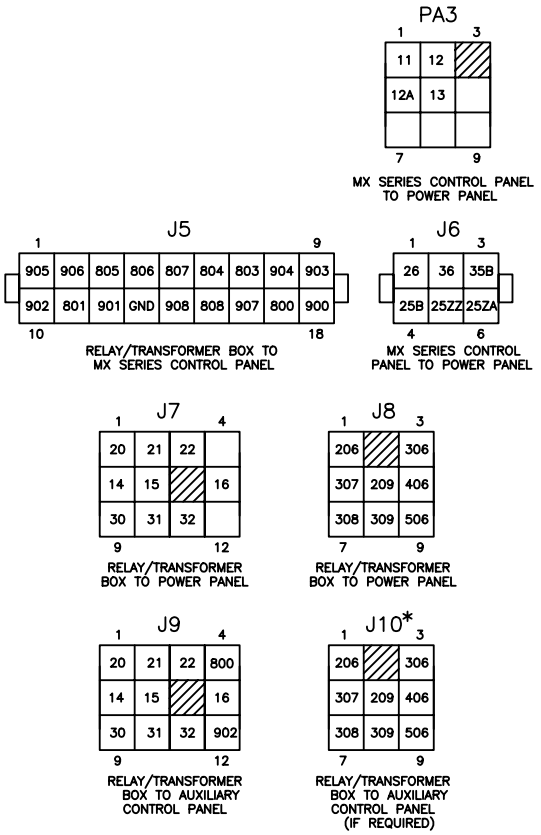
RELAY/TRANSFORMER BOX



INTERCONNECT PLUG DIAGRAM



INTERCONNECT PLUGS



LEGEND	REFERENCE	NOTES
—● WIRE CONNECTION * OPTIONAL		

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
E	S–7123	03/30/99	SG	KK
F	S–7377	03/20/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION.
DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: RELAY/XFR BOX & INTERCONNECT PLUGS
JOB/MODEL: ZBTSDL60–120 (600–1200 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	56A–5000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SDW	SB	12/14/95	–	2 OF 5	F

OPERATION: BYPASS/ISOLATION SWITCH

AUTOMATIC

1. Manually operated Bypass Switch contacts (BN/BE) are open and ATS is supplying load.
2. Disconnect Switch (DS) is in "AUTO".

TO BYPASS ATS

1. Open bottom cabinet door and turn DS to "INHIBIT".
2. Turn Bypass Selector Switch (BSS) to same power source as ATS.
3. Move the Manual Bypass Handle (MBH) upward.

TO TEST ATS

1. Bypass per above instructions.
2. Rotate crank mechanism counterclockwise until ATS TEST light is illuminated.
3. Turn DS to "AUTO".
4. Test Switch (TS) on bottom cabinet door will allow electrical operation of ATS.

TO ISOLATE ATS

1. Bypass per above instructions.
2. Rotate crank mechanism counterclockwise until ATS ISOLATED light is illuminated.

TO REMOVE ATS

1. Bypass and Isolate per above instructions.
2. Disconnect multipin plugs and external connections to ATS.
3. Rotate four power panel latches to vertical position, slide ATS forward & lock mechanism in place.
4. ATS can now be removed from cabinet.

TO RECONNECT ATS

1. Place ATS in slide mechanism.
2. Unlock slide mechanism. Slide ATS over power panel latches and rotate latches to horizontal position.
3. Turn DS Switch to "INHIBIT".
4. Manually position ATS into same source as Bypass Switch.
5. Reconnect multipin plugs and external connections to ATS.
6. Rotate crank mechanism clockwise until ATS TEST light is illuminated.
7. Turn DS Switch to "AUTO" and use TS to electrically operate ATS.
8. Turn DS to "INHIBIT".
9. Rotate crank mechanism clockwise until ATS location pointer is aligned with "AUTO" mark on location indicator. (ATS must be in same source as Bypass).
10. Turn DS to "AUTO" and open Bypass with MBH.
11. ATS is now fully automatic (Figure 1).

NOTES:

1. DS in "INHIBIT" will prevent ATS electrical operation.
2. DO NOT use excessive force on mechanical handles.
3. Above Figures depict Bypass NORMAL. Sequence is same for Bypass EMERGENCY.
4. When ATS is in TEST or ISOLATE, Bypass Switch is a manual transfer switch to either available source. (Indicated on light panel).
5. To operate Bypass Switch when ATS is in TEST or ISOLATE:
   a) Move MBH downward (to open Bypass Contacts BN/BE).
   b) Turn BSS to opposite power source.
   c) Move MBH upward to close into selected power source.

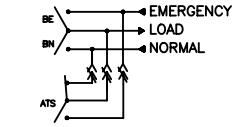


FIG. 1 BP IS OPEN WITH ATS IN NORMAL

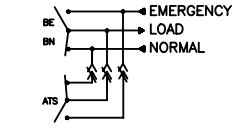


FIG. 2 BP IN NORMAL WITH ATS IN NORMAL

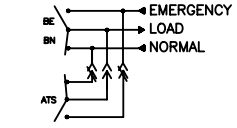


FIG. 3 BP IN NORMAL WITH ATS IN TEST (LOAD CONNECTIONS ARE OPEN)

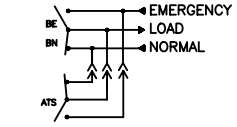


FIG. 4 BP IN NORMAL WITH ATS ISOLATED

NOTES:

1. BP–Bypass switch (indicated by contacts BN/BE) is a 3 position switch.
2. ATS–Automatic Transfer Switch

LEGEND: BYPASS/ISOLATION SWITCH (BP)

I. (BP) BYPASS/ISOLATION SWITCH: MECHANICAL COMPONENTS

N1,2,3(N)..... Normal Line connections
E1,2,3(N)..... Emergency Line connections
T1,2,3(N)..... Load Line connections
BE..... Bypass Emergency contacts
BN..... Bypass Normal contacts
BSS..... Bypass Selector Switch
MBH..... Manual Bypass Handle

II. (BP) BYPASS/ISOLATION: ELECTRICAL COMPONENTS

AA–1,2,3..... Limit switch held actuated in Auto location of ATS, Non–actuated Test and Isolated locations.
AB3–1,2,3,4..... Limit switch, actuated in Bypass Emergency position
AB4–1,2..... Limit switch, actuated in Bypass Normal position
ACU,ACD..... Limit Switch actuated when crankhandle is engaged
AE–1,2..... Limit switch, switches Engine Start from ATS control to bypass control during ATS Isolate
AI–1,2,3..... Limit switch, actuated in Isolate location
AT–1,2..... Limit switch, actuated in Test location
ATR..... Auto/Test Relay. Energized in AUTO and TEST locations
BR–1,2,3..... Bridge Rectifier
C..... Capacitor: RNH
CBC..... Crank Solenoid
CBE..... Emergency Bypass Permissive Solenoid
CBN..... Normal Bypass Permissive Solenoid
D1..... Diode
R1..... Resistor: RNH
RNH..... Relay normally held, 24 VDC coil, 3PDT
XBE..... Emergency line control transformer
XBN..... Normal line control transformer

III. (BP) BYPASS/ISOLATION SWITCH: INDICATOR LIGHTS

LNA..... Normal available
LEA..... Emergency available
LBN (NOTE 1)..... Bypass Normal (BN closed)
LBE (NOTE 1)..... Bypass Emergency (BE closed)
LAT (NOTE 1)..... ATS in Test location
LAI (NOTE 1)..... ATS in Isolate location
LIT (NOTE 1)..... ATS Inhibit
LDS (NOTE 1)..... ATS DS switch in INHIBIT position

NOTES:

1. Indicator off during automatic operation of ATS.
2. Four pole includes neutral lugs.

LEGEND	REFERENCE	NOTES

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
E	S–7123	03/30/99	SG	KK
F	S–7377	03/20/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

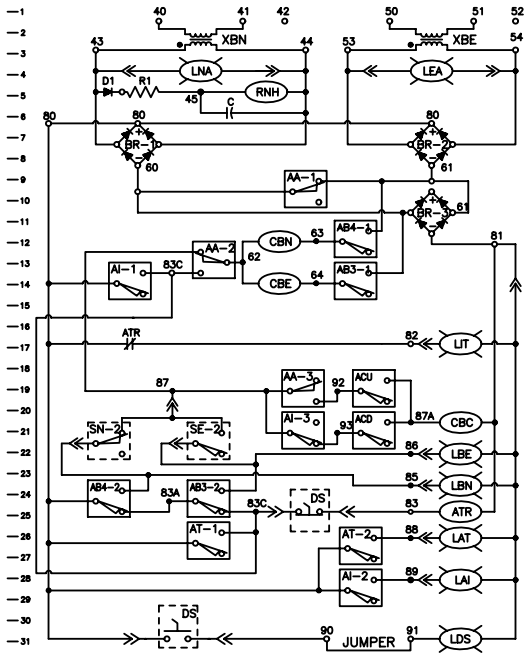
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION.
DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: BP/ISOLATION SW., LEGEND & OPERATION
JOB/MODEL: ZBTSDL60–120 (600–1200 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	56A–5000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SG	SB	07/30/96	–	3 OF 5	F

BYPASS/ISOLATION SCHEMATIC



XBN – BYPASS NORMAL CONTROL TRANSFORMER
XBE – BYPASS EMERGENCY CONTROL TRANSFORMER
LNA – NORMAL AVAILABLE LIGHT
LEA – EMERGENCY AVAILABLE LIGHT
RNH – NORMALLY HELD RELAY
D1 – DIODE
R1 – RESISTOR, RNH
C – CAPACITOR, RNH
BR-1,2,3 – BRIDGE RECTIFIER
AA-1 – LIMIT SWITCH, ATS AUTO LOCATION

AB4-1 – LIMIT SWITCH, BYPASS NORMAL
CBN – NORMAL TRANSFER OPERATOR
AA-2 – LIMIT SWITCH, ATS IN AUTO
AB3-1 – LIMIT SWITCH, BYPASS EMERGENCY
CBE – EMERGENCY TRANSFER OPERATOR

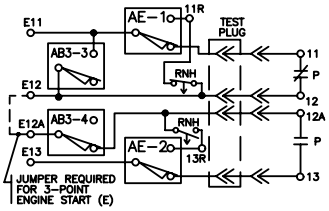
LIT – ATS INHIBIT LIGHT
AI-1 – LIMIT SWITCH, ATS IN ISOLATE
AA-3 – LIMIT SWITCH, ATS IN AUTO
ACD – LIMIT SWITCH, CRANK HANDLE
ACU – ENGAGED
AI-3 – LIMIT SWITCH, ATS IN ISOLATE
CBC – CRANK SOLENOID
LBE – LIGHT, BYPASS EMERGENCY
LBN – LIGHT, BYPASS NORMAL
AB4-2 – LIMIT SWITCH, BYPASS NORMAL
AB3-2 – LIMIT SWITCH, BYPASS EMERGENCY
ATR – AUTO/TEST RELAY
AT-1 – LIMIT SWITCH, ATS TEST LOCATION
LAT – ATS TEST LOCATION
AT-2 – LIMIT SWITCH, ATS IN TEST
LAI – ATS ISOLATE LIGHT
AI-2 – LIMIT SWITCH, ATS IN ISOLATE
DS – ATS DISCONNECT SWITCH
LDS – DISCONNECT SWITCH, INHIBIT POSITION LIGHT

LOCATED ON ATS
LOCATED ON BYPASS

ENGINE START SCHEMATIC

ENGINE START CIRCUIT

AE-1,2 – LIMIT SWITCH, ENGINE START TRANSFER
AB3-3,4– LIMIT SWITCH, BYPASS EMERGENCY



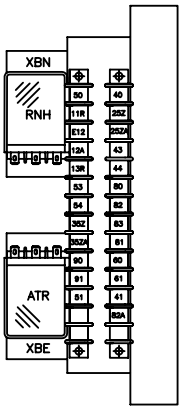
25ZZ — ATR — 25ZA

NORMAL/EMERGENCY TRANSFER PERMIT CIRCUIT. (ALH IN AUTO AND TEST LOCATION WITH DS IN AUTO POSITION)

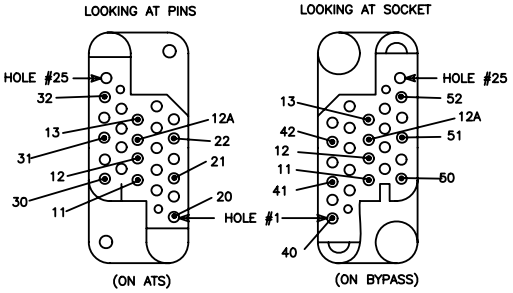
LIMIT SWITCH CHART

X = ACTUATED	ATS LOCATION				ATS MODE		BYPASS MODE	
	AUTO	TEST	ISO	REMOVE	NORM	EMERG.	NORM	EMERG.	OPEN
AA	X								
AT		X							
AI			X	X					
AE			X	X					
SN					X				
SE						X			
AB4							X		
AB3								X	

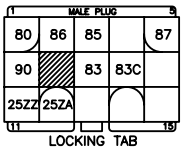
BYPASS SUBPANEL



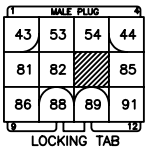
ATS TEST PLUG (TP)



PD1



PC



REFER TO SHEET 2 FOR INTERCONNECT PLUG DIAGRAM

LEGEND	REFERENCE	NOTES
WIRE CONNECTION WIRE ON TERMINAL BLOCK WIRE IN INTERCONNECT PLUG		ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
E	S-7123	03/30/99	SG	KK
F	S-7377	03/20/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

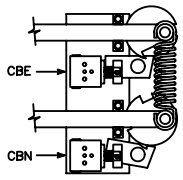
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: BYPASS/ISOLATION SCHEMATIC & PLUGS
JOB/MODEL: ZBTSDL60-120 (600-1200 AMP)

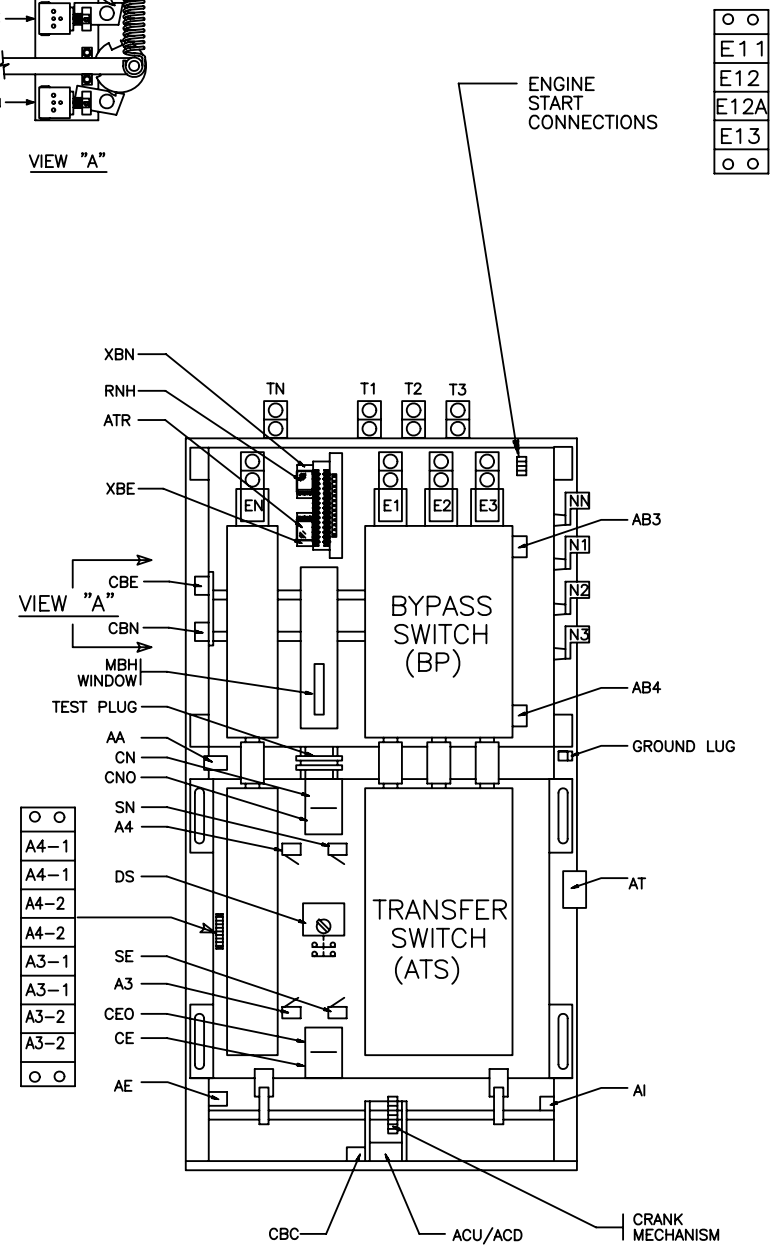
CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	56A-5000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SDW	SB	12/14/95	–	4 OF 5	F

BYPASS/ISOLATION TRANSFER SWITCH



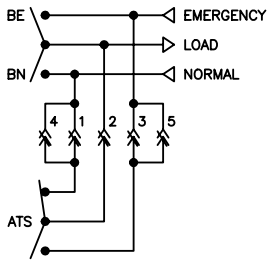
VIEW "A"



WIRE NUMBERING CHART

LIMIT SWITCHES	C	NC	NO
AA–1	60		61
AA–2	62	83C	87
AA–3	87	92	
AB3–1	64		60
AB3–2	83A	83C	86
AB3–3	E12		E11
AB3–4	E12A	12A	
AB4–1	63		61
AB4–2	80	83A	85
ACD	93		87A
ACU	92		87A
AE–1	E11	11	11R
AE–2	E13	13	13R
AI–1	80		83C
AI–2	80		89
AI–3	87	93	
AT–1	80		83C
AT–2	80		88
SE–2	86		87
SN–2	85		87

BYPASS/ISOLATION DIAGRAM



ATS LOCATION	LOAD CARRYING CONTACTS			ATS TEST PLUG (TP)	
	1	2	3	4	5
AUTO	X	X	X	X	X
TEST	O	O	O	X	X
ISOLATE	O	O	O	O	O

X = CLOSED
O = OPEN

LEGEND	REFERENCE	NOTES
		ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
E	S–7123	03/30/99	SG	KK
F	S–7377	03/20/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

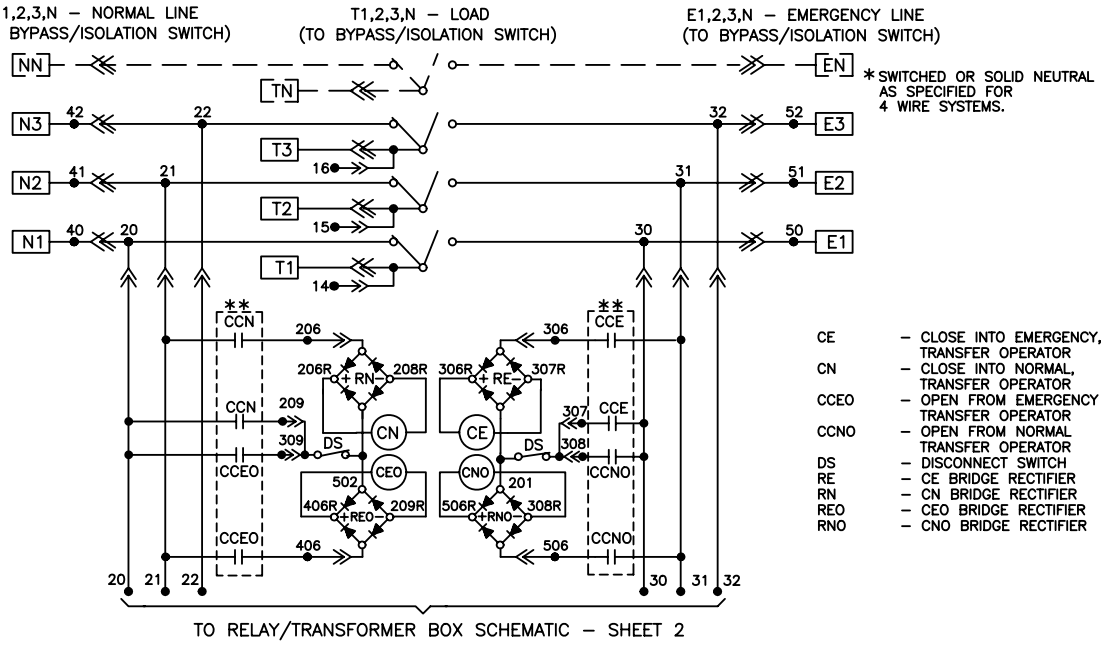
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION.
DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: BYPASS/ISOLATION TRANSFER SWITCH
JOB/MODEL: ZBTSDL60–120 (600–1200 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	56A–5000

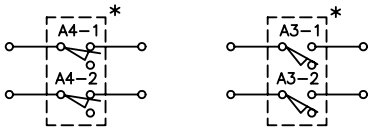
DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SDW	SB	12/14/95	–	5 OF 5	F

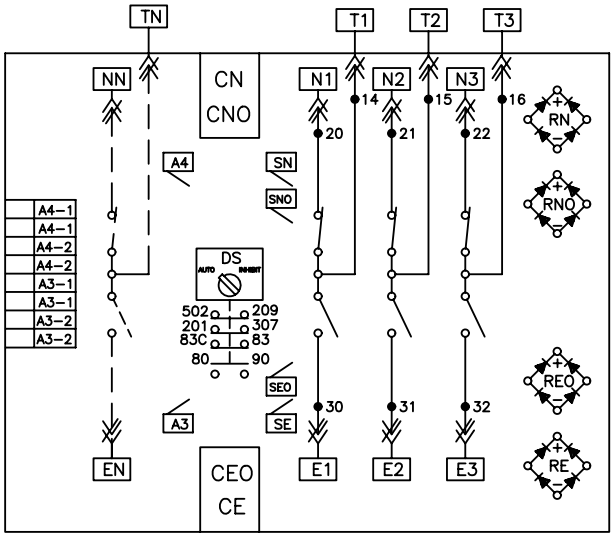
ATS POWER CIRCUIT SCHEMATIC



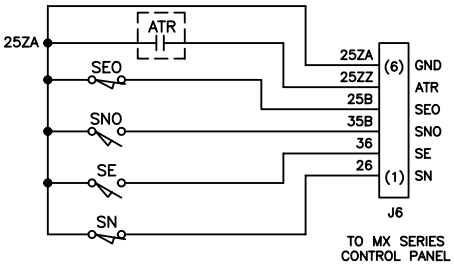
ATS POWER PANEL LAYOUT

AUXILIARY CONTACTS





LIMIT SWITCH SCHEMATIC



ATR – AUTO/TEST RELAY CONTACT (LOCATED ON BYPASS SUB PANEL)
SEO – EMERGENCY OPEN POSITION LIMIT SWITCH
SNO – NORMAL OPEN POSITION LIMIT SWITCH
SE – EMERGENCY POSITION LIMIT SWITCH
SN – NORMAL POSITION LIMIT SWITCH

LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —○— WIRE ON TERMINAL BLOCK —≫— WIRE IN INTERCONNECT PLUG * OPTIONAL ** LOCATED ON RELAY/ TRANSFORMER BOX	LEGEND, OPERATION, AND ACCESSORIES: 56A–0900D. MX200 CONTROLLER– 50A–2000.	ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS				
REV	ECN NO.	DATE	DFT	ENG
A	S–5757	ESTABLISH DWG.		
B	S–6536	07/30/96	SG	SB
C	S–6612	11/05/96	SG	SB
D	S–6849	02/05/98	RMC	SB
E	S–7377	05/19/00	SG	MES
F	S–7580	12/06/00	SG	SB

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

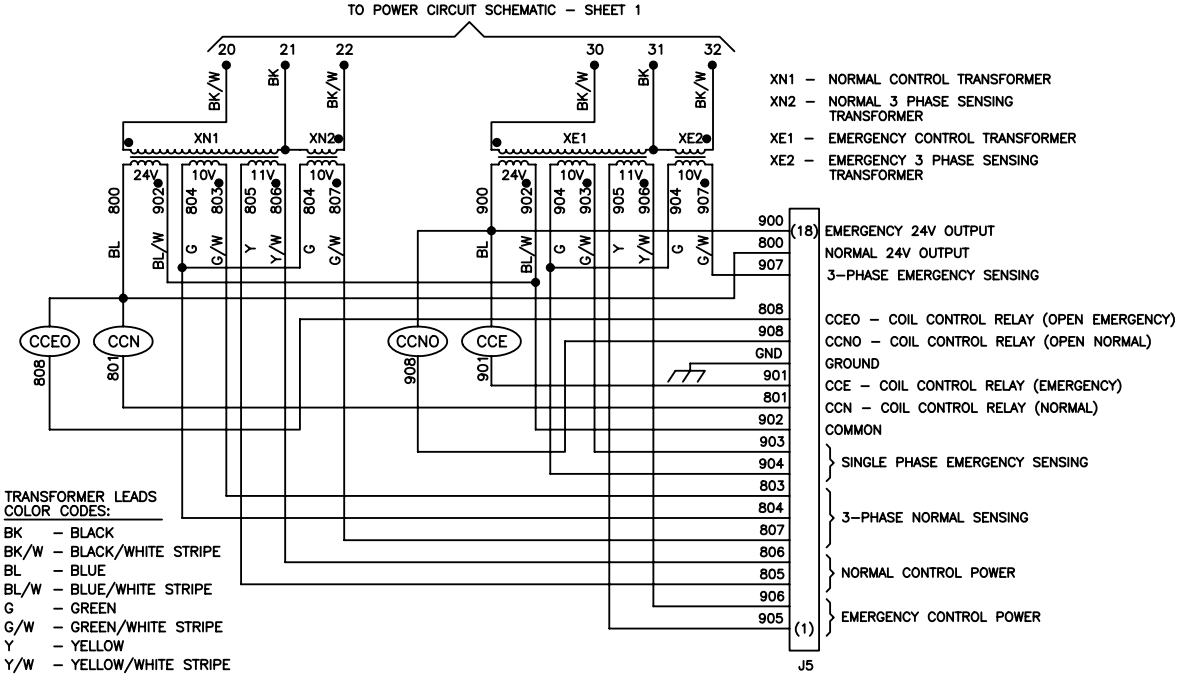
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: ATS POWER CIRCUIT & LIMIT SWITCHES
JOB/MODEL: ZBTSDL160–300 (1600–3000 AMP)

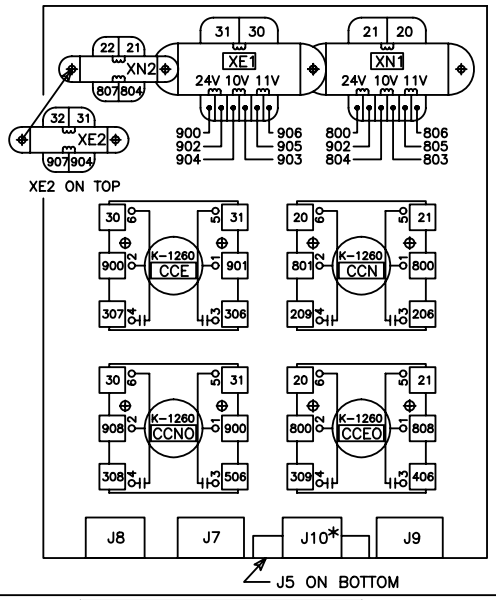
CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	56A–6000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SDW	SB	12/14/95	–	1 OF 5	F

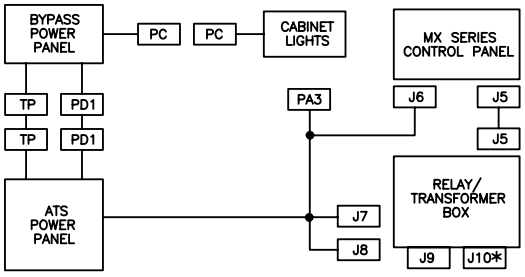
RELAY/TRANSFORMER BOX SCHEMATIC



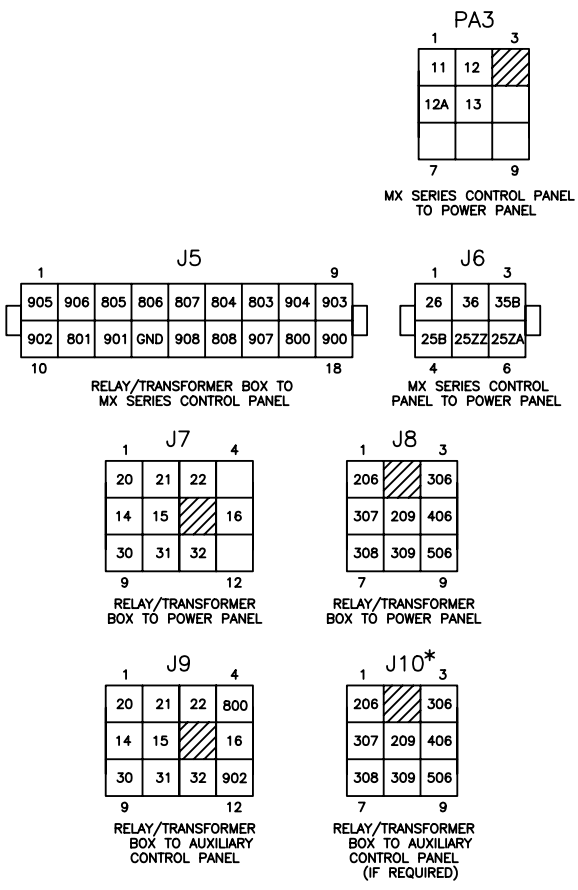
RELAY/TRANSFORMER BOX



INTERCONNECT PLUG DIAGRAM



INTERCONNECT PLUGS



LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION * OPTIONAL		

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S–5757	ESTABLISH DWG.		
B	S–6536	07/30/96	SG	SB
C	S–6612	11/05/96	SG	SB
D	S–6849	02/05/98	RMC	SB
E	S–7377	03/20/00	SG	MES
F	S–7580	12/06/00	SG	SB

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: RELAY/XFR BOX & INTERCONNECT PLUGS
JOB/MODEL: ZBTSDL160–300 (1600–3000 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	56A–6000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SDW	SB	12/14/95	–	2 OF 5	F

OPERATION: BYPASS/ISOLATION SWITCH

AUTOMATIC

1. Manually operated Bypass Switch contacts (BN/BE) are open and ATS is supplying load.
2. Disconnect Switch (DS) is in "AUTO".

TO BYPASS ATS

1. Open bottom cabinet door and turn DS to "INHIBIT".
2. Turn Bypass Selector Switch (BSS) to same power source as ATS.
3. Move the Manual Bypass Handle (MBH) upward.

TO TEST ATS

1. Bypass per above instructions.
2. Rotate crank mechanism counterclockwise until ATS TEST light is illuminated.
3. Turn DS to "AUTO".
4. Test Switch (TS) on bottom cabinet door will allow electrical operation of ATS.

TO ISOLATE ATS

1. Bypass per above instructions.
2. Rotate crank mechanism counterclockwise until ATS ISOLATED light is illuminated.

TO REMOVE ATS

1. Bypass and Isolate per above instructions.
2. Disconnect multipin plugs and external connections to ATS.
3. Slide four corner latches of ATS to innermost position.
4. ATS can now be removed from cabinet.

TO RECONNECT ATS

1. Roll cart back into cabinet.
2. Slide four corner latches of ATS to outermost position.
3. Turn DS Switch to "INHIBIT".
4. Manually position ATS into same source as Bypass Switch.
5. Reconnect multipin plugs and external connections to ATS.
6. Rotate crank mechanism clockwise until ATS TEST light is illuminated.
7. Turn DS Switch to "AUTO" and use TS to electrically operate ATS.
8. Turn DS to "INHIBIT".
9. Rotate crank mechanism clockwise until ATS location pointer is aligned with "AUTO" mark on location indicator. (ATS must be in same source as Bypass).
10. Turn DS to "AUTO" and open Bypass with MBH.
11. ATS is now fully automatic (Figure 1).

NOTES:

1. DS in "INHIBIT" will prevent ATS electrical operation.
2. DO NOT use excessive force on mechanical handles.
3. Above Figures depict Bypass NORMAL. Sequence is same for Bypass EMERGENCY.
4. When ATS is in TEST or ISOLATE, Bypass Switch is a manual transfer switch to either available source. (Indicated on light panel).
5. To operate Bypass Switch when ATS is in TEST or ISOLATE:
   a) Move MBH downward (to open Bypass Contacts BN/BE).
   b) Turn BSS to opposite power source.
   c) Move MBH upward to close into selected power source.

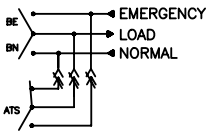


FIG. 1 BP IS OPEN WITH ATS IN NORMAL

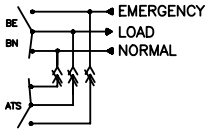


FIG. 2 BP IN NORMAL WITH ATS IN NORMAL

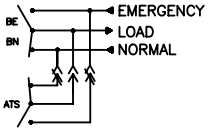


FIG. 3 BP IN NORMAL WITH ATS IN TEST (LOAD CONNECTIONS ARE OPEN)

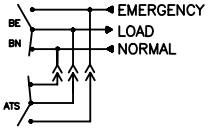


FIG. 4 BP IN NORMAL WITH ATS ISOLATED

NOTES:
1. BP–Bypass switch (indicated by contacts BN/BE) is a 3 position switch.
2. ATS–Automatic Transfer Switch

LEGEND: BYPASS/ISOLATION SWITCH (BP)

I. (BP) BYPASS/ISOLATION SWITCH: MECHANICAL COMPONENTS

N1,2,3(N)..... Normal Line connections
E1,2,3(N)..... Emergency Line connections
T1,2,3(N)..... Load Line connections
BE..... Bypass Emergency contacts
BN..... Bypass Normal contacts
BSS..... Bypass Selector Switch
MBH..... Manual Bypass Handle

II. (BP) BYPASS/ISOLATION: ELECTRICAL COMPONENTS

AA–1,2..... Limit switch held actuated in Auto location of ATS, Non–actuated Test and Isolated locations.
AB3,–1,2,3,4..... Limit switch, actuated in Bypass Emergency position
AB4–1,2..... Limit switch, actuated in Bypass Normal position
AE–1,2..... Limit switch, switches Engine Start from ATS control to bypass control during ATS Isolate
AI–1,2..... Limit switch, actuated in Isolate location
AT–1,2..... Limit switch, actuated in Test location
ATR..... Auto/Test Relay. Energized in AUTO and TEST locations
BR–1,2,3..... Bridge Rectifier
C..... Capacitor: RNH
CBC..... Crank Solenoid
CBE..... Emergency Bypass Permissive Solenoid
CBN..... Normal Bypass Permissive Solenoid
CH–1..... Limit switch actuated when crank handle is engaged
D1..... Diode
R1..... Resistor: RNH
RNH..... Relay normally held, 24 VDC coil, 3PDT
XBE..... Emergency line control transformer
XBN..... Normal line control transformer

III. (BP) BYPASS/ISOLATION SWITCH: INDICATOR LIGHTS

LNA..... Normal available
LEA..... Emergency available
LBN (NOTE 1)..... Bypass Normal (BN closed)
LBE (NOTE 1)..... Bypass Emergency (BE closed)
LAT (NOTE 1)..... ATS in Test location
LAI (NOTE 1)..... ATS in Isolate location
LIT (NOTE 1)..... ATS Inhibit
LDS (NOTE 1)..... ATS DS switch in INHIBIT position

NOTES:
1. Indicator off during automatic operation of ATS.
2. Four pole includes neutral lugs.

LEGEND	REFERENCE	NOTES

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S–5757	ESTABLISH DWG.		
B	S–6536	07/30/96	SG	SB
C	S–6612	11/05/96	SG	SB
D	S–6849	02/05/98	RMC	SB
E	S–7377	03/20/00	SG	MES
F	S–7580	12/06/00	SG	SB

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

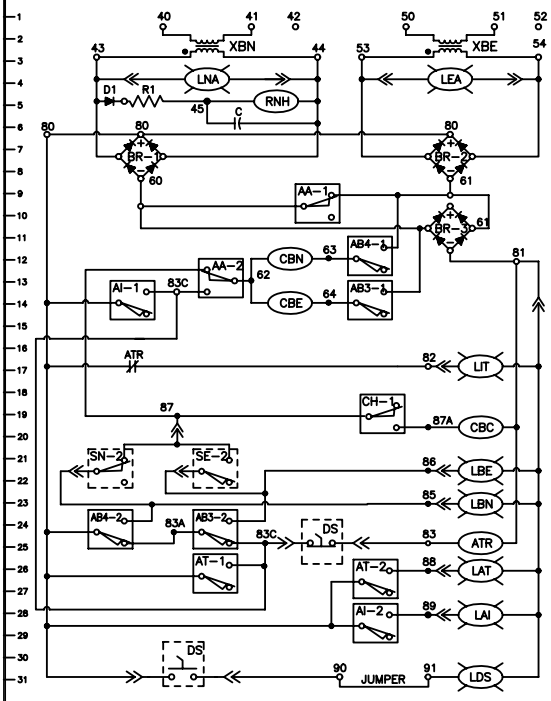
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: BP/ISOLATION SW., LEGEND & OPERATION
JOB/MODEL: ZBTSDL160–300 (1600–3000 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	56A–6000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SDW	SB	07/30/96	–	3 OF 5	F

BYPASS/ISOLATION SCHEMATIC



XBN – BYPASS NORMAL CONTROL TRANSFORMER
XBE – BYPASS EMERGENCY CONTROL TRANSFORMER
LNA – NORMAL AVAILABLE LIGHT
LEA – EMERGENCY AVAILABLE LIGHT
RNH – NORMALLY HELD RELAY
D1 – DIODE
R1 – RESISTOR, RNH
C – CAPACITOR, RNH
BR-1,2,3 – BRIDGE RECTIFIER
AA-1 – LIMIT SWITCH, ATS AUTO LOCATION

AB4-1 – LIMIT SWITCH, BYPASS NORMAL
CBN – NORMAL TRANSFER OPERATOR
AA-2 – LIMIT SWITCH, ATS IN AUTO
AB3-1 – LIMIT SWITCH, BYPASS EMERGENCY
CBE – EMERGENCY TRANSFER OPERATOR

LIT – ATS INHIBIT LIGHT
AI-1 – LIMIT SWITCH, ATS IN ISOLATE

CH-1 – LIMIT SWITCH
CBC – CRANK SOLENOID

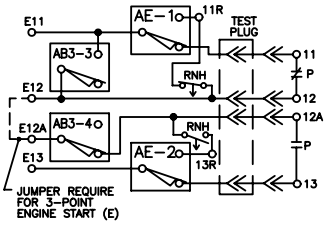
LBE – LIGHT, BYPASS EMERGENCY
LBN – LIGHT, BYPASS NORMAL
AB4-2 – LIMIT SWITCH, BYPASS NORMAL
AB3-2 – LIMIT SWITCH, BYPASS EMERGENCY
ATR – AUTO/TEST RELAY
AT-1 – LIMIT SWITCH, ATS TEST LOCATION
LAT – ATS TEST LOCATION
AT-2 – LIMIT SWITCH, ATS IN TEST
LAI – ATS ISOLATE LIGHT
AI-2 – LIMIT SWITCH, ATS IN ISOLATE
DS – ATS DISCONNECT SWITCH
LDS – DISCONNECT SWITCH, INHIBIT POSITION LIGHT

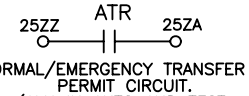
LOCATED ON ATS | LOCATED ON BYPASS

ENGINE START SCHEMATIC

ENGINE START CIRCUIT

AE-1,2 – LIMIT SWITCH, ENGINE START TRANSFER
AB3-3,4– LIMIT SWITCH, BYPASS EMERGENCY



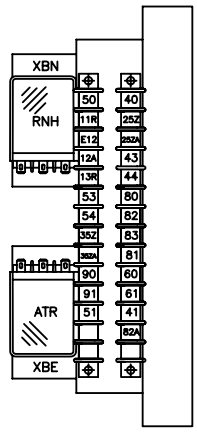


NORMAL/EMERGENCY TRANSFER PERMIT CIRCUIT. (ALH IN AUTO AND TEST LOCATION WITH DS IN AUTO POSITION)

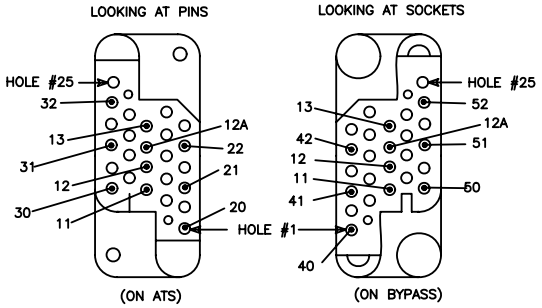
LIMIT SWITCH CHART

X = ACTUATED	ATS LOCATION				ATS MODE		BYPASS MODE		
	AUTO	TEST	ISO	REMOVE	NORM	EMERG.	NORM	EMERG.	OPEN
AA	X								
AT		X							
AI			X	X					
AE			X	X					
SN					X				
SE						X			
AB4							X		
AB3								X	

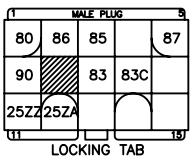
BYPASS SUB PANEL



ATS TEST PLUG (TP)

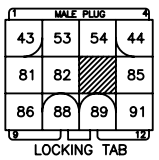


PD1



LOCKING TAB

PC



LOCKING TAB

REFER TO SHEET 2 FOR INTERCONNECT PLUG DIAGRAM

LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —○— WIRE ON TERMINAL BLOCK —≫— WIRE IN INTERCONNECT PLUG		ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S-5757	ESTABLISH DWG.		
B	S-6536	07/31/96	SG	SB
C	S-6612	11/05/96	SG	SB
D	S-6849	02/05/98	RMC	SB
E	S-7377	03/20/00	SG	MES
F	S-7580	12/06/00	SG	SB

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

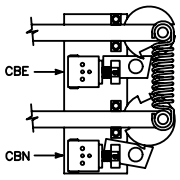
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: BYPASS/ISOLATION SCHEMATIC & PLUGS
JOB/MODEL: ZBTSDL160-300 (1600-3000 AMP)

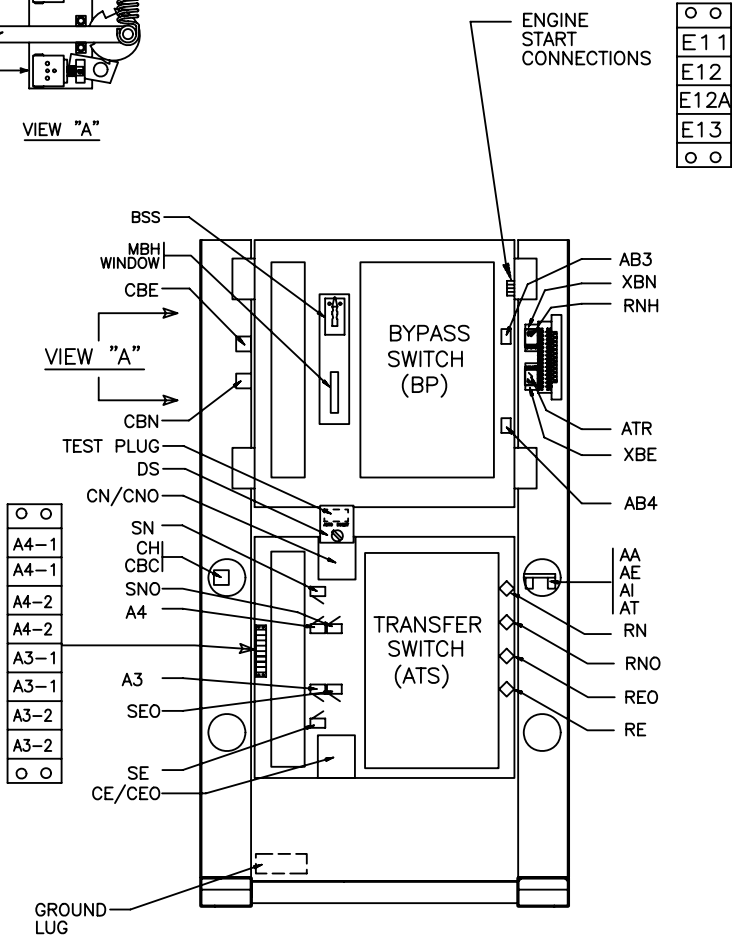
CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	56A-6000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SDW	SB	12/14/95	–	4 OF 5	F

BYPASS/ISOLATION TRANSFER SWITCH



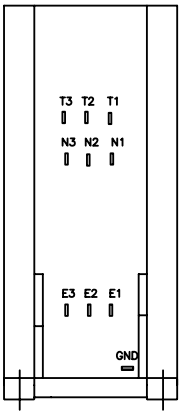
VIEW "A"



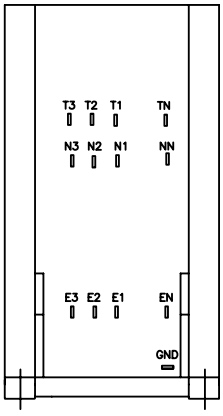
WIRE NUMBERING CHART

LIMIT SWITCHES	C	NC	NO
AA–1	60		61
AA–2	62	83C	87
AB3–1	64		60
AB3–2	83A	83C	86
AB3–3	E12		E11
AB3–4	E12A	12A	
AB4–1	63		61
AB4–2	80	83A	85
AE–1	E11	11	11R
AE–2	E13	13	13R
AI–1	80		83C
AI–2	80		89
AT–1	80		83C
AT–2	80		88
CH–1	87	87A	
SE–2	86		87
SN–2	85		87

STANDARD LUG CONFIGURATION
(CONSULT FACTORY FOR OPTIONAL CONFIGURATIONS)
REAR VIEW OF ENCLOSURE

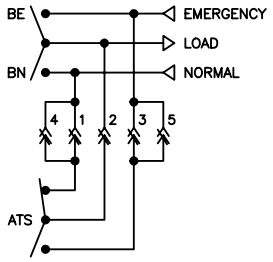


2/3–POLE SWITCH



4–POLE SWITCH

BYPASS/ISOLATION DIAGRAM



ATS LOCATION	LOAD CARRYING CONTACTS			ATS TEST PLUG (TP)	
	1	2	3	4	5
AUTO	X	X	X	X	X
TEST	O	O	O	X	X
ISOLATE	O	O	O	O	O

X = CLOSED
O = OPEN

LEGEND	REFERENCE	NOTES
		ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S–5757	ESTABLISH DWG.		
B	S–6536	07/31/96	SG	SB
C	S–6612	11/05/96	SG	SB
D	S–6849	02/05/98	RMC	SB
E	S–7377	03/20/00	SG	MES
F	S–7580	12/06/00	SG	SB

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

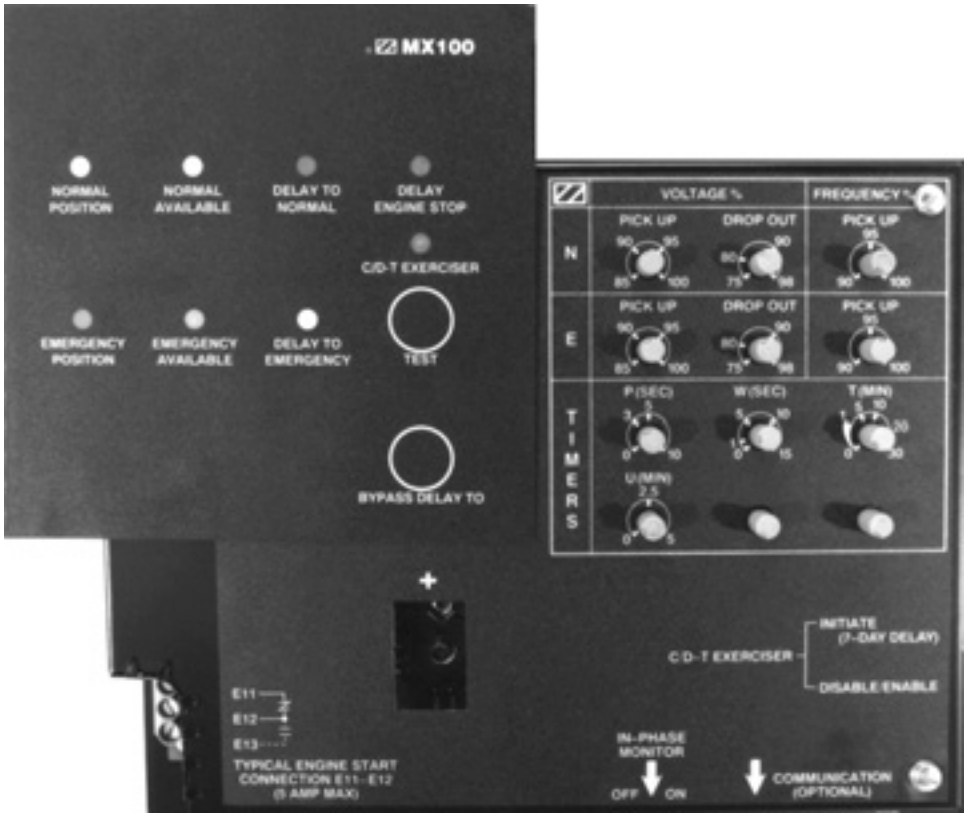
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: BYPASS/ISOLATION TRANSFER SWITCH
JOB/MODEL: ZBTSDL160–300 (1600–3000 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	56A–6000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SDW	SB	12/14/95	–	5 OF 5	F

OPERATION AND MAINTENANCE MANUAL
TRANSFER SWITCH CONTROL PANEL
MX100 MICROPROCESSOR CONTROLLER



GE Zenith Controls

ISO 9001

50R-1000C
5/99

Table of Contents

Page

Safety 1
- Final Equipment Inspection 1
- Equipment Inspection and Storage 1

Installation 2
- Engine Start Control Connections 2
- Initial Energization 3

Operation and Testing 4
- Standard Transition ATS Testing (w/o A6 or T3/W3) 4
- Delayed Transition ATS Testing 5
- Standard Transition ATS Testing (w/A6 or T3/W3) 6
- Operation Sequence 8

Control Features and Options 9
- Control Features 9
- Control Options 10

User Settings 11
- Voltage and Frequency Pickup/Dropout Adjustments 12
- Timer Adjustments 12

Relay/Transformer Box (R/T Box) 14
- Standard Transition 14
- Delayed Transition 15
- Standard Transition R/T Box Schematic 16
- Delayed Transition R/T Box Schematic 16

Troubleshooting and Diagnostics 17
- General Troubleshooting Chart 17
- Diagnostic Annunciation 18
- Standard Transition ATS (two position ATS) 18
- Delayed Transition ATS (three position ATS) 19
- Standard Transition ATS (with A6) 20

Safety

⚠ DANGER

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Installation for each ATS is detailed in the information package which includes:

- Operation and Maintenance Manual for Control Panel (this manual)
- Power Panel Manual
- Specific Schematics Supplied With Each Transfer Switch

Final Equipment Inspection

Prior to energizing the transfer switch:

1. Remove any debris incurred due to shipment or installation. **DO NOT** use a blower since debris may become lodged in the electrical and mechanical components and cause damage. Use of a vacuum is recommended.
2. Verify that all cabled connections are correct and that phase rotation of both sources match.
3. Check engine start connections and verify the correct connection of all control wires.
4. Check settings of all timers and adjust as necessary. Also adjust any optional accessories as required.
5. Check the integrity of power connections by verifying actual lug torque values as specified in the power panel manual.
6. Make sure that all covers and barriers are installed and properly fastened.

NOTE: Power Panels ship from Zenith in the Normal Position.

Equipment Inspection and Storage

Immediately inspect the transfer switch when received to detect any damage which may have occurred during transit. If damage is found or suspected, file claims as soon as possible with the carrier and notify the nearest Zenith representative.

Before installation, it is necessary to store the transfer switch in a clean dry place, protected from dirt and water. Provide ample air circulation and heat, if necessary, to prevent condensation.

Storage Temperature:	-30 C to + 85 C (-22 F to +149 F)
Operating Temperature (Ambient):	-20 C to +75 C (-4 F to +167 F) [40-260 Amps] -20 C to +60 C (-4 F to +104 F) [400-4000 Amps]
Humidity:	5% to 95% (non-condensing)

Installation

⚠ DANGER

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Engine Start Control Connections

Engine-start control wires connect to control terminals below of the MX100. Engine start terminals are indicated by a schematic symbol (the symbol indicates the contact state for a de-energized Normal source). Figure 1 shows the engine-start contacts.

Make all other necessary control connections to the control panel terminal blocks per the schematics supplied with the ATS. **All control wires (18-12 AWG) must be torqued to 19 in-lbs.**

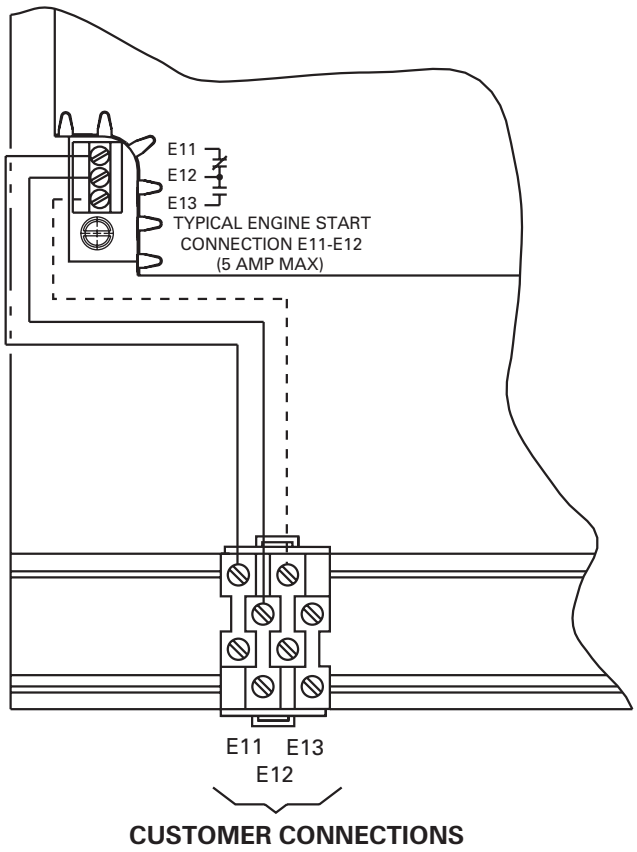


Figure 1 - Din Rail

⚠ DANGER

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Initial Energization

Functional testing of the ATS consists of electrical tests described in this section. Before proceeding, refer to the information package supplied with the ATS and read and understand the information on all accessories provided. (Caution: Certain accessories, per specific schematics, can inhibit automatic transfer. See Section 3.)

After all options and accessories are checked and verified, follow these steps to set up the ATS. Refer to MX100 display Figure 2. The annunciation LEDs illuminate to indicate (1) source availability, (2) ATS position, and (3) MX100 control function (timing).

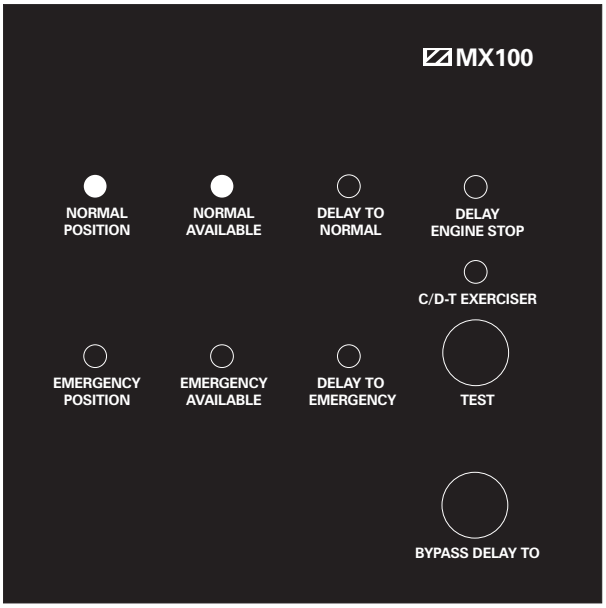


Figure 2 - Standard Transition Annunciation LEDs and Test Switch

⚠ CAUTION

Engine Gen-Set could start when engine control wires are attached.

NOTICE: **If LEDs are flashing, refer to Troubleshooting and Diagnostics.**

Step 1: If equipped with the disconnect switch (DS) option, turn to INHIBIT. Close the external (up-stream) Normal circuit breaker. The Normal Available and Normal Position LEDs illuminate. (If the Normal Available LED does not illuminate verify that Normal source voltage is above the preset pick-up value.) On initial start-up, the Delay to Engine Stop Timing LED will illuminate for the duration of its setting.

NOTICE: **Gen-Set will start and run while Delay to Engine Stop is timing.**

Step 2: Close the external (up-stream) Emergency line circuit breaker and start the engine generator in MANUAL mode. When the voltage and the frequency reach preset values, the Emergency Available LED will illuminate.

Step 3: Verify the line-to-line voltages at the Emergency line terminals, and verify that the Emergency and Normal source phase rotations are the same (either A-B-C or A-C-B).

Step 4: After the sources have been verified, shut down the engine generator (place in AUTOMATIC mode). The Emergency Available LED will turn off.

NOTICE: **Engine generator will continue to run if Delay to Engine Stop Timing LED is illuminated.**

Step 5: Turn the DS (disconnect switch) to ENABLE if so equipped. Make a final inspection of the ATS and close and lock the cabinet door.

Operation and Testing

Standard Transition ATS Testing (w/o A6 or T3/W3)

For this test description, please refer to MX100 standard transition display *Figure 2*.

Initiate testing with the ATS in Normal position and Normal power available (Normal Position and Normal Available LEDs illuminated). **Press and hold the test switch until transfer (releasing the test switch prematurely will abort the test).** The delay to engine start timer (P) begins its timing cycle. After the P timer has completed its timing cycle, the engine start contacts close to start the generator.

When Emergency voltage and frequency reach preset pickup points the Emergency Available LED illuminates. Simultaneously, the delay to emergency timer (W) begins its timing cycle and the Delay to Emergency LED illuminates. When the W time delay is completed the switch will transfer to emergency. The Delay to Emergency and Normal Position LEDs go off, and the Emergency Position LED illuminates.

Release the test switch to start retransfer to Normal. The delay to normal timer (T) begins its timing cycle illuminating the Delay to Normal LED. When the T timer has completed its timing cycle the switch will transfer into Normal. The Delay to Normal and Emergency Position LEDs go off, and the Normal Position LED illuminates. The delay engine stop timer (U) begins its timing cycle and the Delay Engine Stop LED illuminates. The generator runs unloaded for the duration of the U timing cycle. When the timer completes its timing cycle, the generator will stop. The Delay Engine Stop and the Emergency Available LEDs go off.

⚠ NOTICE

A periodic test of the transfer switch under load conditions is recommended to insure proper operation. (See National Electric Code articles 700 and 701).

Standard Transition Transfer Sequence (w/o A6 or T3/W3)	LED Annunciation Status						
	Normal Position	Normal Available	Emergency Position	Emergency Available	Delay to Normal	Delay to Emergency	Delay Engine Stop
Normal Position	●	●					
W Time Delay	●	○		●		●	
Emergency Position		○	●	●			
T Time Delay		●	●	●	●		
Normal Position/ Engine Overrun Timer	●	●		●			●

○ Illuminated only when running TEST, not on Normal power failure

Delayed Transition ATS Testing

Refer to Delayed Transition display Figure 3. Initiate testing with the ATS in Normal position and Normal power available (Normal Position and Normal Available LEDs illuminated). Press and hold the test switch until transfer (releasing the test switch prematurely will abort the test).

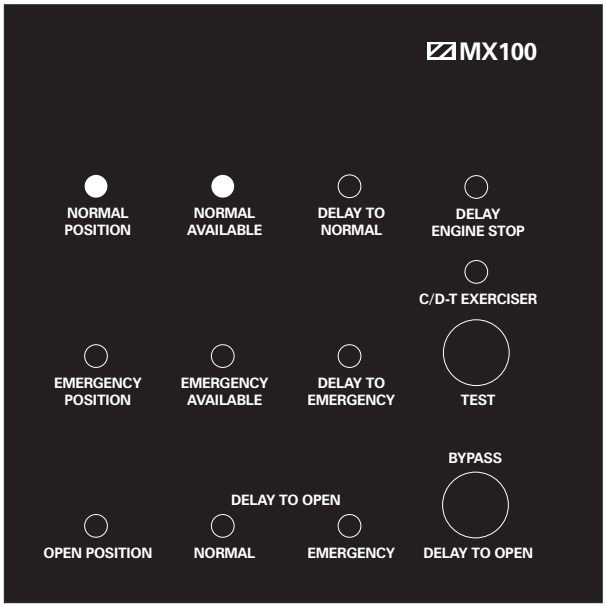


Figure 3 - Delayed Transition Annunciation LEDs and Test Switch

The delay to engine start timer (P) begins its timing cycle. After the P time delay the engine start contacts close to start the generator.

When Emergency voltage and frequency reach the preset pickup points the Emergency Available LED illuminates. Simultaneously, the delay to open normal timer (W) begins its timing cycle and the Delay to Open Normal LED illuminates. After the W time delay the ATS transfers out of Normal position into the Open position. The Delay to Open Normal and Normal Position LEDs go off, and the Open Position and Delay to Emergency LEDs illuminate. (Releasing the test switch now will allow the test to continue.)

Time delay to emergency (DW) then begins. When the DW time delay is completed the switch will transfer to Emergency. The Delay to Emergency and Open Position LEDs go off, and the Emergency Position LED illuminates.

The MX100 microcontroller will automatically begin the retransfer sequence to Normal. The delay to open emergency (T) timer begins its timing cycle and the Delay to Open Emergency LED illuminates. When the T timer has completed its timing cycle, the ATS transfers to the open position. The Delay to Open Emergency and the Emergency Position LEDs turn off, and the Open Position and the Delay to Normal LEDs illuminate. The delay to normal timer (DT) then begins its timing cycle illuminating the Delay to Normal LED. When the DT timer has completed its timing cycle the ATS will transfer out of the open position into the Normal position. Delay to Normal and the Open Position LEDs turn off, and the Normal Position LED illuminates.

The delay engine stop timer (U) begins its timing cycle and the Delay Engine Stop LED illuminates. The generator runs unloaded for the duration of the U timing cycle. Upon completion of the U time delay, the generator will stop. The Delay Engine Stop and the Emergency Available LEDs go off.

Operation and Testing *(cont'd)*

⚠ NOTICE

A periodic test of the transfer switch under load conditions is recommended to insure proper operation. (See National Electric Code articles 700 and 701).

Delay Transition Transfer Sequence	LED Annunciation Status									
	Normal Position	Normal Available	Emergency Position	Emergency Available	Delay to Normal	Delay to Emergency	Delay Engine Stop	Open Position	Delay to Open Normal	Delay to Open Emergency
Normal Position	●	●								
W Time Delay	●	○		●					●	
Open Position/ DW Time Delay		○		●		●		●		
Emergency Position		○	●	●						
T Time Delay		●	●	●						●
Open Position/ DT Time Delay		●		●	●			●		
Normal Position/ Engine Overrun Timer	●	●		●			●			

○ **Illuminated only when running TEST, not on Normal power failure**

Standard Transition ATS Testing (w/A6 or T3/W3)

Refer to Standard Transition w/A6 or T3/W3 display Figure 4. Initiate testing with the ATS in Normal position and Normal power available (Normal Position and Normal Available LEDs illuminated). Press and hold the test switch until transfer (releasing the test switch prematurely will abort the test).

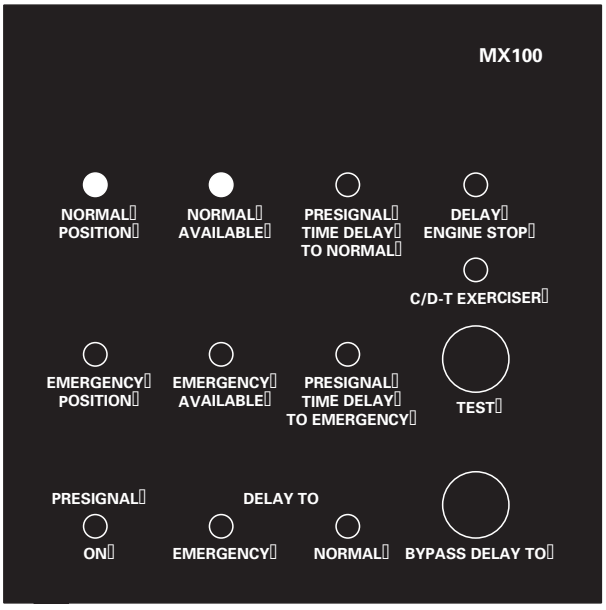


Figure 4 - Standard Transition w/A6 Annunciation LEDs and Test Switch

The delay to engine start timer (P) begins its timing cycle. After the P time delay the engine start contacts close to start the generator.

When Emergency voltage and frequency reach the preset pickup points the Emergency Available LED illuminates. Simultaneously, the delay to emergency timer (W) begins its timing cycle and the Delay to Emergency LED illuminates. After the W time delay the ATS presignal is initiated. The Delay to Emergency and Normal Position LEDs go off, and the Presignal On and Presignal Time Delay to Emergency LEDs illuminate. (Releasing the test switch now will allow the test to continue).

Presignal Time Delay to emergency (TA6) then begins. When the TA6 time delay is completed, the switch will transfer to Emergency. The Presignal Time Delay to Emergency and Presignal On LEDs go off, and the Emergency Position LED illuminates.

The MX100 microcontroller will automatically begin the retransfer sequence to Normal. The delay to normal (T) timer begins its timing cycle and the Delay to Normal LED illuminates. When the T timer has completed its timing cycle, the ATS presignal is initiated. The Delay to Normal and the Emergency Position LEDs turn off, and the Presignal On and the Presignal Time Delay to Normal LEDs illuminate. The Presignal Time Delay to normal (TA5) then begins. When the TA5 timer has completed its timing cycle, the ATS will transfer to the Normal position. Presignal Time Delay to Normal and Presignal On LEDs turn off, and the Normal Position LED illuminates.

The delay engine stop timer (U) begins its timing cycle and the Delay Engine Stop LED illuminates. The generator runs unloaded for the duration of the U timing cycle. Upon completion of the U time delay, the generator will stop. The Delay Engine Stop and the Emergency Available LEDs go off.

⚠ NOTICE

A periodic test of the transfer switch under load conditions is recommended to insure proper operation. (See National Electric Code articles 700 and 701).

	LED Annunciation Status									
Standard Transition Transfer w/A6 or T3/W3 Sequence	Normal Position	Normal Available	Emergency Position	Emergency Available	Presignal Time Delay to Normal	Presignal Time Delay to Emergency	Delay Engine Stop	Presignal On	Delay to Emergency	Delay to Normal
Normal Position	●	●								
W Time Delay	●	○		●					●	
Open Position/ TA6 Time Delay		○		●		●		●		
Emergency Position		○	●	●						
T Time Delay		●	●	●						●
Open Position/ TA5 Time Delay		●		●	●			●		
Normal Position/ Engine Overrun Timer	●	●		●			●			

○ Illuminated only when running TEST, not on Normal power failure

The MX100 continuously monitors source voltage. In the event that Normal voltage falls below a preset drop-out value, the unit will perform in exactly the same way as noted in the test procedure (either standard transition or delayed transition).

Operation Sequence

Normal Power Failure. When Normal voltage has fallen below the preset dropout value, the engine start (P) timer begins its timing cycle (factory set 3 seconds). The P timer allows for momentary undervoltage conditions in the Normal source without triggering the generator to start. If the Normal voltage remains below the dropout point throughout the P timing cycle, a generator start signal will be sent. The MX100 then monitors generator voltage and frequency to determine if they are within preset parameters. When the generator voltage and frequency reach acceptable limits the W timer begins its timing cycle. The W timer governs either the time delay for transfer to Emergency or to the open position (standard or delayed transition, respectively). The W timer (typically 1 second) assures that the generator voltage and frequency are stable before transfer.

The transfer to Emergency sequence is then completed as follows:

Standard Transition—after the W time delay, the ATS transfers to Emergency position and load power is supplied by the generator.

Delayed Transition—following the W time delay, the switch opens out of Normal to the Open position. The DW timer is activated. The DW time delay is typically set to 5 seconds. After the DW time delay, the switch completes transfer to Emergency.

Standard Transition w/A6 or T3/W3—following the W time delay, the presignal is initiated. The TA6 timer is started. The TA6 time delay is typically set to 5 seconds. After the TA6, the ATS transfers to Emergency.

Restoration of Normal Power. When Normal power reaches the preset pickup value, the T timer begins its timing cycle (factory set 30 minutes). The T timer is used to ensure that the Normal source has fully restored before retransfer. If Normal voltage remains above the pickup values for the duration of the T timer, transfer to Normal position is performed. Retransfer is accomplished as follows:

Standard Transition—ATS transfers to the Normal position and the load power is supplied by utility.

Delayed Transition—the switch opens out of Emergency to the Open position. The DT timer activates, typically set to 5 seconds. After the DT time delay, the switch completes transfer to Normal.

Standard Transition w/A6 or T3/W3—following the T time delay, the presignal is initiated. The TA5 timer is started. The TA5 time delay is typically set to 5 seconds. After the TA5, the ATS transfers to Normal.

The U timer then times out (factory set 5 minutes) to allow the generator to run unloaded for a cooldown period.

Control Features and Options

Control Features

A6. Motor load disconnect capability (standard transition only). Ensures that closing into the oncoming source does not create a large disturbance due to phase angle difference between the load and the oncoming source. Motor loads can be disconnected for an adjustable period of 0-60 seconds prior to transfer of the main contacts. This feature includes LEDs to indicate when the motor load is disconnected.

CDT Exerciser. A built in 7 day exerciser timer is incorporated into the MX100, (standard feature, all models). Pressing the initiate switch will start a timer that will continue for 167 hours and 40 minutes. Along with initiating the timer, an LED will illuminate to indicate that the timer has been started. After 167 hours and 40 minutes, a load test (ATS transfers to Emergency) or a no load test (ATS signals the genset to start but does not transfer) occurs. The exercise mode is determined by the MX100 PCboard jumper location (TSL = load, TSNL = no load). The test lasts for 20 minutes. The CDT Exerciser LED will flash when the exercising is in progress. This 20 minute exercise does not include the time delay to retransfer to normal (T timer) when the ATS is transferred (load test) or the time delay engine stop (U timer) for either load or no load tests. Disabling the exercise event is done by pressing the disable/enable switch. When this is done the exercise event will not occur, although the timer will not be affected. The CDT Exerciser LED will turn off when the disable/enable switch is pressed for the first time after initiating the timer. Pressing the disable/enable switch again will re-enable the exercise event while turning the CDT Exerciser LED back on. The time of the exercise event can be changed by re-initiating the event. The time that the button is pressed will be the end of the exercise event one week later.

CDT Exerciser Notes

1. To avoid unintentional intiating/disabling the button should be held down for 3 seconds when pressed.
2. A 9V battery is supplied to prevent CDT exercise timer from losing it's "set exercise time" in the event of an extended power outage. The battery can back up the processor for up to 8 hours. The battery should be replaced if it has supplied power to the microprocessor for an extended outage.
3. The 9V battery cannot be plugged into a PCboard that is deenergized. The PCboard includes large capacitors that the battery will not be able to charge. If the capacitors are charged, the battery will still discharge eventually due to the load of the PCboard. Therefore, do not install a battery until the PCboard is energized. The battery will then be able to maintain the CDT "set exercise time" in the event of an extended outage.

R50. In-phase monitor (standard transition w/o A6 only). R50 ensures that the phase angle difference between the load voltage and the oncoming source voltage is minimal (live source-to source transfers). The feature requires a fast acting transfer switch, therefore is only available with a standard transition ATS. The in-phase monitor is suitable for isochronous through 3% droop governors. The microprocessor anticipates the synchronized condition

by monitoring the phase angle and frequency differential between the sources. Then it signals a transfer at the precise moment to ensure minimal phase difference between the sources at the completion of transfer. R50 also includes a PCboard-mounted switch to override the in-phase monitor function if necessary. The override toggle switch is located below the MX100 cover, but the toggle position to enable or disable the function is clearly indicated on the cover.

YEN. Pushbutton time delay transfer/retransfer bypass.

Control Options

Five control input options can be used with the MX100:

- 6A
- C
- C/D
- Q2
- ZNET100

Note: Consult the factory when field adding Q2 option.

6A. *Maintained test switch.* An auxiliary two position maintained test switch is located on the cabinet door. This is in addition to the standard test switch found on all MX100 models. When the auxiliary test switch is activated in the TEST position, it will simulate a Normal line failure. The transfer switch will automatically transfer the load to the Emergency position. When the test switch is returned to the AUTOMATIC position the transfer switch will restore the load to the Normal position. Should Emergency fail while ATS is in Emergency position the ATS will transfer back to Normal immediately, if Normal is available.

C. *Plant Exerciser.* Automatically starts generator for selected time intervals. Runs generator unloaded.

C/D. *Plant Exerciser.* Automatically starts generator to run unloaded, or simulate a power failure and starts generator to run under load.

Q2. *Connections for remote peak shave or area protection.* Includes bypass for immediate return to Normal if Emergency line fails and Normal is available.

Z-NET100. *Communication Capability.* The MX100 can be equipped with an optional network card that allows digital communication of ATS position, source availability, control timers and test mode. A test signal can also be initiated from a remote PC or annunciator panel. Communication is via one twisted pair of wires.

User Settings

All user settings are adjustable on the back of the MX100 display. Figure 5 shows the MX100 user adjustments.

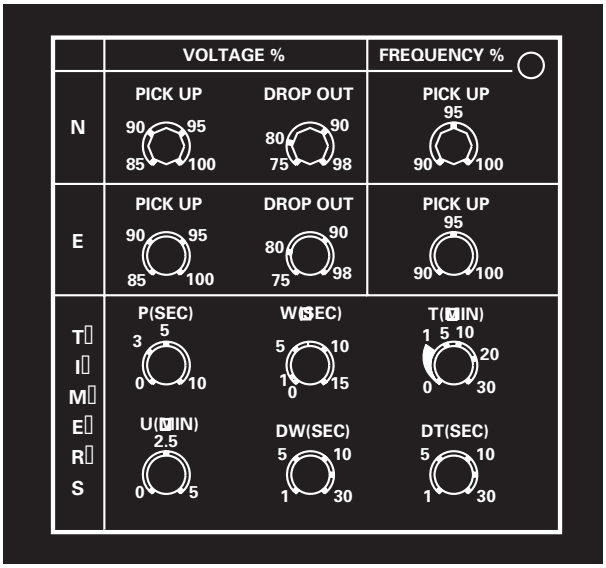


Figure 5 - Delayed Transition User Adjustments

⚠ NOTICE

All adjustments are factory preset to values in the table below, unless otherwise specified by the user.

Factory Settings of Voltage, Frequency and Timer Adjustments	
Normal Pickup Voltage	90% Nominal Line Voltage
Normal Dropout Voltage	80% Nominal Line Voltage
Normal Pickup Frequency	90% Nominal Line Frequency
Emergency Pickup Voltage	90% Nominal Line Voltage
Emergency Dropout Voltage	80% Nominal Line Voltage
Emergency Pickup Frequency	95% Nominal Line Frequency
P Timer	3 seconds
W Timer	1 second
T Timer	30 minutes
U Timer	5 minutes
DW Timer *	5 seconds
DT Timer *	5 seconds
TA5 **	5 seconds
TA6 **	5 seconds

* Delayed
** Standard w/A6 or T3/W3

Voltage and Frequency Pickup/Dropout Adjustments

Normal Pickup Voltage %: Pickup voltage is adjustable from 85 to 100% of nominal line voltage. Standard factory setting is 90%.

Normal Dropout Voltage %: The dropout voltage is adjustable from 75 to 98% of nominal line voltage. Standard factory setting is 80%. Dropout must be a minimum of 2% below Normal pickup voltage under all conditions. Note: The microprocessor will automatically set the Normal dropout voltage 2% below the Normal pickup voltage if it is not properly set by the user.

Normal Pickup Frequency %: The pickup frequency is adjustable from 90 to 100% of nominal line frequency. Standard factory setting is 90%.

Emergency Pickup Voltage %: The pickup voltage is adjustable 85 to 100% of nominal line voltage. The standard factory setting is 90%.

Emergency Dropout Voltage %: The dropout voltage is adjustable from 75 to 98% of nominal line voltage. Standard factory setting is 80%. Emergency dropout voltage must be a minimum of 2% below emergency pickup voltage under all conditions. Note: The microprocessor will automatically set the Emergency dropout voltage 2% below the Emergency pickup voltage if it is not properly set by the user.

Emergency Pickup Frequency %: The pickup frequency is adjustable from 90 to 100% of nominal line frequency. Dropout is fixed at 2 Hz below pickup. Dropout has a 5 second delay. Standard factory setting is 95%.

Timer Adjustments

P Timer (delay to engine start). Time delay before engine start after Normal voltage failure: adjustable 0 to 10 seconds. P timer is designed to avoid engine starts on momentary Normal source failures. Standard factory setting is 3 seconds.

W Timer (delay to Emergency or delay to open Normal timer). Time delay before initiating transfer to Emergency: adjustable 0 to 15 seconds. Standard factory setting is 1 second. After the successful acquisition of correct Emergency voltage and frequency, the W timer function provides a time delay before initiating transfer to Emergency. This permits the Emergency source to stabilize. On completion of the time out, transfer to Emergency is initiated.

Transfer to Emergency is non-commit. This means that should the Normal voltage be restored before the timeout of the W timer, the ATS will remain in the Normal position and initiate the delay to engine stop timer.

User Settings *(cont'd)*

T Timer (delay to Normal or delay to open Emergency). Time delay before initiating retransfer to Normal: adjustable 0 to 30 minutes. Standard factory setting is 30 minutes. On return of acceptable Normal voltage the time delay is initiated. T time delay ensures Normal source has stabilized before transferring to Normal position. On completion of the time out, transfer to Normal is initiated. Should Emergency power fail when the ATS is in the Emergency position, the T timer function will be bypassed when normal power is restored.

U Timer (delay engine stop). Time delay to engine stop, after retransfer to Normal, for purpose of cooling the engine after the load is removed: adjustable 0 to 5 minutes. Standard factory setting is 5 minutes.

DW Timer (time delay from Open position to Emergency position). Delayed Transition Transfer only: adjustable 0 to 60 seconds. Standard factory setting is 5 seconds. DW timer activates when the switch enters open position on a transfer from Normal to Emergency. After time out, the transfer to Emergency is complete.

DT Timer (time delay from Open position to Normal position). Delayed Transition Transfer only: adjustable 0 to 60 seconds. Standard factory setting is 5 seconds. DT timer activates when the switch enters the open position on transfer from Emergency to Normal. After time out, the transfer to Normal is complete.

MX100, Standard Transition w/A6 or T3/W3
(A6 = motor load disconnect circuit)
(T3/W3 = elevator presignal circuit)

TA5 (presignal time delay to normal). Time delay is available only on standard transition ATSs specifically configured with the presignal circuit. Adjustable 0 to 60 seconds. Standard factory setting is 5 seconds.

TA6 (presignal time delay to emergency). Time delay is available only on standard transition ATSs specifically configured with the presignal circuit. Adjustable 0 to 60 seconds. Standard factory setting is 5 seconds.

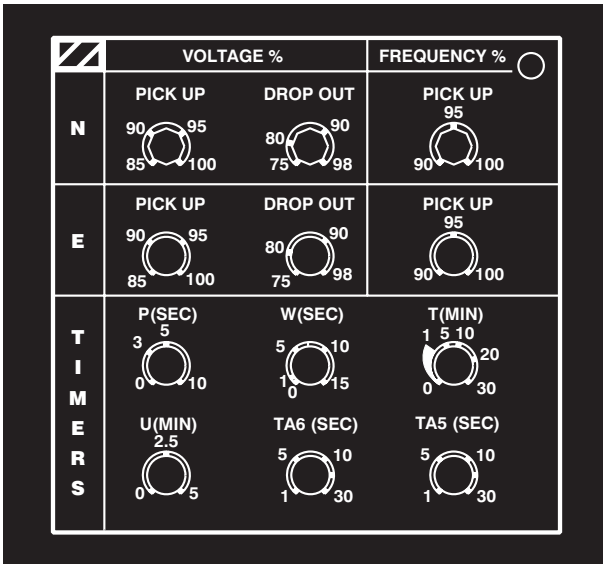


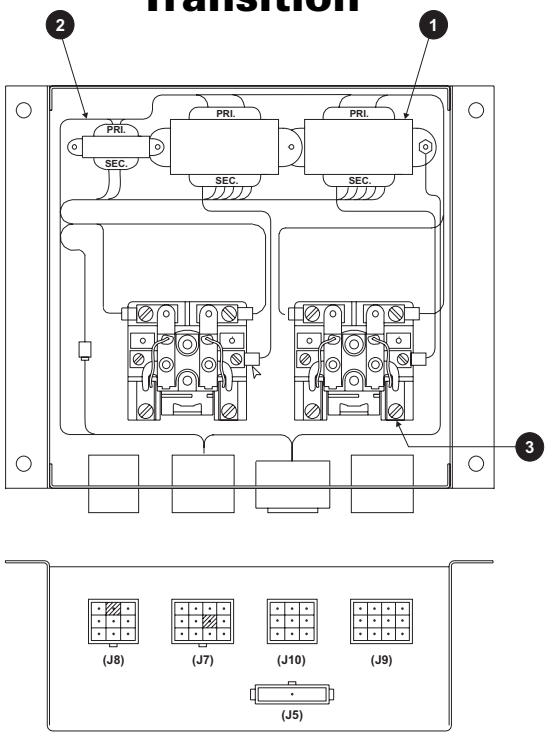
Figure 6 - Standard Transition w/A6 or T3/W3 User Adjustments

Relay/Transformer Box (R/T Box)

Each MX100 microprocessor based ATS controller requires a relay/transformer box to apply line voltage to the ATS operator via coil control relays. Also required is a means to power the MX100 printed circuit board and a means to apply sensing voltage proportional to line voltage. This is accomplished by the relay transformer box. This method of switching operator voltage and applying power and sensing voltage to the printed circuit board isolates the MX100 from the line voltage, further protecting the controller from harmful line transients. Two versions of the R/T box exist depending on the type of ATS (standard transition or delayed transition).

The following layout drawings of the R/T box components (standard and delayed transition) include a bill of materials for replacement parts. Schematics are included to indicate proper wiring.

Standard Transition



Bill of Material

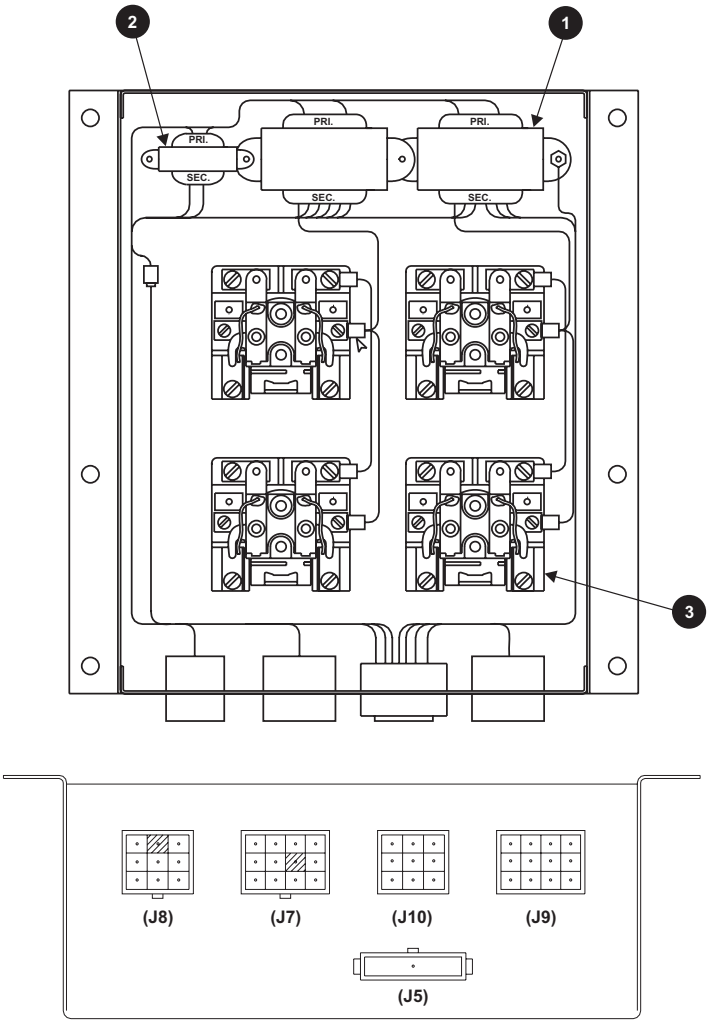
Item	Part No.	Description	Qty
1	See Chart	Transformer, 25VA	2
2	See Chart	Transformer, 1VA	1
3	K-1260	Coil Control Relay, 24V	2

Transformer Usage

R/T Box Assembly Part No.	Primary Voltage at 50/60 Hz	1VA XFMR Part No.	25VA XFMR Part No.
50P-1005	120V	K-3216	K-3224
50P-1006	208-220V	K-3217	K-3225
50P-1007	230-240V	K-3218	K-3226
50P-1008	277V	K-3219	K-3227
50P-1009	380-400V	K-3220	K-3228
50P-1010	416-440V	K-3221	K-3229
50P-1011	460-480V	K-3222	K-3230
50P-1012	575-600V	K-3223	K-3231

Relay/Transformer Box (R/T Box) *(cont'd)*

Delayed Transition



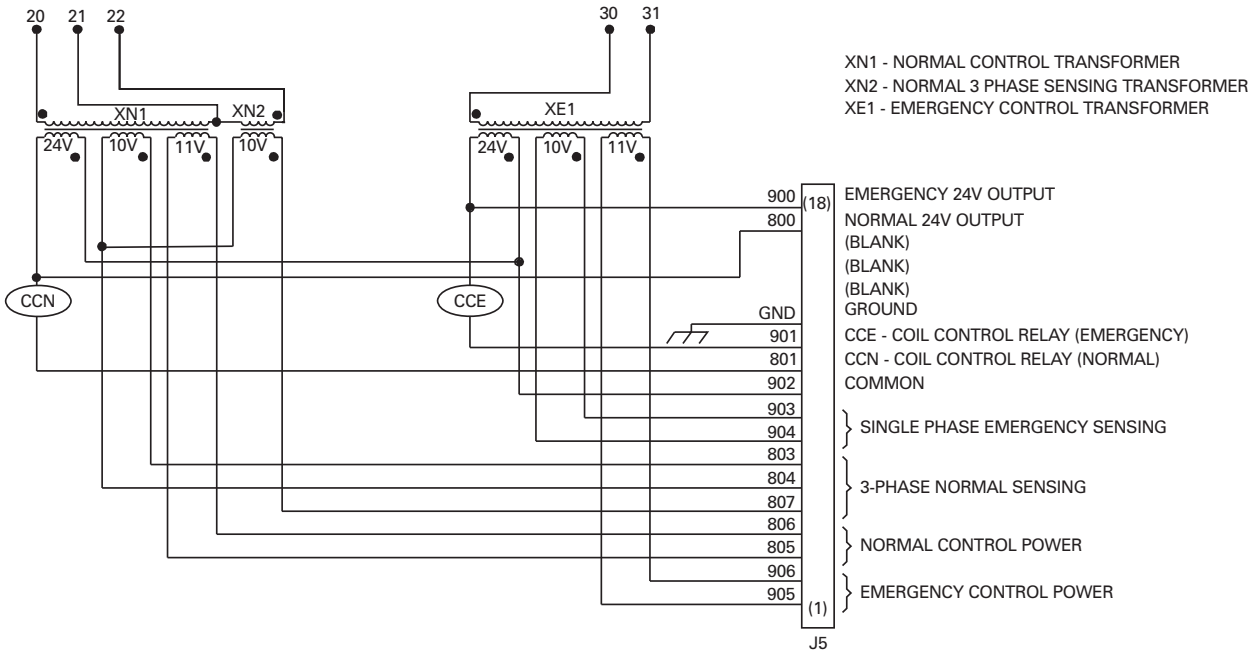
Bill of Material

Item	Part No.	Description	Qty
1	See Chart	Transformer, 25VA	2
2	See Chart	Transformer, 1VA	1
3	K-1260	Coil Control Relay, 24V	4

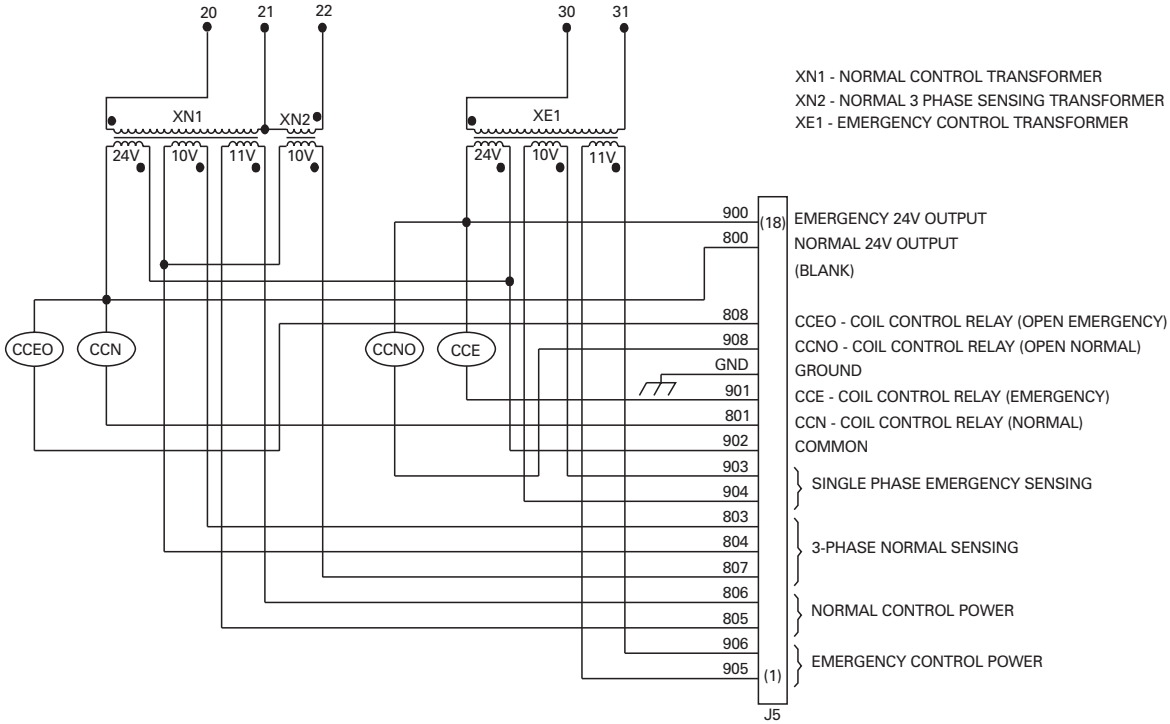
Transformer Usage

R/T Box Assembly Part No.	Primary Voltage at 50/60 Hz	1VA XFMR Part No.	25VA XFMR Part No.
50P-1013	120V	K-3216	K-3224
50P-1014	208-220V	K-3217	K-3225
50P-1015	230-240V	K-3218	K-3226
50P-1016	277V	K-3219	K-3227
50P-1017	380-400V	K-3220	K-3228
50P-1018	416-440V	K-3221	K-3229
50P-1019	460-480V	K-3222	K-3230
50P-1020	575-600V	K-3223	K-3231

Standard Transition R/T Box Schematic



Delayed Transition R/T Box Schematic



Troubleshooting and Diagnostics

⚠ DANGER

HAZARDOUS VOLTAGES CAN CAUSE SEVERE INJURY OR DEATH.
These charts may indicate problems that require authorized Zenith service personnel.
Hazardous voltages may exist on termination plugs other than those that go into the MX100.

General Troubleshooting

The following chart can be used to troubleshoot the ATS system. Diagnostics are indicated by one or more flashing position LED(s). Diagnostic troubleshooting charts follow this chart.

Symptom	Annunciation	Possible Cause(s)	Corrective Action
No engine start	EMERGENCY AVAILABLE LED off	Engine start wires not properly connected	Check engine start connections (Figure 1)
		Generator in OFF position	Place engine control switch in AUTO
No engine stop	DELAY TO ENGINE STOP LED on	U timing cycle not complete	Check U timer setting
	NORMAL AVAILABLE, NORMAL POSITION, and EMERGENCY AVAILABLE LEDs on	Engine start wires not properly connected	Check engine start connections (Figure 1)
		Generator in MANUAL	Place engine control switch in AUTO
ATS will not transfer to EMERGENCY	EMERGENCY AVAILABLE LED off	Emergency voltage or frequency not within settings	Check: engine start connections, generator breaker closed, generator output (compare to MX100 settings) and place engine control switch in AUTO
	All LEDs off	Power supply harness unplugged (18 pin connector on MX100)	Plug in harness
	EMERGENCY AVAILABLE LED on	ZTC models only - verify zero volts DC from pin 5 to pin 6 of 6 pin plug on MX100	If 5V measured, ZTC is tripped; refer to Power Panel Manual (51R-1000) for ZTC instructions
ATS will not transfer to NORMAL	NORMAL AVAILABLE LED off	Normal voltage or frequency not within acceptable parameters	Check: normal voltage within MX100 settings; verify Normal breaker source breaker is closed
	All LEDs off	Power supply harness unplugged (18 pin connector on MX100)	Plug in harness
	NORMAL AVAILABLE LED on	ZTC models only - verify zero volts DC from pin 5 to pin 6 of 6 pin plug on MX100	If 5V measured, ZTC is tripped; refer to Power Panel Manual (51R-1000) for ZTC instructions
Improper LED annunciation	Neither source available LEDs illuminate, position LED only	MX100 PC board may be configured for wrong frequency (60 Hz vs. 50 Hz)	1. Verify source voltage and frequency 2. Consult Zenith Controls for information to reconfigure hardware
	NORMAL and/or EMERGENCY AVAILABLE LEDs on when frequency is below the present pick up value	MX100 PC board may be configured for wrong frequency (60 Hz vs. 50 Hz)	1. Verify source voltage and frequency 2. Consult Zenith Controls for information to reconfigure hardware

Troubleshooting and Diagnostics *(cont'd)*

Diagnostic Annunciation

The MX100 controller incorporates diagnostics that allows ease of troubleshooting. Diagnostic annunciations are flashing position LEDs. The symptoms that the diagnostic annunciation indicate include inhibiting transfer or incorrect transfer sequence. A more general troubleshooting chart that addresses system problems precedes these charts.

⚠ DANGER

HAZARDOUS VOLTAGES CAN CAUSE SEVERE INJURY OR DEATH.

These charts may indicate problems that require authorized Zenith service personnel.

Hazardous voltages may exist on termination plugs other than those that go into the MX100.

Standard Transition ATS

(Two Position ATS—Normal and Emergency)
(Not for Standard Transition w/A6)

⚠ WARNING

If limit switch plug is disconnected or reconnected and power is available, the switch may transfer.

Use caution when servicing.

Symptom	Annunciation	Possible Cause(s)	Corrective Action
ATS will not transfer out of Normal	Flashing NORMAL POSITION LED	Solenoid circuit	Contact authorized Zenith service representative
ATS will not transfer out of Emergency	Flashing EMERGENCY POSITION LED	Solenoid circuit	Contact authorized Zenith service representative
ATS will not transfer; ATS is not in a defined position as indicated by the limit switch contact (no SN or SE limit switch input)	Flashing NORMAL POSITION and EMERGENCY POSITION LEDs	1. Limit switch plugs not connected 2. Limit switches not within adjustment	1. Connect all plugs to the MX100 2. Contact authorized Zenith service representative

Troubleshooting and Diagnostics *(cont'd)*

Delayed Transition ATS (Three Position ATS—Normal, Open and Emergency)

⚠ WARNING

If limit switch plug is disconnected or reconnected and power is available, the switch may transfer.

Use caution when servicing.

Symptom	Annunciation	Possible Cause(s)	Corrective Action
ATS will not transfer out of Normal	Flashing NORMAL POSITION LED	1. ZTC in manual mode (ZTC models only) 2. Solenoid circuit	1. Put ZTC in AUTO (ref. ZTC Power Panel Manual 51R-1000) disconnect and reconnect MX100 18 pin plug 2. Contact authorized Zenith service representative
ATS will not transfer out of Emergency	Flashing EMERGENCY POSITION LED	1. ZTC in manual mode (ZTC models only) 2. Solenoid circuit	1. Put ZTC in AUTO (ref. ZTC Power Panel Manual 51R-1000) disconnect and reconnect MX100 18 pin plug 2. Contact authorized Zenith service representative
ATS will not transfer out of Open position	Flashing OPEN POSITION LED	1. ZTC in manual mode (ZTC models only) 2. Solenoid circuit	1. Put ZTC in AUTO (ref. ZTC Power Panel Manual 51R-1000) disconnect and reconnect MX100 18 pin plug 2. Contact authorized Zenith service representative
ATS is not in a defined position as indicated by the limit switch contacts (no SN or SNO limit switch inputs)	Flashing NORMAL POSITION and OPEN POSITION LEDs	Limit switches not registered as opened or closed	Contact authorized Zenith service representative
ATS is not in a defined position as indicated by the limit switch contacts (no SN or SEO limit switch inputs)	Flashing EMERGENCY POSITION and OPEN POSITION LEDs	Limit switches not registered as opened or closed	Contact authorized Zenith service representative
ATS is not in a defined position as indicated by the limit switch contacts (no SN, SE, SNO, or SEO limit switch inputs)	Flashing NORMAL POSITION, OPEN POSITION and EMERGENCY POSITION LEDs	1. Limit switch plugs not connected 2. Limit switches not registered as opened or closed	Connect all plugs to the MX100

Troubleshooting and Diagnostics *(cont'd)*

Standard Transition ATS (with A6)

WARNING

If limit switch plug is disconnected or reconnected and power is available, the switch may transfer.

Use caution when servicing.

Symptom	Annunciation	Possible Cause(s)	Corrective Action
ATS will not transfer out of Normal; motor load still connected	Flashing NORMAL POSITION LED	Motor load disconnect relay is not latching	Check connections to RA6 relay
ATS will not transfer out of Emergency; motor load still connected	Flashing EMERGENCY POSITION LED	Motor load disconnect relay is latched	Check connections to RA6 relay
ATS will not transfer after motor load disconnect operated	Flashing MOTOR CONTROL OFF LED	Solenoid circuit	Contact authorized Zenith service representative
ATS is not in a defined position as indicated by the limit switch contacts (no SN or RA6 limit switch inputs)	Flashing NORMAL POSITION and MOTOR CONTROL OFF LEDs	Limit switches not registered as closed or RA6 contact is not registered	Contact authorized Zenith service representative
ATS is not in a defined position as indicated by the limit switch contacts (no SE or RA6 limit switch inputs)	Flashing EMERGENCY POSITION and MOTOR CONTROL OFF LEDs	Limit switches not registered as closed or RA6 contact is not registered	Contact authorized Zenith service representative
ATS is not in a defined position as indicated by the limit switch contacts (no SN, SE, SNO, or SEO limit switch inputs)	Flashing NORMAL POSITION, OPEN POSITION and EMERGENCY POSITION LEDs	1. Limit switch plugs not connected 2. Limit switches not registered as opened or closed	Connect all plugs to the MX100

830 West 40th Street
Chicago, IL 60609 USA

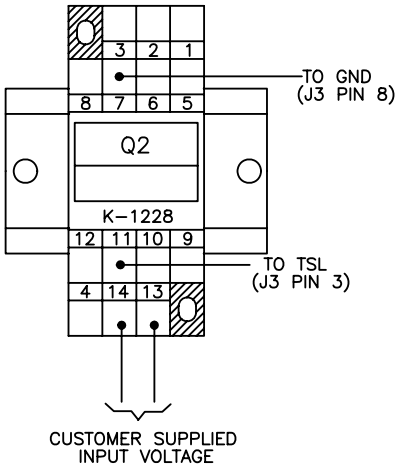
Phone: 773 299-6600

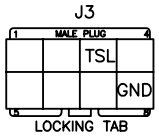
www.zenithcontrols.com

© 1999 Zenith Controls, Inc.

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
N	S-7698 REVISED DWG	07/04/01	SK

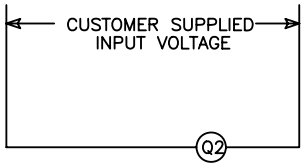
CONNECTION DIAGRAM

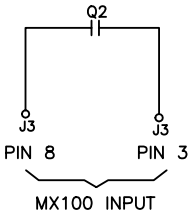




MX100 CONTROL PANEL
TO Q2 RELAY ON DIN RAIL

SCHEMATIC





LEGEND

Q2 Relay..... K-1232, 24VAC; K-1242, 24VDC; K-1204, 120VAC
K-1228, Base
PS-6161 Din Rail

J3 Plug - MX100.....PS-5134 Socket Receptacle 8 pt. Mini
PS-5127 Socket Female Mini (Qty. 2)

OPERATION

Q2 - Remote Peak Shave or Area Protection Circuit
Energize Q2 Relay to simulate a normal line failure causing the Generator to start and transfer the load to Emergency. Should Emergency fail during this operation, the transfer switch will retransfer back to Normal.

INSTRUCTIONS

Mount Q2 Relay on Din Rail on MX100 Control Panel.

GE PROPRIETARY AND CONFIDENTIAL INFORMATION
This document is the property of General Electric ("GE") and contains proprietary information of GE. This document is loaned on the express condition that neither it nor the information contained therein shall be disclosed to others without the express written consent of GE Industrial Systems, and that the information shall be used by the recipient only as approved expressly by GE Industrial Systems. This document shall be returned to GE upon its request. This document may be subject to certain restrictions under U.S. export controls laws and regulations.

THIRD ANGLE PROJECTION

FOR ADDITIONAL INFO REFER TO
APPLIED PRACTICES
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
2 PL. DECIMALS ± .020
3 PL. DECIMALS ± .005
ANGLES ± 1°
FRACTIONS ± 1/64
FINISH

SIGNATURES		DATE
MODEL	SG	02/15/01
DETAIL		
CHECKED		
ENGRG	SB	
MFG		
QUALITY		
ISSUED		

DRAWING FILE: 50r-1001-n-1.dwg
MODEL / ASSEMBLY FILE: MX100
CTQs | CRITICAL TO QUALITY CHARACTERISTIC
AutoCad Generated

GE Zenith Controls

TITLE
Q2 ACCESSORY

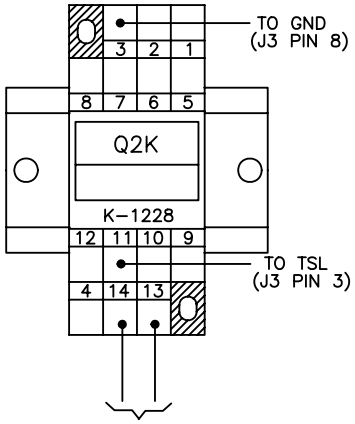
FIRST MADE FOR:

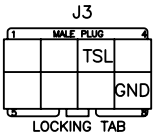
SIZE	CAGE CODE	DWG NO
B		50R-1001

SCALE: -
SHEET 1 OF 3

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
N	S-7698 REVISED DWG	07/04/01	SK

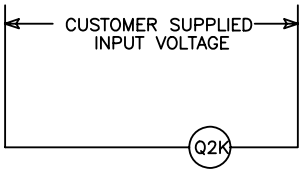
CONNECTION DIAGRAM

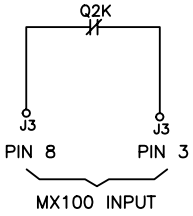




MX100 CONTROL PANEL
TO Q2K RELAY ON DIN RAIL

SCHEMATIC





LEGEND

Q2K Relay..... K-1232, 24VAC; K-1242, 24VDC; K-1204, 120VAC
K-1228, Base
PS-6161 Din Rail

J3 Plug – MX100.....PS-5134 Socket Receptacle 8 pt. Mini
PS-5127 Socket Female Mini (Qty. 2)

OPERATION

Q2K – Remote Peak Shave or Area Protection Circuit
De-energize Q2K Relay to simulate a normal line failure causing the Generator to start and transfer the load to Emergency. Should Emergency fail during this operation, the transfer switch will retransfer back to Normal.

INSTRUCTIONS

Mount Q2K Relay on Din Rail on MX100 Control Panel.

GE PROPRIETARY AND CONFIDENTIAL INFORMATION
This document is the property of General Electric ("GE") and contains proprietary information of GE. This document is loaned on the express condition that neither it nor the information contained therein shall be disclosed to others without the express, written consent of GE Industrial Systems, and that the information shall be used by the recipient only as approved expressly by GE Industrial Systems. This document shall be returned to GE upon its request. This document may be subject to certain restrictions under U.S. export controls laws and regulations.

THIRD ANGLE PROJECTION

FOR ADDITIONAL INFO REFER TO
APPLIED PRACTICES
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
2 PL. DECIMALS ± .020
3 PL. DECIMALS ± .005
ANGLES ± 1°
FRACTIONS ± 1/64
FINISH

SIGNATURES		DATE
MODEL	SG	02/15/01
DETAIL		
CHECKED		
ENGRG	SB	
MFG		
QUALITY		
ISSUED		

DRAWING FILE: 50r-1001-n-2.dwg
MODEL / ASSEMBLY FILE: MX100
CTQs
CRITICAL TO QUALITY CHARACTERISTIC
AutoCad Generated

GE Zenith Controls

TITLE
Q2K ACCESSORY

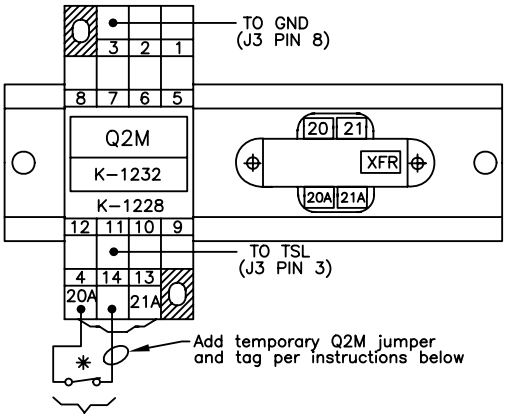
FIRST MADE FOR:

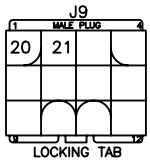
SIZE	CAGE CODE	DWG NO
B		50R-1001

SCALE: –

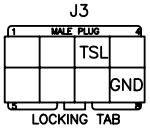
REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
N	S-7698 REVISED DWG	07/04/01	SK

CONNECTION DIAGRAM



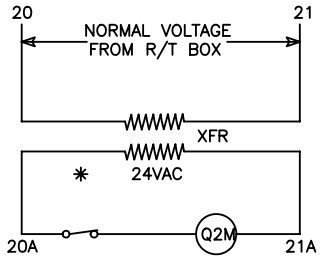


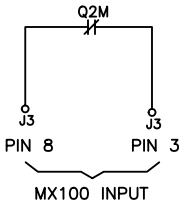
RELAY/TRANSFORMER BOX
TO XFR ON DIN RAIL



MX100 CONTROL PANEL
TO Q2M RELAY ON DIN RAIL

SCHEMATIC





* NOTE – MAX DISTANCE EXTERNAL CONTACT CAN BE LOCATED FROM CONTROLLER

AWG	MAX FT
18	400
16	650
14	1000

LEGEND

Q2M RELAY..... K-1232, 24 VAC
K-1228, Base
PS-6161 Din Rail

J3 Plug – MX100..... PS-5134 Socket Receptacle 8 pt. Mini
PS-5127 Socket Female Mini (Qty. 2) } REF. 50W-1009

J9 Plug-R/T Box..... PS-5080..... Socket Receptacle 12 Pt.
PS-5084..... Socket Female .093" (Qty. 2) } REF. 50W-1071

XFR..... Transformer 10VA
K-3102 208/24 VAC
K-3103 240/24 VAC
K-3104 277/24 VAC
K-3105 480/24 VAC
K-3107 575/24 VAC

OPERATION

Q2M – Remote Peak Shave or Area Protection Circuit
Open external N.C. contact to simulate a normal line failure causing the Generator to start and transfer the load to Emergency. Should Emergency fail during this operation, the transfer switch will retransfer back to Normal.

INSTRUCTIONS

1. Add temporary Q2M jumper. Identify with tag marked "TEMPORARY Q2M JUMPER".
2. Mount Q2M Relay and XFR Transformer on Din Rail on MX100 Control Panel.

GE PROPRIETARY AND CONFIDENTIAL INFORMATION
This document is the property of General Electric ("GE") and contains proprietary information of GE. This document is loaned on the express condition that neither it nor the information contained therein shall be disclosed to others without the express, written consent of GE Industrial Systems, and that the information shall be used by the recipient only as approved expressly by GE Industrial Systems. This document shall be returned to GE upon its request. This document may be subject to certain restrictions under U.S. export controls laws and regulations.

THIRD ANGLE PROJECTION

FOR ADDITIONAL INFO REFER TO
APPLIED PRACTICES
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
2 PL. DECIMALS ± .020
3 PL. DECIMALS ± .005
ANGLES ± 1°
FRACTIONS ± 1/64
FINISH

SIGNATURES		DATE
MODEL	SG	02/15/01
DETAIL		
CHECKED		
ENGRG	SB	
MFG		
QUALITY		
ISSUED		

DRAWING FILE: 50r-1001-n-3.dwg
MODEL / ASSEMBLY FILE: MX100
CTQs ⊖ CRITICAL TO QUALITY CHARACTERISTIC
AutoCad Generated

GE Zenith Controls

TITLE: Q2M ACCESSORY

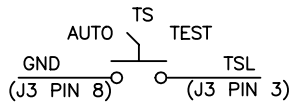
FIRST MADE FOR:

SIZE	CAGE CODE	DWG NO
B		50R-1001

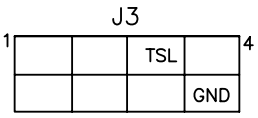
SCALE: –

SHEET 3 OF 3

CONNECTION TO MX100 CONTROL PANEL:



TS MOUNTED ON DOOR OF ENCLOSURE



MX100 CONTROL PANEL
TO TEST SWITCH CONTACT

LEGEND:

6A..... Maintained Test Switch
P9XSMD0N, 2 Pos. Operator
P9B10VN, N.O. Contact Block
V-1505, Nameplate

J3..... Plug - MX100
PS-5134...Socket Receptacle 8 pt. Mini
PS-5127...Socket Female Mini (Qty. 2)

OPERATION:

When activated in the TEST position, TS will simulate a normal line failure. The TS will automatically transfer the load to the emergency position. When the test switch is returned to the AUTOMATIC position, the transfer switch will restore the load to the normal line position. Should Emergency fail while the ATS is in the Emergency position, the ATS will transfer back to Normal.

LEGEND	REFERENCE	NOTES

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S-6449	ESTABLISH DWG.		
B	S-7379-1	04/06/00	SG	SB

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

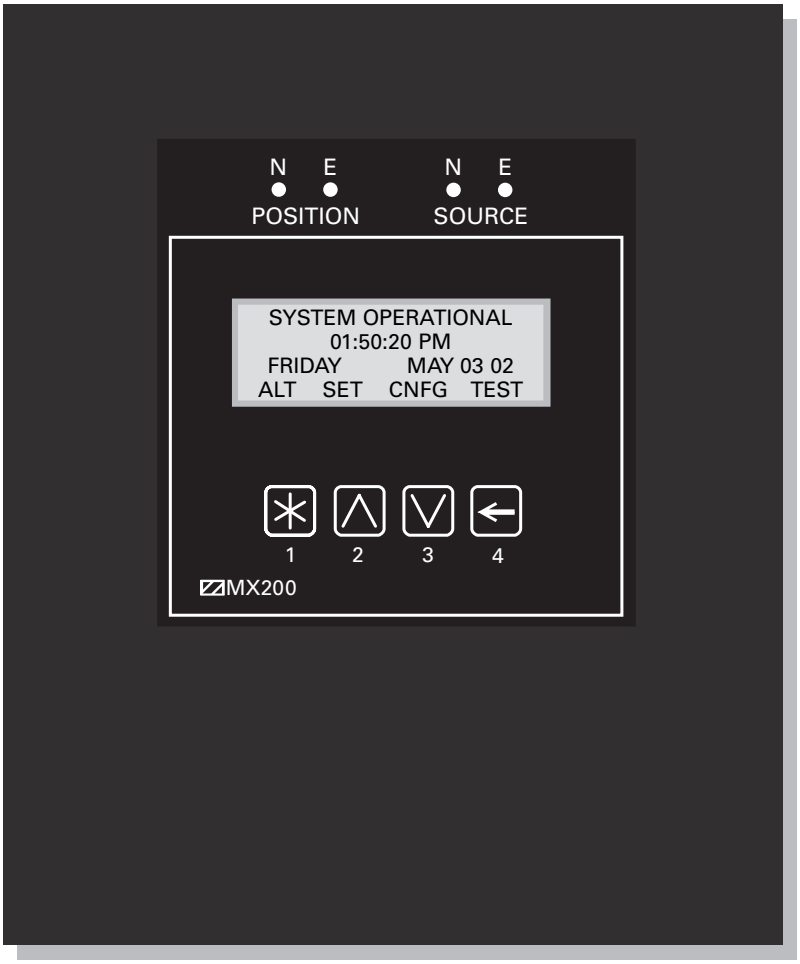
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: 6A TEST SWITCHES
JOB/MODEL: MX100

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	-	50R-1010

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
ALA	SB	25/15/96	-	1 OF 1	B

GE Zenith Controls



50R-2000D
5/02

Operation and Maintenance Manual

Table of Contents

Page

Safety 1
The MX200 Controller Overview 2
Installation - Engine Start Contact 3
Installation - Optional Accessories 4
Programmable Options 10
User Settings - SET Menu 11
User Settings - CNFG Menu 12
User Settings - ALT Menu 13
How to Set the System Clock 14
How to Set the Plant Exerciser 15
Exerciser Types 16
Timers 18
Timer Designations 20
Sensors 21
Normal Sensors 22
Emergency Sensors 23
Optional Pilot Devices 24
Testing 27
Troubleshooting 28
Power Failure Sequence of Operation 29
Index of Terms 32

Safety

⚠ DANGER

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Installation for each ATS is detailed in the information package which includes:

- Operation and Maintenance Manual for Control Panel (this manual)
- Power Panel Manual
- Specific Schematics Supplied With Each Transfer Switch

Final Equipment Inspection

Prior to energizing the transfer switch:

1. Remove any debris incurred due to shipment or installation. **DO NOT** use a blower since debris may become lodged in the electrical and mechanical components and cause damage. Use of a vacuum is recommended.
2. Verify that all cabled connections are correct and that phase rotation of both sources match.
3. Check engine start connections and verify the correct connection of all control wires.
4. Check settings of all timers and adjust as necessary. Also adjust any optional accessories as required.
5. Check the integrity of power connections by verifying actual lug torque values as specified in the power panel manual.
6. Make sure that all covers and barriers are installed and properly fastened.

NOTE: Power Panels ship from Zenith in the Normal Position.

Equipment Inspection and Storage

Immediately inspect the transfer switch when received to detect any damage which may have occurred during transit. If damage is found or suspected, file claims as soon as possible with the carrier and notify the nearest Zenith representative.

Before installation, it is necessary to store the transfer switch in a clean dry place, protected from dirt and water. Provide ample air circulation and heat, if necessary, to prevent condensation.

Storage Temperature:	-30 C to + 85 C (-22 F to +149 F)
Operating Temperature (Ambient):	-20 C to +75 C (-4 F to +167 F) [40-260 Amps] -20 C to +60 C (-4 F to +104 F) [400-4000 Amps]
Humidity:	5% to 95% (non-condensing)

The MX200 Controller Overview

The MX200 CONTROLLER consists of two major assemblies:

I. The ***Microprocessor*** contains the following:

A. Customer Input and Output (I/O) for system interface. Located on the left hand side of the back of the unit (see figure 1)
   1. I/O accessories that can be found here are:
      a. Engine start relay P output
      b. Source Availability A1 and A1E output (optional)
      c. Pre-Signal to transfer T3, W3 and A6 output (optional)
      d. Transfer Inhibit Q3 and Q7 input (optional)
      e. Remote test Q2 input (optional)
      f. Load shed R15 input (optional)
      g. Network interface ZNET200 input/output (optional)

B. LCD and Keypad located on the exterior of the door (see figure 2)
   1. User accessibility to the following:
      a. LED indication of source availability
      b. LED indication of transfer switch position
      c. LCD screen indicates:
         (1) timer count down (numeric)
         (2) event reporting (text)
      d. Keypad provides user interface to: *[in conjunction with LCD screen]*
         (1) Setting sensors and timers
         (2) Configuring logic accessories

II. The ***R/T box*** (relay transformer box) contains the following: (see figure 1)

A. Relays which are required for controller output to energize the transferring mechanism of the transfer switch at line voltage.

B. Transformers which drop line voltage to control level for controller input.

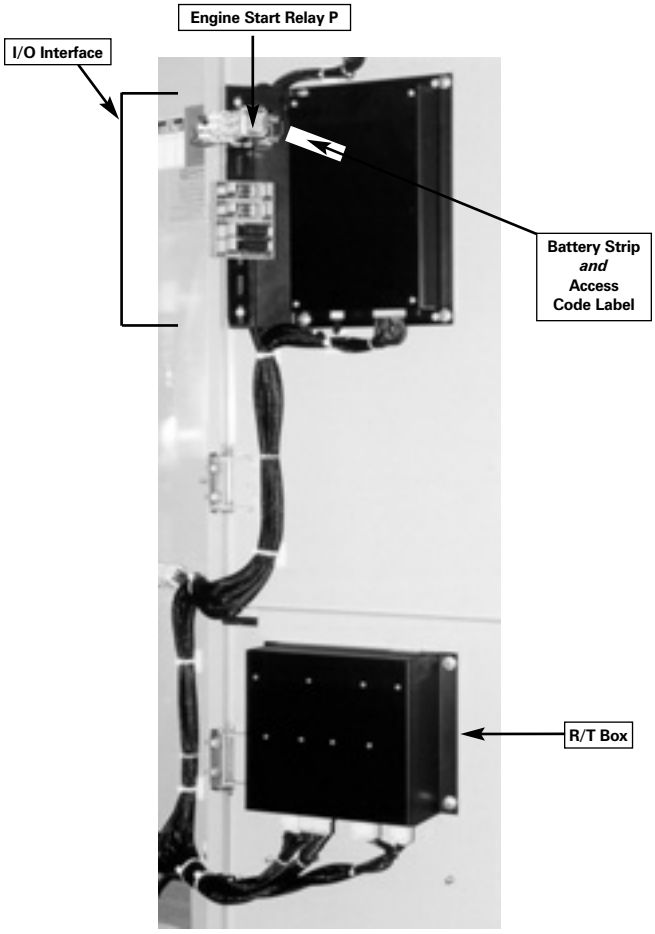


Figure 1

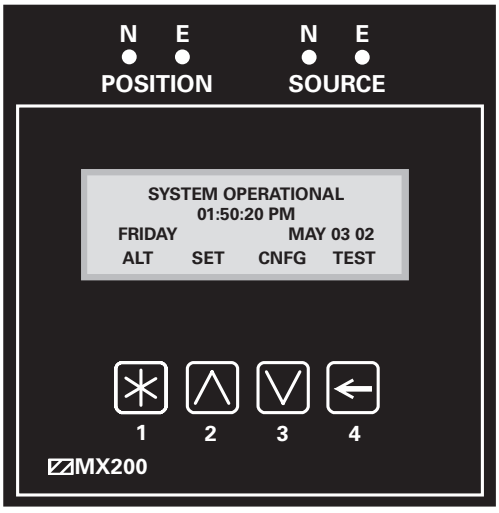


Figure 2

Installation

⚠ DANGER

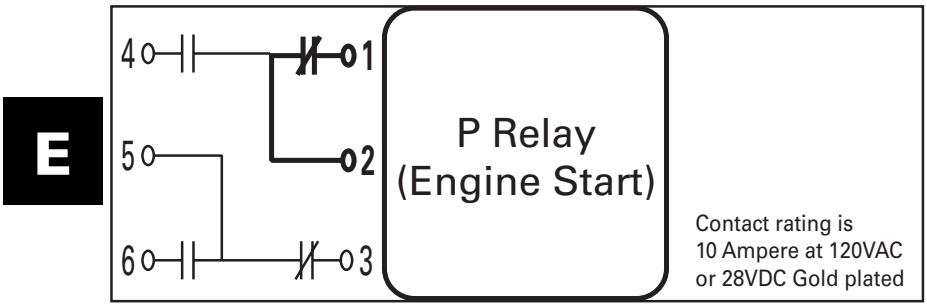
HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Connecting Engine Start may cause Generator to start. Before connecting, turn Generator OFF.

Engine Control Connections (E contacts)

Connections for Engine Control are located on the upper left side of the unit (see figure 1). The P relay provides this output. This contact is controlled by the P timer. To change response time to Normal power outage (see page 18 and 20).



The above diagram represents a de-energized P relay (utility shown de-energized). The majority of generator manufacturers require a contact closure to start Engine. Use terminals #1 and #2.

Note 1: Bypass Isolation Transfer Switches have an auxiliary Engine Start feature. This provides an Engine Start even if the ATS and controls are isolated (*THIS IS A STANDARD FEATURE EXCLUSIVELY ON ZENITH BYPASS PRODUCTS*). The Customer connections on these products are located on the Power Panel, upper right-hand corner. Please refer to the Power Panel instruction manual for complete details.

Note 2: Products equipped with Engine control options such as S1, S2 or P2 provide customer connections on an auxiliary terminal block located on the MX200 DIN rail or auxiliary control panel. Please refer to corresponding option drawing.

Installation - Optional Accessories

⚠ DANGER

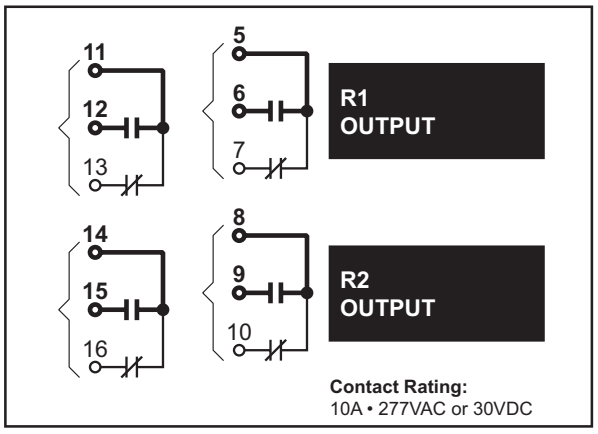
HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Generally the input and output options are located below the P relay on the same DIN rail (see figure 1). In some cases it may be necessary to mount additional accessories on an auxiliary panel.

Output Option Connections

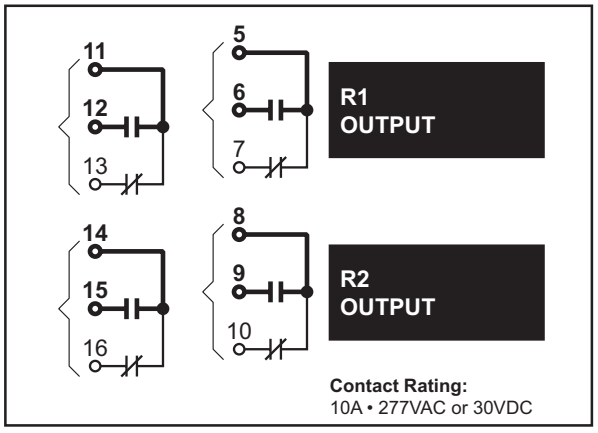
A1



Auxiliary contact(s) that operate(s) based on Normal source availability. Contacts located on R1 and/or R2. Refer to labeling.

Example: Terminal numbers 11 and 12 are closed when Normal source is acceptable (11 and 13 are open). When the Normal source is unacceptable, the opposite is true. Diagrams are shown with Normal unavailable.

A1E



Auxiliary contact(s) that operate(s) based on Emergency source availability. Contacts located on R1 and/or R2. Refer to labeling.

Example: Terminal numbers 11 and 12 are closed when Emergency source is acceptable (11 and 13 are open). When the Emergency source is unacceptable, the opposite is true. Diagrams are shown with Emergency unavailable.

Installation - Optional Accessories *(cont'd)*

⚠ DANGER

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

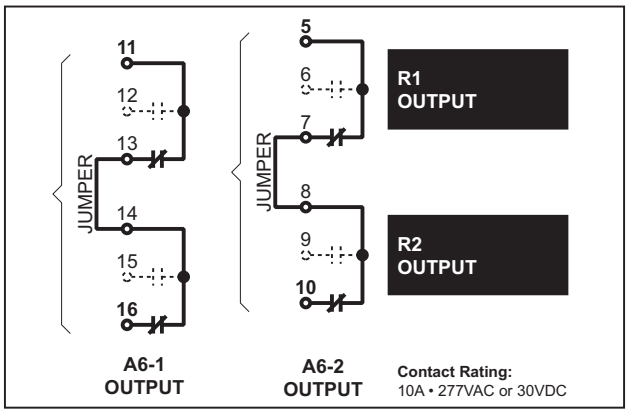
Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Output Option Connections *(cont'd)*

A3/A4

These connections are located on the Power Panel. Exact location depends upon which model is used. Refer to the Power Panel instruction manual for details. In all cases the A4 contact closes when the Transfer Switch is in the Normal position and the A3 contact closes when the Transfer Switch is in the Emergency position.

A6



Auxiliary contact(s) that open prior to transfer in either direction.

Example: Terminals 11 to 16 will open five* seconds prior to transfer in either direction and close instantaneously after transfer.

* Pre-signal time is adjustable via T3/W3 timers (see page 11, 19 and 20)

For complete sequence of operation, see page 19

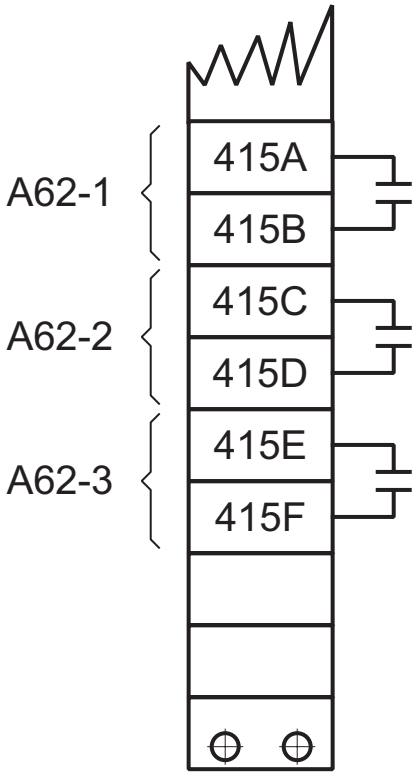
⚠ DANGER

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Output Option Connections *(cont'd)*

A62



Contact Ratings:
5A 250 VAC

Auxiliary contact(s) that open prior* to transfer in either direction and close in sequence** after transfer.

All A62 contacts will open five* seconds prior to transfer in either direction. Contacts close after transfer when their corresponding timers have timed out.

- A62-1 contact sequence timer is T62-1
- A62-2 contact sequence timer is T62-2
- A62-3 contact sequence timer is T62-3

Example: When all three sequence timers are set for 5 seconds:

- A62-1 closes 5 seconds after transfer and starts T62-2 timer
- A62-2 will close 10 seconds after transfer and then start the T62-3 timer
- A62-3 will then close 15 seconds after transfer and so on.

* pre-signal time is adjustable via T3/W3 timers (see page 11, 19 and 20)

** sequence timers are adjustable and located on the auxiliary panel

Installation - Optional Accessories *(cont'd)*

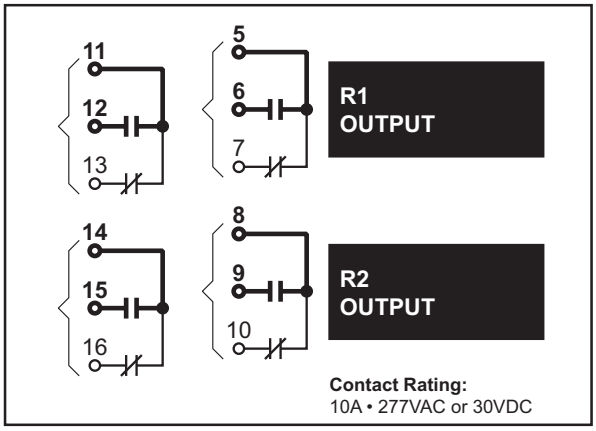
⚠ DANGER

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Output Option Connections *(cont'd)*

T3/W3



Auxiliary contacts that close five* seconds prior to transfer, and open instantaneously after transfer. Contacts located on R1 and/or R2. Refer to labeling.

- T3 is prior to transfer to Normal.
- W3 is prior to transfer to Emergency.
- T3/W3 is canceled when transfer is due to source outage.

*pre-signal time is adjustable (see page 11, 19 and 20)

Installation - Optional Accessories *(cont'd)*

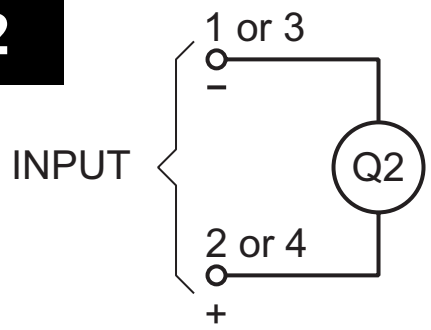
⚠ DANGER

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Input Options Connections

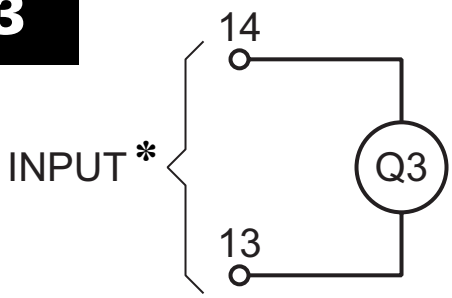
Q2



Remote Peak Shave or Area Protection Circuit
Energize Q2 input to simulate a Normal line failure causing the Generator to start and transfer the load to Emergency. Should Emergency fail during this operation, the Transfer Switch will retransfer back to Normal.

Q2 Input Modules:
K-1267, 120VAC INPUT (*Standard*)
K-1266, 24V (AC or DC) or 12VDC INPUT (*Optional*)

Q3

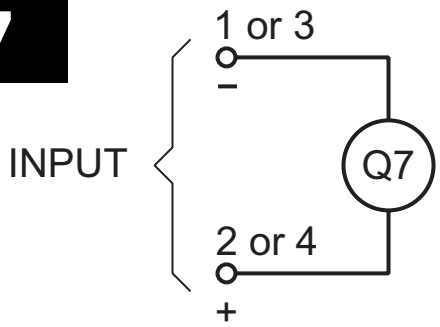


Remote Inhibit Transfer to Emergency Circuit
Voltage applied to Q3 input will allow transfer to Emergency. Conversely, no input on Q3 will inhibit transfer to Emergency.

* To enable Q3 option, engage Q3 jumper.

Q3 Relay:
K-1204, 120VAC *(Standard)*
K-1232, 24VAC; K-1242, 24VDC *(Optional)*

Q7



Remote Inhibit Transfer to Normal Circuit
Energize Q7 input to prevent transfer to Normal.

Q7 Input Modules:
K-1267, 120VAC INPUT (*Standard*)
K-1266, 24V (AC or DC) or 12VDC INPUT (*Optional*)

Installation - Optional Accessories *(cont'd)*

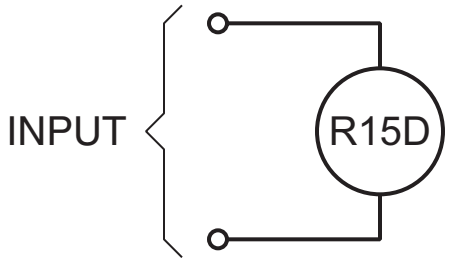
⚠ DANGER

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Input Options Connections *(cont'd)*

R15/R15D



Load Shed
Input, that when energized, causes the unit to transfer out of the Emergency position. The customer can use this to prevent generator overload.

On a ***Standard*** transfer switch, the R15 will transfer the unit to a dead Normal.

On a ***Delay*** transfer switch, the R15D will transfer the unit to a neutral (open) position. (Unit will transfer to Normal if acceptable)

Q3 is used to keep the unit from transferring back to Emergency.

R15/R15D Relay:
K-1204, 120VAC *(Standard)*
K-1232, 24VAC; K-1242, 24VDC *(Optional)*

Communication Connections

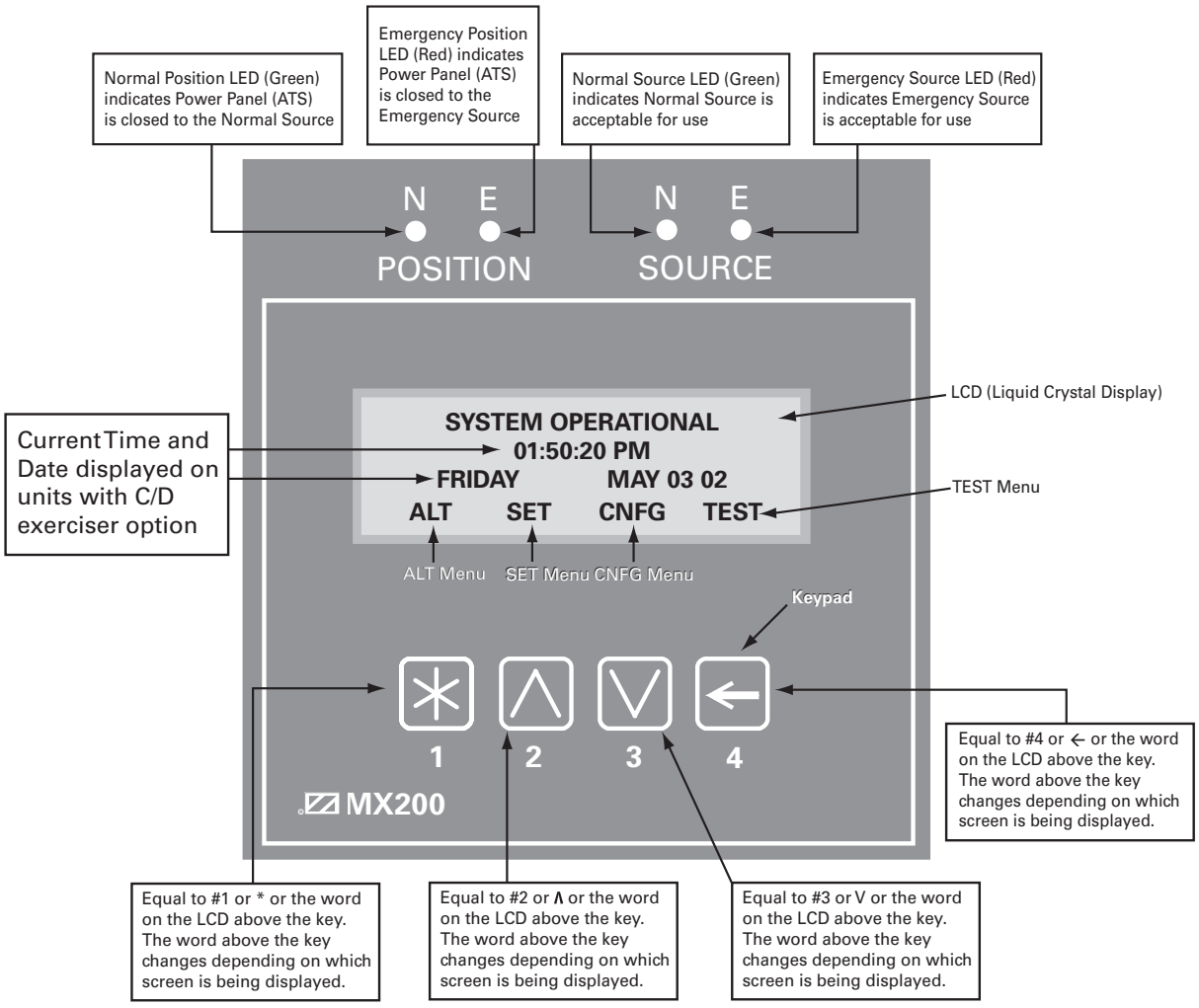
ZNET200

Network card allows communication of ATS position, available source, timers running, etc. to a remote annunciator panel, PC or PLC via one pair of twisted wires. Connections located below P relay. Refer to labeling. Network cable to be Belden 8471, 16AWG (unshielded two conductor twisted pair, not included).

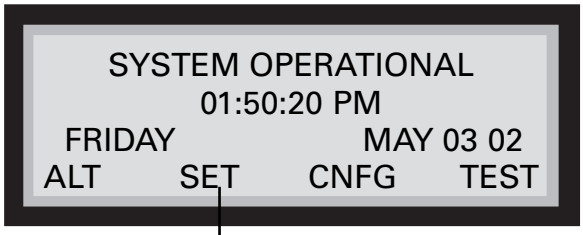
Programmable Options

These options are accessible through the LCD and keypad (see figure below). To become familiar with the options loaded into a particular unit, scrolling through the SET and CNFG menu will show the descriptions of the options (see page 11 and 12). These menus are the very same menus that are used to access the setting and/or configuration of these options. The SET (setting) menu is primarily used to show or change, time and voltage settings. The CNFG menu is primarily used to turn an option on or off. When scrolling through these menus, no changes can be made without entry of the access code. The factory set six-digit access code is located on a white label on the back of the unit (see figure 1).

The MX200 has many logic options. Each controller is downloaded with options at the time of manufacture. The collection of options that any one controller has is specified at the time of order placement. The following pages include all the options that can reside in the controller. Not all units include all options.



User Settings - SET Menu



- * SYSTEM CLOCK (pg. 14)
- * EXERCISER EVENTS (pg. 15)
- N PICKUP VOLTAGE (pg. 22)
- N DROPOUT VOLTAGE (pg. 22)
- N PICKUP FREQ (pg. 22)
- E PICKUP VOLTAGE (pg. 23)
- E DROPOUT VOLTAGE (pg. 23)
- E PICKUP FREQ (pg. 23)
- ENG START DELAY (pg. 18)
- * DELAY TO EMERG PRE SIGNAL (pgs. 19-20)
- * EMERG PRE SIGNAL (pgs. 19-20)
- * DELAY TO OPEN NORMAL (pgs. 18 and 20)
- DELAY TO EMERG (pgs. 18 and 20)
- DELAY TO NORMAL (pgs. 18 and 20)
- * DELAY TO NORMAL PRE SIGNAL
- * NORMAL PRE SIGNAL (pgs. 19-20)
- * DELAY TO EMERG OPEN (pgs. 18-20)
- ENG STOP DELAY (pgs. 18 and 20)
- CALIBRATE NORMAL
- CALIBRATE EMERGENCY

Change adjustable values through keypad via SET menu.

Key stroke (SET ^ 2) (SELECT ^ v 2 3) scroll to accessory description to be changed, then (SET ← 4).

Enter six-digit access code (******) ♦

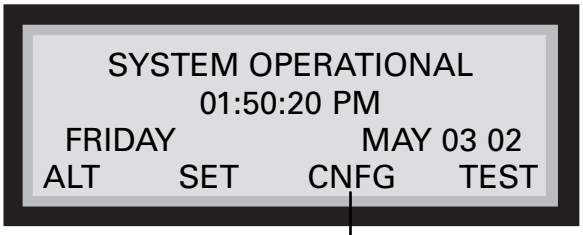
(SET ← 4) (SELECT ^ v 2 3) scroll to choose New Value

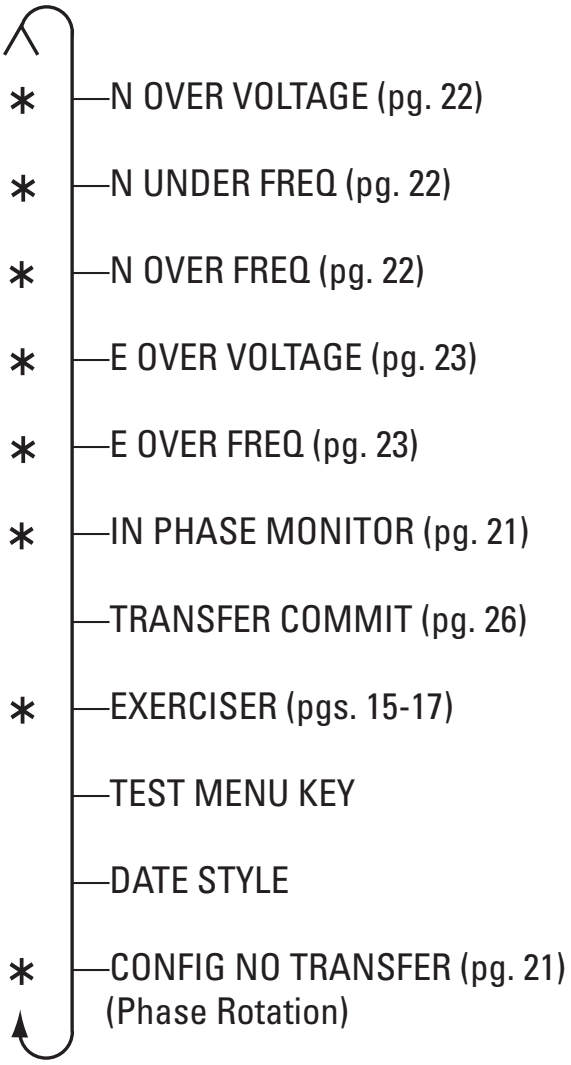
(STORE ← 4) this will be repeated for each digit to be set then (BACK * 1) to get out of SET screens and save your changes.

♦ The factory assigned six-digit access code is located on the white label on the back of the controller (see figure 1).

* optional

User Settings - CNFG Menu





Turn options ON or OFF via keypad through the CNFG menu.

Key stroke (CNFG ∨ 3) (SELECT ∧ 2 ∨ 3) scroll to accessory description then (CNFG ← 4)

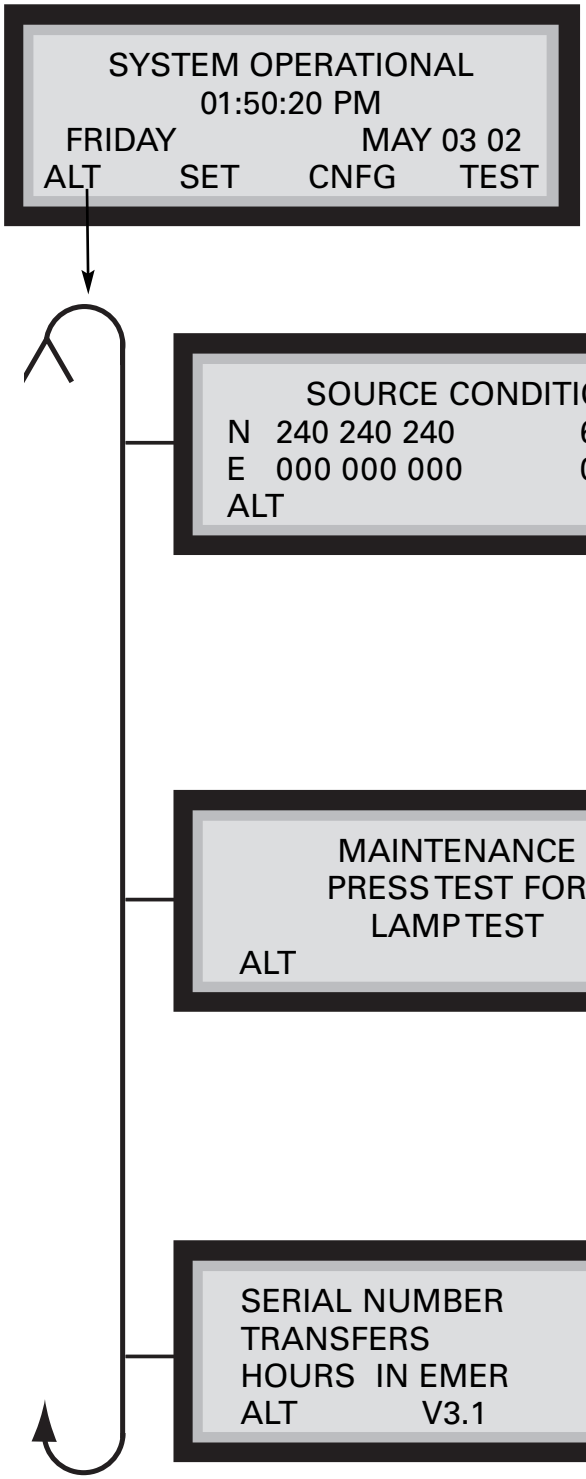
enter six-digit access code (******)♦

(CNFG ← 4) (∨ 3) scroll to ON or OFF

(STORE ← 4) (BACK * 1) to get out of CNFG screen and save changes.

♦ The factory assigned six-digit access code is located on the white label on the back of the controller (see figure 1).

User Settings - ALT Menu



This screen displays line to line voltage values of both sources (A to B, B to C and A to C). Frequency of both sources is also displayed. Display will remain once selected, until transfer occurs. This is an alternate main screen.

This screen provides a lamp test. Pressing TEST 4 key will test LEDs above screen. This display will revert back to SYSTEM OPERATIONAL after 5 seconds.

This screen provides:

SERIAL NUMBER of the transfer switch unique to each switch.
TRANSFERS is a count of how many times the unit has transferred to Emergency (Total).
HOURS IN EMER is a running total of hours the unit has provided Emergency to the load.
V# is the software version number.

How to Set the System Clock

Set **SYSTEM CLOCK**, time and date:

- Only controllers with the Plant exerciser (C/D) option will show a system clock.
- When the controller does not have this option, the second and third line of the display will be blank during **SYSTEM OPERATIONAL** screen.
- When the clock is present but not set, the display will show **SET SYSTEM CLOCK** on the second line of the **SYSTEM OPERATIONAL** screen.
- The **SYSTEM OPERATIONAL** screen will show time (hours, minutes and seconds) on the second line if the system clock has been set. (Date on third line)

Set the system clock via the SET menu: (Start from **SYSTEM OPERATIONAL** screen)

* 1. Remove battery protective white plastic strip near P relay (see figure 1)
2. Press **SET**
3. Scroll to **SET SYSTEM CLOCK** using the up and down keys (SELECT)
4. Press **SET**
5. **ENTER ACCESS CODE** located on the white label on the back of the controller (see figure 1)
6. Press **SET**
7. Use the up and down keys to change the hour value (AM or PM is also selected)
8. Press **STORE** (this will enter this value and move cursor to minutes)
9. Use the up and down keys to change the minutes
10. Press **STORE** (this will enter this value and move cursor to month)
11. Use the up and down keys to change the month
12. Press **STORE** (this will enter this value and move cursor to date)
13. Use the up and down keys to change the date
14. Press **STORE** (this will enter this value and move cursor to year)
15. Use the up and down keys to change year
16. Press **STORE** (this will enter this value and complete the clock setting)
17. To edit settings, press **SET** and repeat steps 6 - 16
18. If the setting is satisfactory, press BACK (unit then returns to the **SYSTEM OPERATIONAL** screen)

* *Replacement battery Part # K-4100*
Battery will last 5 years and provides power to retain clock function only
(Controller functions without battery)

How to Set the Plant Exerciser C/D

- Units equipped with this option will display the time of day on second line of **SYSTEM OPERATIONAL** screen (if time is correct, go to step one; if not, see page 14 "How to Set the System Clock").
- When the second line displays **SET SYSTEM CLOCK** the unit is equipped with the exerciser option, but the **SYSTEM CLOCK** has not been set. **SYSTEM CLOCK** must be set before proceeding (see page 14 "How to Set the System Clock").
- When a unit is not equipped with this option, the second and third line of the **SYSTEM OPERATIONAL** screen will be blank (Plant Exerciser option is not installed).

Verify the Exerciser is on with the following:

1. Beginning from the **SYSTEM OPERATIONAL** screen, press **CNFG**
2. Using up and down keys, scroll to **CONFIG EXERCISER** screen
3. The lower right-hand corner (above **CNFG**) will show on or off
4. If **on**: press **BACK** and skip to step 12
5. If **off**: continue
6. Press **CNFG**
7. Enter **ACCESS CODE** located on white label on the back of the controller (see figure 1)
8. Press **CNFG**
9. Select "**on**" using up and down keys
10. Press **STORE**
11. Press **BACK** to return the **SYSTEM OPERATIONAL** screen.

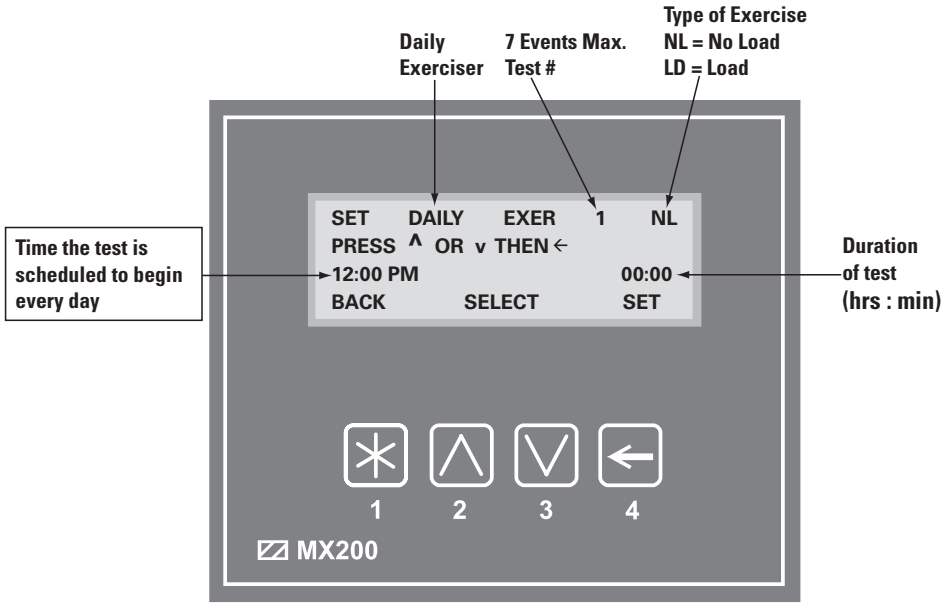
Set the **PLANT EXERCISER** via the **SET** menu after verifying the unit is equipped with this option and it is turned on as per above:

12. Beginning from the **SYSTEM OPERATIONAL** screen, press **SET**
13. Using up and down keys, scroll to **SET PLANT EXERCISER** screen (if this screen cannot be found begin at the top of the page)
14. Press **SET**
15. Enter **ACCESS CODE** located on white label on the back of the controller (see figure 1)
16. Press **SET**
17. The **SET 1WEEK EXER** screen is now displayed (refer to page 16 and 17 to verify type of exerciser installed; 1WEEK, 2WEEK, DAILY OR CLNDR)
18. Press **SET** again
19. Cursor is indicated as a line under character to be changed, move cursor via **STORE** key
20. Change values with up and down keys, press **STORE** after each entry (test duration is hours and minutes)
21. Press **STORE** when complete, until **SAVING RECORD** is displayed
22. Press **BACK** twice when done to return to the **SYSTEM OPERATIONAL** screen.

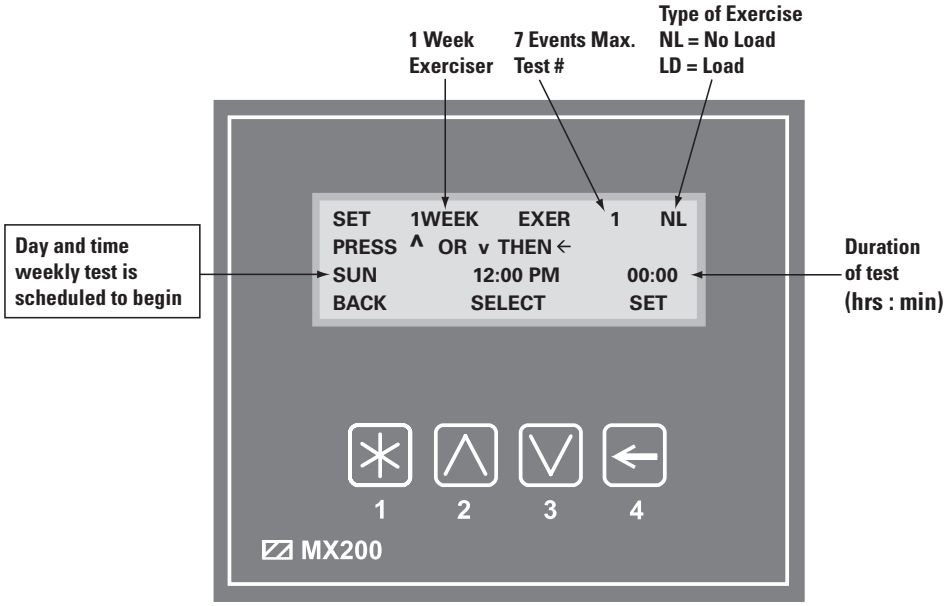
Exerciser Types

Units equipped with the Exerciser Option require that the System Clock be set first. (see page 14)

Daily Exerciser

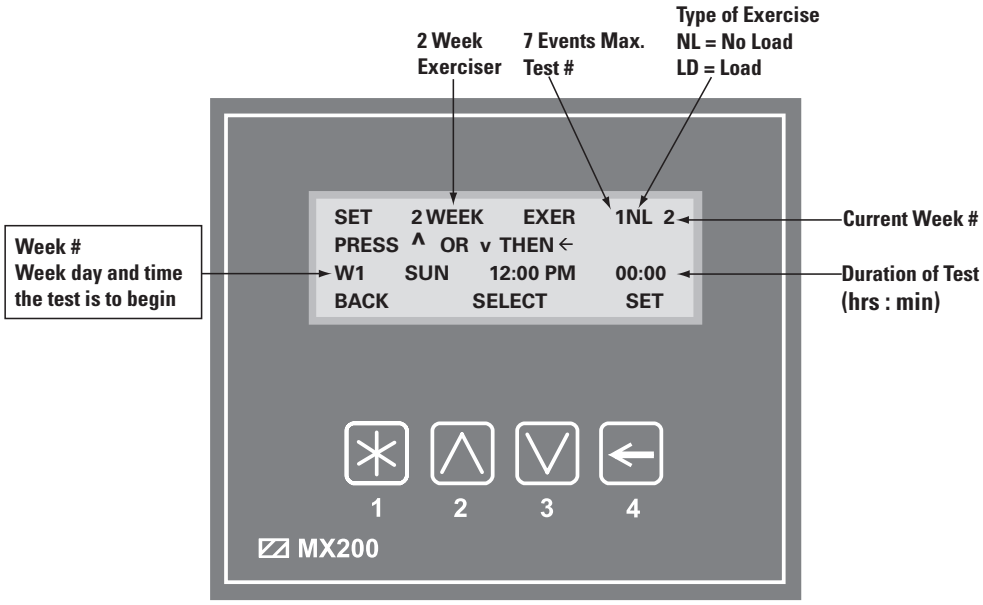


1 Week Exerciser

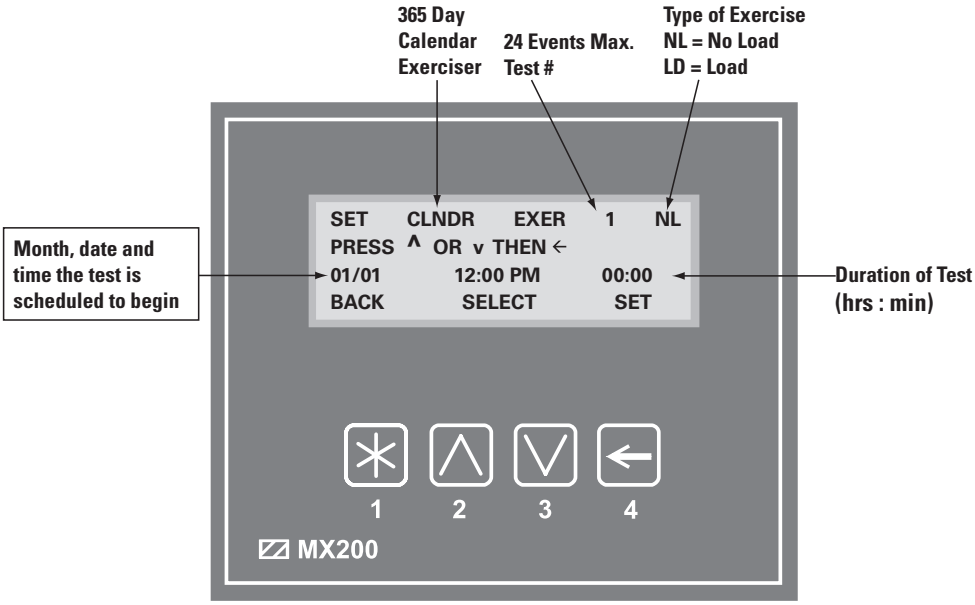


Exerciser Types *(cont'd)*

2 Week Exerciser



365 Day Calendar Exerciser



Timers

P (Engine Start Timer)

adjust via SET menu *(see page 11)*

Factory default 3 seconds

- The purpose of this timer is to ensure that the transfer switch does not start the engine when the Normal power outage is very short.
- The P time range is 0 to 10 seconds in 1/10 of a second increments.
- Timer begins when the Normal fails to meet adjusted parameters.
- When the time setting has lapsed, P relay contacts will operate to start engine (DPDT).

W (Transfer to Emergency Timer)

adjust via SET menu *(see page 11)*

Factory default 1 second

- The purpose of this timer is to ensure the Generator is stable before transfer.
- The W time range is 0 to 5 minutes in 1 second increments.
- Timer begins once the Generator output satisfies adjusted parameters.
- When time setting has lapsed, transfer to Generator will be initiated.

T (Transfer to Normal Timer)

adjust via SET menu *(see page 11)*

Factory default 30 minutes

- The purpose of this timer is to verify that the Normal source has consistently met the sensor parameters for a minimum duration.
- The T time range is 0 to 60 minutes in 1 second increments.
- The T timer begins when Normal satisfies sensor parameters.
- When the timer setting has lapsed, retransfer back to Normal will be initiated. (Timer bypassed upon Emergency failure)

U (Engine Cool Down Timer)

adjust via SET menu *(see page 11)*

Factory default 5 minutes

- The purpose of this timer is to run the Generator unloaded prior to stop.
- The time range is 0 to 60 minutes in 1 second increments.
- The timer begins once the transfer switch has transferred to Normal.
- When the timer setting has lapsed, the P relay will operate to stop engine.

DT/DW (Open Delay Timers)

adjust via SET menu *(see page 11)*

Factory default 5 seconds

- Both DT and DW are center position timers for Delay style ATS Power Panels.
- The purpose of these timers is to control the center off position of delay power panels to allow the back EMF of the load to decay before re-energizing the load.
- These timers have a range of 0 to 10 minutes in increments of one second.
- DT controls how long the ATS stays open when transferring from Emergency to Normal.
- DW controls how long the ATS stays open when transferring from Normal to Emergency.

T3/W3, A6 and A62 (Pre-signal Timers)

adjust via SET menu *(see page 11)*
output connection *(see page 5-7)*

Factory default 20 seconds

* ■ Both T3 and W3 are pre-signal timers.

- The purpose of these timers is to provide an output prior to transfer.
- These outputs are provided to coordinate building systems preparedness for the impending interruption that will occur when transferring from one live source to another.
- These timers have a range of 0 to 60 seconds in increments of one second.
- Output is relay contacts (DPDT).
- T3 takes place prior to transfer to Normal and W3 takes place prior to transfer to Emergency.
- These timers are bypassed when transferring from a dead source (power outage).
- Outputs from these timers are commonly used in conjunction with elevators and UPS systems.

Example: A five second T3 timer setting will give a relay output of a 5 second duration, during the last 5 seconds prior to transferring to the Normal source. Once the ATS is in the Normal position, the T3 signal is terminated.

Note: The operation of T3 time is added to the T time (T+T3 = transfer delay to Normal). Both T and T3 are canceled if the generator fails during transfer delay. The operation of W3 time is added to the W time (W+W3 = transfer delay to Emergency). W3 is canceled during Normal power loss transfer to Emergency. W3 is only active during testing. W timer is always used when transferring to Emergency.

* ■ **A6** provides contact pre-signal in both directions and is normally closed.

- **A6** utilizes T3/W3 timers to provide pre-signal time setting. This option is configured without the dead source bypassing feature utilized on the standard T3/W3 operating scheme.

* ■ **A62** option utilizes independent external timers to sequence contact outputs after transfer. These contacts are normally closed contacts that open prior to transfer in both directions (pre-signal duration determined by T3/W3 setting) and re-close in sequence after the transfer is complete (determined by the external timers designated T61, T62, T63…).

- **A62** option is commonly used to shed multiple motor loads prior to transfer and sequentially add these loads after transfer is complete. This option is configured without the bypassing feature utilized on the standard T3/W3 operating scheme.

* optional

Timer Designations

Timer Designations as they appear in the SET menu

ATS Type	P	W	W3 (A6)	DW	T	T3 (A6)	DT	U
Standard ATS	ENG. START DELAY	TO EMERGENCY	→	→	TO NORMAL	→	→	ENG. STOP DELAY
Standard ATS with pre-signal option; T3/W3, A6 or A62	ENG. START DELAY	TO PRESIGNAL	EMERGENCY PRESIGNAL	→	TO N-PRE	NORMAL PRESIGNAL	→	ENG. STOP DELAY
Delay ATS	ENG. START DELAY	TO OPEN N	→	TO EMERGENCY	TO OPEN E	→	TO NORMAL	ENG. STOP DELAY
Delay ATS with pre-signal option; T3/W3, A6 or A62	ENG. START DELAY	TO E-PRE	TO OPEN N	TO EMERGENCY	TO N-PRE	TO OPEN E	TO NORMAL	ENG. STOP DELAY

NORMAL FAILS → TRANSFER TO EMERGENCY → NORMAL RETURNS → TRANSFER TO NORMAL → ENGINE COOLDOWN →

* R50 (In Phase Monitor)

can be turned on or off via CNFG menu *(see page 12)*

Factory default off

- This feature restricts ***live source to live source transfers*** to occur only when sources are within 7 electrical degrees or less of each other (***Live source to live source transfers*** usually occur during transfer back to Normal or testing).
- R50 does not change the operation of the ATS in a power failure mode.
- R50 operation occurs after all timer functions have lapsed.
- Once the transfer timers have lapsed, the CHECKING FOR SOURCE SYNCHRONISM will be displayed.
- Transfer will then take place once the sources come into sync.
- In the event that the sources do not come within 7 electrical degrees of each other, within 60 seconds the unit will display the message: SYNCH CHECKING PRESS ← TO BYPASS.
- If ← is pressed at this point, the following will be displayed: WARNING PRESSING ← MAY CAUSE DAMAGE TO LOAD DUE TO OUT OF PHASE TRANSFER. Pressing ← again will then actually bypass the R50.
- Since this is a passive device the amount of time that it takes to sync is dependent on the frequency difference between the two sources.
- The Normal source is usually a utility and the frequency is not within the control of the consumer. The Emergency source needs to be adjusted to create an adequate difference in order for the transfer to happen in a timely fashion.

Note: **For optimum performance the generator should be adjusted maximum 2 Hertz above or below the utility frequency, minimum .1 Hertz different (58 to 59.9) or (60.1 to 62) Hertz** *(adjustment of generator to 60.0 hz will cause lengthy transfer delay).*

* R16 (Phase Sequencing/Rotation)

can be turned on or off via CNFG menu *(see page 12)*

Factory default on

This feature prevents ***live source to live source transfers*** from occurring between dissimilar phase sequences. This condition is primarily caused by an installation error. Connections from the Normal and Emergency need to be verified, compared and corrected to remedy the inconsistent phase rotation between the two sources.

WARNING: Turning off this option can cause severe damage to loads.

* optional

Normal Sensors

Pick Up Voltage

Factory Default: 90%

This adjustment determines the minimum acceptable voltage required to transfer to Normal. Adjust via the SET menu. Range is 85 to 100% in 1% increments *(see page 11)*. Once satisfied, the T timer will begin timing to transfer to Normal.

Pick Up Frequency

Factory Default: 95%

This adjustment determines the minimum acceptable frequency required to transfer to Normal. Adjust via the SET menu. Range is 90 to 100% in 1% increments *(see page 11)*. Once satisfied, the T timer will begin timing to transfer to Normal.

Drop Out Voltage

Factory Default: 80%

This adjustment determines the low voltage threshold. Adjust via the SET menu. Range is 75 to 98% in 1% increments *(see page 11)*. Drop out must be a minimum of 2% below pickup setting. Once voltage falls below threshold, P timer begins timing to signal generator to start.

* *Over Voltage (R1)*

This feature, when on, provides a maximum voltage threshold at 110% of nominal system voltage. Turn on or off via CNFG menu *(see page 12)*. Once threshold is exceeded, P timer begins timing to signal generator to start.

* *Under Frequency (J1N)*

This feature, when on, provides a minimum frequency threshold at 2Hz below pick up frequency. Turn on or off via the CNFG menu *(see page 12)*. Once the frequency drops below this threshold for more than 5 seconds, the P timer will begin timing to signal the generator to start.

* *Over Frequency (J2N)*

This feature, when on, provides a maximum frequency threshold of 2 Hz above nominal frequency. Turn on or off via CNFG menu *(see page 12)*. Once frequency exceeds threshold, P timer begins timing to signal generator to start.

* optional

Emergency Sensors

Pick Up Voltage

Factory Default: 90%

This adjustment determines the minimum acceptable voltage. Adjust via the SET menu. Range is 85 to 100% in 1% increments *(see page 11)*. Once satisfied, the W timer will begin timing to transfer to Emergency.

Pick Up Frequency

Factory Default: 95%

This adjustment determines the minimum acceptable frequency. Adjust via the SET menu. Range is 90 to 100% in 1% increments *(see page 11)*. Once satisfied, the W timer will begin timing to transfer to Emergency.

Drop Out Voltage

Factory Default: 80%

This adjustment determines the low voltage threshold. Adjust via the SET menu. Range is 75 to 98% in 1% increments *(see page 11)*. Drop out must be a minimum of 2% below pickup setting. Once the voltage falls below this threshold, the T timer will be bypassed to expedite the transfer to Normal.

* *Over Voltage (R8)*

This feature, when on, provides a maximum voltage threshold at 110% of nominal voltage. Turn on or off via the CNFG menu *(see page 12)*. Once this threshold is exceeded, the T timer will be bypassed to expedite the transfer to Normal.

* *Over Frequency (J2E)*

This feature, when on, provides a maximum frequency threshold of 2Hz above of nominal frequency. Turn on or off via the CNFG menu *(see page 12)*. Once the frequency exceeds this threshold, the T timer will be bypassed to expedite the transfer to Normal.

Under Frequency

This feature provides a minimum frequency threshold at 2Hz below pick up frequency. Once the frequency drops below this threshold, if sustained for more than 5 seconds, the T timer will be bypassed to expedite the transfer to Normal.

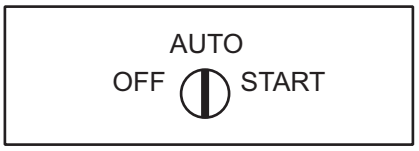
* optional

Optional Pilot Devices

Door Mounted Options

The S options are usually options related to a manually operated switch mounted on the door of the enclosure, which provides access to a feature or function.

S1



Selector Switch

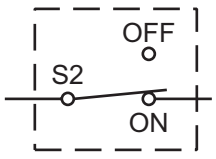
Provides start-stop control of the engine from the transfer switch panel.

AUTO Position provides Normal operation of the transfer switch and the engine.

OFF Position disconnects the transfer switch start contact from the engine. Then engine can only be started manually in this position.

START Position closes the circuit to the engine, causing it to start and run until the switch is moved from the start position.

S2

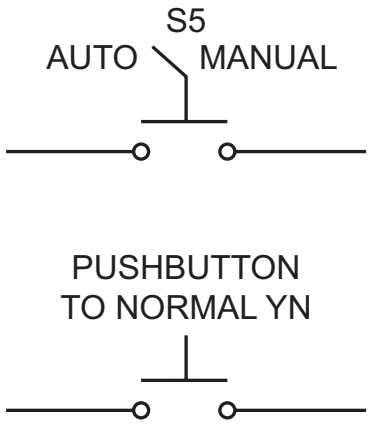


Engine Disconnect Switch

Interrupts the engine start circuit when in the “OFF” position.

Optional Pilot Devices *(cont'd)*

S5

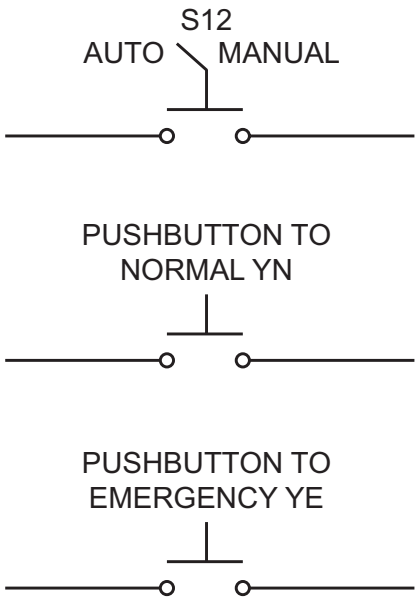


Auto/Manual Retransfer Selector Switch

In **AUTO**, retransfer to Normal is Automatic after T timer times out. T time delay is bypassed if Emergency fails.

In **MANUAL**, retransfer to Normal occurs upon manual depression of YN or if Emergency fails.

S12



Auto/Manual Selector Switch

When the S12 is in the AUTO position, the Automatic Transfer Switch functions automatically as specified with the switch drawing.

When the S12 Switch is in the MANUAL position, the Automatic Transfer Switch will transfer either direction only by depression of Normal (YN) or Emergency (YE) Pushbutton.

NOTE:	When in MANUAL, the switch maintains position, even if the selected power fails.

S13 Transfer Commit

(this feature is standard)

can be turned on or off via CNFG menu *(see page 12)*

When the Transfer commit is set to the Y (Yes) position

- The ATS is committed to transfer to the Emergency position once the W timer has begun timing, even if Normal returns before the transfer to Emergency occurs.
- This is to ensure that the transfer takes place, because one outage is often followed by another.

When the transfer commit is set to N (No) position (factory default)

- The ATS is not committed to transfer unless the outage duration is longer than the timers that precede the transfer to the Emergency position.
- This assumes that the outage will be an isolated event.

S14 Test Switch, Three Position, Key Operated (Spring Return to Center)

Holding the Selector Switch in **TEST** will transfer the ATS to Emergency. Releasing the switch (to **AUTO** position) will return the ATS to Normal through the **T** timer function.

Holding the Selector Switch in **YN** Normal position will bypass the **T** timer and immediately transfer the ATS back to Normal. Releasing the Selector Switch allows the Selector Switch to return to **AUTO** position.

Testing

⚠ NOTICE

A periodic test of the transfer switch under load conditions is recommended to insure proper operation. (See National Electric Code articles 700 and 701).

Start generator and verify proper voltage, frequency and phase sequence (match to Normal). Shut down gen set and place in Auto. Complete the visual inspection of the transfer switch, and close the cabinet door.

Initiate the test by pressing the TEST button on the LCD keypad. The controller will then prompt for your access code (as shown on Figure 1). After entering the code, three test options will appear—STD LOAD, FAST LOAD and NO LOAD (See Figure 3).

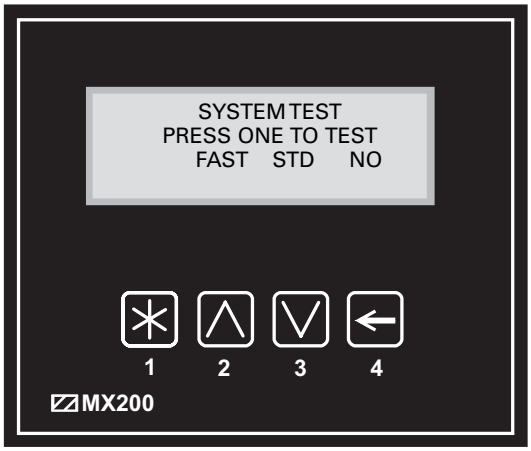


Figure 3

- **STD LOAD** test starts the generator and using the current timer settings, transfers the load to the Emergency source.
- **FAST LOAD** test presets timer values to a maximum 30 seconds during the test. After completion of the test, all timers are reset to their original values. (T3, W3, DT and DW remain)
- **NO LOAD** test starts the generator but does not transfer the load to the Emergency source. Press and hold the desired test option button until the switch transfers to the Emergency source (load test) or until the generator has been run for the desired amount of time (no load test). Releasing the test button before W timer timeout will abort the test (Exception: see transfer commit option, page 26).

When the test is initiated, the controller first starts the P timer. Upon completion of the P time delay, an engine start signal is sent. After Emergency has reached preset levels, the W timer begins its timing cycle. This timer is used to ensure the voltage and frequency of Emergency has stabilized before transfer. If either the voltage or frequency of Emergency fall below preset limits the test will be terminated, and the U timer will time out. If the voltage and frequency remain within preset limits for the duration of the W time delay, the transfer switch will close into the Emergency source.

Deactivating the test switch initiates retransfer to the Normal source. The switch will retransfer after the time delay of the T timer. This timer is used to ensure that the Normal source is stable before retransfer. Immediately after retransfer, the U timer begins its timing cycle. The U timer is the engine cool down timer which allows the engine generator to run unloaded.

NOTE: Only the P timer is used during the no load test.

Troubleshooting

Before beginning any troubleshooting activity, refer to the information package supplied with the transfer switch and review the description and operation of all accessories supplied. Also refer to the Installation section of this manual.

Engine Does Not START

Annunciation	Possible Cause	Corrective Action
EMERGENCY AVAILABLE LED off	Engine start wires not terminated properly	Check Engine Start Connections
	Generator in "OFF" position	Investigate why Engine Control Switch was turned off

Engine Does Not STOP

Annunciation	Possible Cause	Corrective Action
LCD Display - "Delay to Engine Stop"	**U** timing cycle not complete	Check **U** Timer setting
NORMAL POSITION, and NORMAL and EMERGENCY AVAILABLE LEDs on, but U timer has timed out	Engine start wires not terminated correctly	Check Engine Start Connections
	Generator in "Manual"	Put generator in "Auto"

ATS Will Not Transfer To EMERGENCY

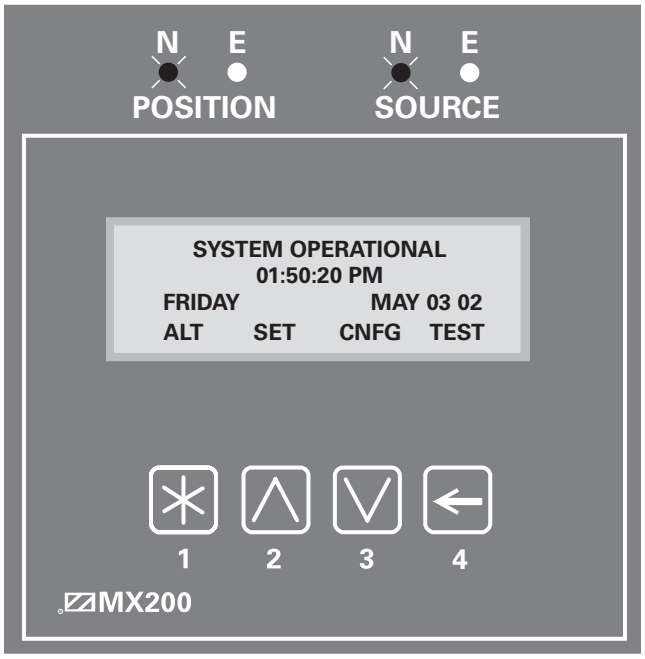
Annunciation	Possible Cause	Corrective Action
EMERGENCY AVAILABLE LED off	Emergency voltage or frequency not within acceptable parameters	Check Engine Start Connections, Generator Breaker, Generator output, and Engine Control Switch
None	Power supply connector unplugged	Plug in connector
LCD Display - "Mechanical Failure"	Limit switch or RT box connector unplugged	Plug in connector
LCD Display - "Delay to Emergency"	**W** timing cycle not complete	Check **W** Timer setting

ATS Will Not Transfer To NORMAL

Annunciation	Possible Cause	Corrective Action
NORMAL AVAILABLE LED off	Normal voltage or frequency not within acceptable parameters	Check utility and utility breakers
None	Power supply connector unplugged	Plug in connector
LCD Display - "Mechanical Failure"	Limit switch or RT box connector unplugged	Plug in connector
LCD Display - "Delay to Normal"	**T** timing cycle not complete	Check **T** Timer setting

Power Failure Sequence of Operation

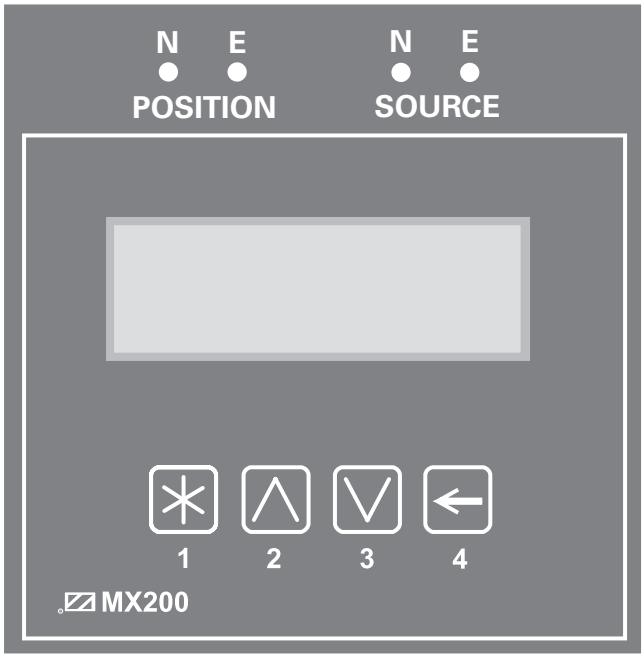
LEDs Green - Green



Normal Source Available

ATS Normal Position

LEDs OFF

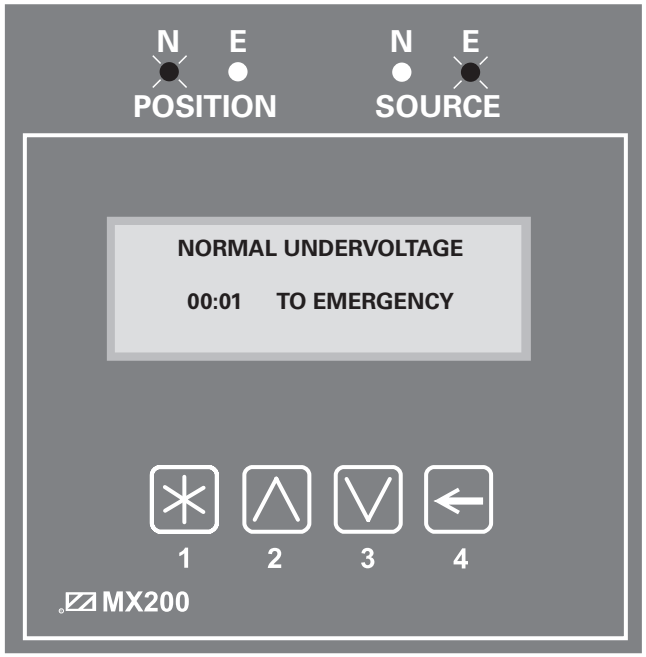


Normal Source Failed

Engine Starts After ENG START DELAY (P) (No Power Available)

Power Failure Sequence of Operation *(cont'd)*

LEDs Green - Red

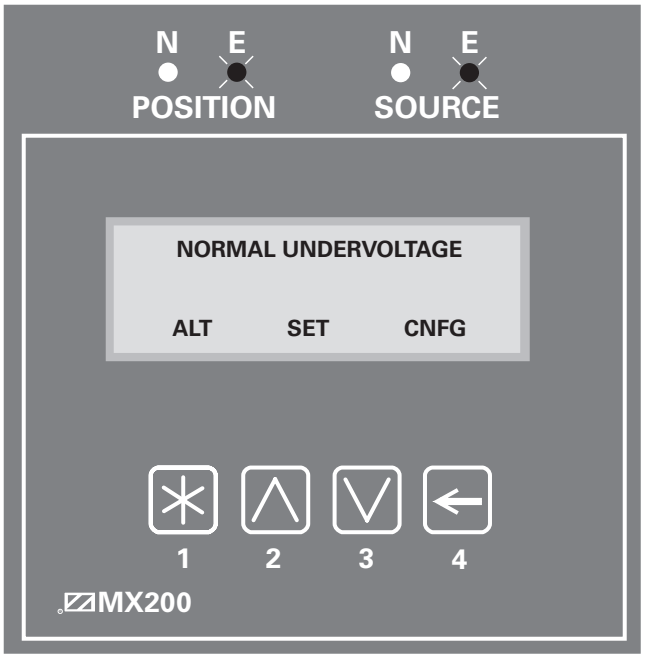


ENG START DELAY Lapsed

Emergency Source Available

Transfer TO EMERGENCY Timing (W)

LEDs Red - Red

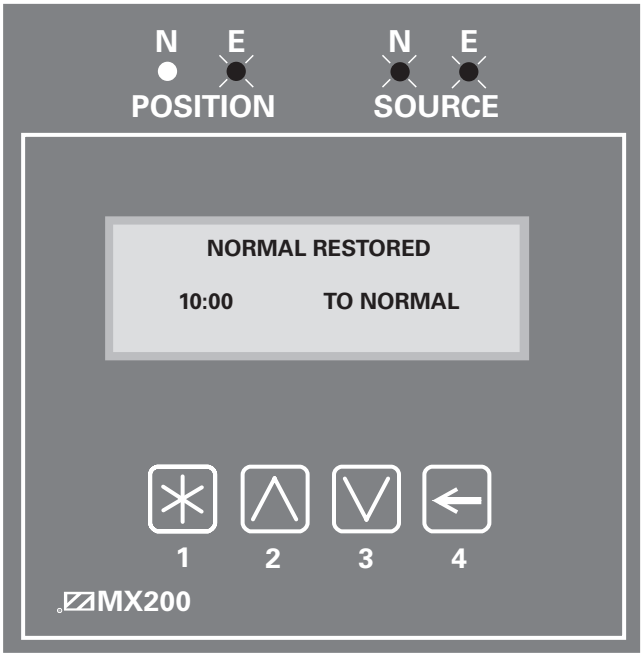


TO EMERGENCY Lapsed (W)

ATS Transferred to Emergency Position

Power Failure Sequence of Operation *(cont'd)*

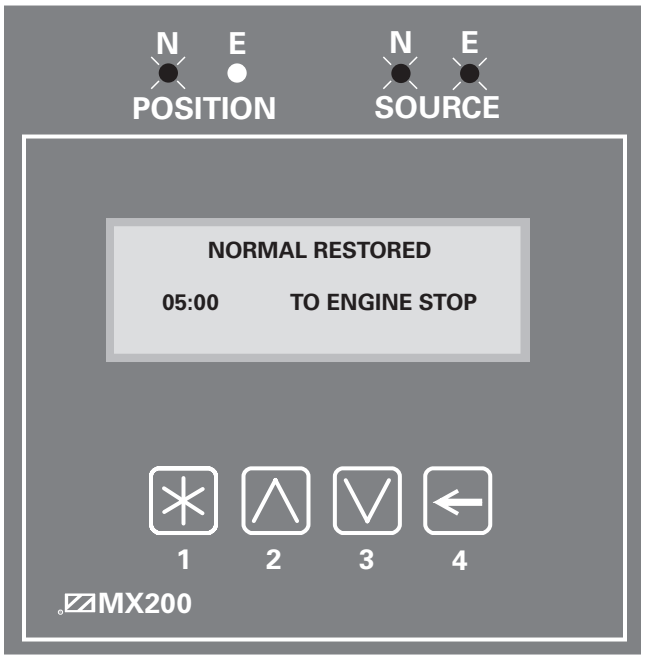
LEDs Red - Green - Red



Normal Source Returned

TO NORMAL Timing (T)

LEDs Green - Green - Red



Transfer TO NORMAL Lapsed (T)

ATS Transferred to Normal Position

Once ENGINE STOP is complete, return to Screen #1

Index of Terms

Term	Definition	Page
A1	Normal Availability output relay contact	4
A1E	Emergency Availability output relay contact	4
A3	Emergency position output contact	5
A4	Normal position output contact	5
A6	Pre-signal contact either direction	5
A62	A6 with sequential pick up after transfer	6
Access Code	Six numeric digit required for program changes	2 (figure 1)
ALT	Alternate Main Screen	13
ATS	Automatic Transfer Switch	
Aux. Panel	Auxiliary Control Panel	
Battery	Clock Battery K-4100	14
CNFG	Menu for configure parameters	12
D Type Switch	Transfer switch with an off position (3 position)	
DS	Disconnect Switch (located on Power Panel)	
DT	Delay Timer from open to Normal (D Type Switch)	18, 20
DW	Delay Timer from open to Emergency (D Type Switch)	18, 20
E	Emergency	
E-Contact	Engine Start output relay contact	3
Emergency	Alternate Power Plant / Engine Generator Set	
Exerciser Clock	Time clock for automatic generator test	15-17
Input	Voltage applied from a remote source	
J1N	Normal Under Frequency Sensor	22
J2E	Emergency Over Frequency Sensor	23
J2N	Normal Over Frequency Sensor	22
Keypad	User interface keys	10
LCD	Liquid Crystal Display	10
LED	Light Emitting Diode	10
MX200	Micro processor based controller	
N	Normal	
Normal	Utility power (preferred source)	
Output	Indication via dry contacts	3-7
P	Delay timer to Engine Start	18, 20
P2	Extended time range P	

Index of Terms

Term	Definition	Page
Pre-Signal	Signal prior to transfer	19, 20
Power Panel	Structure that transfers load between two sources of power	
Q2	Input for Remote Peak Shave/Test	8
Q3	Input to inhibit transfer to Emergency	8
Q7	Input to inhibit transfer to Normal	8
R1	Normal Over Voltage Sensor	22
R8	Emergency Over Voltage Sensor	23
R15 (load shed)	Input to transfer off Emergency to dead Normal	9
R15D (load shed)	Input to transfer off Emergency to open position (D Type Switch)	9
R16	Phase sequence sensor	21
R50	In phase monitor	21
Retransfer	Transfer back to Normal source	
RT box	Relay Transformer Box	2 (figure 1)
S1	Selector; Engine (OFF-AUTO-START)	24
S12	Selector; Automatic or Manual ATS	25
S13	Transfer Commit	26
S14	Selector; Test-Auto-YN	26
S2	Selector; Engine (OFF-ON)	24
S5	Selector; Auto or Manual retransfer	25
SET	Menu for Setting parameters	11
T	Delay timer to transfer to Normal	18, 20
T3	Pre-signal to Normal transfer timer	19, 20
Test	Simulated utility power outage	
Test Switch	Simulates utility power outage	
U	Engine cool down timer	18, 20
UPS	Uninterruptable Power Source	
W	Delay timer to transfer to Emergency	18, 20
W3	Pre-signal to Emergency transfer timer	19, 20
YE	Push button to Emergency	25
YN	Push button to Normal	25
ZNET200	Network communication card	9
ZTS	Zenith Transfer Switch	

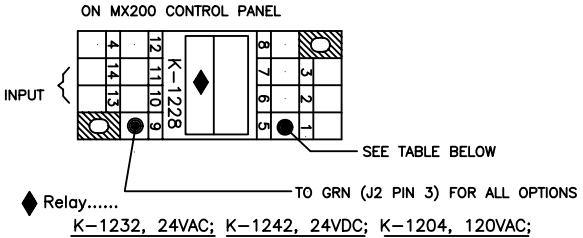


GE Zenith Controls

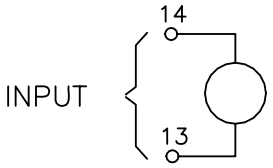
GE Industrial Systems – Power Equipment Business
General Electric Company
830 West 40th Street, Chicago, IL 60609 USA
773 299-6600, Fax: 773 247-7805
www.zenithcontrols.com

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
G	S-7759 REVISE DRW	12/13/01	VZ

INPUT MODULES



♦ Relay.....
K-1232, 24VAC; K-1242, 24VDC; K-1204, 120VAC;
K-1228, Base



OPTIONAL ACCESSORIES

OPTION CODE	MX200 CONTROL PANEL INPUT	CONTACT USED
Q2	J4 PIN 12	NORMALLY\OPEN
Q7	J2 PIN 13	NORMALLY\OPEN
S9	J4 PIN 12	NORMALLY\OPEN
YER	J4 PIN 10	NORMALLY\OPEN
YNR	J4 PIN 9	NORMALLY\OPEN

Q2 – Remote Peak Shave or Area Protection Circuit
Energize Q2 input to simulate a normal line failure causing the Generator to start and transfer the load to Emergency. Should Emergency fail during this operation, the transfer switch will retransfer back to Normal.

Q7 – Remote Inhibit Transfer to Normal Circuit.
Energize Q7 input to prevent transfer to Normal.

S9 – Remote Test Switch Circuit.
Energize S9 input to simulate a load test operation.

*YER – Remote Transfer to Emergency Circuit.
Energize YER input to bypass the time delay and transfer to Emergency.

**YNR – Remote Transfer to Normal Circuit.
Energize YNR input to bypass the time delay and retransfer to Normal.

PROGRAMMING NOTES: IN FIELD PROGRAMMING MENU:

INPUT MODULES: K-1232, 24VAC; K-1242, 24VDC; K-1204, 120VAC;
K-1228, Base

* ENABLE YE BYPASS OPTION.
** ENABLE YN BYPASS OPTION.

INSTRUCTIONS

1. INPUT MODULES ARE AVAILABLE IN 24V (AC OR DC) OR 120V.
2. OBSERVE POLARITY MARKS ON K-1242 INPUT MODULE.
3. MOUNT INPUT MODULES ON DIN RAIL ON MX200 CONTROL PANEL FROM TOP TO BOTTOM IN OPTION CODE ORDER. (EXAMPLE: Q2, S9, YER).
4. PLACE IDENTIFICATION LABEL ON INPUT MODULE AND FILL IN OPTION CODE AS REQUIRED.

GE PROPRIETARY AND CONFIDENTIAL INFORMATION
This document is the property of General Electric ("GE") and contains proprietary information of GE. This document is loaned on the express condition that neither it nor the information contained therein shall be disclosed to others without the express written consent of GE Industrial Systems, and that the information shall be used by the recipient only as approved expressly by GE Industrial Systems. This document shall be returned to GE upon its request. This document may be subject to certain restrictions under U.S. export controls laws and regulations.

THIRD ANGLE PROJECTION

FOR ADDITIONAL INFO REFER TO
APPLIED PRACTICES
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
2 PL. DECIMALS ± .020
3 PL. DECIMALS ± .005
ANGLES ± 1°
FRACTIONS ± 1/64
FINISH

SIGNATURES		DATE
MODEL	GG	12/13/01
DETAIL		
CHECKED		
ENGRG	SK	
MFG		
QUALITY		
ISSUED		

DRAWING FILE: 50r-2001-g-1.dwg
MODEL / ASSEMBLY FILE:
AutoCad Generated
CTQs ⊖ CRITICAL TO QUALITY CHARACTERISTIC

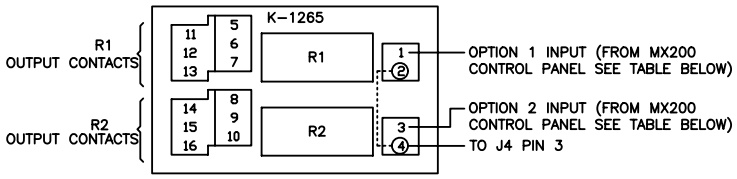
GE Zenith Controls

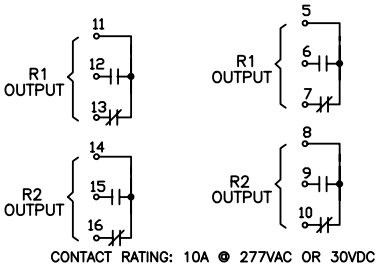
TITLE
MX-200
OPTIONAL ACCESSORIES
FIRST MADE FOR: TRANSFER SWITCHES WITH MX200

SIZE	CAGE CODE	DWG NO
B		50R-2001

SCALE: NA SHEET 1 OF 1

RELAY OUTPUT MODULE





CONTACT RATING: 10A @ 277VAC OR 30VDC

OPTION CODE	RELAY	MX200 CONTROL PANEL OUTPUT
A1	RAI	J4 PIN 6
A1E	RAE	J4 PIN 5
A2	RAI	J4 PIN 6
A5	RI	J2 PIN 6
A34N	RA34N	J4 PIN 4
F	RAE	J4 PIN 5
T3	RT3	J2 PIN 6
W3	RW3	J2 PIN 10

OPTIONAL ACCESSORIES

A1 – Auxiliary Contact,
Operates on Normal Line Failure.

A1E – Auxiliary Contact,
Operates on Emergency Line Failure.

A2 – Auxiliary Contact,
Operates on Normal Line Failure.

** A5 – Auxiliary Contact, (See Note)
opens 0–60 seconds prior to transfer
to Normal, recloses after retransfer.

A34N – Auxiliary Contact,
closed in Neutral Position.

F – Fan Contact,
Operates when generator is running.

* T3 – Elevator Pre–Signal – Normal (See Note)

* W3 – Elevator Pre–Signal – Emergency (See Note)

PROGRAMMING NOTES IN FIELD PROGRAMMING MENU:

* ENABLE T3/W3 & T3/W3 BYPASS OPTION.
** ENABLE T3 & DISABLE T3 BYPASS OPTION.

NOTES/INSTRUCTIONS

1. MOUNT RELAY OUTPUT MODULE ON DIN RAIL ON MX200 CONTROL PANEL FROM TOP TO BOTTOM IN OPTION CODE ORDER. (EXAMPLE: A1, AN, F).
2. PLACE IDENTIFICATION LABEL ON RELAY OUTPUT MODULE AND FILL IN OPTION CODE AS REQUIRED.
3. F CONTACT USES RAE RELAY CONTACT.

Note:
When T3–W3 is used in conjunction with A6–Disable T3/W3 bypass option in field program menu.

LEGEND	REFERENCE	NOTES

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	-	ESTABLISH DWG.		
A	S-6548	08/15/96	BRB	SB
B	S-6873	02/16/98	SG	CK
C	S-6913	04/17/98	EC	CK
D	S-6981	09/04/98	RWB	CK
E	S-7219	09/10/99	SG	CK

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

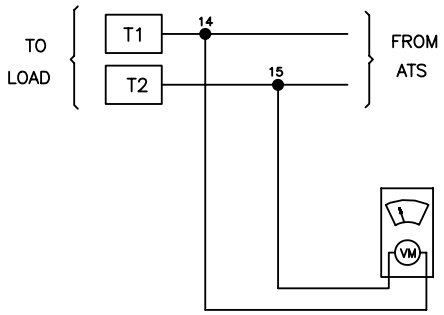
DWG TITLE: OPTIONAL ACCESSORIES FOR MX200 C.P.
JOB/MODEL: TRANSFER SWITCHES WITH MX200

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	-	50R-2002

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
RMC	SB	11/13/95	N/A	1 OF 1	E

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
C	S-7854 REVISED DWG.	09/30/02	GG KK

M3 SINGLE PHASE VOLTMETER



LEGEND

VM.....Voltmeter
(see table for part#)
* Gasket, PS-3464

CAP PLUG..... PS-3643 (QTY. 2)

OPERATION

Voltmeter (VM) indicates phase load voltage.

NOTES:

1. (*) Not supplied on NEMA 1 Enclosures.
2. On Bypass-Isolation transfer switches, wire to Load Bus of bypass switch. Renumber wires 14 & 15 to 14T & 15T respectively.

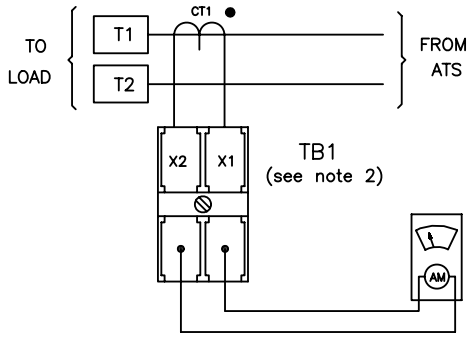
PART # TABLE

SYSTEM VOLTAGE (60HZ)	PT PART #	*VOLTMETER PART #	VOLTMETER SCALE
120	-	PS-4206	0-300
208	-	PS-4206	0-300
220	-	PS-4206	0-300
230	-	PS-4206	0-300
240	-	PS-4206	0-300
380	-	PS-4207	0-600
416	-	PS-4207	0-600
440	-	PS-4207	0-600
480	-	PS-4207	0-600
575	K-3100	PS-4218	0-750
600	K-3100	PS-4218	0-750

PT is only required for 575V & 600V systems (not shown).

* When mounting Voltmeter in on enclosure other than a NEMA 1, add "W" to the end of the part number. A weep hole will be added to voltmeter.

M1 SINGLE PHASE AMMETER



LEGEND

AM..... Ammeter (SEE TABLE FOR PART#)
*** Gasket, PS-3464
** CT1..... Current Transformer (SEE TABLE FOR PART#)
TB1..... 2-Point Shorting Terminal Block - Y620014 (see note 2)

CAP PLUG..... PS-3643 (QTY. 2)

OPERATION

Ammeter (AM) indicates load Amperes.

NOTES:

1. (***) Not supplied on NEMA 1 Enclosures.
2. Mount TB1 on or adjacent to power panel.
3. (**) ⚠ DANGER: - HAZARDOUS CONDITIONS. CT SECONDARY CIRCUITS ARE CAPABLE OF GENERATING LETHAL VOLTAGES AND CURRENTS WHEN OPEN CIRCUITED WITH THEIR PRIMARY CIRCUIT ENERGIZED. Standard safety precautions should be followed while performing any installation or service on the device (for example, shorting the CT, secondaries, etc.).

PART # TABLE

CURRENT RATING OF ATS	CT PART # NON-BYPASS	CT PART# BYPASS	*AMMETER PART #	AMMETER SCALE
40	PS-4118	NA	PS-4201	0-50
80	PS-4119	NA	PS-4202	0-100
100	PS-4119	PS-4119	PS-4202	0-100
150	PS-4120	PS-4120	PS-4203	0-150
225	PS-4121	PS-4121	PS-4204	0-300
260	PS-4121	PS-4121	PS-4204	0-300
400	PS-4122	PS-4122	PS-4205	0-400
600	PS-4928	PS-4123	PS-4210	0-600
800	PS-4929	PS-4124	PS-4211	0-800
1000	PS-4930	PS-4125	PS-4212	0-1200
1200	PS-4930	PS-4126	PS-4212	0-1200
1600	PS-4129	PS-4217	PS-4213	0-2000
2000	PS-4129	PS-4217	PS-4213	0-2000
3000	PS-4974	PS-4974	PS-4214	0-3000
4000	568TL402	568TL402	PS-4219	0-4000

* When mounting Ammeter in on enclosure other than a NEMA 1, add "W" to the end of the part number. A weep hole and mounting gasket will be added to ammeter standard bill of materials.

GE PROPRIETARY AND CONFIDENTIAL INFORMATION
This document is the property of General Electric ("GE") and contains proprietary information of GE. This document is loaned on the express condition that neither it nor the information contained therein shall be disclosed to others without the express, written consent of GE Industrial Systems, and that the information shall be used by the recipient only as approved expressly by GE Industrial Systems. This document shall be returned to GE upon its request. This document may be subject to certain restrictions under U.S. export controls laws and regulations.

THIRD ANGLE PROJECTION

FOR ADDITIONAL INFO REFER TO
APPLIED PRACTICES
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
2 PL. DECIMALS ± .020
3 PL. DECIMALS ± .005
ANGLES ± 1°
FRACTIONS ± 1/64
FINISH
AutoCad Generated

SIGNATURES		DATE
MODEL	BRB	10/23/96
DETAIL		
CHECKED		
ENGRG	KK	
MFG		
QUALITY		
ISSUED		

DRAWING FILE: 50r-2004-c-1.dwg
MODEL / ASSEMBLY FILE: MX200
CTQs
CRITICAL TO QUALITY CHARACTERISTIC

GE Zenith Controls

TITLE
M1,M3 OPTION
MX200

FIRST MADE FOR:

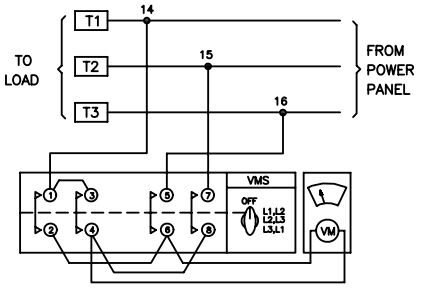
SIZE	CAGE CODE	DWG NO
B		50R-2004

SCALE: NA
SHEET 1 OF 1

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
D	S-7854 REVISED DWG.	09/30/02	GG KK

M4 3 PHASE VOLTMETER

CONNECTION



VOLTMETER SWITCH (VMS) ACTION TABLE

1,2	3,4	5,6	7,8	SWITCH POSITION
O	O	O	O	OFF
X	O	O	X	L1,L2
O	O	X	X	L2,L3
O	X	X	O	L3,L1

X–INDICATES CLOSED DOUBLE MAKE CONTACT
O–INDICATES OPEN DOUBLE BREAK CONTACT

LEGEND

VM..... Voltmeter (see table for part#)
**Gasket, PS–3464
VMS..... Voltmeter Switch, L–4006
**Gasket & Spacer, PS–3584
CAP PLUG..... PS–3643 (QTY. 2)

PART # TABLE

SYSTEM VOLTAGE	PT PART #	*VOLTMETER PART #	VOLTMETER SCALE
120	–	PS–4206	0–300
208	–	PS–4206	0–300
220	–	PS–4206	0–300
230	–	PS–4206	0–300
240	–	PS–4206	0–300
380	–	PS–4207	0–600
416	–	PS–4207	0–600
440	–	PS–4207	0–600
480	–	PS–4207	0–600
575	K–3100	PS–4218	0–750
600	K–3100	PS–4218	0–750

PT is only required for 575V & 600V systems (not shown).

*When mounting Voltmeter in on enclosure other than a NEMA 1, add "W" to the end of the part number. A weep hole will be added to voltmeter.

**Not supplied on NEMA 1 enclosure.

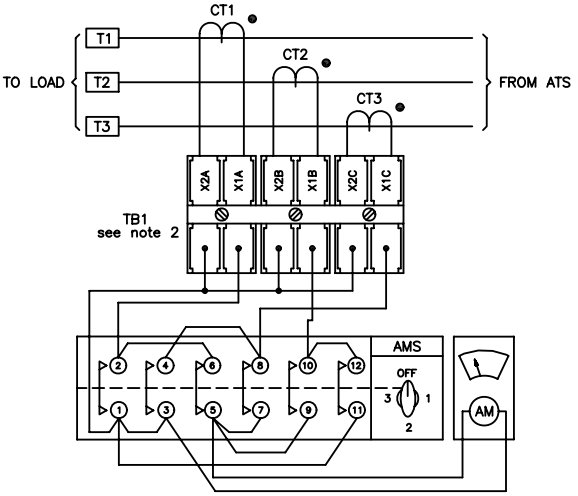
OPERATION

VM Voltmeter indicates phase voltage of that load which the Voltmeter switch manually selects lines (1, 2), (2, 3), or (1, 3).
VM Voltmeter reads zero at off position.

NOTE:
On Bypass–Isolation transfer switches, wire to Load bus of bypass switch. Renumber wires 14,15,16 to 14T,15T,16T respectively.

M2 3 PHASE AMMETER

CONNECTION



AMMETER SWITCH (AMS) ACTION TABLE

1,2	3,4	5,6	7,8	9,10	11,12	SWITCH POSITION
X	X	O	O	O	X	OFF
O	X	X	O	O	X	1
X	X	O	O	X	O	2
X	O	O	X	O	X	3

X – INDICATES CLOSED DOUBLE MAKE CONTACT
O – INDICATES OPEN DOUBLE BREAK CONTACT

LEGEND

AM..... AMMETER..... (SEE TABLE FOR PART #)
**Gasket, PS–3464
AMS..... AMMETER SWITCH..... L–4007
**Gasket & Spacer, PS–3584
CT1,2,3.... CURRENT TRANSFORMERS..... (SEE TABLE FOR PART #) (see note 3)
TB1..... 6 POINT SHORTING TERMINAL BLOCK.... Y610091
CAP PLUG..... PS–3643 (QTY. 2)

PART # TABLE

CURRENT RATING OF ATS	CT PART # NON–BYPASS	CT PART# BYPASS	*AMMETER PART #	AMMETER SCALE
40	PS–4118	NA	PS–4201	0–50
80	PS–4119	NA	PS–4202	0–100
100	PS–4119	PS–4119	PS–4202	0–100
150	PS–4120	PS–4120	PS–4203	0–150
225	PS–4121	PS–4121	PS–4204	0–300
260	PS–4121	PS–4121	PS–4204	0–300
400	PS–4122	PS–4122	PS–4205	0–400
600	PS–4928	PS–4123	PS–4210	0–600
800	PS–4929	PS–4124	PS–4211	0–800
1000	PS–4930	PS–4126	PS–4212	0–1200
1200	PS–4930	PS–4126	PS–4212	0–1200
1600	PS–4129	PS–4217	PS–4213	0–2000
2000	PS–4129	PS–4217	PS–4213	0–2000
3000	PS–4974	PS–4974	PS–4214	0–3000
4000	568TL402	568TL402	PS–4219	0–4000

* When mounting Ammeter in on enclosure other than a NEMA 1, add "W" to the end of the part number. Aweep hole and mounting gasket will be added to ammeter standard bill of materials.

OPERATION

Ammeter (AM) indicates the load current of the phase being selected by the ammeter switch (AMS) (Phase 1, 2, or 3).
Ammeter (AM) reads zero at "OFF" position.

NOTES:
1. (**) Not supplied on NEMA 1 Enclosures.
2. Mount TB1 on or adjacent to power panel.
3. ⚠ DANGER: – HAZARDOUS CONDITIONS. CT SECONDARY CIRCUITS ARE CAPABLE OF GENERATING LETHAL VOLTAGES AND CURRENTS WHEN OPEN CIRCUITED WITH THEIR PRIMARY CIRCUIT ENERGIZED. Standard safety precautions should be followed while performing any installation or service on the device (for example, shorting the CT, secondaries, etc.).

GE PROPRIETARY AND CONFIDENTIAL INFORMATION
This document is the property of General Electric ("GE") and contains proprietary information of GE. This document is loaned on the express condition that neither it nor the information contained therein shall be disclosed to others without the express, written consent of GE Industrial Systems, and that the information shall be used by the recipient only as approved expressly by GE Industrial Systems. This document shall be returned to GE upon its request. This document may be subject to certain restrictions under U.S. export controls laws and regulations.

THIRD ANGLE PROJECTION

FOR ADDITIONAL INFO REFER TO
APPLIED PRACTICES
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
2 PL. DECIMALS ± .020
3 PL. DECIMALS ± .005
ANGLES ± 1°
FRACTIONS ± 1/64
FINISH

SIGNATURES		DATE
MODEL	BRB	8/21/96
DETAIL		
CHECKED		
ENGRG	SB	8/21/96
MFG		
QUALITY		
ISSUED		

DRAWING FILE: 50r–2005–d–1.dwg
MODEL / ASSEMBLY FILE: MX200
AutoCad Generated
CTQs ⊖ CRITICAL TO QUALITY CHARACTERISTIC

GE Zenith Controls

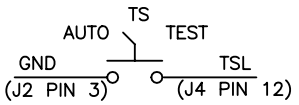
TITLE
M2, M4 OPTION
MX200

FIRST MADE FOR:

SIZE	CAGE CODE	DWG NO
B		50R–2005

SCALE: NA
SHEET 1 OF 1

CONNECTION TO MX200 CONTROL PANEL:



TS MOUNTED ON DOOR OF ENCLOSURE

LEGEND:

6A..... Maintained Test Switch
P9XSMD0N, 2 Pos. Operator
P9B10VN, N.O. Contact Block
V-1505, Nameplate

6B..... Momentary Key Operated Test Switch
P9XSCD5A95, 2 Pos. Operator
P9B10VN, N.O. Contact Block
V-1503, Nameplate

6C..... Maintained Key Operated Test Switch
P9XSCD0A95, 2 Pos. Operator
P9B10VN, N.O. Contact Block
V-1505, Nameplate

OPERATION:

When activated in the TEST position, TS will simulate a normal line failure. The TS will automatically transfer the load to the emergency position. When the test switch is returned to the AUTOMATIC position, the transfer switch will restore the load to the normal line position. Should Emergency fail while the ATS is in the Emergency position, the ATS will transfer back to Normal.

LEGEND	REFERENCE	NOTES

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S-6548	ESTABLISH DWG.		
B	S-7379-1	04/06/00	SG	SB

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

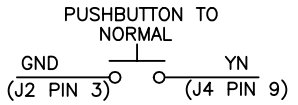
DWG TITLE: 6A, 6B, 6C

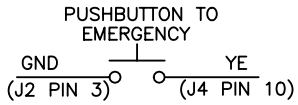
JOB/MODEL: MX200

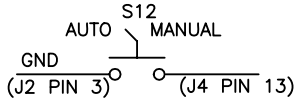
CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	-	50R-2009

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
ALA	SB	08/21/96	-	1 OF 1	B

CONNECTION TO MX200 CONTROL PANEL:







MOUNTED ON DOOR OF ENCLOSURE

LEGEND:

S12.....AUTO/MANUAL Selector Switch
P9XSMD0N, Switch (two position) – Maintained (Not Keyed)
P9XSCD0K95, Switch – Maintained (Keyed)
P9B10VN, N.O. Contact Block
V–1510, Nameplate

YN, YE.....Pushbutton to Normal & Emergency Respectively
YN = P9XPNNG, Pushbutton
P9B10VN, N.O. Contact Block
V–1143, Nameplate
YE = P9XPNNG, Pushbutton
P9B10VN, N.O. Contact Block
V–1144, Nameplate

PROGRAMMING NOTES IN FIELD PROGRAMMING MENU:
ENABLE (S12) AUTO/MANUAL OPTION.

OPERATION:

When S12 is in the AUTO position, the Automatic Transfer Switch functions automatically as specified with switch drawing.

When S12 Switch is in the MANUAL position, the Automatic Transfer Switch will transfer either direction by depression of Normal or Emergency Pushbutton.

Once transferred in MANUAL, the switch maintains position selected, even if the selected power fails.

LEGEND	REFERENCE	NOTES

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S–6636	ESTABLISH DWG.		
B	S–6877	02/26/98	SG	SB
C	S–6981	09/04/98	RWB	CK
D	S–7379–1	04/06/00	SG	SB

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: S12 OPTION (KEYED OR NOT KEYED)
JOB/MODEL: MX200

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	50R–2011

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SG	SB	12/13/96	–	1 OF 1	D

GE Zenith Controls

MX150 Microprocessor Controller
Transfer Switch Control Panel



70R-2000C
11/04

Operation and Maintenance Manual

Authorized Service

For GE parts and service, call: (773) 299-6600

Table of Contents

	Page
Introduction	2
Safety	3
Equipment Inspection and Storage	3
Final Equipment Inspection	3
Installation	4
Engine Start Control Connections	4
Initial Energization	4-5
Control Connections	6
MX150 Microprocessor Controller	7
Overview	7
LCD & Keypad	8
User Setting for Voltage & Frequency	9
Standard Features, MSTDG Option Pkg.	9-10
Standard Features, MEXEG Option Pkg.	11
Optional Accessories	12
How to Set the System Clock	13
CDT One Event Timer Exerciser	13-14
CDP Clock Exerciser	15
User Setup - CFG Menu	16
User Setup - SET Menu	17
User Setup - System Info	18
Testing	19
Standard Transition	19
Delayed Transition	19
Sequence of Operation	20
Standard Transition	20
Delayed Transition	20
Controls Power Supply (CPS)	21
Schematics, Standard and Delay	22
Troubleshooting & Diagnostics	23
Maintenance and Testing	24
Inspection and Cleaning	24
Servicing	24
Testing	24

Introduction

GE Zenith Transfer Switches are used to provide a continuous source of power for lighting and other critical loads by automatically transferring from source 1 power to source 2 power in the event that source 1 voltage falls below preset limits.

Voltage sensing and system control is performed via a state-of-the-art microcontroller located on the cabinet door. It is designed to give highly accurate control of the transfer switch system.

All GE Zenith transfer switches are designed for use on emergency or standby systems, and are rated for total system or motor loads. Transfer switches are UL Listed under Standard 1008 and CSA Certified under Standard C22.2 No. 178 and IEC Listed under Standard 947.

NOTES: A protective device such as a molded case circuit breaker or fused disconnect switch MUST be installed on both sources of incoming power for circuit protection and as a disconnection device.

All references made within this manual about the term "S1" or "Source 1" relate to a Normal Power Source. All references made about the term "S2" or "Source 2" relate to an Emergency or Alternative Power Source.

Safety / Installation

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

The safe operation of your switch is GE Zenith's focus. The proper storage, installation, operation and maintenance will help increase the life of the switch.

⚠ CAUTION ⚠

Due to hazardous voltage and current, GE Zenith recommends that a GE Zenith Certified technician or a qualified electrician must perform the installation and maintenance of the switch.

Equipment Inspection and Storage

Once you have received the transfer switch, inspect it for any damage. This includes damage to the enclosure, power panel, control panel and wiring harness. If any damage is found or suspected, file a claim as soon as possible with the carrier and notify the nearest GE Zenith representative.

Before installation, if it is necessary, store the transfer switch in a clean dry place, protected from dirt and water. Provide ample air circulation and heat, if necessary, to prevent condensation.

Storage Temperature	Operating Temperature (Ambient):	Humidity
-30°C to +75°C (-22°F to +167°F)	**40-400 AMP** *(molded shell)* -20°C to +65°C (-4°F to +149°F) **40-4000 AMP** *(all other frame and panel types)* -20°C to +60°C (-4°F to +140°F)	5% to 95% (non-condensing)

Final Equipment Inspection

Prior to energizing the transfer switch:

1. Remove any debris incurred, with a vacuum, due to shipment or installation.
2. Verify that all cabled connections are correct and that phase rotation of both sources match.
3. Check engine start connections.
4. Verify the correct connection of all control wires.
5. Check settings of all timers and adjust as necessary.
6. Adjust any optional accessories as required.
7. Check the lug torque values of the power connections.

   NOTE: Lug torque values are specified in the power panel manual.

8. Make sure that all covers and barriers are installed and properly fastened.

   NOTE: Power panels ship from GE Zenith in Source 1 Position.

⚠ WARNING ⚠

Do not use a blower since debris may become lodged in the electrical and mechanical components and cause damage.

Each GE Zenith transfer switch is factory wired and tested. A complete information package is furnished with each switch which includes:

a. Sequence of operation.
b. Description and operation of all accessories supplied.
c. Power panel connection diagram and schematic.
d. Description and identification of all customer field connections.

Installation of GE Zenith transfer switches includes:

a. Mounting the transfer switch cabinet.
b. Connection of Source 1, Source 2, and Load cables or bus bars.
c. Connection of external control circuits as required.

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

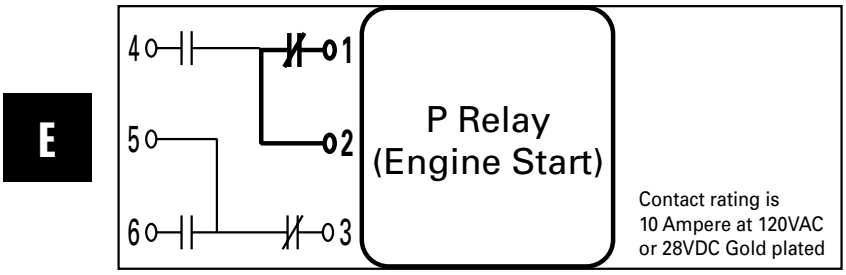


Figure 3

Engine Start Control Connections

The engine-start terminals are clearly identified by a label on the microcontroller backplate. In the case of manual transfer switches, or in other applications not requiring the microprocessor, clearly marked terminal blocks are provided in the upper left corner of the control panel for the engine start control wires.

Terminals for field connections to the A3 Emergency auxiliary contacts and the A4 Normal auxiliary contacts are also provided. These terminals are clearly marked and appear on the side of the power panel. On 400 amp metal frame units these terminals appear on the bracket above the operator handle.

Initial Energization

Before proceeding, refer to the information package supplied with the ATS and read and understand the information on all accessories provided.

1. Unlock the enclosure.
2. Open the enclosure.
3. Verify the correct system voltage.

   NOTE: The equipment rating nameplate on the transfer switch lists the voltage. See *Figure 3*.

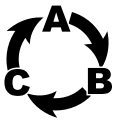
4. Close Source 1 circuit. breaker.

   NOTE:The controller will illuminate Source 1 Available LED if proper voltage is sensed.

5. Verify the phase to phase voltages at the Normal line terminals.
6. Close the Emergency source circuit breaker.
7. Start the generator's engine.

   NOTE: The controller will illuminate Source 2 Available LED when preset voltage and frequency levels are reached.

8. Verify the phase to phase voltages at Source 1 line terminals.
9. Verify that the phase rotation of Source 1 is the same as the phase rotation of Source 2.



10. Shut down the generator's engine.
11. Place the starting control in the Automatic position.
12. Complete the visual inspection of the transfer switch.
13. Close the enclosure.
14. Lock the enclosure.

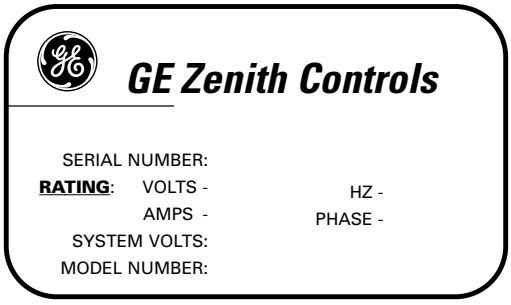


Figure 4

⚠CAUTIONS ⚠

Certain accessories, per specific schematics, can inhibit automatic transfer. Engine Gen-Set could start when engine control wires are attached.

Initial Energization *(cont'd)*

After all options and accessories are checked and verified, follow these steps to set up the ATS. Refer to MX150 display *Figure 5*. The annunciation LEDs illuminate to indicate (1) source availability, (2) ATS position, and (3) MX150 control function (timing).

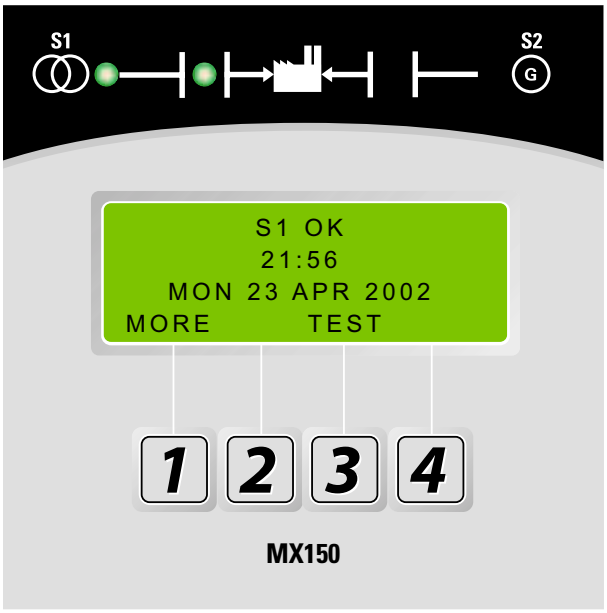


Figure 5 – LCD and keypad

1. Unlock the enclosure.
2. Open the enclosure.
3. Place the Disconnect Switch in the Inhibit.

   NOTE: This step is only performed if the "DS" Option was purchased.

4. Close the external (up-stream) Source 1 circuit breaker.

   NOTES: Source 1 Available and Source 1 Position LED's will illuminate.

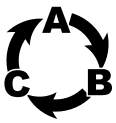
   If Source 1 Available LED does not illuminate, verify that Source 1 Voltage is above the preset restore value.

   The Gen-Set will start and run while Source 2 stop Delay Timer is timing.

5. Close the External (up-stream) Source 2 line circuit breaker.
6. Start the engine generator in MANUAL mode.

   NOTE: When the voltage and frequency reach preset values, the Source 2 Available LED will illuminate.

7. Verify the phase to phase voltages at Source 2 line terminals.
8. Verify that the phase rotation of Source 2 is the same as the phase rotation of Source 1.



9. Shut down the generator's engine. (Place in Automatic Mode.)

   NOTE: Source 2 Available LED will turn off.

   NOTE: The engine generator will continue to run for the duration of Source 2 Stop Delay Timer.

10. Place the disconnect switch to ENABLE.
11. Complete the visual inspection of the transfer switch.
12. Close the enclosure.
13. Lock the enclosure.

⚠ WARNING ⚠

When performing a hi-pot or dielectric test on the power section, DISCONNECT the control panel plugs from the microprocessor to avoid potential damage.

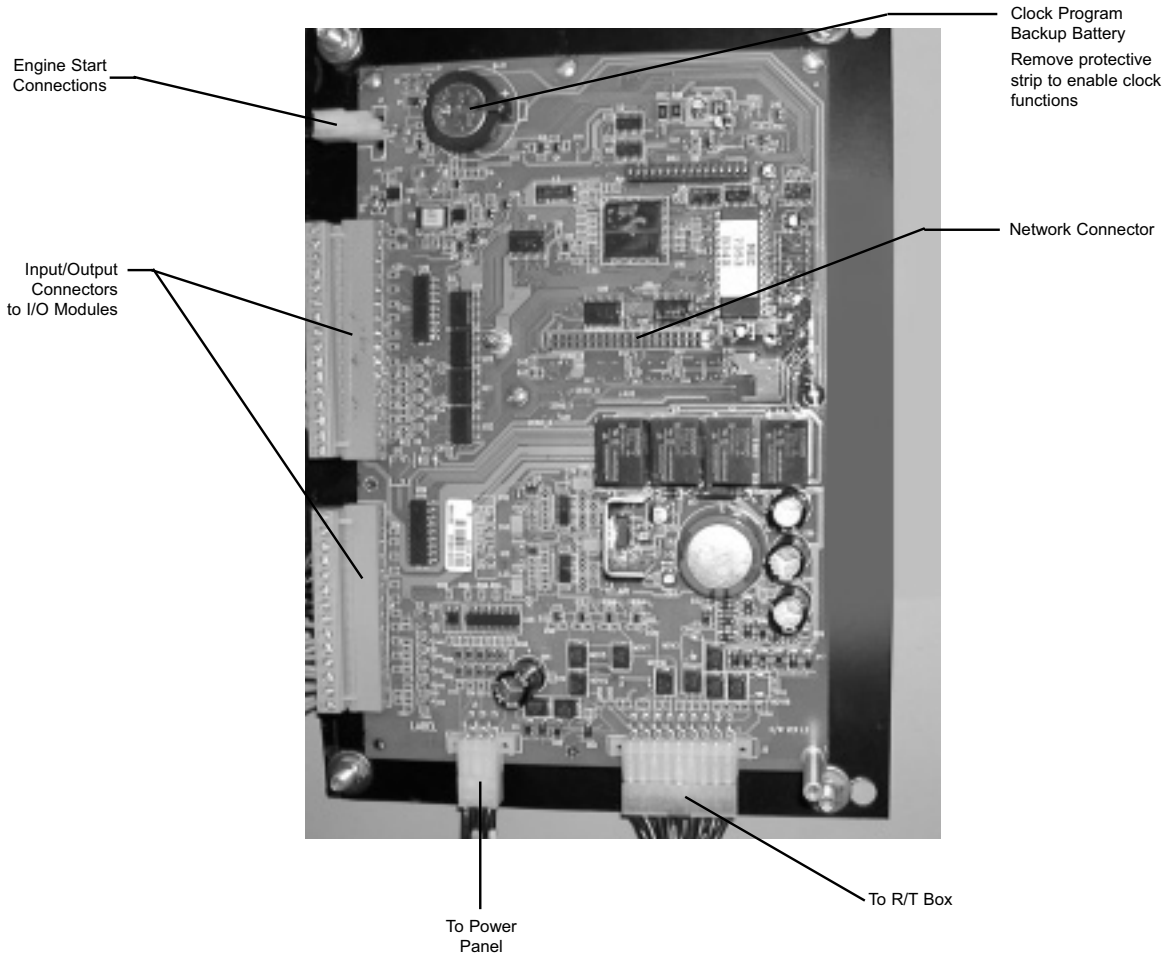
⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Control Connections

Figure 2



A complete information package is furnished with each transfer switch including a complete connection diagram and schematic which details all necessary control circuit field connections.

The engine start control wires connect to the engine start relay terminals located to the left of the microprocessor. Figure 2 shows the location of these terminals.

The terminals are clearly identified by a label on the microcontroller backplate. In the case of manual transfer switches, or in other applications not requiring the microprocessor, clearly marked terminal blocks are provided in the upper left corner of the control panel for the engine start control wires.

MX150 Controller

Consists of two major assemblies:

I. The **Microprocessor** contains the following:

A. MX150 Board - Customer Input and Output (I/O) for system interface. Located on the left hand side of the back of the unit (see figure 6)

1. I/O accessories that can be found here are:
   a. Engine start relay P output
   b. Pre-Signal to transfer T3, W3 and UMD output (optional)
   c. Transfer Inhibit Q3 and Q7 input (optional)
   d. Remote test Q2 input (optional)
   e. Network interface ZNET input/output (optional)

B. LCD and Keypad located on the exterior of the door (see figure 7)

1. User accessibility to the following:
   a. LED indication of source availability
   b. LED indication of transfer switch position
   c. LCD screen indicates:
      (1) timer count down (numeric)
      (2) event reporting (text)
   d. Keypad provides user interface to: *[in conjunction with LCD screen]*
      (1) Setting sensors and timers
      (2) Configuring logic accessories

II. The **Controls Power Supply (CPS)**

Contains transformers which drop line voltage to control level for controller input and SCR inputs (see figure 6).

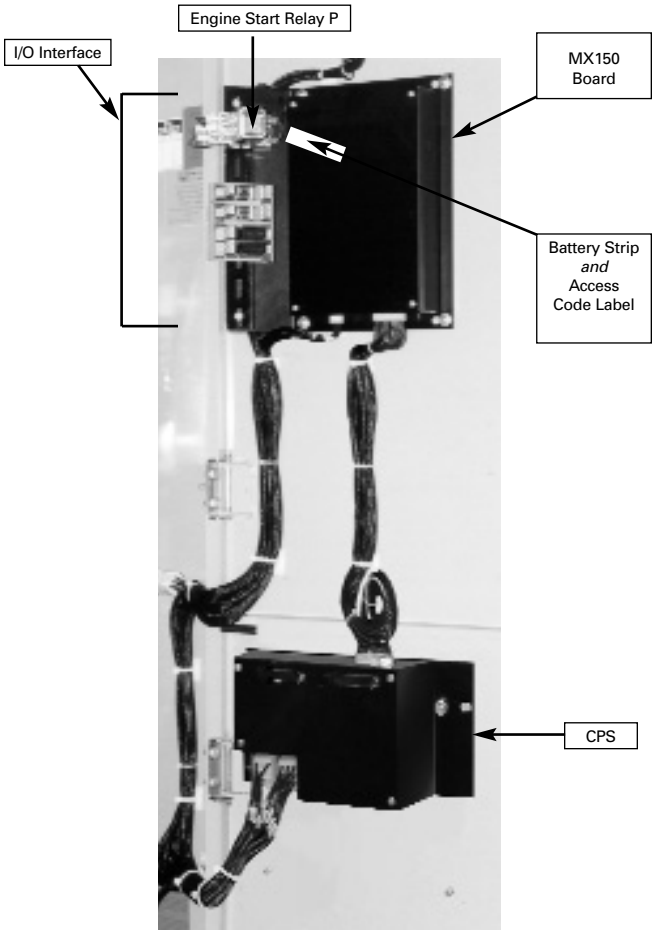


Figure 6

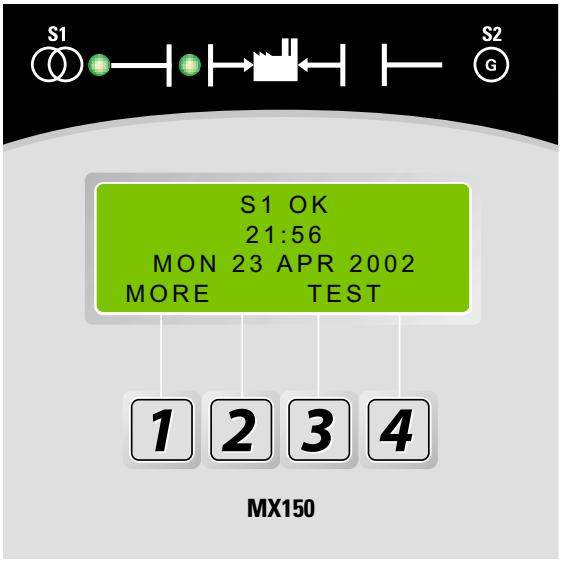


Figure 7

LCD & Keypad

These options are accessible through the LCD and keypad (see figure below). To become familiar with the options loaded into a particular unit, scrolling through the SET and CFG menu will show the descriptions of the options (see pages 16). These menus are the very same menus that are used to access the setting and/or configuration of these options. The SET (setting) menu is primarily used to show or change, time and voltage settings. The CFG menu is primarily used to turn an option on or off. When scrolling through these menus, no changes can be made without entry of the access code. The factory set six-digit access code is located on a white label on the back of the unit (see figure 9 pgs. 16-18).

The MX150 has many logic options. Each controller is downloaded with options at the time of manufacture. The collection of options that any one controller has is specified at the time of order placement. The following pages include all the options that can reside in the controller. Not all units include all options.

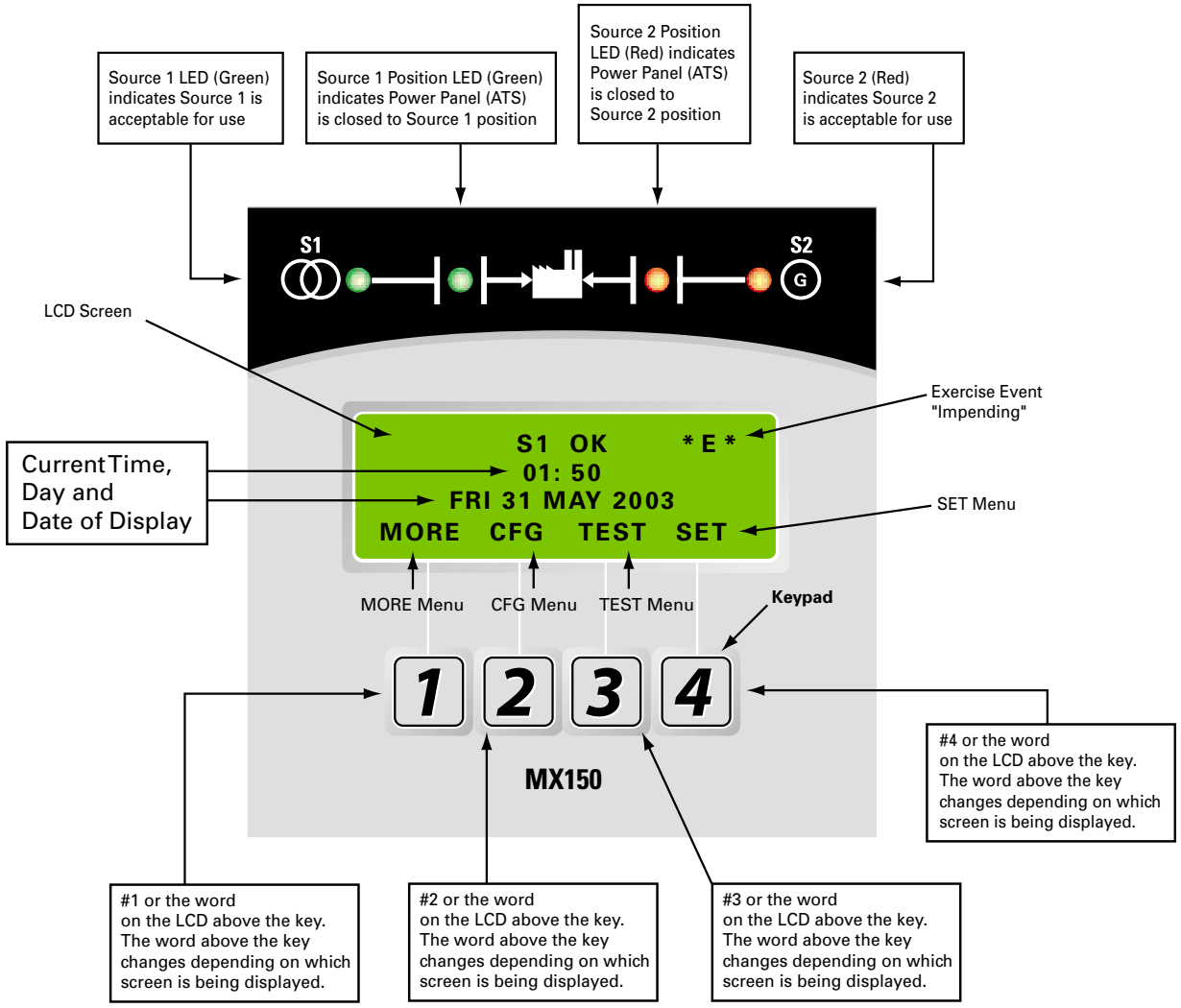


Figure 8

User Setting for Voltage & Frequency

Source 1

Voltage "Restore"
Factory Default: 90%
This adjustment determines the minimum acceptable voltage required to transfer to Source 1.
Adjust via the SET menu. Range is 85% to 100% in 1% increments (see page 17).
Once satisfied, the T timer will begin timing to transfer to Source 1.

Voltage "Fail"
Factory Default: 80%
This adjustment determines the low voltage threshold.
Adjust via the SET menu. Range is 75% to 98% in 1% increments (see page 17).
"Fail" must be a minimum of 2 % below "Restore" setting. Once voltage falls below threshold, P timer begins timing to signal Source 2 Generator to start.

Source 2

Voltage "Restore"
Factory Default: 90%
This adjustment determines the minimum acceptable voltage required to transfer to Source 2.
Adjust via the SET menu. Range is 85% to 100% in 1% increments (see page 17).
Once satisfied, the W timer will begin timing to transfer to Source 2.

Voltage "Fail"
Factory Default: 80%
This adjustment determines the low voltage threshold.
Adjust via the SET menu. Range is 75% to 98% in 1% increments (see page 17).
"Fail" must be a minimum of 2 % below "Restore" setting. Once voltage falls below threshold, T timer will be bypassed to expedite the transfer to Source 1.

Frequency "Restore"
Factory Default: 95%
This adjustment determines the minimum acceptable frequency required to transfer to Source 2.
Adjust via the SET menu. Range is 90% to 100% in 1% increments (see page 17).
Once satisfied, the W timer will begin timing to transfer to Source 2.

Frequency "Fail"
Factory Default: 90%
This adjustment determines the low frequency threshold.
Adjust via the SET menu. Range is 88% to 98% in 1% increments (see page 17).
"Fail" must be a minimum of 2 % below "Restore" setting.
Once satisfied, the W timer will begin timing to transfer to Source 2.

Standard Features, MSTDG Option Pkg.

6
Test Switch, Momentary

A3
Auxiliary Contact: Closed when the switch is in Source 2 position.

A4
Auxiliary Contact: Closed when the switch is in Source 1 position.

Calibrate
While monitoring the actual Phase to Phase voltage levels and Frequency with a calibrated test equipment, the Phase to Phase voltage sensing and Frequency can be adjusted accordingly. Calibration capabilities are available for Frequency and AB, BC, CA Phase to Phase voltage for both Sources. Adjust via SET menu (see page 18)

CDT
Load or NO-Load. One event exerciser with adjustable Engine exercise timer. Exercise duration can be set between 5 and 60 minutes in 1 minute increments. Can be configured to run every 1, 7, 14, or 28 days. Factory Default is 20minutes. When exerciser is impending, (*E*) appears in the upper right hand corner of LCD screen. See page 13-14 for instructions. Configured via CFG (see page 16). Set via SET menu (see page 17).

DS
Disconnect Switch, Auto/Inhibit.
Inhibits transfer in either direction when in inhibit.
Allows automatic operation when in Auto.
(800-4000 Amp units)

DT *(Delayed Transition Only)*
Time Delay from Neutral Switch position to Source 1 position. Adjustable 0-10 minutes in 1 second increments. Standard setting is 5 seconds Adjust via SET menu (see page 17)

DW *(Delayed Transition Only)*
Time Delay from Neutral Switch position to Source 2 position. Adjustable 0-10 minutes in 1 second increments. Standard setting is 5 seconds.Adjust via SET menu (see page 17)

E
Engine Start Contact

Std. Features, MSTDG Option Pkg. *(cont'd)*

EL/P

Event Log: Sequentially Numbered Log of 16 events that track date, time, reason and action taken

System Data: Total Life Transfers (N2P)
Days Powered Up
Total Transfers to S2
Total S1 Failures
Time S1 available in Hrs
Time S2 available in Hrs. (N1P)

K/P

Frequency Indication for S1 and S2

L

LNP Center-off position LCD-Indicator
Indicating LED lights:

- **L1** Indicates Switch in Source 2 position.
- **L2** Indicates Switch in Source 1 position.
- **L3** Indicates Source 1 available.
- **L4** Indicates Source 2 available.

P1

Time Delay Source 2 Start. Adjustable 0-10 seconds. Standard setting is 3 seconds.
Adjust via SET menu (see page 17)

Q2

Peak Shave / Remote Load Test: Input for Peak Shave or Remote Load Test. Includes automatic return to Source 1 if Source 2 fails and Source 1 present.

R2E

Under voltage sensing of Source 2 for single-phase. (R17 replaces R2E for Utility to Utility switches)

R50

In Phase Monitor this feature restricts **Live to Live Source Transfers** to occur unless both Sources are within 7 electrical degrees or less of each other. (live Source to live Source transfers usually occur during transfer back to Source 1 or during Testing). R50 does not change the operation of the Automatic Transfer Switch in a power failure mode. After all timer functions have elapsed, **the CHECKING FOR SOURCE SYNCHRONISM** will be displayed as well as the direction of transfer (S1-S2 for example denotes transfer from Source 1 to Source2). When synchronism is accomplished, transfer will take place.

Notes:
- **If S2 Frequency is less than S1 Frequency, display will show a series of (- - - - -…..) symbols.**
- **If S2 Frequency is greater than S1 Frequency, display will show a series of (+++++…..) symbols.**
- **Each (-) or (+) symbol represents 10 electrical degrees out of phase. A maximum of 18 symbols (180 electrical degrees) can be monitored.**
- **The number of (-) or (+) symbols decrease as the two sources approach synchronism and increase as the two sources drift out of synchronism.**
- **If S1 and S2 Frequencies are identical, the display will show a series of alternating symbols (ŧŧŧŧ…) which also indicate the approximate out of phase degrees**

In the event that the Sources do not come within 7 electrical degrees of each other within 60 seconds, the unit will display the message: **SYNCH CHECKING** and will allow the user to **BYPASS**. If the **BYPASS** button is pressed, the unit will display the message: **WARNING MAY CAUSE DAMAGE TO THE LOAD**. Pressing **XFR** will actually bypass the R50. Since R50 is a passive device, the length of time it takes to reach Synchronism is dependent on the frequency difference between the two Sources. Source 1 is usually a Utility and the frequency is not within the control of the consumer. Source 2 needs to be adjusted to create an adequate difference in order for the transfer to happen a timely fashion.

Note: For optimum performance, Source 2 Generator should be adjusted a Maximum of 2 Hertz above or below the Utility frequency, minimum of 0.1 Hertz. (58 to 59.9) or (60.1 to 62) Hertz. Adjustment of Generator to 60Hertz could cause lengthy transfer delay.

R50 Feature can be turned ON or OFF via CFG Menu (see page 16). Factory Default if OFF.

S13

Transfer Commit. Configured via CFG menu. (see page 16) When this Feature is set to OFF: The transfer Switch is not committed to transfer unless the outage duration is longer than the timers that precede the transfer to Source 2 position. This assumes that the outage will be an isolated event. When this Feature is set to ON: The transfer Switch is committed to transfer to Source 2 position once the W timer has begun timing, even if Source 1 power returns before the transfer to Source 2. This is to ensure that the transfer takes place, because one outage may be followed by another.

T

Time Delay (S1) Source 1 Stable Timer. To delay transfer to Source 1 (immediate retransfer on Source 2 failure). Adjustable 0-60 minutes in 1 second increments. Standard setting is 30 minutes. Adjust via SET menu (see page 17)

U

(S2) Source 2 Stop Delay Timer. Allows Engine to run unloaded after switch retransfer to Source 1. Adjustable 0-60 minutes in 1 second increments. Standard setting is 5 minutes. Adjust via SET menu (see page 17)

W

Time Delay (S2) Source 2 Stable Timer. To delay transfer to Source 2. Adjustable 0-5 minutes in 1 second increments. Standard setting is 1 second. Adjust via SET menu (see page 17)

YEN

Bypass Timers Key utilizing Keypad. When applicable, the system prompts the user to press a button to bypass (T) or (W) Timers should the user so desires.

Standard Features, MEXEG Option Pkg.

In addition to the features listed under the MSTDG Option Package, this enhanced package includes the following features:

A3
Additional Auxiliary contact: closed when switch is in Source 2 position.

A4
Additional Auxiliary contact: Closed when the transfer switch is in Source 1 position.

CDP (replaces CDT)
Clock Exerciser Load/ No Load: Allows the Generator to start and run unloaded or to simulate a power failure, start Generator and run under load.
Can be configured by end user for 1, 7, 14, 28, 365 day cycle.

VI
Voltage Imbalance (Three Phase)
For a three phase source, this feature monitors phase voltage ratios based on a selected range within a selected time window. Should any phase fall below the selected lower window limit or exceed the selected higher window limit within the selected time frame, the controller initiates transfer to the other source.

Range: 5% to 20% of Nominal voltage,
10 to 30 seconds window, user adjustable.
Resolution: 1% Increments
Minimum Differential: 2% between “Fail” and “Restore” settings.
Factory default: 10% “Fail”, 8% “Restore, 30 Seconds.
See CFG Menu page 16 to configure ON or OFF.
See SET Menu page 17 to set Percentage and time windows

Optional Accessories

6A
Test Switch, Maintained / Momentary

6AP
Test Switch, Maintained / Momentary, utilizing Keypad

A1
Auxiliary Contact, operates on Source 1 line failure.

A1E
Auxiliary Contact, operates on Source 2 line failure.

A3
Auxiliary Contacts: Closed when the transfer switch is in Source 2 position.

A4
Auxiliary Contacts: Closed when the transfer switch is in Source 1 position.

A62
Sequential Universal Motor Load Disconnect Circuit. Normally closed Auxiliary contacts for Motor Loads. Open 0-60 seconds prior to transfer, after transfer, or both in either direction then re-close in timed sequence after transfer.

CTAP
Alarm Panel on transfer to Source 2 with Silence button.

DS
Disconnect Switch, Auto/Inhibit.
Inhibits transfer in either direction when in inhibit.
Allows automatic operation when in Auto.
(40-600 Amp units)

HT
Heater and Thermostat.

Manual
Manual Transfer Switch transfers in either direction by depressing designated pushbuttons.

M80
Digital Power Meter with Display: Amps, Volts, and Frequency.

M82
Digital Meter w/Display of Amps, Watts, Volts, Frequency, KVA, KVAR, PF, etc.

M83A
Digital Meter w/Diplay of Amps, Watts, Volts, Frequency, KVA, KVAR, PF, etc. Plus THD capability w/Modbus.

T3/W3
Elevator Pre-Signal Auxiliary Contacts: Open 0-60 seconds prior to transfer to either direction, re-closes after transfer.

UMD
Universal Motor Load Disconnect Circuit: Auxiliary Contact opens 0-60 seconds prior to transfer in either direction, re-closes after transfer. Can be configured by end user for Pre-transfer, Post-transfer, or both.

VI
Voltage Imbalance (Three Phase)
For a three phase source, this feature monitors phase voltage ratios based on a selected range within a selected time window. Should any phase fall below the selected lower window limit or exceed the selected higher window limit within the selected time frame, the controller initiates transfer to the other source.

Range: 5% to 20% of Nominal voltage,
10 to 30 seconds window, user adjustable.
Resolution: 1% Increments
Minimum Differential: 2% between “Fail” and “Restore” settings.
Factory default: 10% “Fail”, 8% “Restore, 30 Seconds.
See CFG Menu page 16 to configure ON or OFF.
See SET Menu page 17 to set Percentage and time windows

ZNET
Network Communications Interface Card

How to Set the System Clock

How to Set the System Clock

Set System Clock, time and date

- If the clock is not set, the display will show SET SYSTEM CLOCK on the second line of the S1 OK screen.
- The S1 OK screen will show time (hours and minutes) on the second line if the system clock has been set. (Date on third line)

Setting the System Clock

(Start from **S1 OK** screen)

1. Remove battery protective white plastic strip near **P** relay. *
2. Press **MORE** then press **SET**.
3. Press **MORE** and scroll to **SET SYSTEM CLOCK** using the **MORE** key.
4. Press **SEL**.
5. **ENTER ACCESS CODE** located on the white label on the back of the controller.
6. Press **SEL**.
7. Use the up and down keys to change the hour value.
8. Press **SAVE** (this will enter this value and move cursor to minutes).
9. Use the up and down keys to change the minutes.
10. Press **SAVE** (this will enter this value and move cursor to month).
11. Use the up and down key up to change the month.
12. Press **SAVE** (This will enter this value and complete the clock setting).
13. Use the up and down keys to change the date.
14. Press **SAVE** (this will enter this value and move cursor to year).
15. Use the up and down keys to change year.
16. Press **SAVE** (this will enter this value and compete the clock setting).
17. To edit settings, press **SEL** and repeat steps 6-16.
18. If the setting is satisfactory, press **MORE** (unit then returns to the **SET** menu then press **BACK**, then **ESC**.)

* Replacement battery part #K-4100
Battery will last 5 years and provides power to retain clock function only (Controller functions without battery).

CDT One Event Timer Exerciser

Load / No-Load

One event Exerciser with adjustable Timer. Exercise duration can be set between 5 and 60 minutes in 1 minute increments. Can be configured to run every 1,7,14, or 28 days. Factory default is 20 minutes.

How to CONFIGURE (CFG) and Set (SET) the Timer Exerciser

1. Beginning from the **S1 OK** screen, press **MORE** then **CFG**.
2. Press **MORE** to scroll to **CONFIG TIMER EXERCISER** screen.
3. The third line of the **CONFG TIMER EXERCISER** will show either **DAILY**, **WEEKLY**, **14 DAY**, **28 DAY**, or **OFF**.
4. If the third line of the **CONFG TIMER EXERCISER** shows **DAILY**, **WEEKLY**, **14 DAY**, or **28 DAY** as desired, then proceed to step 10.
5. If the third line of the **CONFG TIMER EXERCISER** shows **OFF** or if another timer selection is desired, continue.
6. Press **SEL**.
7. Enter **ACCESS** code located on white label on the back of the controller.
8. Press **UP** or **DOWN** to select **DAILY**, **WEEKLY**, **14 DAY**, or 28 **DAY** as desired.
9. Press **SAVE**.
10. Press **MORE** to scroll to **CONFG TIMER EXERCISER (XFR)** or **(NO XFR)**.
11. Press Up or Down to select **XFR** (Load Transfer) or **NO XFR** (No Load Transfer).
12. Press **SAVE**.
13. Press **MORE** repeatedly to **BACK** then **S1 OK** screen.

Set (SET) the Exerciser:

14. Beginning from the **S1 OK** screen, press **MORE** then **SET**.
15. Press **MORE** repeatedly until **EXER S2 RUN TIME** screen.
16. Press **SEL**
17. Enter **ACCESS** code located on white label on the back of the controller.
18. Press **SEL**
19. Cursor is indicated as a line under character to be changed. Change values with up and down keys.
20. Press **SAVE** when complete.
21. Press **MORE** repeatedly until **SET USER SETUP** then press **BACK** then **ESC** to the **S1 OK** screen.

CDT One Event Timer Exerciser *(cont'd)*

How to Initiate CDT Exerciser and to start an exercise cycle every 1, 7, 14, or 28 days

From S1 screen

1) Press **TEST**
2) Press **MORE**
3) Press **START TEST TIMER** (to initiate Test).

- If the CDT Exerciser is Factory configured for a Load Exerciser, the Controller will immediately start a load exercise. The controller will start the generator, transfer the load to Source 2 and remain in Source 2 for the duration set for **EXER S2 RUN TIME** in the **SET** menu. The controller will retransfer the load back to Source 1 after the S1 stable timer has timed out and run the generator unloaded for the duration of the S2 stop delay timer (Engine Cool Down Timer).
- If the CDT Exerciser is Factory configured for a No-Load Exerciser, the Controller will immediately start a No-load exercise. The controller will start the generator and run it unloaded for the duration of the S2 stop delay timer (Engine Cool Down Timer).

Exercise will be repeated at the same time as initiated on every 1, 7, 14, or 28 days according to the selection made in the Configure **CFG** menu.

How to Bypass (Cancel) an exercise during an exercise cycle

1) Press **BPASS**
2) Allow the controller to complete the Engine cool down cycle

If the CDT Exerciser is Factory configured for a No-Load Exerciser Or allow the controller to complete retransfer to Source 1 If the CDT Exerciser is Factory configured for a Load Exerciser

How to Bypass the next exercise event and Keep the rest of scheduled events unchanged

1) Press Test
2) Press **MORE**
3) Press **BYPASS EXER**

To re-institute the next exercise event back, press **CANCL BPASS**

How to initiate a new exercise start time

1) Press **TEST**
2) Press **MORE**
3) Press **EXER CANCL**
4) Press **START TIMER TEST**

How to check the next exercise event

1) From **S1 OK** screen, press **MORE** three times.
2) The unit will display the **PLANT EXERCISER NEXT** event in **DAYS**, **HOURS**, and **MINUTES**
3) Press **ESC** to **S1 OK** Screen.

Notes:

- ***E*** appears in the upper right hand corner of LCD screen when exercise is impending.
- For Load Exerciser, actual exercise period (ATS in S2 position)= CDT (Exerciser) timing period +T (S1 stable Timer) timing period.

CDP Clock Exerciser

Load / No-Load Clock Exerciser

Allows the Generator to start and run unloaded or to simulate a power failure, start Generator and run under load. Can be configured by the end user for 1, 7, 14, 28, or 365 day cycles.

- A total of 7 independent No Load exercise periods (up to 10 hours each) can be programmed for each of the daily, weekly, 14-day, and 28-day exercisers.
- A total of 12 independent No Load exercise periods (up to 10 hours) can be programmed for the 365-day Exerciser.

How to Configure (CFG) the Exerciser

1. Beginning from the **S1 OK** screen, press **MORE** then **CFG**.
2. Press **MORE** to scroll to **CONFIG CLOCK EXERCISER** screen.
3. The third line of the **CONFG CLOCK EXERCISER** will show either **DAILY**, **WEEKLY**, **14 DAY**, **28 DAY**, **365 DAY** or **OFF**.
4. If the third line of the **CONFG CLOCK EXERCISER** shows **DAILY**, **WEEKLY**, **14 DAY**, **28 DAY**, or **365 DAY** as desired, press **MORE** repeatedly to **BACK**. Press **ESC** then proceed to the **SET** menu to set the **EXERCISER**.
5. If the third line of the **CONFG CLOCK EXERCISER** shows **OFF**, continue.
6. Press **SEL**.
7. Enter **ACCESS** code located on white label on the back of the controller.
8. Press **UP** or **DOWN** to select **DAILY**, **WEEKLY**, **14 DAY**, **28 DAY**, or **365 DAY** as desired.
9. Press **SAVE**.
10. Press **MORE** repeatedly to **BACK** then **ESC** to **S1 OK** screen.

How to set (SET) the DAILY Exerciser

1. Beginning from the **S1 OK** screen, press **MORE** then **SET**.
2. Press **MORE** repeatedly until **SET EXERCISER** screen.
3. Press **SEL**.
4. Enter **ACCESS** code located on white label on the back of the controller.
5. Press **SEL**
6. Cursor is indicated as a line under character to be changed. Change values with up and down keys. Press **SAVE** after each entry to save value and to move to the next value to be changed.
7. Press **BACK** when complete.
8. Press **MORE** repeatedly until **SET USER SETUP**. Press **BACK** then **ESC** to the **S1 OK** screen.

How to Bypass (Cancel) an exercise during an exercise cycle

1) Press **BPASS**
2) Allow the controller to complete the Engine cool down cycle.

If the CD Exerciser is configured or Set for a No-Load Exercise. Or allow the controller to complete retransfer to Source 1. If the CD Exerciser is configured for a Load Exerciser

How to Bypass the next exercise event and Keep the rest of scheduled events unchanged

1) Press **TEST**
2) Press **MORE**
3) Press **BYPASS EXER**

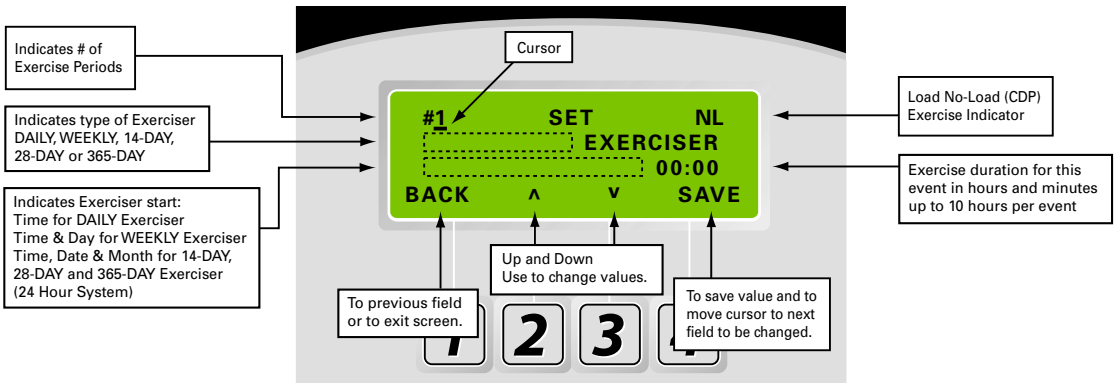
To re-institute the next exercise event back, press **CANCL BPASS**

How to check the next exercise event

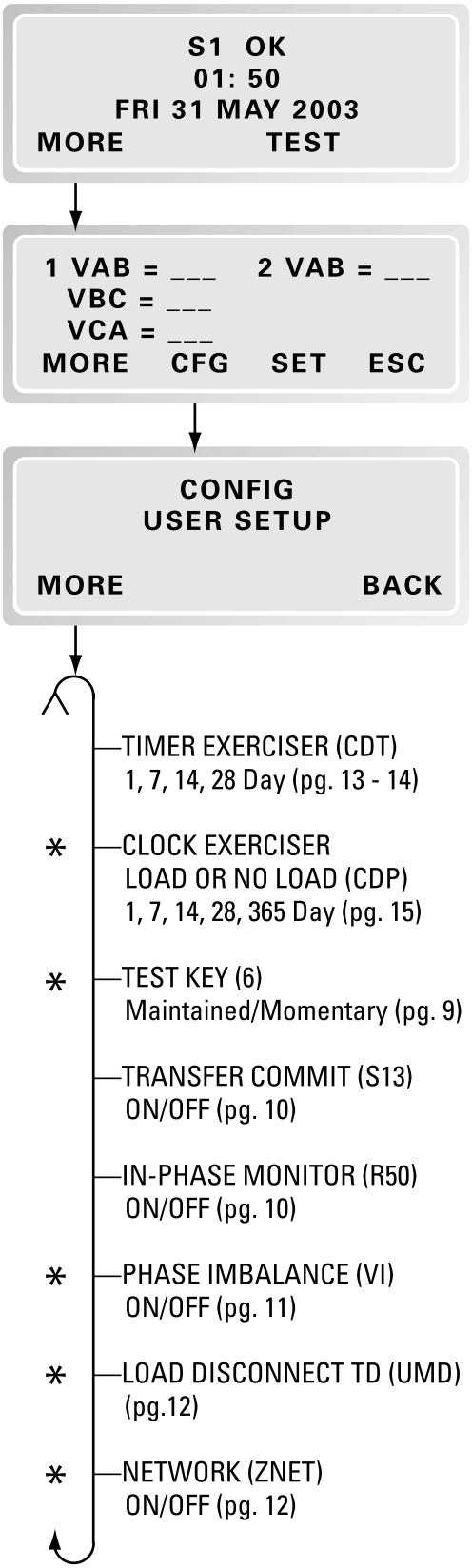
1) From **S1 OK** screen, press **MORE** three times.
2) The unit will display the **PLANT EXERCISER NEXT** event in **DAYS**, **HOURS**, and **MINUTES**
3) Press **ESC** to **S1 OK** Screen.

Notes:

- In the **S1 OK** screen, an (***E***) appears in the upper right hand corner of LCD screen when exercise is impending.
- For Load Exerciser, actual exercise period (ATS in S2 position)= **CDT** (Exerciser) timing period +T (S1 Stable Timer) timing period.
- A value greater than zero must be entered in the Exerciser duration field to be accepted as a valid exercise period.
- The Exercise cycle will be repeated on a regular basis as programmed and initiated in the **SET** menu depending on what Exerciser was configured (selected) in the **CFG** menu.



MX150 User Setup - CFG Menu



* Optional Accessories

Turn options ON or OFF via keypad through the CFG menu

Enter six digit access code
(The factory assigned six-digit access code is located on the back of the controller)

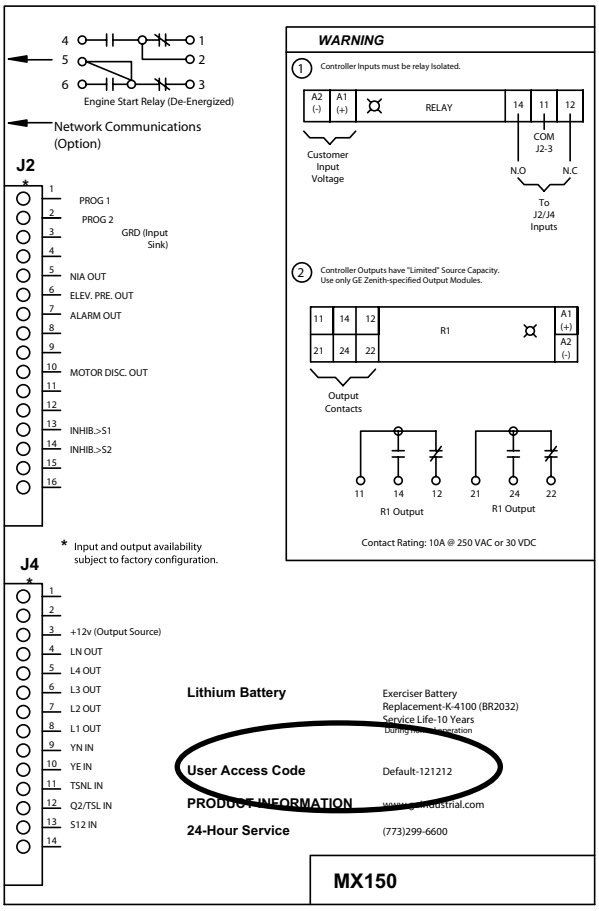
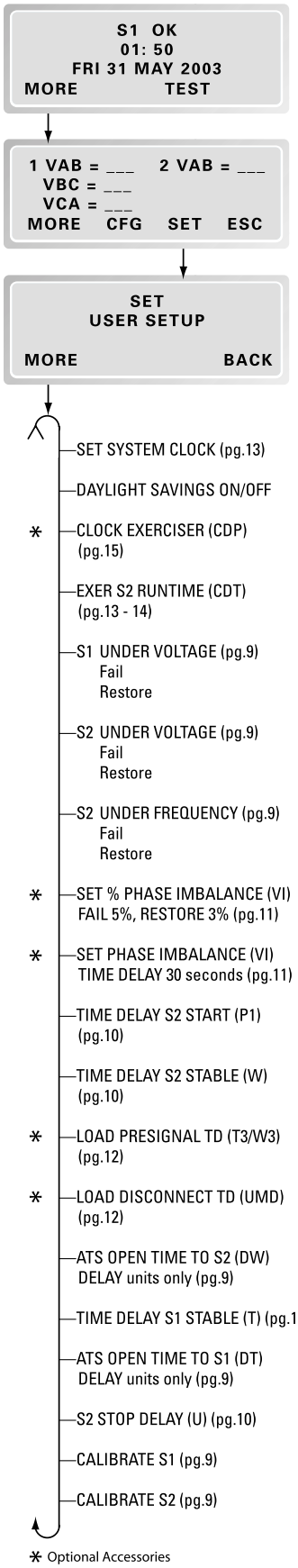


Figure 9

MX150 User Setup - SET Menu



Change adjustable values through the SET menu.

Enter six digit access code
(The factory assigned six-digit access code is located on the back of the controller)

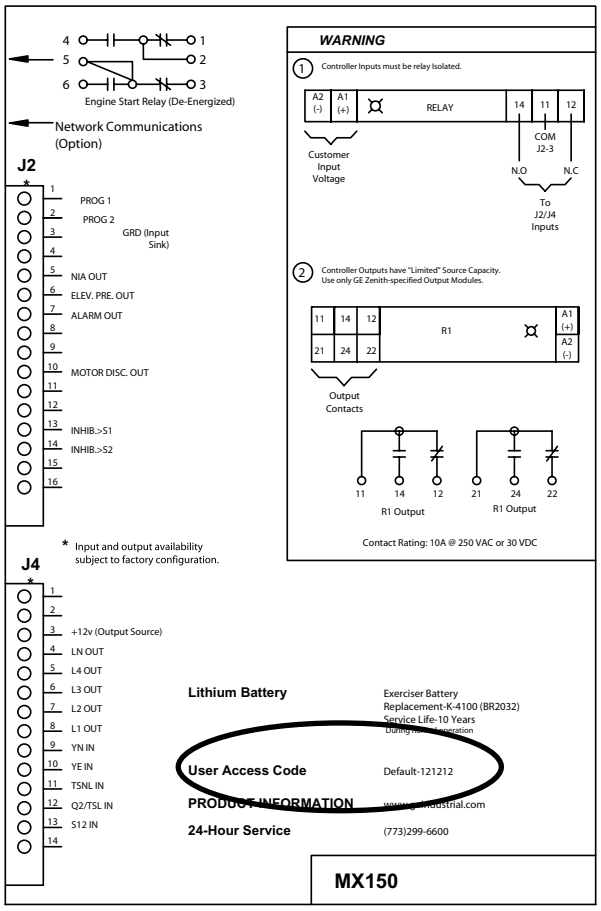
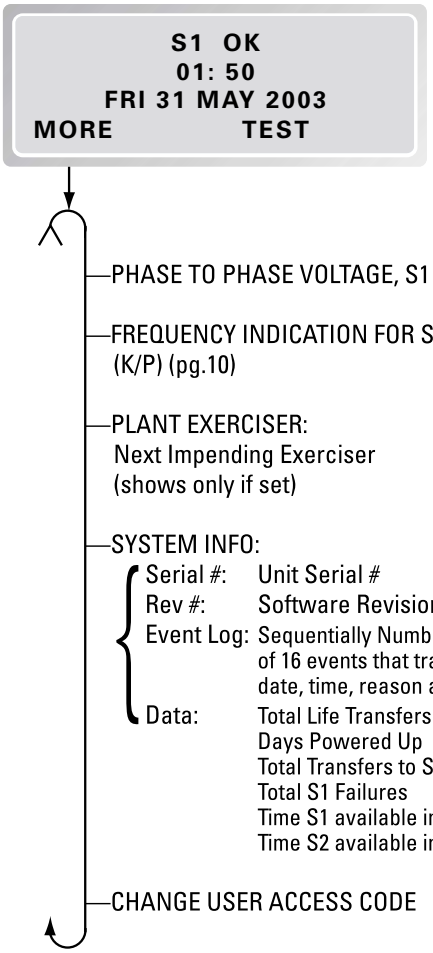


Figure 9

MX150 User Setup - System Info



View System Data

Enter six digit access code
(The factory assigned six-digit access code
is located on the back of the controller)

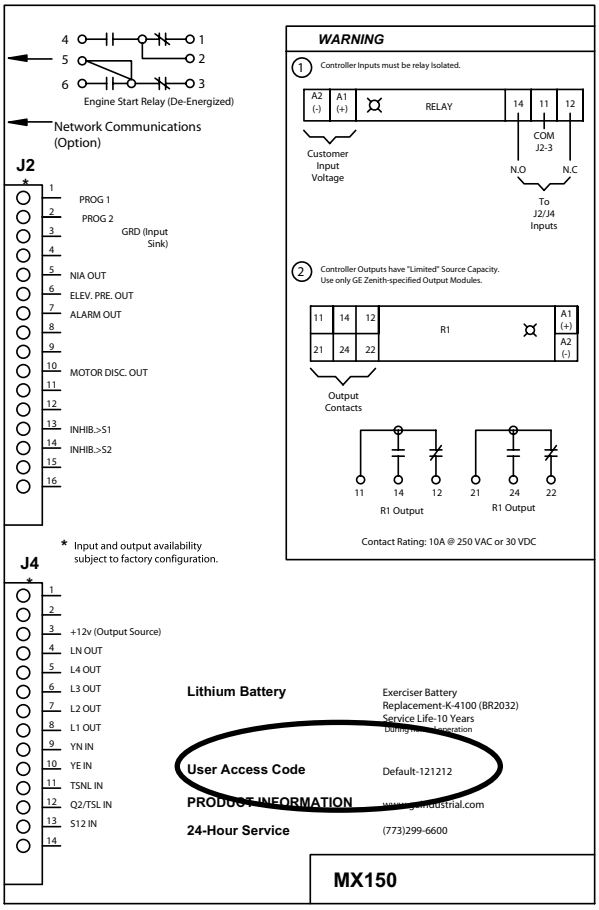


Figure 9

Testing

⚠ NOTICE ⚠

A periodic test of the transfer switch under load conditions is recommended to insure proper operation. (See National Electric Code articles 700 and 701)

ATS Testing

Start generator and verify proper voltage, frequency and phase sequence (match to Source 1). Shut down gen set and place in Auto. Complete the visual inspection of the transfer switch, and close the cabinet door.

Initiate the test by pressing the TEST button on the LCD keypad. The controller will then prompt for your access code. After entering the code, three test options will appear—XFR LOAD, FAST TEST and NO XFR (See Figure 10).

- **XFR LOAD** test starts the generator and using the current timer settings, transfers the load to Source 2.
- **FAST TEST** test presets timer values to a maximum 30 seconds during the test. After completion of the test, all timers are reset to their original values. (T3, W3, DT and DW remain)
- **NO XFR** test starts the generator but does not transfer the load to the Source 2.

Press and hold the desired test option button until the switch transfers to Source 2 (load test) or until the generator has been run for the desired amount of time (no load test). Releasing the test button before W timer timeout will abort the test (Exception: when the transfer commit option, is configured “ON”).

To test lamps, press TEST then scroll through MORE, then press LAMP TEST. To cancel LAMP TEST press MORE.

Standard Transition

When the test is initiated, the controller initiates the Time Delay Source 2 Start Timer (Engine Start Timer "P") cycle. A manual CANCEL button is provided to cancel the test if desired. Upon completion of the (P) time delay, an Engine start Signal is sent to Source 2. When Source 2 voltage and frequency reach the preset "Restore" Values, the time delay to Source 2 Timer (W) begins its timing cycle to ensure voltage and frequency stabilization before transfer. A manual pushbutton BYPASS is provided to bypass the "W" time delay if desired. After the (W) time delay, the MX controller initiates a transfer signal through the SCR-E to operate the main transfer operator. The load is now transferred to Source 2 line. The transfer switch is mechanically locked. SN limit switch awaits the next operation to Source 1.

Restoration of Source 1 Power:

Deactivating the test switch initiates re-transfer to Source 1 sequence. The delay to Source 1 Timer (T) begins its timing cycle to ensure voltage and frequency stabilization before retransfer. A manual pushbutton BYPASS is provided to bypass the "T" time delay if desired. After the (T) time delay, the MX controller initiates a transfer signal through the SCR-N to operate the main transfer operator. The load is now transferred to Source 1 line. The transfer switch is mechanically locked. SE limit switch awaits the next operation to Source 2.

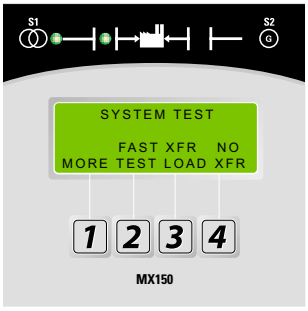


Figure 10

Immediately after re-transfer, the S2 Stop Delay Timer (Delay to Engine Stop "U") begins its cycle to allow Source 2 Engine to run unloaded. A manual pushbutton BYPASS is provided to bypass the "U" time delay if desired. Upon completion of the (U) timing cycle, the controller sends an Engine stop signal.

Delayed Transition

Source 1 Power Failure:

When the test is initiated, the controller initiates the Time Delay Source 2 Start (Engine Start Timer "P") cycle. A manual CANCEL button is provided to cancel the test if desired Upon completion of the (P) time delay, an Engine start Signal is sent to Source 2. When Source 2 voltage and frequency reach the preset "Restore" values, the time delay to open Source 1 timer (W) begins its timing cycle to ensure voltage and frequency stabilization before re-transfer. A manual pushbutton BYPASS is provided to bypass the "W" time delay if desired. After the (W) time delay, the MX controller initiates a transfer signal through the SCR-NO to operate the main transfer operator. The load is now transferred to the Open position. The time delay to Source 2 timer (DW) begins its timing cycle. After the (DW) time delay, the MX controller initiates a transfer signal through the SCR-E to operate the main transfer operator. The load is now transferred to Source 2 line. The transfer switch is mechanically locked. SN limit switch awaits the next operation to Source 1.

Restoration of Source 1 Power:

Deactivating the test switch initiates re-transfer to Source 1sequence. The delay to open Source 2 Timer (T) begins its timing cycle to ensure voltage and frequency stabilization before retransfer. A manual pushbutton BYPASS is provided to bypass the "T" time delay if desired. After the (T) time delay, the MX controller initiates a transfer signal through the SCR-EO to operate the main transfer operator. The load is now transferred to the Open position. The time delay to Source 1 timer (DT) begins its timing cycle. After the (DT) time delay, the MX controller initiates a transfer signal through the SCR-N to operate the main transfer operator. The load is now transferred to Source 1 line. The transfer switch is mechanically locked. SE limit switch awaits the next operation to Source 2.

Immediately after re-transfer, the S2 Stop Delay Timer (Delay to Engine Stop "U") begins its cycle to allow Source 2 Engine to run unloaded. A manual pushbutton BYPASS is provided to bypass the "U" time delay if desired. Upon completion of the (U) timing cycle, the controller sends an Engine stop signal.

Sequence of Operation

Standard Transition

Source 1 Power Failure:
When Source 1 voltage or frequency has fallen below the preset "Fail" values, the controller initiates the Time Delay Source 2 Start Timer (Engine Start Timer "P") cycle. Upon completion of the (P) time delay, an Engine start Signal is sent to Source 2. When Source 2 voltage and frequency reach the preset "Restore" Values, the time delay to Source 2 Timer (W) begins its timing cycle to ensure voltage and frequency stabilization before transfer. A manual pushbutton BYPASS is provided to bypass the "W" time delay if desired. After the (W) time delay, the MX controller initiates a transfer signal through the SCR-E to operate the main transfer operator. The load is now transferred to Source 2 line. The transfer switch is mechanically locked. SN limit switch awaits the next operation to Source 1.

Restoration of Source 1 Power:
When Source 1 power reach the preset "Restore" values, the controller initiates re-transfer to Source 1sequence. The delay to Source 1 Timer (T) begins its timing cycle to ensure voltage and frequency stabilization before retransfer. A manual pushbutton BYPASS is provided to bypass the "T" time delay if desired. After the (T) time delay, the MX controller initiates a transfer signal through the SCR-N to operate the main transfer operator. The load is now transferred to Source 1 line. The transfer switch is mechanically locked. SE limit switch awaits the next operation to Source 2.

Immediately after re-transfer, the S2 Stop Delay Timer (Delay to Engine Stop "U") begins its cycle to allow Source 2 Engine to run unloaded. A manual pushbutton BYPASS is provided to bypass the "U" time delay if desired. Upon completion of the (U) timing cycle, the controller sends an Engine stop signal.

Delayed Transition

Source 1 Power Failure:
When Source 1 voltage or frequency has fallen below the preset "Fail" values, the controller initiates the Time Delay Source 2 Start (Engine Start Timer "P") cycle. Upon completion of the (P) time delay, an Engine start Signal is sent to Source 2. When Source 2 voltage and frequency reach the preset "Restore" values, the time delay to open Source 1 timer (W) begins its timing cycle to ensure voltage and frequency stabilization before re-transfer. A manual pushbutton BYPASS is provided to bypass the "W" time delay if desired. After the (W) time delay, the MX controller initiates a transfer signal through the SCR-NO to operate the main transfer operator. The load is now transferred to the Open position. The time delay to Source 2 timer (DW) begins its timing cycle. After the (DW) time delay, the MX controller initiates a transfer signal through the SCR-E to operate the main transfer operator. The load is now transferred to Source 2 line. The transfer switch is mechanically locked. SN limit switch awaits the next operation to Source 1.

Restoration of Source 1 Power:
When Source 1 power reach the preset "Restore" values, the controller initiates re-transfer to Source 1 sequence. The delay to open Source 2 Timer (T) begins its timing cycle to ensure voltage and frequency stabilization before retransfer. A manual pushbutton BYPASS is provided to bypass the "T" time delay if desired. After the (T) time delay, the MX controller initiates a transfer signal through the SCR-EO to operate the main transfer operator. The load is now transferred to the Open position. The time delay to Source 1 timer (DT) begins its timing cycle. After the (DT) time delay, the MX controller initiates a transfer signal through the SCR-N to operate the main transfer operator. The load is now transferred to Source 1 line. The transfer switch is mechanically locked. SE limit switch awaits the next operation to Source 2.

Immediately after re-transfer, the S2 Stop Delay Timer (Delay to Engine Stop "U") begins its cycle to allow Source 2 Engine to run unloaded. A manual pushbutton BYPASS is provided to bypass the "U" time delay if desired. Upon completion of the (U) timing cycle, the controller sends an Engine stop signal.

Table 3

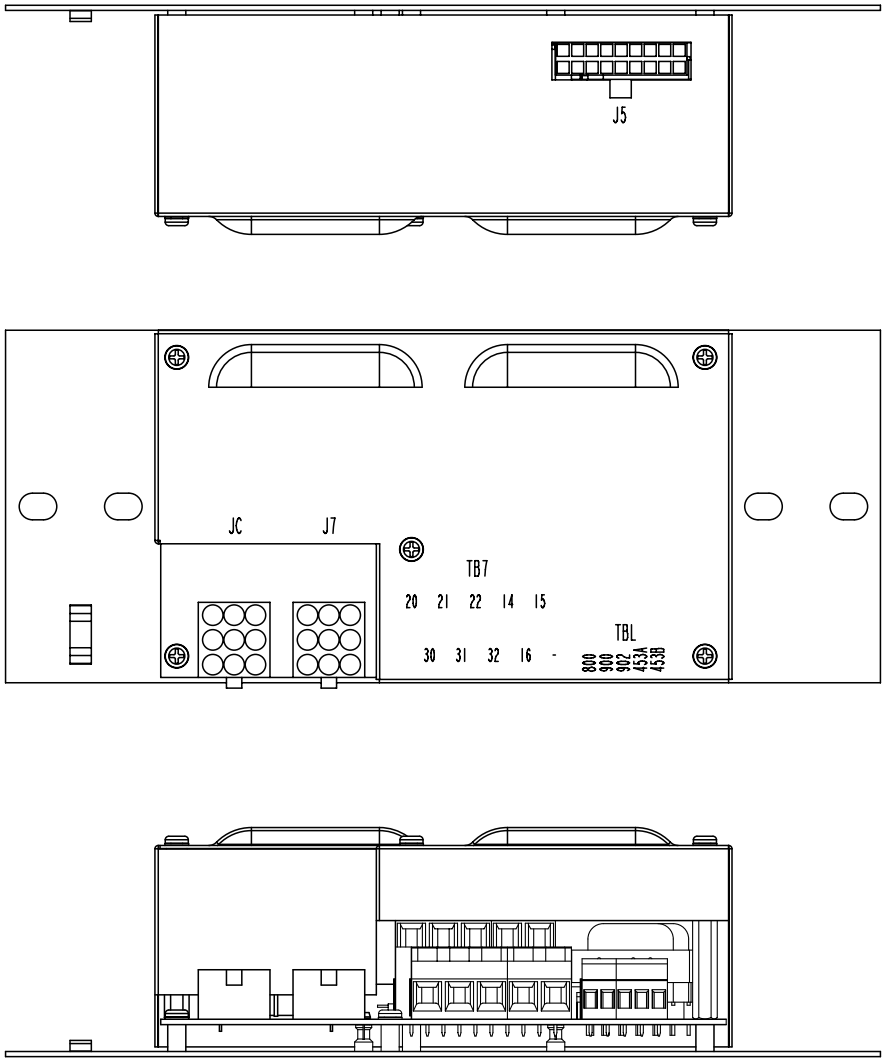
Timer Designations as they appear in the SET menu

ATS Type	P	W	DW	T	DT	U
Standard	Time Delay S2 Start	Time Delay S2 Stable	→	Time Delay S1 Stable	→	S2 Stop Delay
Delay	Time Delay S2 Start	Time Delay S2 Stable	ATS Open Time to S2	Time Delay S1 Stable	ATS Open Time to S1	S2 Stop Delay
Source 1 Fails	Transfer to Source 2 →			Source 1 Returns ↓	Transfer to Source 1 →	Engine Cooldown

Controls Power Supply (CPS)

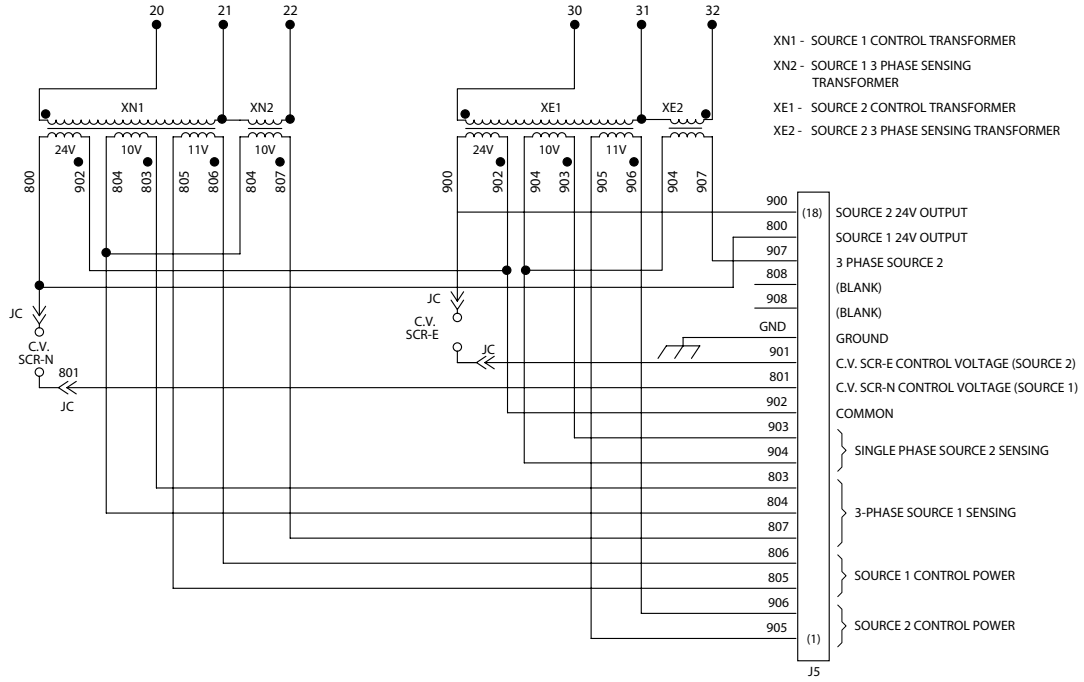
Standard and Delay Transition

Each MX150 microprocessor based ATS controller requires a Controls Power Supply (CPS) to apply line voltage to the ATS operator via SCRs. Also required is power for the MX150 printed circuit board and an application of sensing voltage proportional to line voltage. This is accomplished by the Controls Power Supply (CPS). This method of switching operator voltage and applying power and sensing voltage to the printed circuit board isolates the MX150 from the line voltage, further protecting the controller from harmful line transients.

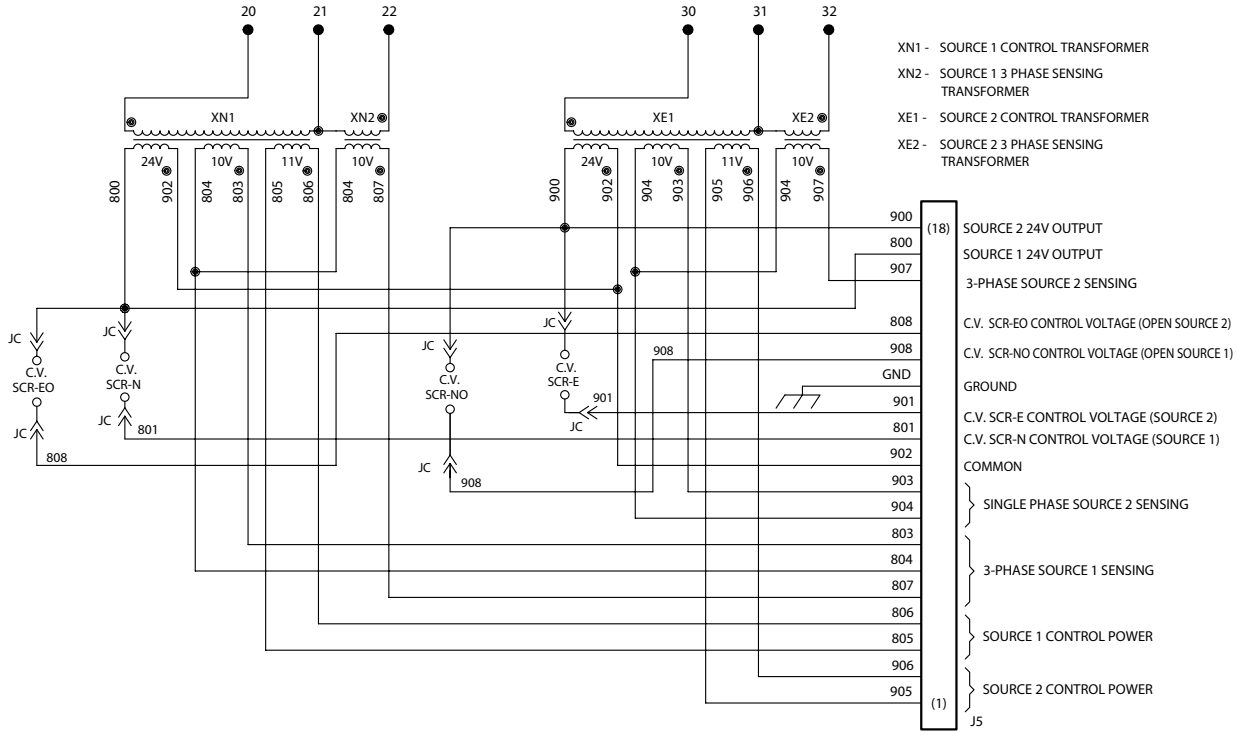


Primary Voltage at 50/60 Hz	CPS Assembly Part No.	CPS Board No.
120V	50P-1224	50P-1200
208-220V	50P-1225	50P-1201
230-240V	50P-1226	50P-1202
277V	50P-1227	50P-1203
380-400V	50P-1228	50P-1204
416-440V	50P-1229	50P-1205
460-480V	50P-1230	50P-1206
575-600V	50P-1231	50P-1207

Standard Transition CPS Schematic



Delayed Transition CPS Schematic



Troubleshooting and Diagnostics

⚠ DANGER ⚠

HAZARDOUS VOLTAGES CAN CAUSE SEVERE INJURY OR DEATH.
These charts may indicate problems that require authorized GE Zenith service personnel.
Hazardous voltages may exist on termination plugs other than those that go into the MX150.

General Troubleshooting

The following troubleshooting guide is used to recognize, and determine basic faults. When using this guide, it will ask several questions about the condition of the switch. This guide will then list an order of the possible faults. You will then look at the first suspected fault to determine if it is the problem. If it is not a fault, you go to the second suspected fault. If you go through all of the suspected faults, or the chart instructs you to, call a GE Zenith Representative for further assistance.

NOTE: When you use the troubleshooting charts, the Annunciation column refers to the LED's on the control panel.

Symptom	Annunciation	Possible Cause(s)	Corrective Action
Engine does not START	SOURCE 2 AVAILABLE LED off	Engine start wires not terminated properly	Check engine start connections
		Generator is in OFF position	Investigate why Engine Control Switch was turned off
Engine does not stop	LCD Display - "TD Engine Cool Down"	U timing cycle not complete	Check U timer setting
	SOURCE 1 POSITION, and SOURCE 1 and SOURCE 2 AVAILABLE LEDs on, but U timer has timed out	Engine start wires not terminated correctly	Check Engine Start Connections
		Generator in MANUAL	Place generator in AUTO
ATS will not transfer to SOURCE 2 ZTG Series	SOURCE 2 AVAILABLE LED off	SOURCE 2 voltage or frequency not within acceptable parameters	Check: Engine Start Connections, Generator Breaker, Generator Output, and Engine Control Switch
	None	Power supply connector unplugged	Plug in connector
	LCD Display - "S1 _ _ _ _ TD XFR S1>S2 Time Remaining _ _ _ _"	**W** timing cycle not complete	Check **W** Timer setting
ATS will not transfer to SOURCE 1 ZTGD Series	LCD Display - "ATS Open Time Remaining _ _ _ _"	**DW** timing cycle not complete	Check **DW** Timer setting
	SOURCE 1 AVAILABLE LED off	SOURCE 1 voltage or frequency not within acceptable parameters	Check utility and utility breakers
	None	Power supply connector unplugged	Plug in connector
	LCD Display - "Diagnostic Code 001"	Limit switch or RT box connector unplugged	Call Technical Services
	LCD Display - "S1 OK Time Remaining _ _ _ _ Bypass"	**T** timing cycle not complete	Check **T** Timer setting
	LCD Display - "ATS Open Time Remaining _ _ _ _"	**TD** timing cycle not complete	Check **DT** Timer setting

Maintenance and Testing

⚠ CAUTION ⚠

Due to hazardous voltage and current, GE Zenith recommends that a GE Zenith Certified technician or a qualified electrician must perform the installation and maintenance of the switch.

⚠ WARNING ⚠

Both power sources must be disconnected before manual operation of the switch.

A preventive maintenance program will insure high reliability and long life for the transfer switch. The preventive maintenance program for the transfer switch should include the following items:

Inspection and Cleaning

The switch should be inspected for any accumulation of dust, dirt, or moisture, and should be cleaned by vacuuming or wiping with a dry cloth or soft brush. do not use a blower since debris may become lodged in the electrical and mechanical components and cause damage.

Remove the transfer switch barriers and check the condition of the contacts. Any surface deposits must be removed with a clean cloth (do not use emery cloth or a file). If the contacts are pitted or worn excessively, they should be replaced. A general inspection of mechanical integrity should be made to include loose, broken or badly worn parts.

Servicing

All worn or inoperative parts must be replaced using GE Zenith recommended replacement parts. Please refer to the Replacement Parts manual for specific part information and ordering procedures. Please contact the GE Zenith Technical Services Department for the Replacement Parts manual.

The operating mechanism of the transfer switch is lubricated with Lubriplate 105. The lubricant applied at the factory provides adequate lubrication for the lifetime of the switch. Should debris contaminate the mechanism, clean and apply additional Lubriplate.

GE Zenith can provide complete preventative maintenance services. Please contact the GE Zenith Technical Services Department for additional information.

CDT battery replacement - lithium batteries may last up to 10 years, however it is recommended that battery replacement be included in a 3-5 year service cycle. The battery maintains the exerceser memory only and does not otherwise affect the operation.

Testing

A manual operator handle is provided with the transfer switch for maintenance purposes only. Manual operation of the switch must be checked before it is operated electrically. **Both power sources must be disconnected before manual operation of the switch.** Insert the handle and operate the transfer switch between the Source 1 and Source 2 positions. The transfer switch should operate smoothly without binding. Return the switch to Source 1 position, remove the handle, and return it to the holder provided.

After completing the inspection, cleaning and servicing of the transfer switch, reinstall the switch cover, and close and lock the cabinet door. Reclose the circuit breakers feeding the utility and generator sources to the switch.

Initiate the electrical transfer test by activating the TS test switch. P timer will time out and the microcontroller will send an engine start signal. When the W time has elapsed, the switch will complete its transfer by closing into Source 2.

Deactivating the test switch will start retransfer to Source 1. The switch will complete its retransfer to Source 1 after the time delay of the T timer. The U engine overrun timer allows the engine generator to run unloaded for a preset cool down period.

NOTE: A periodic test of the transfer switch under load conditions is recommended to insure proper operation. (See National Electric Code articles 700 and 701).

⚠ WARNING ⚠

When performing a hi-pot or dielectric test on the power section, DISCONNECT the control panel plugs from the microprocessor to avoid potential damage.



GE Zenith Controls

A Product of GE Industrial Systems
General Electric Company
830 West 40th Street, Chicago, IL 60609 USA
773 299-6600, Fax: 773 247-7805
www.geindustrial.com

GE Zenith Controls

Entelli-Switch 250
Microprocessor Controller
Transfer Switch Control Panel



71R-2000A
11/04

Operation and Maintenance Manual

Authorized Service

For GE parts and service, call: (773) 299-6600

Table of Contents

	Page
Introduction	2
Safety	3
Equipment Inspection and Storage	3
Final Equipment Inspection	3
Installation	4
Engine Start Control Connections	4
Initial Energization	4-5
Control Connections	6
Entelli-Switch 250 Microprocessor Controller	7
Overview	7
LCD & Keypad	8
User Setting for Voltage & Frequency	9
Accessory Group Packages	10
Accessory Definitions	11-14
How to Set the System Clock	14
CDT One Event Timer Exerciser	15
CDP Clock Exerciser	16
User Setup - CFG Menu	17
User Setup - SET Menu	18
User Setup - System Info	19
Testing	20
Introduction	20
Test Options	20
Standard Transition	21
Delayed Transition	21
Closed Transition	22
Emergency Service Procedure for Extended Parallel Time	23
Sequence of Operation	24
Standard Transition	24
Delayed Transition	24
Closed Transition	25
Controls Power Supply (CPS)	26
Schematics	27
Troubleshooting & Diagnostics	28
Maintenance and Testing	29
Inspection and Cleaning	29
Servicing	29
Testing	29

Introduction

GE Zenith Transfer Switches are used to provide a continuous source of power for lighting and other critical loads by automatically transferring from source 1 power to source 2 power in the event that source 1 voltage falls below preset limits.

Voltage sensing and system control is performed via a state-of-the-art microcontroller located on the cabinet door. It is designed to give highly accurate control of the transfer switch system.

All GE Zenith transfer switches are designed for use on emergency or standby systems, and are rated for total system or motor loads. Transfer switches are UL Listed under Standard 1008 and CSA Certified under Standard C22.2 No. 178 and IEC Listed under Standard 947.

NOTES: A protective device such as a molded case circuit breaker or fused disconnect switch MUST be installed on both sources of incoming power for circuit protection and as a disconnection device.

All references made within this manual about the term "S1" or "Source 1" relate to a Normal Power Source. All references made about the term "S2" or "Source 2" relate to an Emergency or Alternative Power Source.

Safety / Installation

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

The safe operation of your switch is GE Zenith's focus. The proper storage, installation, operation and maintenance will help increase the life of the switch.

⚠ CAUTION ⚠

Due to hazardous voltage and current, GE Zenith recommends that a GE Zenith Certified technician or a qualified electrician must perform the installation and maintenance of the switch.

Equipment Inspection and Storage

Once you have received the transfer switch, inspect it for any damage. This includes damage to the enclosure, power panel, control panel and wiring harness. If any damage is found or suspected, file a claim as soon as possible with the carrier and notify the nearest GE Zenith representative.

Before installation, if it is necessary, store the transfer switch in a clean dry place, protected from dirt and water. Provide ample air circulation and heat, if necessary, to prevent condensation.

Storage Temperature	Operating Temperature (Ambient):	Humidity
-30°C to +75°C (-22°F to +167°F)	**40-400 AMP** *(molded shell)* -20°C to +65°C (-4°F to +149°F) **40-4000 AMP** *(all other frame and panel types)* -20°C to +60°C (-4°F to +140°F)	5% to 95% (non-condensing)

Table 1

Final Equipment Inspection

Prior to energizing the transfer switch:

1. Remove any debris incurred, with a vacuum, due to shipment or installation.
2. Verify that all cabled connections are correct and that phase rotation of both sources match.
3. Check engine start connections.
4. Verify the correct connection of all control wires.
5. Check settings of all timers and adjust as necessary.
6. Adjust any optional accessories as required.
7. Check the lug torque values of the power connections.

   NOTE: Lug torque values are specified in the power panel manual.

8. Make sure that all covers and barriers are installed and properly fastened.

   NOTE: Power panels ship from GE Zenith in Source 1 Position.

⚠ WARNING ⚠

Do not use a blower since debris may become lodged in the electrical and mechanical components and cause damage.

Each GE Zenith transfer switch is factory wired and tested. A complete information package is furnished with each switch which includes:

a. Sequence of operation.
b. Description and operation of all accessories supplied.
c. Power panel connection diagram and schematic.
d. Description and identification of all customer field connections.

Installation of GE Zenith transfer switches includes:

a. Mounting the transfer switch cabinet.
b. Connection of Source 1, Source 2, and Load cables or bus bars.
c. Connection of external control circuits as required.

Installation *(cont'd)*

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

E

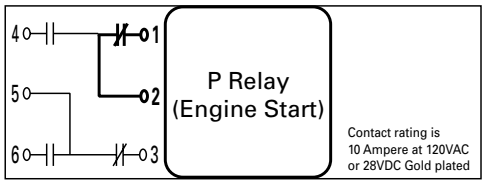


Figure 1

Engine Start Control Connections

The engine-start terminals are clearly identified by a label on the microcontroller backplate. In the case of manual transfer switches, or in other applications not requiring the microprocessor, clearly marked terminal blocks are provided in the upper left corner of the control panel for the engine start control wires.

Figure 2 shows location of engine start connections for Bypass Isolation Transfer Switch. Figure 5 (pg.6) shows location of engine start connections for Automatic Transfer Switch.

Terminals for field connections to the A3 Source 2 auxiliary contacts and the A4 Source 1 auxiliary contacts are also provided. These terminals are clearly marked and appear on the side of the power panel. On 400 amp metal frame units these terminals appear on the bracket above the operator handle.

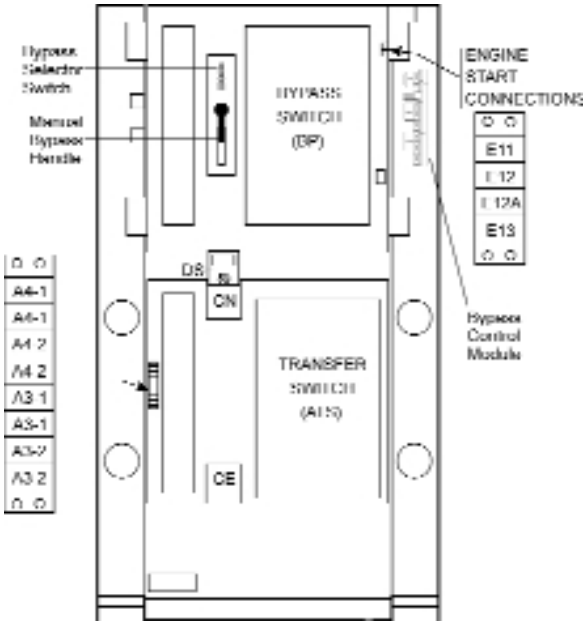


Figure 2 (Typical)

Initial Energization

Before proceeding, refer to the information package supplied with the ATS and read and understand the information on all accessories provided.

1. Unlock the enclosure.
2. Open the enclosure.
3. Verify the correct system voltage.

   NOTE: The equipment rating nameplate on the transfer switch lists the voltage. See *Figure 3*.

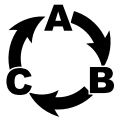
4. Close Source 1 circuit. breaker.

   NOTE:The controller will illuminate Source 1 Available LED if proper voltage is sensed.

5. Verify the phase to phase voltages at Source 1 line terminals.
6. Close Source 2 circuit breaker.
7. Start the generator's engine.

   NOTE: The controller will illuminate Source 2 Available LED when preset voltage and frequency levels are reached.

8. Verify the phase to phase voltages at Source 1 line terminals.
9. Verify that the phase rotation of Source 1 is the same as the phase rotation of Source 2.



10. Shut down the generator's engine.
11. Place the starting control in the Automatic position.
12. Complete the visual inspection of the transfer switch.
13. Close the enclosure.
14. Lock the enclosure.

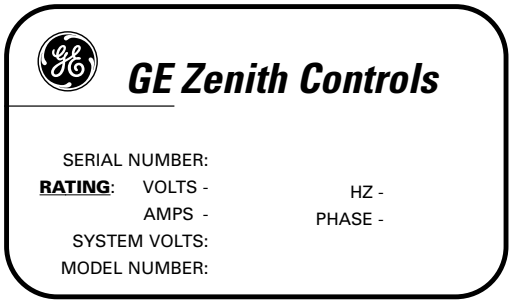


Figure 3

⚠ CAUTIONS ⚠

Certain accessories, per specific schematics, can inhibit automatic transfer.
Engine Gen-Set could start when engine control wires are attached.

Initial Energization *(cont'd)*

After all options and accessories are checked and verified, follow these steps to set up the ATS. Refer to Entelli-Switch 250 display *Figure 4*. The annunciation LEDs illuminate to indicate (1) source availability, (2) ATS position, and (3) Entelli-Switch 250 control function (timing).

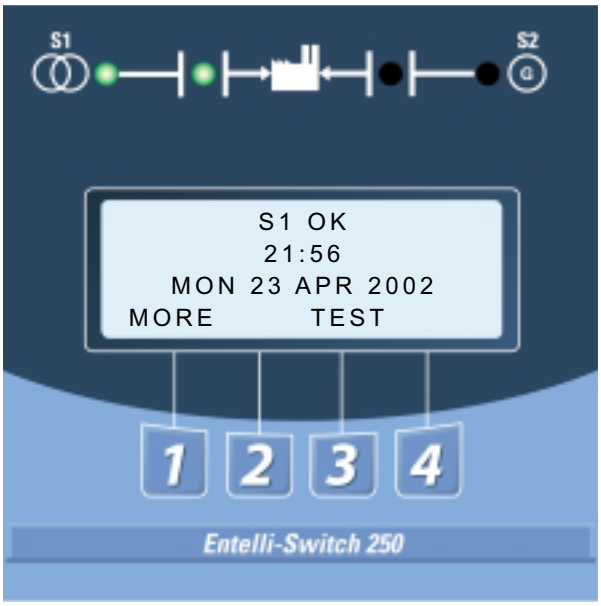


Figure 4 – LCD and keypad

1. Unlock the enclosure.
2. Open the enclosure.
3. Place the Disconnect Switch in the Inhibit.

   NOTE: This step is only performed if the "DS" Option was purchased.

4. Close the external (up-stream) Source 1 circuit breaker.

   NOTES: Source 1 Available and Source 1 Position LED's will illuminate.

   If Source 1 Available LED does not illuminate, verify that Source 1 Voltage is above the preset restore value.

   The Gen-Set will start and run while Source 2 stop Delay Timer is timing.

5. Close the External (up-stream) Source 2 line circuit breaker.
6. Start the engine generator in MANUAL mode.

   NOTE: When the voltage and frequency reach preset values, the Source 2 Available LED will illuminate.

7. Verify the phase to phase voltages at Source 2 line terminals.
8. Verify that the phase rotation of Source 2 is the same as the phase rotation of Source 1.



9. Shut down the generator's engine. (Place in Automatic Mode.)

   NOTE: Source 2 Available LED will turn off.

   NOTE: The engine generator will continue to run for the duration of Source 2 Stop Delay Timer.

10. Place the disconnect switch to ENABLE.
11. Complete the visual inspection of the transfer switch.
12. Close the enclosure.
13. Lock the enclosure.

⚠ WARNING ⚠

When performing a hi-pot or dielectric test on the power section, DISCONNECT the control panel plugs from the microprocessor to avoid potential damage.

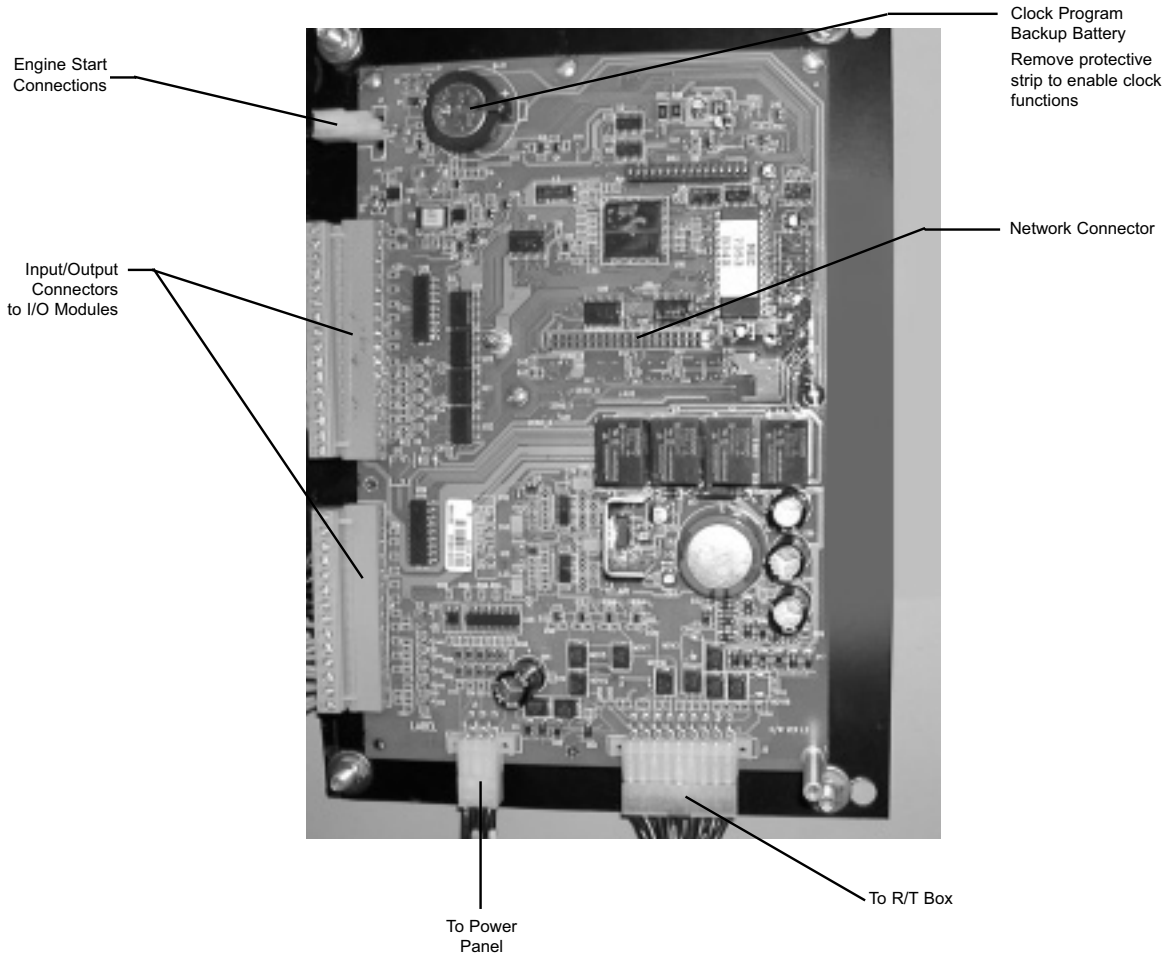
⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Control Connections

Figure 5



A complete information package is furnished with each transfer switch including a complete connection diagram and schematic which details all necessary control circuit field connections.

The engine start control wires connect to the engine start relay terminals located to the left of the microprocessor. Figure 5 shows the location of these terminals.

The terminals are clearly identified by a label on the microcontroller backplate. In the case of manual transfer switches, or in other applications not requiring the microprocessor, clearly marked terminal blocks are provided in the upper left corner of the control panel for the engine start control wires.

Entelli-Switch 250 Controller

Consists of two major assemblies:

I. The **Microprocessor** contains the following:

A. Entelli-Switch 250 Board - Customer Input and Output (I/O) for system interface. Located on the left hand side of the back of the unit (see figure 6)

1. I/O accessories that can be found here are:
   a. Engine start relay P output
   b. Pre-Signal to transfer T3, W3 and UMD output (optional)
   c. Transfer Inhibit Q3 and Q7 input (optional)
   d. Remote test Q2 input (optional)
   e. Network interface ZNET input/output (optional)

B. LCD and Keypad located on the exterior of the door (see figure 7)

1. User accessibility to the following:
   a. LED indication of source availability
   b. LED indication of transfer switch position
   c. LCD screen indicates:
      (1) timer count down (numeric)
      (2) event reporting (text)
   d. Keypad provides user interface to: *[in conjunction with LCD screen]*
      (1) Setting sensors and timers
      (2) Configuring logic accessories

II. The **Controls Power Supply (CPS)**

Contains transformers which drop line voltage to control level for controller input and SCR inputs (see figure 6).

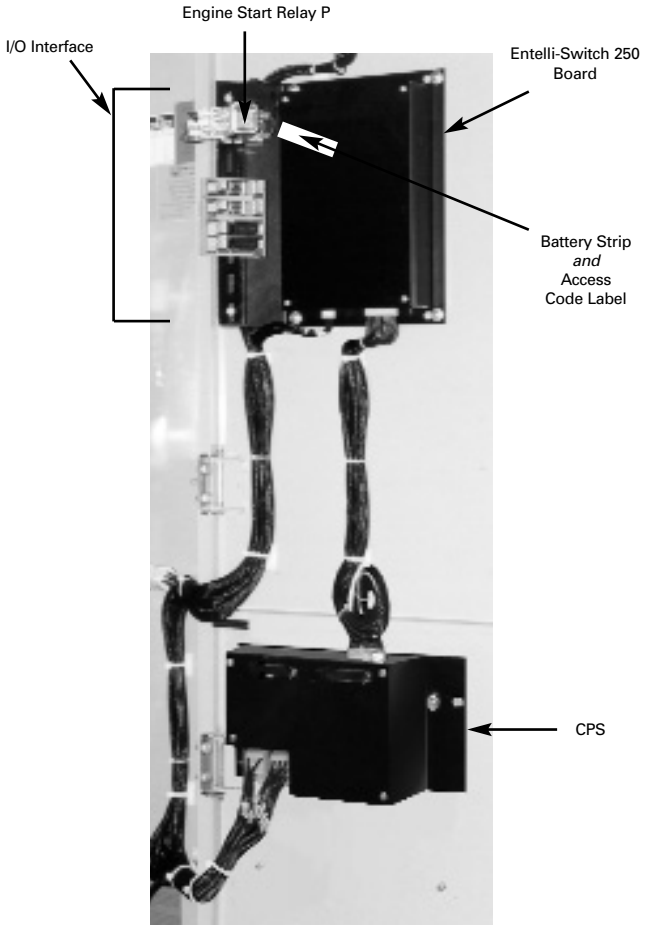


Figure 6

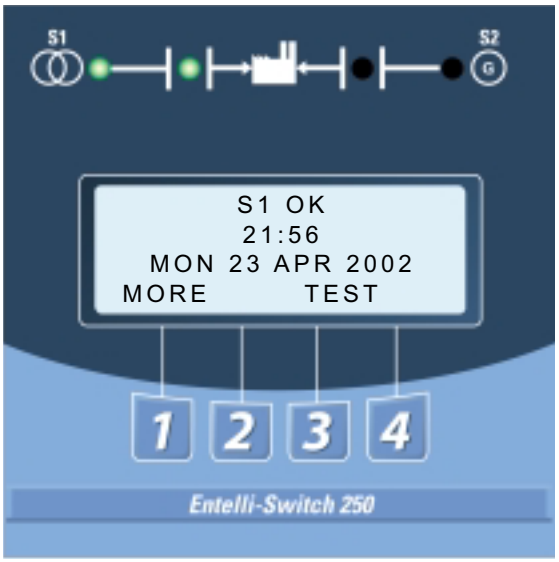


Figure 7

LCD & Keypad

These options are accessible through the LCD and keypad (see figure below). To become familiar with the options loaded into a particular unit, scrolling through the SET and CFG menu will show the descriptions of the options (see pages 17-18). These menus are the very same menus that are used to access the setting and/or configuration of these options. The SET (setting) menu is primarily used to show or change, time and voltage settings. The CFG menu is primarily used to turn an option on or off. When scrolling through these menus, no changes can be made without entry of the access code.

The factory set six-digit access code is located on a white label on the back of the unit (see figure 10 pgs. 17-19).

The Entelli-Switch 250 has many logic options. Each controller is downloaded with options at the time of manufacture. The collection of options that any one controller has is specified at the time of order placement. The following pages include all the options that can reside in the controller. Not all units include all options.

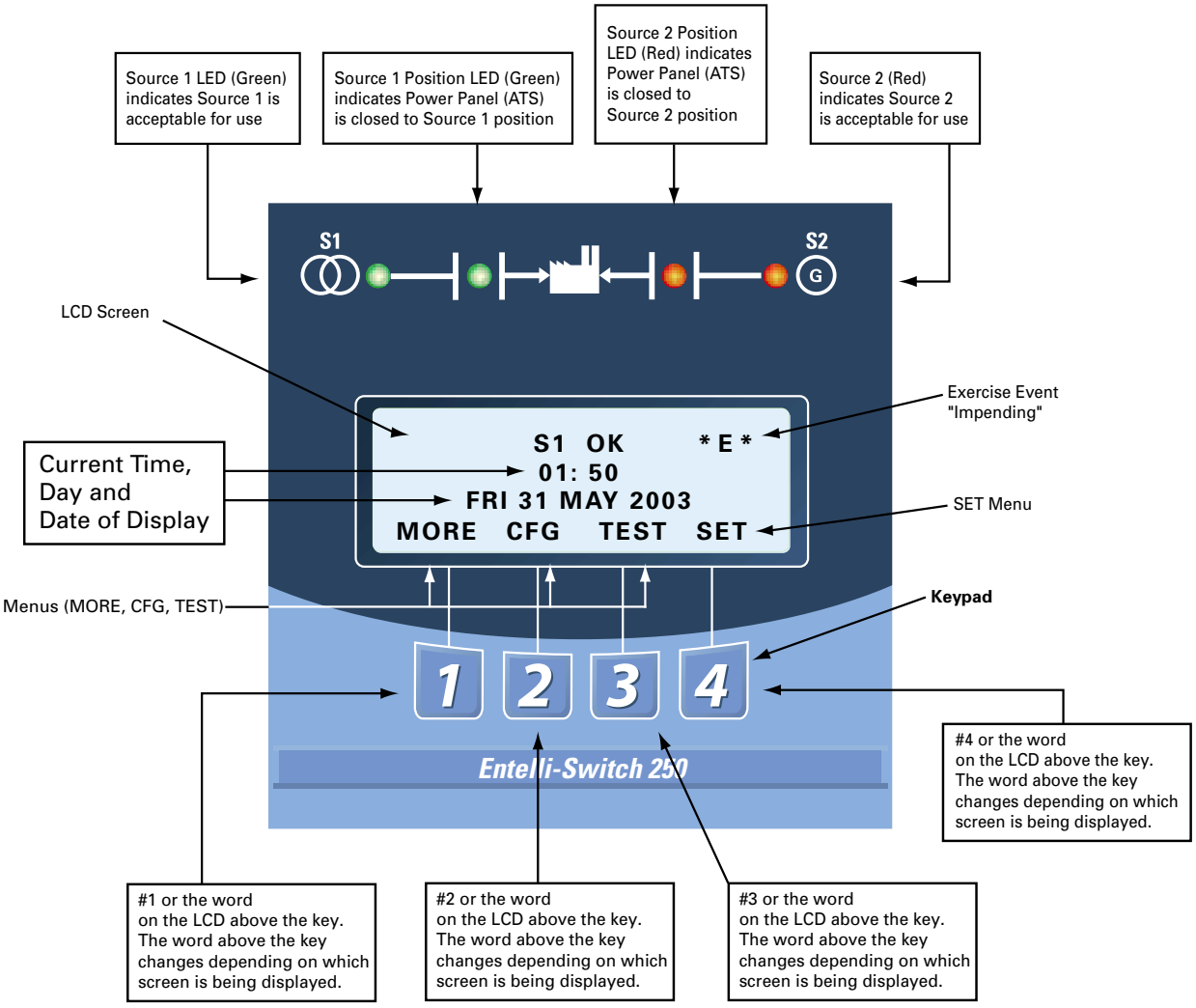


Figure 8

User Setting for Voltage & Frequency

Standard 3-Phase Sensing on 3 and 4 Pole Units

Source 1

Under Voltage "Restore"
Factory Default: 90%
This adjustment determines the minimum acceptable voltage required to transfer to Source 1.
Adjust via the SET menu. Range is 85% to 100% in 1% increments (see page 18).
Once satisfied, the T timer will begin timing to transfer to Source 1.

Under Voltage "Fail"
Factory Default: 80%
This adjustment determines the low voltage threshold. Adjust via the SET menu. Range is 75% to 98% in 1% increments (see page 18).
"Fail" must be a minimum of 2 % below "Restore" setting. Once voltage falls below threshold, P timer begins timing to signal Source 2 Generator to start.

Under Frequency "Restore"
Factory Default: 95%
This adjustment determines the minimum acceptable frequency required to transfer to Source 1.
Adjust via the SET menu. Range is 90% to 100% in 1% increments (see page 18).
Once satisfied, the T timer will begin timing to transfer to Source 1.

Under Frequency "Fail"
Factory Default: 90%, (5 seconds minimum).
This adjustment determines the low frequency threshold. Adjust via the SET menu. Range is 88% to 98% in 1% increments (see page 18).
"Fail" must be a minimum of 2 % below "Restore" setting. Once satisfied, the T timer will begin timing to transfer to Source 1.

Over Frequency "Restore"
Factory Default: 102%
This adjustment determines the minimum acceptable Over Frequency threshold at which the transfer switch is allowed to re-transfer to Source 1.
Adjust via the SET menu. Range is 102% to 104% in 1% increments (see page 18). “Restore” must be a minimum of 1% below “Fail” setting.

Over Frequency "Fail"
Factory Default: 105%
This adjustment determines the maximum acceptable Over Frequency.
Adjust via the SET menu. Range is 103% to 105% in 1% increments (see page 18).Once exceeded, the P timer begins timing to signal the generator to start.

Source 2

Under Voltage "Restore"
Factory Default: 90%
This adjustment determines the minimum acceptable voltage required to transfer to Source 2.
Adjust via the SET menu. Range is 85% to 100% in 1% increments (see page 18).
Once satisfied, the W timer will begin timing to transfer to Source 2.

Under Voltage "Fail"
Factory Default: 80%
This adjustment determines the low voltage threshold. Adjust via the SET menu. Range is 75% to 98% in 1% increments (see page 18).
"Fail" must be a minimum of 2 % below "Restore" setting. Once voltage falls below threshold, T timer will be bypassed to expedite the transfer to Source 1.

Over Voltage "Fail"
Factory Default: 110%
This adjustment determines the maximum acceptable Over Voltage. Adjust via the SET menu. Range is 105% to 110% in 1% increments (see page 18). Once exceeded, the T timer will be bypassed to expedite the transfer to Source 1.

Over Voltage "Restore"
Factory Default: 105%
This adjustment determines the minimum acceptable Over Voltage threshold at which the transfer switch is allowed to transfer to Source 2. Adjust via the SET menu. Range is 103% to 105% in 1% increments (see page 18). “Restore” must be a minimum of 2% below “Fail” setting.

Under Frequency "Restore"
Factory Default: 95%
This adjustment determines the minimum acceptable frequency required to transfer to Source 2.
Adjust via the SET menu. Range is 90% to 100% in 1% increments (see page 18).
Once satisfied, the W timer will begin timing to transfer to Source 2.

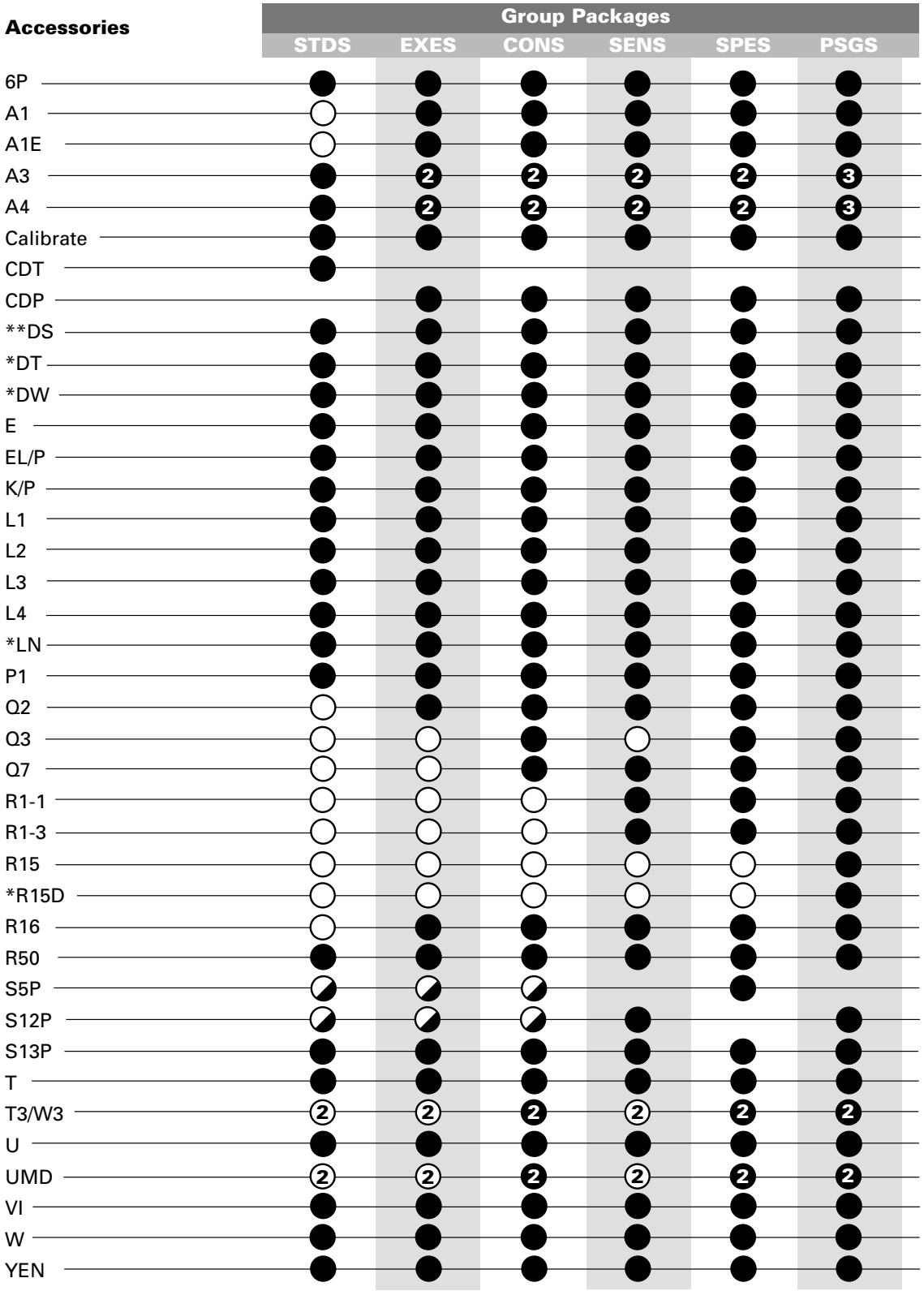
Under Frequency "Fail"
Factory Default: 90%, (5 seconds minimum).
This adjustment determines the low frequency threshold. Adjust via the SET menu. Range is 88% to 98% in 1% increments (see page 18).
"Fail" must be a minimum of 2 % below "Restore" setting. Once satisfied, the W timer will begin timing to transfer to Source 2.

Over Frequency "Fail"
Factory Default: 105%
This adjustment determines the maximum acceptable Over Frequency. Adjust via the SET menu. Range is 103% to 105% in 1% increments (see page 18). Once exceeded, the T timer will be bypassed to expedite the transfer to Source 1.

Over Frequency "Restore"
Factory Default: 102%
This adjustment determines the minimum acceptable Over Frequency threshold at which the transfer switch is allowed to re-transfer to Source 2. Adjust via the SET menu. Range is 102% to 104% in 1% increments (see page 18). “Restore” must be a minimum of 1% below “Fail” setting.

Accessory Group Packages

Table 2



● Standard Accessory included in the group package.
○ Optional Accessory not included but can be added to group package.
◪ Optional Accessory. Can not be used with accessory having the same symbol.
— N/A
②❷ Denotes an Accessory with 2 circuits as a standard.
❸ Denotes an Accessory with 3 circuits as a standard.

* Delayed Transition Units Only.
** Optional for 40-400 Amp

Accessory Definitions

6P
Test Switch, Momentary

6A
Test Switch, Maintained Auto/Momentary Test

6AP
Test Switch, Maintained/Momentary utilizing keypad

6B
Test Switch, Maintained - Auto / Momentary - Test, Key Operated

6C
Test Switch, Maintained - Auto / Maintained - Test, Key Operated

A1
Auxiliary Contact, operates on Source 1 line failure.

A1E
Auxiliary Contact, operates on Source 2 line failure.

A3
Auxiliary Contact: Closed in emergency (Source 2) Additional Available (10 max.) and need to be specified.

A4
Auxiliary Contact: Closed in normal (Source 1) Additional Available (10 max.) and need to be specified.

A62
Sequential Universal Motor Load Disconnect Circuit. Normally closed auxiliary contacts for motor loads. Open 0-60 seconds prior to transfer, after transfer, or both in either direction then re-close in timed sequence after transfer.

AB3
Auxiliary Contact: Closed in bypass emergency (Source 2) (S.P.D.T.) (Standard up to 400 Amp) Additional Available (10 max.) and need to be specified.

AB4
Auxiliary Contact: Closed in bypass normal (Source 1) (S.P.D.T.) (Standard up to 400 Amp) Additional Available (10 max.) and need to be specified.

B9
Battery charger connections.

Calibrate
While monitoring the actual Phase to Phase voltage levels and Frequency with a calibrated test equipment, the Phase to Phase voltage sensing and Frequency can be adjusted accordingly. Calibration capabilities are available for Frequency and AB, BC, CA Phase to Phase voltage for both Sources. Adjust via SET menu (see page 18)

CDP
Clock Exerciser Load/ No Load: Allows the Generator to start and run unloaded or to simulate a power failure, start Generator and run under load. Can be configured by end user for 1, 7, 14, 28, 365 day cycle. (See page 16)

CDT
Load or NO-Load. One event exerciser with adjustable Engine exercise timer. Exercise duration can be set between 5 and 60 minutes in 1 minute increments. Can be configured to run every 1, 7, 14, or 28 days. Factory Default is 20minutes. When exerciser is impending, (*E*) appears in the upper right hand corner of LCD screen. See page 15 for instructions. Configured via CFG (see page 17). Set via SET menu (see page 18).

CTAP
Alarm Panel on transfer to Source 2 with Silence button.

DS
Disconnect Switch, Auto/Inhibit.
Inhibits transfer in either direction when in inhibit.
Allows automatic operation when in Auto.
(40-400 Amps optional, 600-4000 Amps standard)

DT *(Delayed Transition Only)*
Time Delay from Neutral Switch position to Source 1 position. Adjustable 0-10 minutes in 1 second increments. Standard setting is 5 seconds Adjust via SET menu (see page 18)

DW *(Delayed Transition Only)*
Time Delay from Neutral Switch position to Source 2 position. Adjustable 0-10 minutes in 1 second increments. Standard setting is 5 seconds.Adjust via SET menu (see page 18)

E
Engine Start Contact

EL/P
Event Log: Sequentially Numbered Log of 16 events that track date, time, reason and action taken

System Data: Total Life Transfers (N2P)
Days Powered Up
Total Transfers to S2
Total S1 Failures
Time S1 available in Hrs
Time S2 available in Hrs. (N1P)

F
Fan contact, operates when generator is running.

HT
Heater and Thermostat

K
Frequency Meter, Door mount.

K/P
Frequency Indication for S1 and S2

L
LNP Center-off position LCD-Indicator
Indicating LED lights:

- **L1** Indicates Switch in Source 2 position.
- **L2** Indicates Switch in Source 1 position.
- **L3** Indicates Source 1 available.
- **L4** Indicates Source 2 available.

Accessory Definitions *(cont'd)*

M1
Single Phase Amp Meter

M2
Three Phase Amp Meter

M80
3000 Digital Power Monitor

M82
5200 Digital Power Meter

M83A
EPM 5300 Digital Power Meter with Modbus Port

M83B
EPM 5350 Digital Power Meter with Ethernet Port

M84
7430 Digital Power Meter , Wye or Delta

M85A
EPM 9450 Digital Power Meter, Ethernet

M85B
EPM 9450 Digital Power Meter with Internal 56K Mod.

M86A
EPM 9650 Digital Power Meter, Wye or Delta, RS232 or RS485

M86B
EPM 9650 Digital Power Meter, Wye or Delta, RS232 or RS485

N1
Running Time Meter, Door mount

N2
Operation Counter, Door Mount

P1
Time Delay Source 2 Start. Adjustable 0-10 seconds. Standard setting is 3 seconds.
Adjust via SET menu (see page 18)

P2
Time Delay S2 Start. Adjustable 1/6 to 300 seconds.

Q2
Remote Peak Shave or Area Protection Circuit. Energize Q2 to simulate Source 1 Line failure causing the Generator to start and transfer the load to Source 2. Should Emergency fail during this operation, Transfer Switch will retransfer back to Source 1.

Q3
Remote inhibit transfer to Source 2 circuit. Energize Q3 input to allow transfer to Source 2. To enable Q3 option, engage Q3 jumper.

Q7
Inhibit transfer to Source 1 circuit. Energize Q7 input to prevent transfer to Source 1.

R1-1/R1-3
Source 1 Over Voltage sensing for single and three phase systems.
Source 1 Over Voltage "Fail"
Factory Default: 110%
This adjustment determines the maximum acceptable over voltage. Adjust via the SET menu. Range is 105% to 110% in 1% increments (see page 18).
Once exceeded, the P timer begins timing to signal the Generator to start.

Source 1 Over Voltage "Restore"
Factory Default: 105%
This adjustment determines the minimum acceptable over Voltage threshold at which the Transfer Switch is allowed to automatically transfer to Source 1. Adjust via SET menu. Range is 103% to 108% in 1% increments. "Restore" must be a minimum of 2% below "Fail" setting (see page 18).

R15/R15D
Load Shed
Should Source 2 become overloaded, a signal can be given to switch to the dead or Mid position.

R16
Phase Rotation Sensing
Can be turned on or off via CFG menu (see page 17). Factory Default is on.
This feature prevents Line Source to Line Source transfers from occurring between dissimilar phase sequences. This condition is primarily caused by an installation error. Connections from Source 1 and Source 2 need be verified, compared, and corrected to remedy the inconsistent phase rotation between the sources.
WARNING: Turning off this feature can cause severe damage to loads.

R26
Interruptable Power Rate Provisions.
Allow transfer out of Source 1 position to Source 2 or dead Source 2. Alarm and Pre-Signal circuit included.

R50
In Phase Monitor this feature restricts **Live to Live Source Transfers** to occur unless both Sources are within 7 electrical degrees or less of each other. (live Source to live Source transfers usually occur during transfer back to Source 1 or during Testing). R50 does not change the operation of the Automatic Transfer Switch in a power failure mode. After all timer functions have elapsed, **the CHECKING FOR SOURCE SYNCHRONISM** will be displayed as well as the direction of transfer (S1-S2 for example denotes transfer from Source 1 to Source2). When synchronism is accomplished, transfer will take place.

Accessory Definitions *(cont'd)*

Notes: - If S2 Frequency is less than S1 Frequency, display will show a series of (- - - - -…..) symbols.
- If S2 Frequency is greater than S1 Frequency, display will show a series of (+++++…..) symbols.
- Each (-) or (+) symbol represents 10 electrical degrees out of phase. A maximum of 18 symbols (180 electrical degrees) can be monitored.
- The number of (-) or (+) symbols decrease as the two sources approach synchronism and increase as the two sources drift out of synchronism.
- If S1 and S2 Frequencies are identical, the display will show a series of alternating symbols (+-+-+…) which also indicate the approximate out of phase degrees

In the event that the Sources do not come within 7 electrical degrees of each other within 60 seconds, the unit will display the message: **SYNCH CHECKING** and will allow the user to **BYPASS**. If the **BYPASS** button is pressed, the unit will display the message: **WARNING MAY CAUSE DAMAGE TO THE LOAD**. Pressing **XFR** will actually bypass the R50. Since R50 is a passive device, the length of time it takes to reach Synchronism is dependent on the frequency difference between the two Sources. Source 1 is usually a Utility and the frequency is not within the control of the consumer. Source 2 needs to be adjusted to create an adequate difference in order for the transfer to happen a timely fashion.

Note: For optimum performance, Source 2 Generator should be adjusted a Maximum of 2 Hertz above or below the Utility frequency, minimum of 0.1 Hertz. (58 to 59.9) or (60.1 to 62) Hertz. Adjustment of Generator to 60Hertz could cause lengthy transfer delay.

R50 Feature can be turned ON or OFF via CFG Menu (see page 17). Factory Default if OFF.

S5P

Auto / Semi Manual selector
In "Auto" position, retransfer to Source 1 is automatic after the T timer has timed out. The T time delay is bypassed if Source 2 fails.
In "Manual", retransfer to Source 1 is upon depression of BYPASS DELAY button YEN or if Source 2 fails.

S12P

Auto / Manual Selector
In "Auto" position, the Automatic Transfer Switch functions automatically as specified with the Switch drawings.
In "Manual" the Automatic Transfer Switch will transfer to either direction upon depression of Source 1 or Source 2 transfer buttons.
Should Source 1 fail, the Generator (Source 2), will automatically start. Once transferred in Manual, the Switch maintains position selected even if selected power fails.

S13P

Transfer Commit. Configured via CFG menu. (see page 17) When this Feature is set to OFF: The transfer Switch is not committed to transfer unless the outage duration is longer than the timers that precede the transfer to Source 2 position. This assumes that the outage will be an isolated event. When this Feature is set to ON: The transfer Switch is committed to transfer to Source 2 position once the W timer has begun timing, even if Source 1 power returns before the transfer to Source 2. This is to ensure that the transfer takes place, because one outage may be followed by another.

S14

Test / Auto / Source 1 Selector, Door mount

SW1

Auto/Off/Start Engine control selector, Door mount (Keyed or non-keyed operation available)

SW2

Auto / Off Engine control selector, Door mount (Keyed or non-keyed operation available)

SW3

Source Priority Selector Switch, Door mount
Allows selection of Source 1 or Source 2 to be the Prime Source. Transfer Switch will transfer to selected Prime Source if that Source is available. (Keyed or non-keyed operation available)

T

Time Delay (S1) Source 1 Stable Timer. To delay transfer to Source 1 (immediate retransfer on Source 2 failure). Adjustable 0-60 minutes in 1 second increments. Standard setting is 30 minutes. Adjust via SET menu (see page 18)

T3/W3

Elevator Pre-Signal Auxiliary Contacts: Open 0-60 seconds prior to transfer to either direction, re-closes after transfer.

U

(S2) Source 2 Stop Delay Timer. Allows Engine to run unloaded after switch retransfer to Source 1. Adjustable 0-60 minutes in 1 second increments. Standard setting is 5 minutes. Adjust via SET menu (see page 18)

UMD

Universal Motor Load Disconnect Circuit: Auxiliary Contact opens 0-60 seconds prior to transfer in either direction, re-closes after transfer. Can be configured by end user for Pre-transfer, Post-transfer, or both.

Accessory Definitions *(cont'd)*

VI

Voltage Imbalance (Three Phase)
For a three phase source, this feature monitors phase voltage ratios based on a selected range within a selected time window. Should any phase fall below the selected lower window limit or exceed the selected higher window limit within the selected time frame, the controller initiates transfer to the other source.

Range: 5% to 20% of Nominal voltage,
10 to 30 seconds window, user adjustable.
Resolution: 1% Increments
Minimum Differential: 2% between "Fail" and "Restore" settings.
Factory default: 10% "Fail", 8% "Restore", 30 Seconds.
See CFG Menu page 17 to configure ON or OFF.
See SET Menu page 18 to set Percentage and time windows

W

Time Delay (S2) Source 2 Stable Timer. To delay transfer to Source 2. Adjustable 0-5 minutes in 1 second increments. Standard setting is 1 second. Adjust via SET menu (see page 18)

YEN

Bypass Timers Key utilizing Keypad. When applicable, the system prompts the user to press a button to bypass (T) or (W) Timers should the user so desires.

ZNET

Network Communications Interface Card

How to Set the System Clock

How to Set the System Clock

Set System Clock, time and date

- If the clock is not set, the display will show SET SYSTEM CLOCK on the second line of the S1 OK screen.
- The S1 OK screen will show time (hours and minutes) on the second line if the system clock has been set. (Date on third line)

Setting the System Clock

(Start from **S1 OK** screen)

1. Remove battery protective white plastic strip near **P** relay. *
2. Press **MORE** then press **SET**.
3. Press **MORE** and scroll to **SET SYSTEM CLOCK** using the **MORE** key.
4. Press **SEL**.
5. **ENTER ACCESS CODE** located on the white label on the back of the controller.
6. Press **SEL**.
7. Use the up and down keys to change the hour value.
8. Press **SAVE** (this will enter this value and move cursor to minutes).
9. Use the up and down keys to change the minutes.
10. Press **SAVE** (this will enter this value and move cursor to month).
11. Use the up and down key up to change the month.
12. Press **SAVE** (This will enter this value and complete the clock setting).
13. Use the up and down keys to change the date.
14. Press **SAVE** (this will enter this value and move cursor to year).
15. Use the up and down keys to change year.
16. Press **SAVE** (this will enter this value and compete the clock setting).
17. To edit settings, press **SEL** and repeat steps 6-16.
18. If the setting is satisfactory, press **MORE** (unit then returns to the **SET** menu then press **BACK**, then **ESC**.)

* Replacement battery part #K-4100
Battery will last 5 years and provides power to retain clock function only (Controller functions without battery).

CDT One Event Timer Exerciser

Load / No-Load
One event Exerciser with adjustable Timer. Exercise duration can be set between 5 and 60 minutes in 1 minute increments. Can be configured to run every 1,7,14, or 28 days. Factory default is 20 minutes.

How to CONFIGURE (CFG) and Set (SET) the Timer Exerciser

1. Beginning from the **S1 OK** screen, press **MORE** then **CFG**.
2. Press **MORE** to scroll to **CONFIG TIMER EXERCISER** screen.
3. The third line of the **CONFG TIMER EXERCISER** will show either **DAILY**, **WEEKLY**, **14 DAY**, **28 DAY**, or **OFF**.
4. If the third line of the **CONFG TIMER EXERCISER** shows **DAILY**, **WEEKLY**, **14 DAY**, or **28 DAY** as desired, then proceed to step 10.
5. If the third line of the **CONFG TIMER EXERCISER** shows **OFF** or if another timer selection is desired, continue.
6. Press **SEL**.
7. Enter **ACCESS** code located on white label on the back of the controller.
8. Press **UP** or **DOWN** to select **DAILY**, **WEEKLY**, **14 DAY**, or 2**8 DAY** as desired.
9. Press **SAVE**.
10. Press **MORE** to scroll to **CONFG TIMER EXERCISER (XFR)** or **(NO XFR)**.
11. Press Up or Down to select **XFR** (Load Transfer) or **NO XFR** (No Load Transfer).
12. Press **SAVE**.
13. Press **MORE** repeatedly to **BACK** then **S1 OK** screen.

Set (SET) the Exerciser:

14. Beginning from the **S1 OK** screen, press **MORE** then **SET**.
15. Press **MORE** repeatedly until **EXER S2 RUN TIME** screen.
16. Press **SEL**
17. Enter **ACCESS** code located on white label on the back of the controller.
18. Press **SEL**
19. Cursor is indicated as a line under character to be changed. Change values with up and down keys.
20. Press **SAVE** when complete.
21. Press **MORE** repeatedly until **SET USER SETUP** then press **BACK** then **ESC** to the **S1 OK** screen.

How to Initiate CDT Exerciser and to start an exercise cycle every 1, 7, 14, or 28 days
From S1 screen
1) Press **TEST**
2) Press **MORE**
3) Press **START TEST TIMER** (to initiate Test).

- If the CDT Exerciser is Factory configured for a Load Exerciser, the Controller will immediately start a load exercise. The controller will start the generator, transfer the load to Source 2 and remain in Source 2 for the duration set for **EXER S2 RUN TIME** in the **SET** menu. The controller will retransfer the load back to Source 1 after the S1 stable timer has timed out and run the generator unloaded for the duration of the S2 stop delay timer (Engine Cool Down Timer).
- If the CDT Exerciser is Factory configured for a No-Load Exerciser, the Controller will immediately start a No-load exercise. The controller will start the generator and run it unloaded for the duration of the S2 stop delay timer (Engine Cool Down Timer).

Exercise will be repeated at the same time as initiated on every 1, 7, 14, or 28 days according to the selection made in the Configure **CFG** menu.

How to Bypass (Cancel) an exercise during an exercise cycle
1) Press **BPASS**
2) Allow the controller to complete the Engine cool down cycle
If the CDT Exerciser is Factory configured for a No-Load Exerciser Or allow the controller to complete retransfer to Source 1 If the CDT Exerciser is Factory configured for a Load Exerciser

How to Bypass the next exercise event and Keep the rest of scheduled events unchanged
1) Press Test
2) Press **MORE**
3) Press **BYPASS EXER**
To re-institute the next exercise event back, press **CANCL BPASS**

How to initiate a new exercise start time
1) Press **TEST**
2) Press **MORE**
3) Press **EXER CANCL**
4) Press **START TIMER TEST**

How to check the next exercise event
1) From **S1 OK** screen, press **MORE** three times.
2) The unit will display the **PLANT EXERCISER NEXT** event in **DAYS**, **HOURS**, and **MINUTES**
3) Press **ESC** to **S1 OK** Screen.

Notes:
- ***E*** appears in the upper right hand corner of LCD screen when exercise is impending.
- For Load Exerciser, actual exercise period (ATS in S2 position)= CDT (Exerciser) timing period +T (S1 stable Timer) timing period.

CDP Clock Exerciser

Load / No-Load Clock Exerciser

Allows the Generator to start and run unloaded or to simulate a power failure, start Generator and run under load. Can be configured by the end user for 1, 7, 14, 28, or 365 day cycles.

- A total of 7 independent No Load exercise periods (up to 10 hours each) can be programmed for each of the daily, weekly, 14-day, and 28-day exercisers.
- A total of 12 independent No Load exercise periods (up to 10 hours) can be programmed for the 365-day Exerciser.

How to Configure (CFG) the Exerciser

1. Beginning from the **S1 OK** screen, press **MORE** then **CFG**.
2. Press **MORE** to scroll to **CONFIG CLOCK EXERCISER** screen.
3. The third line of the **CONFG CLOCK EXERCISER** will show either **DAILY**, **WEEKLY**, **14 DAY**, **28 DAY**, **365 DAY** or **OFF**.
4. If the third line of the **CONFG CLOCK EXERCISER** shows **DAILY**, **WEEKLY**, **14 DAY**, **28 DAY**, or **365 DAY** as desired, press **MORE** repeatedly to **BACK**. Press **ESC** then proceed to the **SET** menu to set the **EXERCISER**.
5. If the third line of the **CONFG CLOCK EXERCISER** shows **OFF**, continue.
6. Press **SEL**.
7. Enter **ACCESS** code located on white label on the back of the controller.
8. Press **UP** or **DOWN** to select **DAILY**, **WEEKLY**, **14 DAY**, **28 DAY**, or **365 DAY** as desired.
9. Press **SAVE**.
10. Press **MORE** repeatedly to **BACK** then **ESC** to **S1 OK** screen.

How to set (SET) the DAILY Exerciser

1. Beginning from the **S1 OK** screen, press **MORE** then **SET**.
2. Press **MORE** repeatedly until **SET EXERCISER** screen.
3. Press **SEL**.
4. Enter **ACCESS** code located on white label on the back of the controller.
5. Press **SEL**
6. Cursor is indicated as a line under character to be changed. Change values with up and down keys. Press **SAVE** after each entry to save value and to move to the next value to be changed.
7. Press **BACK** when complete.
8. Press **MORE** repeatedly until **SET USER SETUP**. Press **BACK** then **ESC** to the **S1 OK** screen.

How to Bypass (Cancel) an exercise during an exercise cycle

1) Press **BPASS**
2) Allow the controller to complete the Engine cool down cycle.

If the CD Exerciser is configured or Set for a No-Load Exercise. Or allow the controller to complete retransfer to Source 1. If the CD Exerciser is configured for a Load Exerciser

How to Bypass the next exercise event and Keep the rest of scheduled events unchanged

1) Press **TEST**
2) Press **MORE**
3) Press **BYPASS EXER**

To re-institute the next exercise event back, press **CANCL BPASS**

How to check the next exercise event

1) From **S1 OK** screen, press **MORE** three times.
2) The unit will display the **PLANT EXERCISER NEXT** event in **DAYS**, **HOURS**, and **MINUTES**
3) Press **ESC** to **S1 OK** Screen.

Notes:

- In the **S1 OK** screen, an (***E***) appears in the upper right hand corner of LCD screen when exercise is impending.
- For Load Exerciser, actual exercise period (ATS in S2 position)= **CDT** (Exerciser) timing period +T (S1 Stable Timer) timing period.
- A value greater than zero must be entered in the Exerciser duration field to be accepted as a valid exercise period.
- The Exercise cycle will be repeated on a regular basis as programmed and initiated in the **SET** menu depending on what Exerciser was configured (selected) in the **CFG** menu.

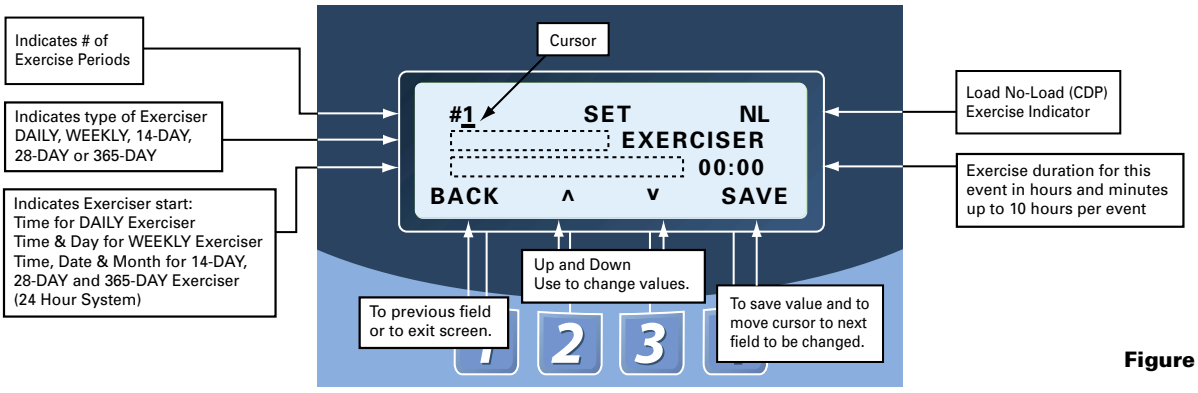
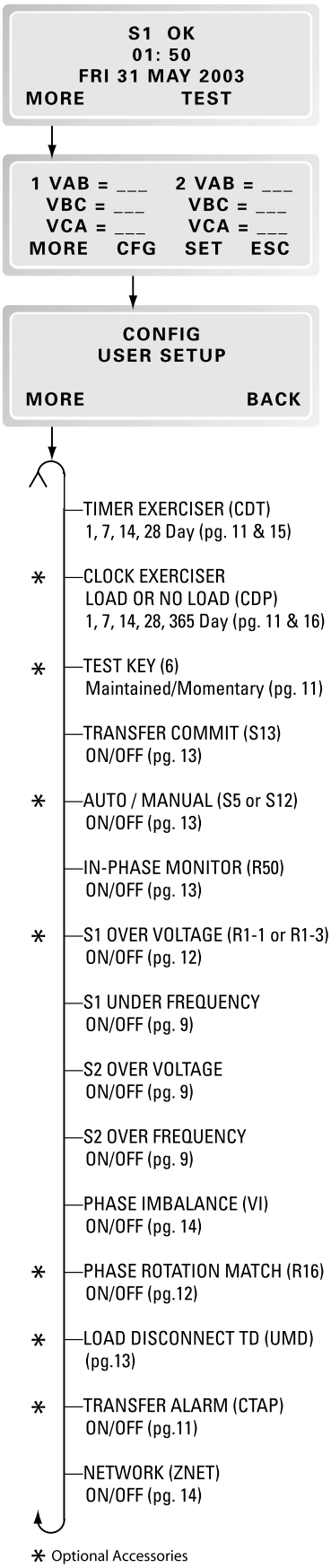


Figure 9

Entelli-Switch 250 User Setup - CFG Menu



Turn options ON or OFF via keypad through the CFG menu

Enter six digit access code
(The factory assigned six-digit access code is located on the back of the controller)

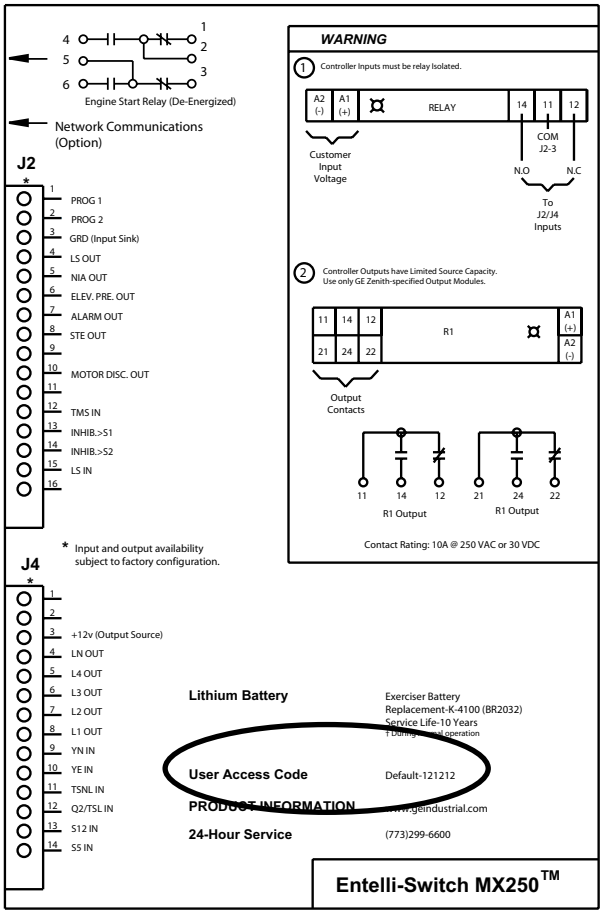
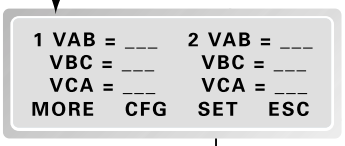


Figure 10

Entelli-Switch 250 User Setup - SET Menu







- SET SYSTEM CLOCK (pg.14)
- DAYLIGHT SAVINGS ON/OFF
- * CLOCK EXERCISER (CDP) (pg.11 & 16)
- EXER S2 RUNTIME (CDT) (pg.11 & 15)
- S1 UNDER VOLTAGE (pg.9) Fail Restore
- S1 UNDER FREQUENCY (pg.9) Fail Restore
- * S1 OVER VOLTAGE (pg.12) Fail Restore
- S1 OVER FREQUENCY (pg.9) Fail Restore
- S2 UNDER VOLTAGE (pg.9) Fail Restore
- S2 UNDER FREQUENCY (pg.9) Fail Restore
- S2 OVER VOLTAGE (pg.9) Fail Restore
- S2 OVER FREQUENCY (pg.9) Fail Restore
- SET % PHASE IMBALANCE (VI) FAIL 5%, RESTORE 3% (pg.14)
- SET PHASE IMBALANCE (VI) TIME DELAY 30 seconds (pg.14)
- TIME DELAY S2 START (P1) (pg.12)
- TIME DELAY S2 STABLE (W) (pg.14)
- * LOAD PRESIGNAL TD (T3/W3) (pg.13)
- * LOAD DISCONNECT TD (UMD) (pg.13)
- * ATS OPEN TIME TO S2 (DW) DELAY units only (pg.11)
- TIME DELAY S1 STABLE (T) (pg.13)
- * ATS OPEN TIME TO S1 (DT) DELAY units only (pg.11)
- S2 STOP DELAY (U) (pg.13)
- CALIBRATE S1 (pg.11)
- CALIBRATE S2 (pg.11)

* Optional Accessories

Change adjustable values through the SET menu.

Enter six digit access code
(The factory assigned six-digit access code is located on the back of the controller)

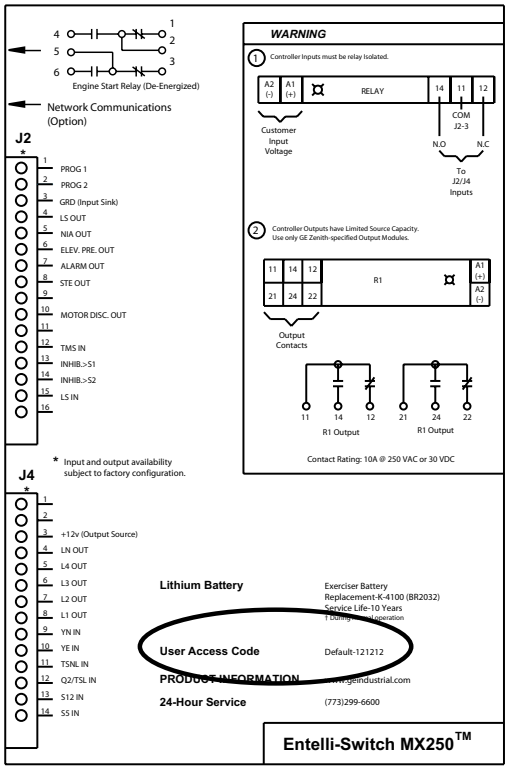
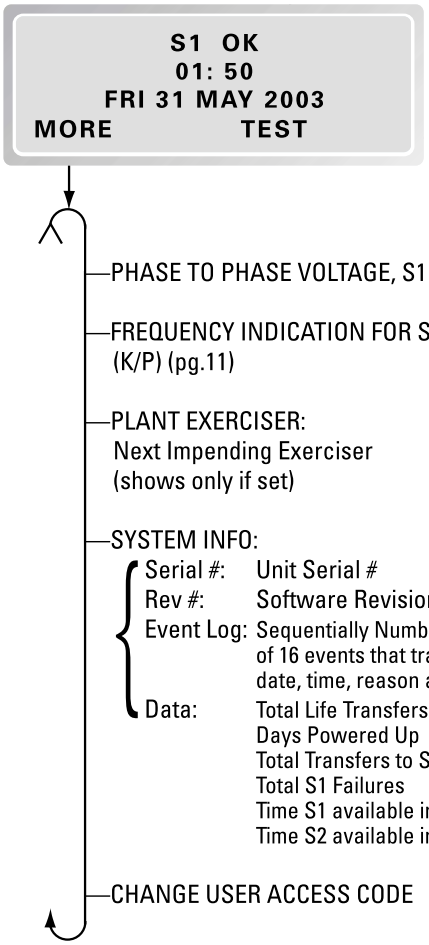


Figure 10



View System Data

Enter six digit access code
(The factory assigned six-digit access code
is located on the back of the controller)

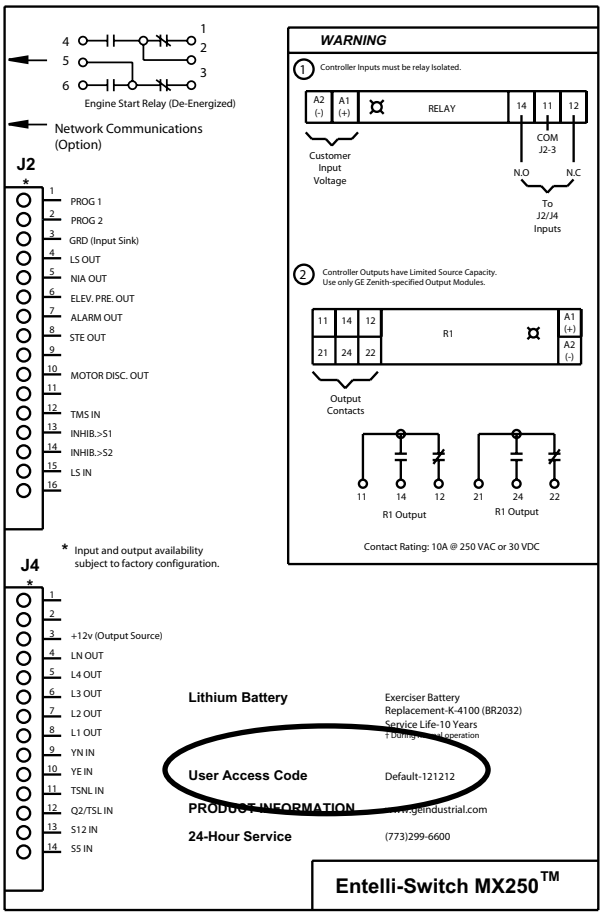


Figure 10

Testing

⚠ CAUTION ⚠

Due to hazardous voltage and current, GE Zenith recommends that a GE Zenith Certified technician or a qualified electrician must perform the installation and maintenance of the switch.

⚠ WARNING ⚠

Both power sources must be disconnected before manual operation of the switch.

Introduction

A manual operator handle is provided with the transfer switch for maintenance purposes only. Manual operation of the switch must be checked before it is operated electrically. **Both power sources must be disconnected before manual operation of the switch.** Insert the handle and operate the transfer switch between the Source 1 and Source 2 positions. The transfer switch should operate smoothly without binding. Return the switch to the Source 1 position, remove the handle, and return it to the holder provided.

After completing the inspection, cleaning and servicing of the transfer switch, reinstall the switch cover, and close and lock the cabinet door. Reclose the circuit breakers feeding the utility and generator sources to the switch.

Initiate the electrical transfer test by activating the test switch. P timer will time out and the microcontroller will send an engine start signal. When the W time has elapsed, the switch will complete its transfer by closing into the Source 2.

Deactivating the test switch will start retransfer to Source 1. The switch will complete its retransfer to Source 1 after the time delay of the T timer. The U engine overrun timer allows the engine generator to run unloaded for a preset cool down period.

Test Options

The ATS can be tested in either of two positions:

1) **"Auto Position"**
   Full Transfer Test - This test checks the complete operation of the ATS by transferring the load's power source from Source 1 to Source 2.
2) **"Test Position"**
   This procedure is recommended for Preventive Maintenance (PM) of ATS without interrupting the Load thru the BYPASS/ISOLATION SWITCH.

NOTE: A periodic test of the transfer switch under load conditions is recommended to insure proper operation. (See National Electric Code articles 700 and 701).

⚠ WARNING ⚠

When performing a hi-pot or dielectric test on the power section, DISCONNECT the control panel plugs from the microprocessor to avoid potential damage.

⚠ NOTICE ⚠

A periodic test of the transfer switch under load conditions is recommended to insure proper operation. (See National Electric Code articles 700 and 701)

ATS Testing

Start generator and verify proper voltage, frequency and phase sequence (match to Source 1). Shut down gen set and place in Auto. Complete the visual inspection of the transfer switch, and close the cabinet door.

Initiate the test by pressing the TEST button on the LCD keypad. The controller will then prompt for your access code. After entering the code, three test options will appear—XFR LOAD, FAST TEST and NO XFR (See Figure 11).

- **XFR LOAD** test starts the generator and using the current timer settings, transfers the load to Source 2.
- **FAST TEST** test presets timer values to a maximum 30 seconds during the test. After completion of the test, all timers are reset to their original values. (T3, W3, DT and DW remain)
- **NO XFR** test starts the generator but does not transfer the load to the Source 2.

Press and hold the desired test option button until the switch transfers to Source 2 (load test) or until the generator has been run for the desired amount of time (no load test). Releasing the test button before W timer timeout will abort the test (Exception: when the transfer commit option, is configured "ON").

To test lamps, press TEST then scroll through MORE, then press LAMP TEST. To cancel LAMP TEST press MORE.

Standard Transition

When the test is initiated, the controller initiates the Time Delay Source 2 Start Timer (Engine Start Timer "P") cycle. A manual CANCEL button is provided to cancel the test if desired. Upon completion of the (P) time delay, an Engine start Signal is sent to Source 2. When Source 2 voltage and frequency reach the preset "Restore" Values, the time delay to Source 2 Timer (W) begins its timing cycle to ensure voltage and frequency stabilization before transfer. A manual pushbutton BYPASS is provided to bypass the "W" time delay if desired. After the (W) time delay, the MX controller initiates a transfer signal through the SCR-E to operate the main transfer operator. The load is now transferred to Source 2 line. The transfer switch is mechanically locked. SN limit switch awaits the next operation to Source 1.

Restoration of Source 1 Power:

Deactivating the test switch initiates re-transfer to Source 1 sequence. The delay to Source 1 Timer (T) begins its timing cycle to ensure voltage and frequency stabilization before retransfer. A manual pushbutton BYPASS is provided to bypass the "T" time delay if desired. After the (T) time delay, the MX controller initiates a transfer signal through the SCR-N to operate the main transfer operator. The load is now transferred to Source 1 line. The transfer switch is mechanically locked. SE limit switch awaits the next operation to Source 2.

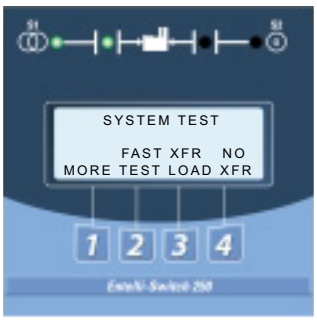


Figure 11

Immediately after re-transfer, the S2 Stop Delay Timer (Delay to Engine Stop "U") begins its cycle to allow Source 2 Engine to run unloaded. A manual pushbutton BYPASS is provided to bypass the "U" time delay if desired. Upon completion of the (U) timing cycle, the controller sends an Engine stop signal.

Delayed Transition

Source 1 Power Failure:

When the test is initiated, the controller initiates the Time Delay Source 2 Start (Engine Start Timer "P") cycle. A manual CANCEL button is provided to cancel the test if desired Upon completion of the (P) time delay, an Engine start Signal is sent to Source 2. When Source 2 voltage and frequency reach the preset "Restore" values, the time delay to open Source 1 timer (W) begins its timing cycle to ensure voltage and frequency stabilization before re-transfer. A manual pushbutton BYPASS is provided to bypass the "W" time delay if desired. After the (W) time delay, the MX controller initiates a transfer signal through the SCR-NO to operate the main transfer operator. The load is now transferred to the Open position. The time delay to Source 2 timer (DW) begins its timing cycle. After the (DW) time delay, the MX controller initiates a transfer signal through the SCR-E to operate the main transfer operator. The load is now transferred to Source 2 line. The transfer switch is mechanically locked. SN limit switch awaits the next operation to Source 1.

Restoration of Source 1 Power:

Deactivating the test switch initiates re-transfer to Source 1 sequence.The delay to open Source 2 Timer (T) begins its timing cycle to ensure voltage and frequency stabilization before retransfer. A manual pushbutton BYPASS is provided to bypass the "T" time delay if desired. After the (T) time delay, the MX controller initiates a transfer signal through the SCR-EO to operate the main transfer operator. The load is now transferred to the Open position. The time delay to Source 1 timer (DT) begins its timing cycle. After the (DT) time delay, the MX contoller initiates a transfer signal through the SCR-N to operate the main transfer operator. The load is now transferred to Source 1 line. The transfer switch is mechanically locked. SE limit switch awaits the next operation to Source 2.

Immediately after re-transfer, the S2 Stop Delay Timer (Delay to Engine Stop "U") begins its cycle to allow Source 2 Engine to run unloaded. A manual pushbutton BYPASS is provided to bypass the "U" time delay if desired. Upon completion of the (U) timing cycle, the controller sends an Engine stop signal.

⚠ NOTICE ⚠

A periodic test of the transfer switch under load conditions is recommended to insure proper operation. (See National Electric Code articles 700 and 701)

Closed Transition

GE Zenith Closed Transition Transfer Switches are designed to Transfer the Load between two available sources with out interrupting power to the Load (Make-Before-Break). Paralleling of the two sources occurs within a predefined window of synchronization and lasts less than 100 milliseconds. The initial Source is then disconnected.

Initiating a Closed Transition
When a Test is initiated, the controller initiates the Time Delay Source 2 Start (Engine Start Timer "P") cycle. Upon completion of the (P) time delay, an Engine start Signal is sent to Source 2. When Source 2 voltage and frequency reach the preset "Restore" values, the time delay to open Source 1 timer (W) begins its timing cycle. After the (W) time delay, the ATS closes into Source 2 only after the controller ensures the proper phase relationship between the two Sources. After the ATS closes into Source 2, the SE limit switch becomes activated. The controller initiates a transfer signal through the SCR-NO which opens the ATS out of Source 1. The SNO limit switch activates. The ATS has now closed back into Source 2 position without interrupting the load.

Re-Transfer with Closed Transition
Deactivating the Test Switch initiates the re-transfer. When Source 1 voltage and frequency reach the preset "Restore" values, the time delay to open Source 2 timer (T) begins its timing cycle. After the (T) time delay, the ATS closes into Source 1 only after the controller ensures the proper phase relationship between the two Sources. After the ATS closes into Source1, the SN limit switch becomes activated. The controller initiates a transfer signal through the SCR-EO which opens the ATS out of Source 2. The SEO limit switch activates. The ATS has now closed back into Source 1 position without interrupting the load.

The ATS defaults to an open transition transfer when Source 1 fails. Closed transition transfer is not possible with only one source available. If the optional Transition Mode Selector (TMS) is available, one can select an Open Transition Transfer or a Closed Transition Transfer when both Sources are available..

If while in Closed Transition Mode, the ATS fails to open the source it is attempting to "transfer out of" within 100 milliseconds, an Alarm will sound and the source that the ATS just closed into will be opened leaving the ATS in its initial source while disabling all other transfer operations until the problem is corrected and the "Fail to Open Lockout Reset" has been pressed.

A signal will be provided (STE) to Shunt Trip the Generator Circuit Breaker if the Transfer Switch remains closed into both Sources for more than 325 milliseconds. The load will then be fed by the Source 1. The maximum time that the two Sources would be parallel, under these conditions, is less than 500 milliseconds. Before operating the Closed Transition Transfer Switch, the condition must be corrected and the Shunt Trip reset. Refer to procedure for servicing the Switch after Shunt Tripping occures.

The unit is Factory set to accomplish transfer within 5 electrical degrees.
Requires an Isochronous Governor with an operating frequency of 60+/- 0.2 Hz.
Requires a Shunt Trip Breaker on the Generator set with a response time not exceeding 50 milliseconds.

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Emergency Service Procedure for Extended Parallel Time

ZTSCT Transfer Switch

If Source 2 breaker shunt trip was triggered after an extended parallel time (malfunction) occurred. Follow these steps to open the transfer switch.

1) Disconnect all power sources from the transfer switch by opening all line breakers (Source 1 and Source 2).
2) Open the cabinet door and turn the disconnect switch to the INHIBIT position.
3) Remove the service access cover on the left hand side of the transfer switch.
4) The manual operator and the manual handle will now be exposed. Insert the handle into the Source 2 side operator. Open the Source 2 side contacts.
5) Close the cabinet door.
6) Energize Source 1 to supply the load until further repairs can be done.

ZBTSCT Transfer/Bypass Switch

a. Auto Location:

Removal of closed transition transfer switch after Source 2 breaker shunt trip.

1) Disconnect all power sources from bypass-isolation transfer switch.
2) Open the bottom cabinet door and turn the Disconnect Switch (DS) to the INHIBIT position.
3) Remove the service access cover on the left hand side of the transfer switch.
4) The manual operator and the manual handle will now be exposed. Insert the handle into the Source 2 side manual operator. Open the Source 2 side contacts.
5) Close bottom cabinet door.
6) Energize Source 1 power.
7) Close the bypass contacts (BN).*
8) Isolate the transfer switch.*
9) Remove the transfer switch from the bypass-isolation transfer switch as indicated on the bypass instruction label to inspect and repair.
10) Re-install the transfer switch after maintenance with contacts closed to the same source as the bypass switch. Reinstall the manual handle in its holder and the service access cover on the left side of the transfer switch.
11) Re-connect the transfer switch to AUTO.*

b. Auto Location:

Removal of the closed transition transfer switch if Source 1 and Source 2 contacts remain open.

1) Close the bypass switch into the available source.*
2) Turn the DS to INHIBIT. Remove the transfer switch service access cover. Close the transfer switch into the same source as the bypass switch. (Incorrect sequencing is prevented by the interlocks while the transfer switch is in AUTO only.)
3) Remove the transfer switch from the bypass-isolation transfer switch to inspect and repair.*

c. Test Location:

Removal of the closed transition transfer switch if both Source 1 and Source 2 contacts remain open.

1) Close the bypass switch contacts (BN) as indicated on the bypass instruction label on the cabinet door.
2) Disconnect all power sources from bypass-isolation closed transition transfer switch.
3) Open bottom cabinet door. Turn the Disconnect Switch (DS) to the INHIBIT position.
4) Remove the service access cover on the left side of the transfer switch.
5) The manual operator and the manual handle will not be exposed. Insert the handle into the Source 1 side and close the Source 1 contacts.
6) Close the bottom cabinet door.
7) Energize Source 1 power.
8) Remove the automatic transfer switch from the bypass-isolation transfer switch.*
9) Re-install the transfer switch after maintenance with contacts closed to the same source as the bypass switch. Reinstall the manual handle in its holder and the service access cover on the left side of the transfer switch.
10) Re-connect the transfer switch to AUTO.*

* As described in the Sequence of Operation section located in the ZTSCT/ZBTSCT Series Manual (71R-5000)

Sequence of Operation

Standard Transition

Source 1 Power Failure:
When Source 1 voltage or frequency has fallen below the preset "Fail" values, the controller initiates the Time Delay Source 2 Start Timer (Engine Start Timer "P") cycle. Upon completion of the (P) time delay, an Engine start Signal is sent to Source 2. When Source 2 voltage and frequency reach the preset "Restore" Values, the time delay to Source 2 Timer (W) begins its timing cycle to ensure voltage and frequency stabilization before transfer. A manual pushbutton BYPASS is provided to bypass the "W" time delay if desired. After the (W) time delay, the MX controller initiates a transfer signal through the SCR-E to operate the main transfer operator. The load is now transferred to Source 2 line. The transfer switch is mechanically locked. SN limit switch awaits the next operation to Source 1.

Restoration of Source 1 Power:
When Source 1 power reach the preset "Restore" values, the controller initiates re-transfer to Source 1 sequence.The delay to Source 1 Timer (T) begins its timing cycle to ensure voltage and frequency stabilization before retransfer. A manual pushbutton BYPASS is provided to bypass the "T" time delay if desired. After the (T) time delay, the MX controller initiates a transfer signal through the SCR-N to operate the main transfer operator. The load is now transferred to Source 1 line. The transfer switch is mechanically locked. SE limit switch awaits the next operation to Source 2.

Immediately after re-transfer, the S2 Stop Delay Timer (Delay to Engine Stop "U") begins its cycle to allow Source 2 Engine to run unloaded. A manual pushbutton BYPASS is provided to bypass the "U" time delay if desired. Upon completion of the (U) timing cycle, the controller sends an Engine stop signal.

Delayed Transition

Source 1 Power Failure:
When Source 1 voltage or frequency has fallen below the preset "Fail" values, the controller initiates the Time Delay Source 2 Start (Engine Start Timer "P") cycle. Upon completion of the (P) time delay, an Engine start Signal is sent to Source 2. When Source 2 voltage and frequency reach the preset "Restore" values, the time delay to open Source 1 timer (W) begins its timing cycle to ensure voltage and frequency stabilization before re-transfer. A manual pushbutton BYPASS is provided to bypass the "W" time delay if desired. After the (W) time delay, the MX controller initiates a transfer signal through the SCR-NO to operate the main transfer operator. The load is now transferred to the Open position. The time delay to Source 2 timer (DW) begins its timing cycle. After the (DW) time delay, the MX controller initiates a transfer signal through the SCR-E to operate the main transfer operator. The load is now transferred to Source 2 line. The transfer switch is mechanically locked. SN limit switch awaits the next operation to Source 1.

Restoration of Source 1 Power:
When Source 1 power reach the preset "Restore" values, the controller initiates re-transfer to Source 1 sequence. The delay to open Source 2 Timer (T) begins its timing cycle to ensure voltage and frequency stabilization before retransfer. A manual pushbutton BYPASS is provided to bypass the "T" time delay if desired. After the (T) time delay, the MX controller initiates a transfer signal through the SCR-EO to operate the main transfer operator. The load is now transferred to the Open position. The time delay to Source 1 timer (DT) begins its timing cycle. After the (DT) time delay, the MX controller initiates a transfer signal through the SCR-N to operate the main transfer operator. The load is now transferred to Source 1 line. The transfer switch is mechanically locked. SE limit switch awaits the next operation to Source 2.

Immediately after re-transfer, the S2 Stop Delay Timer (Delay to Engine Stop "U") begins its cycle to allow Source 2 Engine to run unloaded. A manual pushbutton BYPASS is provided to bypass the "U" time delay if desired. Upon completion of the (U) timing cycle, the controller sends an Engine stop signal.

Table 3

Timer Designations as they appear in the SET menu

ATS Type	P	W	DW	T	DT	U
Standard Transition	Time Delay S2 Start	Time Delay S2 Stable	→	Time Delay S1 Stable	→	S2 Stop Delay
Delay/ Open Transition	Time Delay S2 Start	Time Delay S2 Stable	ATS Open Time to S2	Time Delay S1 Stable	ATS Open Time to S1	S2 Stop Delay
Source 1 Fails	Transfer to Source 2 →			Source 1 Returns ↓	Transfer to Source 1 →	Engine Cooldown

Closed Transition

GE Zenith Closed Transition Transfer Switches are designed to Transfer the Load between two available sources with out interrupting power to the Load (Make-Before-Break). Paralleling of the two sources occurs within a predefined window of synchronization and lasts less than 100 milliseconds. The initial Source is then disconnected.

Initiating a Closed Transition
When a Test is initiated, the controller initiates the Time Delay Source 2 Start (Engine Start Timer "P") cycle. Upon completion of the (P) time delay, an Engine start Signal is sent to Source 2. When Source 2 voltage and frequency reach the preset "Restore" values, the time delay to open Source 1 timer (W) begins its timing cycle. After the (W) time delay, the ATS closes into Source 2 only after the controller ensures the proper phase relationship between the two Sources. After the ATS closes into Source 2, the SE limit switch becomes activated. The controller initiates a transfer signal through the SCR-NO which opens the ATS out of Source 1. The SNO limit switch activates. The ATS has now closed into Source 2 position without interrupting the load.

Re-Transfer with Closed Transition
Deactivating the Test Switch initiates the re-transfer. When Source 1 voltage and frequency reach the preset "Restore" values, the time delay to open Source 2 timer (T) begins its timing cycle. After the (T) time delay, the ATS closes into Source 1 only after the controller ensures the proper phase relationship between the two Sources. After the ATS closes into Source1, the SN limit switch becomes activated. The controller initiates a transfer signal through the SCR-EO which opens the ATS out of Source 2. The SEO limit switch activates. The ATS has now closed back into Source 1 position without interrupting the load.

The ATS defaults to an open transition transfer when Source 1 fails. Closed transition transfer is not possible with only one source available. If the optional Transition Mode Selector (TMS) is available, one can select an Open Transition Transfer or a Closed Transition Transfer when both Sources are available..

If while in Closed Transition Mode, the ATS fails to open the source it is attempting to "transfer out of" within 100 milliseconds, an Alarm will sound and the source that the ATS just closed into will be opened leaving the ATS in its initial source while disabling all other transfer operations until the problem is corrected and the "Fail to Open Lockout Reset" has been pressed.

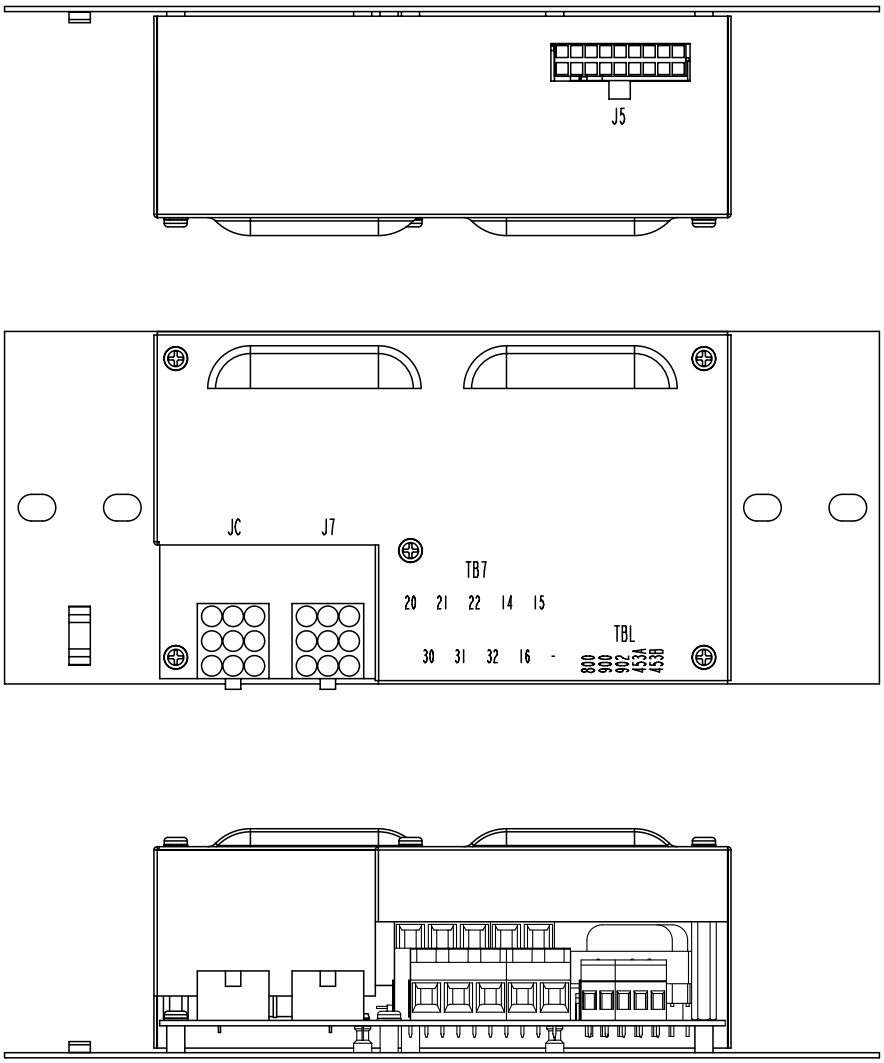
A signal will be provided (STE) to Shunt Trip the Generator Circuit Breaker if the Transfer Switch remains closed into both Sources for more than 325 milliseconds. The load will then be fed by the Source 1. The maximum time that the two Sources would be parallel, under these conditions, is less than 500 milliseconds. Before operating the Closed Transition Transfer Switch, the condition must be corrected and the Shunt Trip reset. Refer to procedure for servicing the Switch after Shunt Tripping occures.

The unit is Factory set to accomplish transfer within 5 electrical degrees.
Requires an Isochronous Governor with an operating frequency of 60+/- 0.2 Hz.
Requires a Shunt Trip Breaker on the Generator set with a response time not exceeding 50 milliseconds.

Controls Power Supply (CPS)

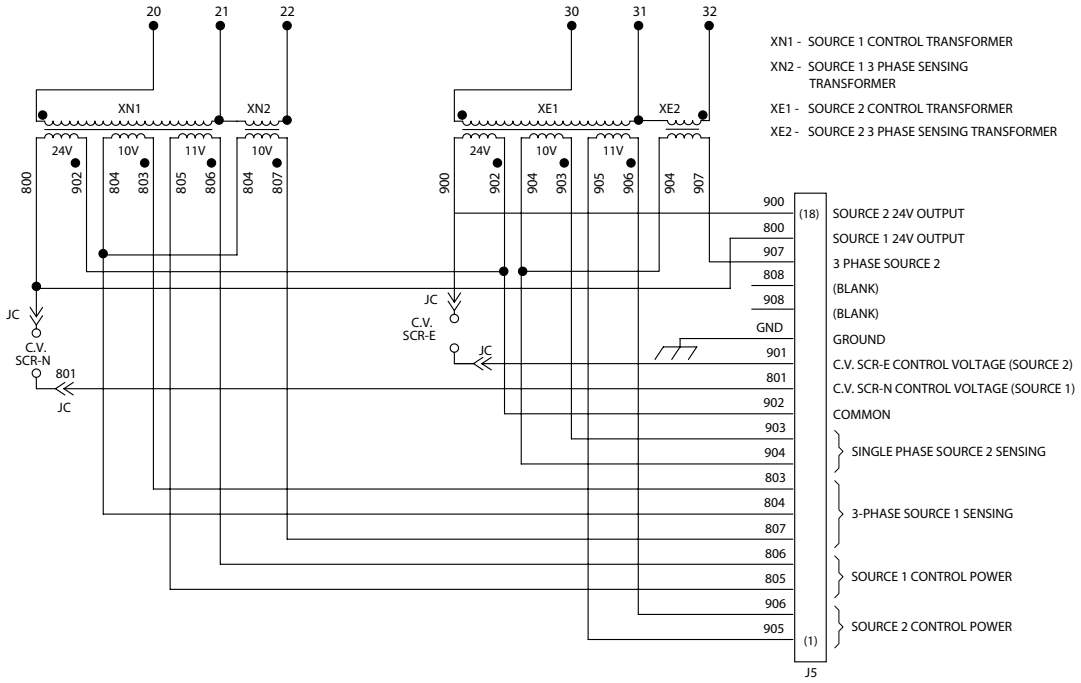
Standard and Delay Transition

Each MX250 microprocessor based ATS controller requires a Controls Power Supply (CPS) to apply line voltage to the ATS operator via SCRs. Also required is power for the MX250 printed circuit board and an application of sensing voltage proportional to line voltage. This is accomplished by the Controls Power Supply (CPS). This method of switching operator voltage and applying power and sensing voltage to the printed circuit board isolates the MX250 from the line voltage, further protecting the controller from harmful line transients.

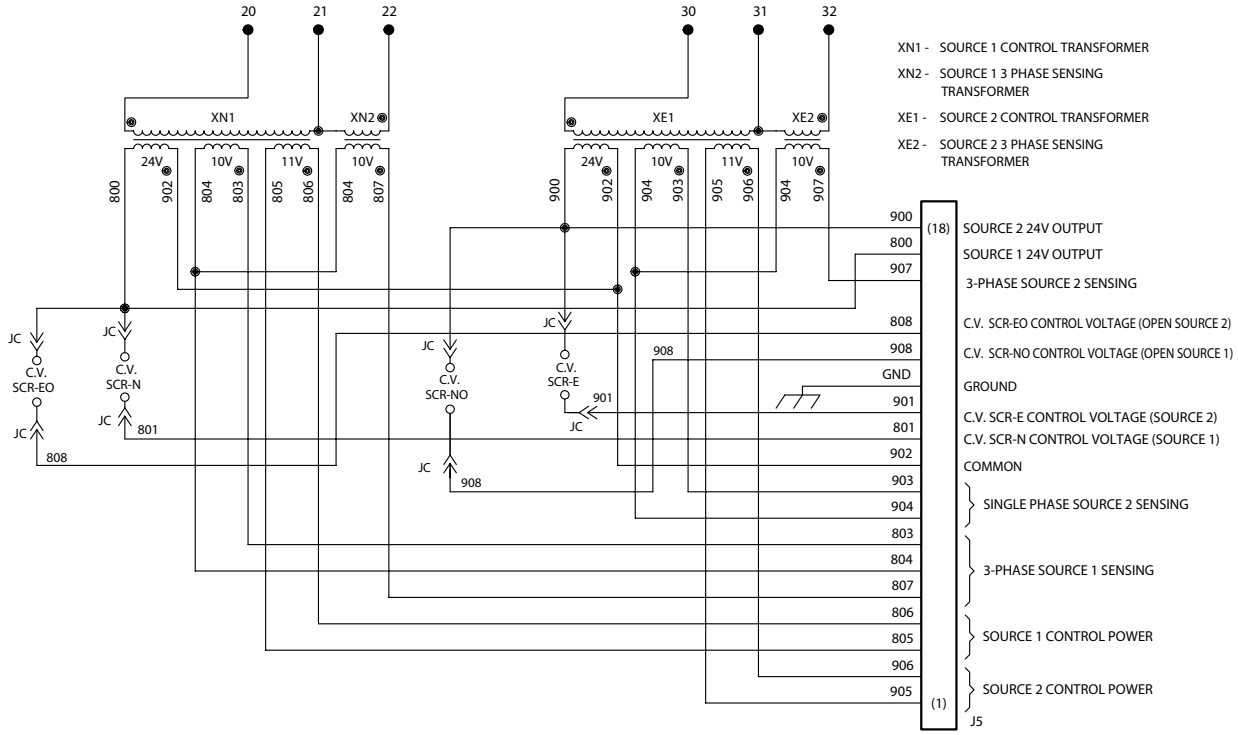


Primary Voltage at 50/60 Hz	CPS Assembly Part No.	CPS Board No.
120V	50P-1224	50P-1200
208-220V	50P-1225	50P-1201
230-240V	50P-1226	50P-1202
277V	50P-1227	50P-1203
380-400V	50P-1228	50P-1204
416-440V	50P-1229	50P-1205
460-480V	50P-1230	50P-1206
575-600V	50P-1231	50P-1207

Standard Transition CPS Schematic



Delayed Transition CPS Schematic



Troubleshooting and Diagnostics

⚠ DANGER ⚠

HAZARDOUS VOLTAGES CAN CAUSE SEVERE INJURY OR DEATH.
These charts may indicate problems that require authorized GE Zenith service personnel.
Hazardous voltages may exist on termination plugs other than those that go into the Entelli-Switch 250.

General Troubleshooting

The following troubleshooting guide is used to recognize, and determine basic faults. When using this guide, it will ask several questions about the condition of the switch. This guide will then list an order of the possible faults. You will then look at the first suspected fault to determine if it is the problem. If it is not a fault, you go to the second suspected fault. If you go through all of the suspected faults, or the chart instructs you to, call a GE Zenith Representative for further assistance.

NOTE: When you use the troubleshooting charts, the Annunciation column refers to the LED's on the control panel.

Symptom	Annunciation	Possible Cause(s)	Corrective Action
Engine does not START	SOURCE 2 AVAILABLE LED off	Engine start wires not terminated properly	Check engine start connections
		Generator is in OFF position	Investigate why Engine Control Switch was turned off
Engine does not stop	LCD Display - "TD Engine Cool Down"	U timing cycle not complete	Check U timer setting
	SOURCE 1 POSITION, and SOURCE 1 and SOURCE 2 AVAILABLE LEDs on, but U timer has timed out	Engine start wires not terminated correctly	Check Engine Start Connections
		Generator in MANUAL	Place generator in AUTO
ATS will not transfer to SOURCE 2 ZTS Series	SOURCE 2 AVAILABLE LED off	SOURCE 2 voltage or frequency not within acceptable parameters	Check: Engine Start Connections, Generator Breaker, Generator Output, and Engine Control Switch
	None	Power supply connector unplugged	Plug in connector
	LCD Display - "S1 _ _ _ _ TD XFR S1>S2 Time Remaining _ _ _ _"	**W** timing cycle not complete	Check **W** Timer setting
ATS will not transfer to SOURCE 1 ZTSD Series	LCD Display - "ATS Open Time Remaining _ _ _ _"	**DW** timing cycle not complete	Check **DW** Timer setting
	SOURCE 1 AVAILABLE LED off	SOURCE 1 voltage or frequency not within acceptable parameters	Check utility and utility breakers
	None	Power supply connector unplugged	Plug in connector
	LCD Display - "Diagnostic Code 001"	Limit switch or RT box connector unplugged	Call Technical Services
	LCD Display - "S1 OK Time Remaining _ _ _ _ Bypass"	**T** timing cycle not complete	Check **T** Timer setting
	LCD Display - "ATS Open Time Remaining _ _ _ _"	**TD** timing cycle not complete	Check **DT** Timer setting

Table 4

Maintenance and Testing

⚠ CAUTION ⚠

Due to hazardous voltage and current, GE Zenith recommends that a GE Zenith Certified technician or a qualified electrician must perform the installation and maintenance of the switch.

⚠ WARNING ⚠

Both power sources must be disconnected before manual operation of the switch.

A preventive maintenance program will insure high reliability and long life for the transfer switch. The preventive maintenance program for the transfer switch should include the following items:

Inspection and Cleaning

The switch should be inspected for any accumulation of dust, dirt, or moisture, and should be cleaned by vacuuming or wiping with a dry cloth or soft brush. do not use a blower since debris may become lodged in the electrical and mechanical components and cause damage.

Remove the transfer switch barriers and check the condition of the contacts. Any surface deposits must be removed with a clean cloth (do not use emery cloth or a file). If the contacts are pitted or worn excessively, they should be replaced. A general inspection of mechanical integrity should be made to include loose, broken or badly worn parts.

Servicing

All worn or inoperative parts must be replaced using GE Zenith recommended replacement parts. Please refer to the Replacement Parts manual for specific part information and ordering procedures. Please contact the GE Zenith Technical Services Department for the Replacement Parts manual.

The operating mechanism of the transfer switch is lubricated with Lubriplate 105. The lubricant applied at the factory provides adequate lubrication for the lifetime of the switch. Should debris contaminate the mechanism, clean and apply additional Lubriplate.

GE Zenith can provide complete preventative maintenance services. Please contact the GE Zenith Technical Services Department for additional information.

CDT battery replacement - lithium batteries may last up to 10 years, however it is recommended that battery replacement be included in a 3-5 year service cycle. The battery maintains the exerceser memory only and does not otherwise affect the operation.

Testing

A manual operator handle is provided with the transfer switch for maintenance purposes only. Manual operation of the switch must be checked before it is operated electrically. **Both power sources must be disconnected before manual operation of the switch.** Insert the handle and operate the transfer switch between the Source 1 and Source 2 positions. The transfer switch should operate smoothly without binding. Return the switch to Source 1 position, remove the handle, and return it to the holder provided.

After completing the inspection, cleaning and servicing of the transfer switch, reinstall the switch cover, and close and lock the cabinet door. Reclose the circuit breakers feeding the utility and generator sources to the switch.

Initiate the electrical transfer test by activating the TS test switch. P timer will time out and the micro-controller will send an engine start signal. When the W time has elapsed, the switch will complete its transfer by closing into Source 2.

Deactivating the test switch will start retransfer to Source 1. The switch will complete its retransfer to Source 1 after the time delay of the T timer. The U engine overrun timer allows the engine generator to run unloaded for a preset cool down period.

NOTE: A periodic test of the transfer switch under load conditions is recommended to insure proper operation. (See National Electric Code articles 700 and 701).

⚠ WARNING ⚠

When performing a hi-pot or dielectric test on the power section, DISCONNECT the control panel plugs from the microprocessor to avoid potential damage.



GE Zenith Controls

A Product of GE Industrial Systems
General Electric Company
830 West 40th Street, Chicago, IL 60609 USA
773 299-6600, Fax: 773 247-7805
www.geindustrial.com

ZTX SERIES
40-400 Amps

GE Zenith Controls



62R-2000C
7/02

Operation and Maintenance Manual

Authorized Service

For GE parts and service, call: 773 299-6600

Table of Contents

	Page
Introduction	ii
How to Remove the Cover	1
Installation	2
Equipment Inspection and Storage	2
Final Equipment Inspection	2
Mounting	2
Power Connections	3
Engine Start Control Connections	4
RM4 Exerciser Option	5
Functional Test	6
RMF Control Interface	7
Optional Indicator LED's	7
Optional Pushbuttons	7
Automatic Transfer Generator Testing	8
Transfer Generator Testing	8
LED Diagnostic Flash Codes	8
Automtic Generator Exerciser	9
Selecting Exercisor without Transfer	9
Selecting Exercisor with Transfer	9
Engine Controller Accesoory Board	10
Example Systems	11
Partial Coverage Systems	11
Total Coverage Systems	11
Typical Diagrams	12
Power Circuit Schematic	12
Power Panel Layout	12
Interconnect Plug	12
Troubleshooting	13
General Troubleshooting	13, 14

Introduction

GE Zenith Transfer Switches are used to provide a continuous source of power for lighting and other critical loads by automatically transferring from the normal source of power to an emergency source of power in the event that the normal source voltage falls below preset limits.

Voltage sensing and system control is performed via a state-of-the-art microcontroller located on the cabinet door. It is designed to give highly accurate control of the transfer switch system.

All GE Zenith transfer switches are designed for use on emergency or standby systems, and are rated for total system or motor loads. Transfer switches are UL Listed under Standard 1008 and CSA Certified under Standard C22.2 No. 178 and IEC Listed under Standard 947.

NOTE: A protective device such as a molded care circuit breaker or fused disconnect switch MUST be installed on both sources of incoming power for circuit potection and as a disconnection device.

How to Remove the Cover

Loosen but do not remove four cover screws. Lift cover off the four screws and hang on two screws (2 bottom or 2 right-hand). See *Figure i* and *ii*.

This will prevent damage to the cable. The cable may also be disconnected at the controller or keypad.

NOTE: Reattach cable before installing cover.



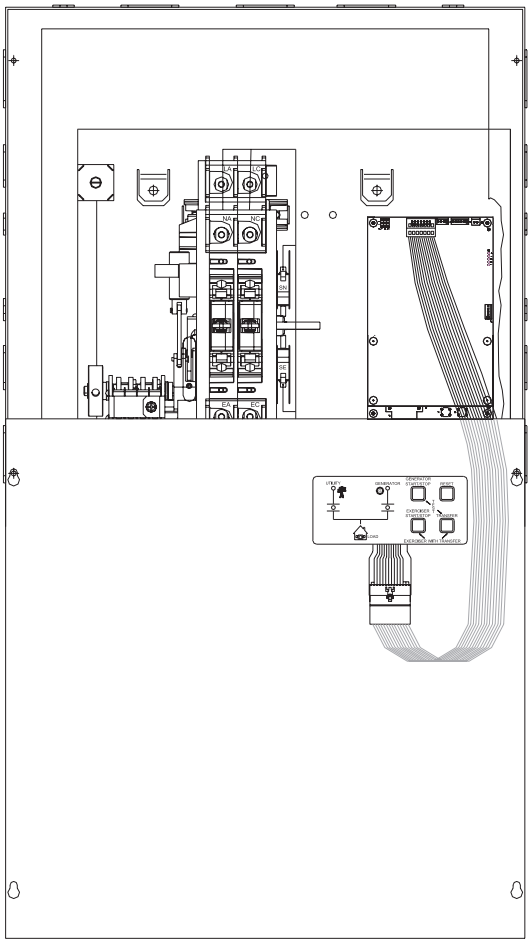


Figure i

FRONT VIEW
W/COVER ON BOTTOM

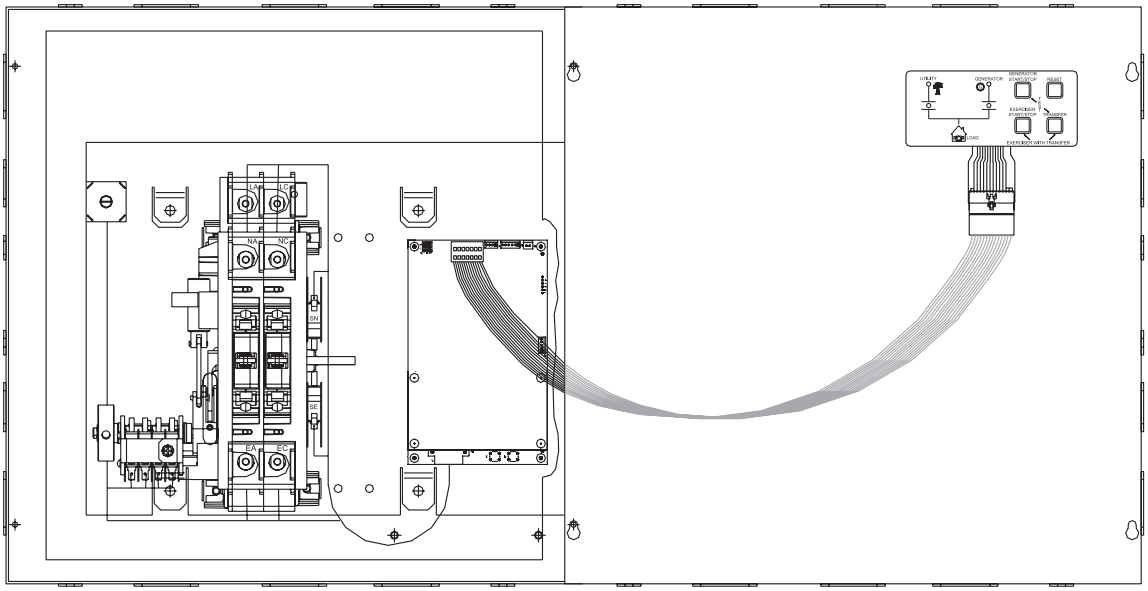


Figure ii

FRONT VIEW
W/COVER TO THE RIGHT

Installation

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

The safe operation of your switch is GE Zenith's focus. The proper storage, installation, operation and maintenance will help increase the life of the switch.

⚠ CAUTION ⚠

Due to hazardous voltage and current, GE Zenith recommends that a GE Zenith Certified technician or a qualified electrician must perform the installation and maintenance of the switch.

Equipment Inspection and Storage

Once you have received the transfer switch, inspect it for any damage. This includes damage to the enclosure, power panel, control panel and wiring harness. If any damage is found or suspected, file a claim as soon as possible with the carrier and notify the nearest GE Zenith representative.

Before installation, it is necessary to store the transfer switch in a clean dry place, protected from dirt and water. Provide ample air circulation and heat, if necessary, to prevent condensation.

Storage Temperature	Operating Temperature (Ambient):	Humidity
-30°C to +75°C (-22°F to +167°F)	-20°C to +65°C (-4°F to +149°F)	5% to 95% (non-condensing)

Final Equipment Inspection

Prior to energizing the transfer switch:

1. Remove any debris incurred, with a vacuum, due to shipment or installation.

⚠ WARNING ⚠

Do not use a blower since debris may become lodged in the electrical and mechanical components and cause damage.

2. Verify that all cabled connections are correct.
3. Check engine start connections and verify the correct connection of all control wires.
4. Check the lug torque values of the power connections.

NOTE: Lug torque values are specified in the power panel manual.

5. Make sure that all covers and barriers are installed and properly fastened.

NOTE: Power panels ship from GE Zenith in the Normal Position.

Each GE Zenith transfer switch is factory wired and tested. A complete information package is furnished with each switch which includes:

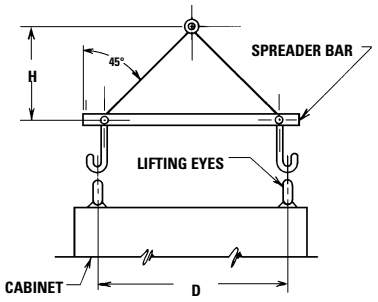
a. Sequence of operation.
b. Description and operation of all accessories supplied.
c. Power panel connection diagram and schematic.
d. Description and identification of all customer field connections.

Installation of GE Zenith transfer switches includes:

a. Mounting the transfer switch cabinet.
b. Connection of all Normal, Emergency, and Load cables or bus bars.
c. Connection of external control circuits as required.

Mounting

Adequate lifting means must be used to mount the transfer switch into place. The recommended method for moving the transfer switch using the lifting eyes, where supplied, and a spreader bar is illustrated here. Enough room should be allowed to open the cabinet doors fully for inspection and servicing of the switch per NEC and local codes.



NOTE: When lifting the switch using a spreader bar, height H must be equal to half of distance D.

⚠ CAUTION ⚠

Before drilling conduit entry holes or any accessory mounting holes, cover and protect the switch and control panel to prevent dirt and metal fragments from entering the mechanical and electrical components.

Failure to do so may result in damage and malfunction of the switch.

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Power Connections

GE Zenith transfer switches are supplied with UL listed solderless screw type terminals as standard for the Normal, Emergency and Load power connections. *Table 1* lists the number and sizes of cable lugs supplied as standard for each switch amp rating.

Connect the Normal, Emergency, and Load conductors to the clearly marked terminals on the transfer switch. Remove surface oxides from cables by cleaning with a wire brush. Verify that all connections are correct before tightening the lugs. All cable lug connections must be tightened to the proper torque values as shown in *Table 2*.

NOTE: Do not run cables or wiring behind front-connected transfer switches.

Screw Type Terminals for External Power Connections

Switch Size (Amps)	*Utility, Generator and Load Terminals*		*Fully Rated Neutral Bar (When Required)*	
	Cable Per Pole	*Range of Wire Sizes*	*No. of Cables*	*Range of Wire Sizes*
40	1	#8 to 3/0 AWG	3	#8 to 1/0 AWG
80	1	#8 to 3/0 AWG	3	#8 to 1/0 AWG
100	1	#8 to 3/0 AWG	3	#8 to 1/0 AWG
150	1	#8 to 3/0 AWG	3	#8 AWG to 300 MCM
200, 225, 250*	1	#6 AWG to 250 MCM	3	#6 AWG to 300 MCM
300, 400	1	#4 AWG to 600 MCM	3	#4 AWG to 300 MCM

Table 1

* IEC Rating Only

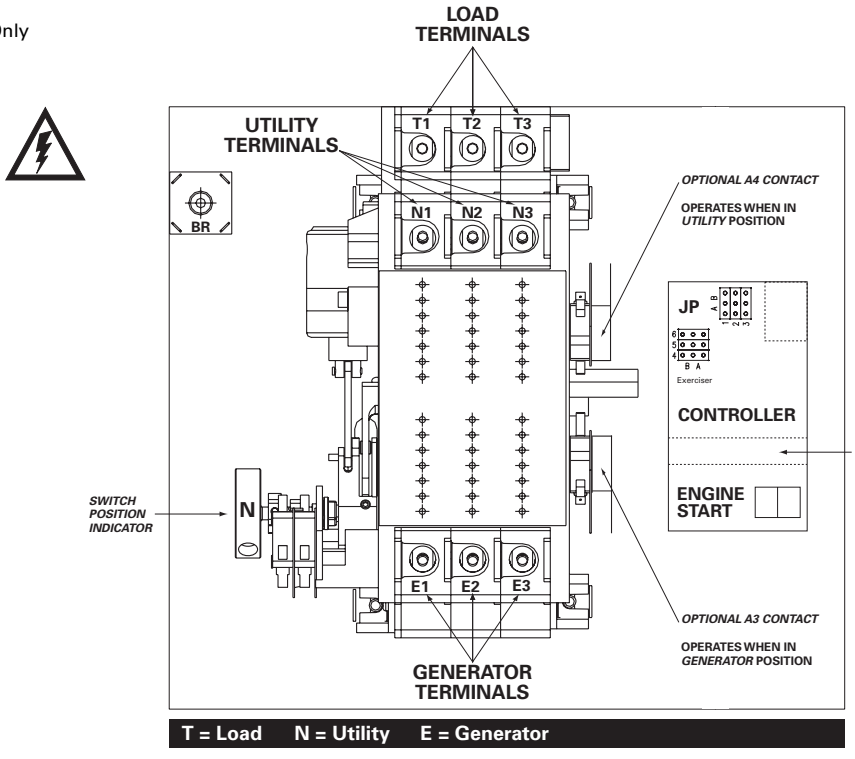


Figure 2 - Power Panel

Tip!
Install load cables first.

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Control Connections

Connecting Engine Start may cause Generator to start. Before connecting, turn Generator OFF.

With the Generator breaker open and the Generator control switch off, install the Generator start connections.

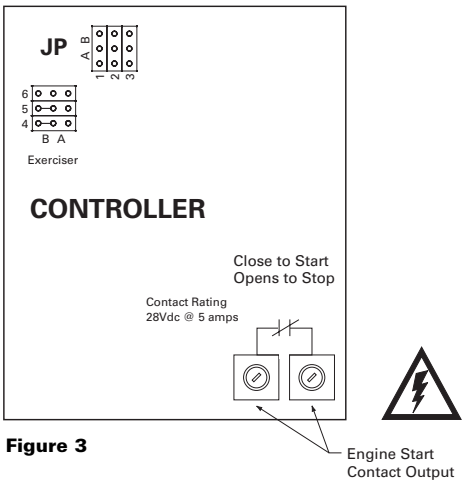


Figure 3

The engine-start terminals are clearly identified by a label on the microcontroller backplate. In the case of manual transfer switches, or in other applications not requiring the microprocessor, clearly marked terminal blocks are provided in the upper left corner of the control panel for the engine start control wires.

Terminals for field connections to the A3 Emergency auxiliary contacts and the A4 Normal auxiliary contacts are also provided. These terminals are clearly marked and appear on the side of the power panel. On 400 amp metal frame units these terminals appear on the bracket above the operator handle.

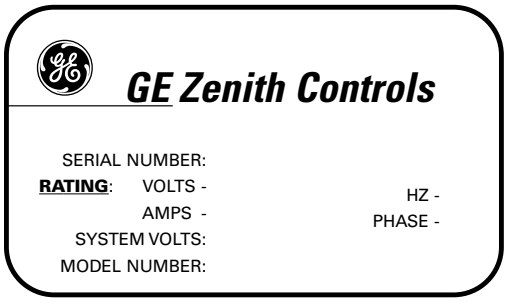


Figure 3

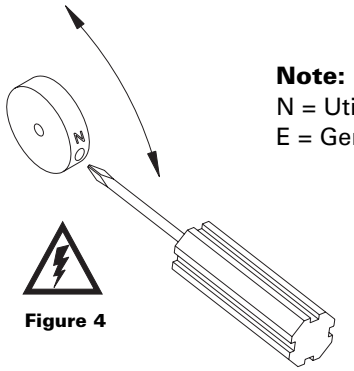


Figure 4

Note:
N = Utility Position
E = Generator Position

Manual operation is possible for maintenance purposes only. Manual operation of the switch can be checked before it is operated electrically.

With all power off, insert a Phillips screwdriver or equivalent size tool into the manual operator socket and operate the transfer switch between the Utility and Generator positions. The transfer switch should operate smoothly without binding. Return the switch to the Utility position, remove the screwdriver.

Tightening Torque for Lugs

Socket Size Across Flats	Torque	
	Lb. - In.	Lb. - Ft.
1/8	45	4
5/32	100	8
3/16	120	10
7/32	150	12
1/4	200	17
5/16	275	23
3/8	375	31
1/2	500	42
9/16	600	50

Table 2

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

ATTENTION!

This applies only to the switches with the RM4-CAT exerciser option:

Upon installation, connect the MX50/90 controller to a 9V battery (not supplied) via the harness that is connected to the controller. The battery should be placed in the holder installed just above the controller. This is to ensure that the setting in the exercisor clock are retained in the event of power outage. The battery should be replaced once a year. If the battery is not installed and/or replaced as recommended, the exerciser clock will lose its settings and the exerciser will not work.

Should the harness become disconnected in shipping, take the controller cover off and plug the harness in the receptacle in the top right corner of the MX controller. Reinstall the cover and connect the battery.

Battery and Holder

Battery Harness

MX50/90 Controller



⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Functional Test

The functional testing of the transfer switch consists of electrical tests described in this section. Before proceeding, read and understand all instructions and review the operation of all accessories provided.

To begin the test, close the Utility source circuit breaker. **The controller will illuminate the optional Utility Available LED when proper voltage is sensed.** Verify the phase to phase voltages at the Utility line terminals.

Next, close the Generator source breaker and start the engine generator. **The optional Generator Available LED will illuminate when proper voltage and frequency levels is sensed. If Generator LED is flashing, use the Reset button to clear.** Check the phase to phase voltages at the Generator line terminals. On three phase units, verify that the phase rotation of the Generator source is same as Utility source.

After the sources have been verified, shut down the engine generator, and put the starting control in the automatic position. Complete the visual inspection of the transfer switch, and replace the cabinet cover **(or close the cabinet door)**.

Initiate the electrical transfer test by opening the Utility side breaker**.** The delay to engine start timer (P) begins its timing cycle. After the P timer has completed its timing cycle, the engine start contacts close to start the generator.

When Generator voltage and frequency reach preset pickup points **the optional Generator Available LED illuminates.** Simultaneously, the delay to Generator timer (W) begins its timing cycle. When the W time delay is completed the switch will transfer to Generator. **The optional Utility Position LED goes off, and the optional Generator Position LED illuminates.**

Reclose the Utility breaker to retransfer to Utility. The delay to Utility timer (T) begins its timing cycle. When the T timer has completed its timing cycle, the switch will transfer into Utility. **The optional Generator Position LEDs go off, and the Utility Position LED illuminates.** The delay engine stop timer (U) begins its timing cycle. The generator runs unloaded for the duration of the U timing cycle. When the timer completes its timing cycle, the generator will stop. **The optional Generator Available LED goes off.**

Factory Settings	
Utility Pickup Voltage	90% Nominal Line Voltage
Utility Dropout Voltage	80% Nominal Line Voltage
Utility Pickup Frequency	90% Nominal Line Frequency
(T) Timer/Delay to Utility	5 minutes*
(U) Timer/Engine Cool Down	5 minutes*

Factory Settings	
Generator Pickup Voltage	90% Nominal Line Voltage
Generator Dropout Voltage	80% Nominal Line Voltage
Generator Pickup Frequency	95% Nominal Line Frequency
(P) Timer/Engine Start	5 seconds*
(W) Timer/Delay to Generator	20 seconds*

Table 3

***** Factory default settings — customer time settings may vary due to specifications from the generator supplier.

RM4 Control Interface (*Optional*)

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Optional Indicator LEDs

A Utility available Green LED. When on, indicates the utility source is acceptable.

B Utility position Green LED. When on, indicates that the transfer switch is connected to the utility.

C Generator available Red LED. When on, indicates the generator source is acceptable.

D Generator position Red LED. When on, indicates that the transfer switch is connected to the generator.

E Load Amber LED. When on, indicates that the load is connected to an acceptable source.

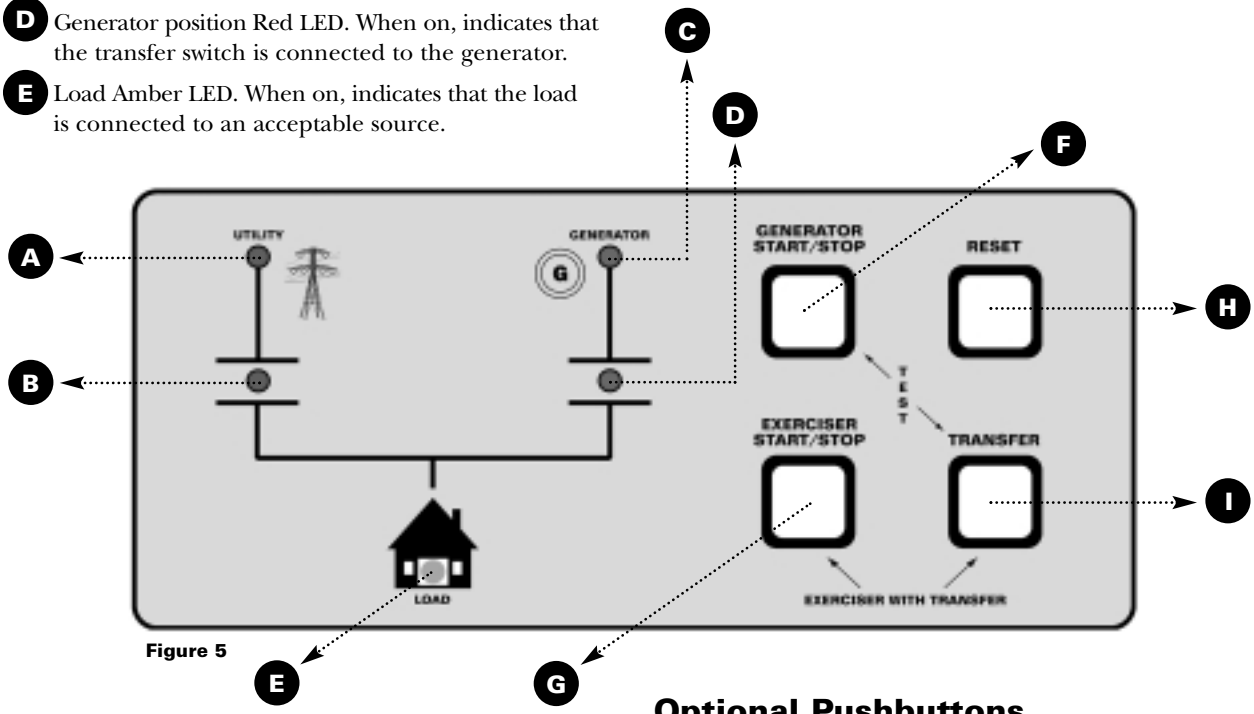


Figure 5

Optional Pushbuttons

F Generator Start/Stop push button. Pressing and holding this button for approximately 5 seconds will cause the generator to start. Pressing this button a second time will stop the generator.

G Exerciser Start/Stop push button. When this button is depressed it will enable the automatic exerciser mode. Pressing this button a second time will cancel the automatic exerciser mode.

H Reset push button. Pressing this button will clear the fault indications.

I Transfer push button. Pressing this button will force the unit to transfer from one position to another when both sources are available.

RM4 Control Interface (*Optional*) *(cont'd)*

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Automatic Transfer Generator Testing (One Time Test)

Verify that the transfer switch **UTILITY** available and position LEDs are illuminated. A + B

Press and hold the **GENERATOR START/STOP** button F and the **TRANSFER** button I for 5 seconds. This will cause the generator to start. Once the generator C has started, the Generator LED will illuminate.

Once the **GENERATOR** power LED C has come on, the transfer switch will now switch the load to the Generator. The **GENERATOR** position LED will illuminate. D

The transfer switch will be connected to the generator for 5 minutes.* Then the switch will automatically return to the utility and the **UTILITY** Position LED will illuminate. B

The generator will cool down for 5 minutes (U Timer) and then shut down. The **GENERATOR** LED will go off. C

This completes the automatic test.

* Pressing and releasing the generator Start/Stop button will cancel current test.

Transfer Generator Testing (Forcing Operation with Keypad)

Verify that the transfer switch **UTILITY** available and position LEDs are illuminated. A + B

Press and hold the **GENERATOR START/STOP** button for 5 seconds. This will start the generator. F

Verify that the **GENERATOR** available LED has illuminated. C

Press the **TRANSFER** button. I The switch will transfer to the Generator source position. The **GENERATOR** position LED will now be illuminated. D

Pressing the **TRANSFER** button I again will cause the unit to transfer to the utility power source. The **UTILITY** position LED will illuminate. B

Pressing the **GENERATOR START/STOP** button will stop the generator. F

NOTE: Transfer will cause short interruption of power.

LED Diagnostic Flash Codes

Rapidly Flashing Generator Availability LED C

- Generator failed to start.
- Generator starts but failed to reach proper operating parameters.
- Generator became over loaded for an extended period of time.
- Optional generator crank board *(see generator fault flash table on page 14)*

Rapidly Flashing Generator D Position LED

- Switch did not transfer to Generator position.

Rapidly Flashing Utility B Position LED

- Switch did not transfer to Utility position.

NOTE: All fault alarms can be cleared by depressing the reset button.

RM4 Control Interface (*Optional*) *(cont'd)*

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Automatic Generator Exerciser

The automatic generator exerciser comes preset with a 28-day exerciser schedule *(the customer unit's preset day cycle may vary due to specifications from the generator supplier).* The exerciser, when enabled, will automatically start the generator every twenty-eighth day and run the unit loaded or unloaded for 10 minutes. The exerciser interval is selectable through (JP) jumper selection on the controller board. The selections are 7, 14, 21 or 28 day.

Selecting Exerciser Without Transfer

To start the automatic exerciser without transfer, depress the Exerciser Start/Stop button. The generator will start and run for 10 minutes.* Once this first exercise is complete, the generator LED will flash at a 1-second interval indicating the exerciser is enabled. Once the exerciser times out (7, 14, 21 or 28 day interval), the generator will start and run again for 10 minutes. This will repeat until the exerciser is disabled. To stop the exerciser mode, depress the exerciser Start/Stop again and the generator light will stop flashing, indicating the exerciser mode has been canceled.

Selecting Exerciser With Transfer

To enable the automatic exerciser with transfer, depress the Exerciser Start/Stop button and the transfer button. The generator will start and the load will be transferred to the generator. After 10 minutes,* the load will be transferred back to the utility. Once this first exercise is complete, the generator LED and the Generator position LED will flash at a 1-second interval indicating the exerciser is enabled. Once the exerciser has timed out (7, 14, 21 or 28 day interval), the generator will start and transfer the load to Generator power for 10 minutes. At the end of this 10-minute period, the unit will transfer the load back to the utility and the generator will shut off. This will repeat until the exerciser is disabled. To stop the exerciser mode, depress the exerciser Start/Stop again and the generator light will stop flashing, indicating the exerciser mode has been canceled.

* Pressing and releasing the generator Start/Stop button will cancel the current test. The exerciser will go off at approximately the same time it was started (7, 14, 21 or 28 days) later.

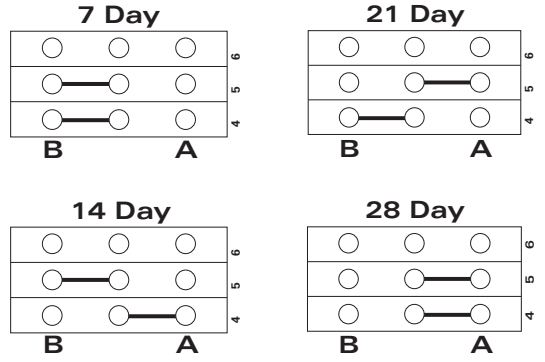
NOTE: Transfer will cause short interruption of power.

⚠ DANGER ⚠

Turn OFF all power before selecting.

JP (CDT SELECT)

See Figure 3, Page 4



JP (VOLTAGE/FREQUENCY SELECT)

See Figure 3, Page 4

Do not adjust the jumper positions.
This service to be performed by qualified personnel only.

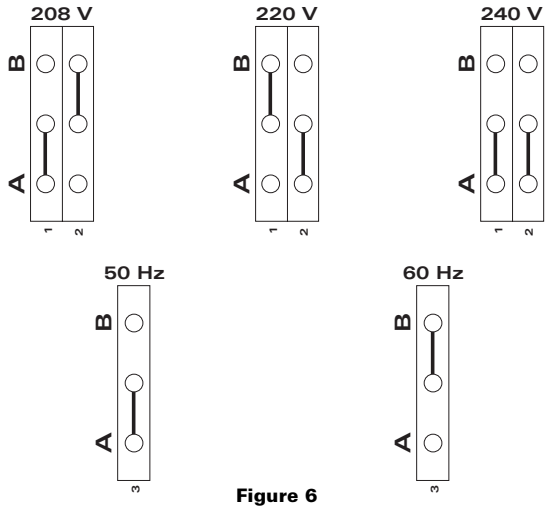


Figure 6

Engine Controller Accessory Board *(Optional)*

Oil Pressure Sensor Input

(Oil pressure contact to be normally open, held closed by adequate oil pressure)

Approximately five seconds after emngine starter signal is sent, if terminal X3 is open to ground or returns to open state thereafter the generator Starter and Fuel/Run outputs are opened and locked out. After cause is determined and corrective action is taken and verified by qualified technician, controller can be reset via reset button.

Temperature Sensor Input

(Temperature sensor contact to be normally open, closed by over-temperature condition)

Approximately five seconds after the engine starter signal is sent, if terminal X1 is connected to ground Starter and Fuel/Run outputs are opened and locked out. After cause is determined and corrective action is taken and verified by a qualified technician, the controller can be reset via the reset button.

Fuel/Run Contact Output

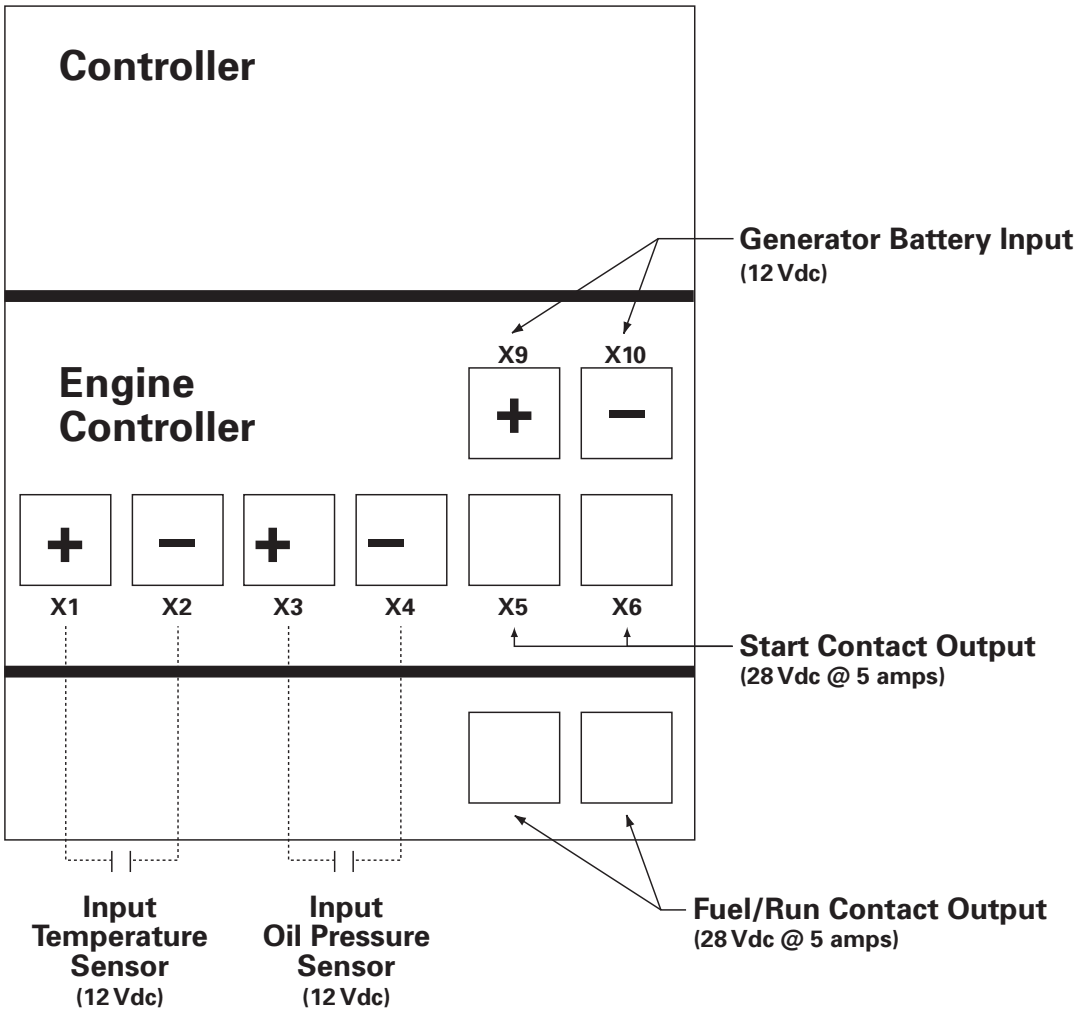
This output is activated closed whenever the engine is running. This will keep the fuel valve open as needed, and will cut fuel supply during the above mentioned lockouts or when the engine is no longer called to run.

Start Contact Output

This output is activated closed during cranking of the engine. Output will deactivate once the controller senses that the generator output has reached 33% of frequency indicating engine has reached running RPM.

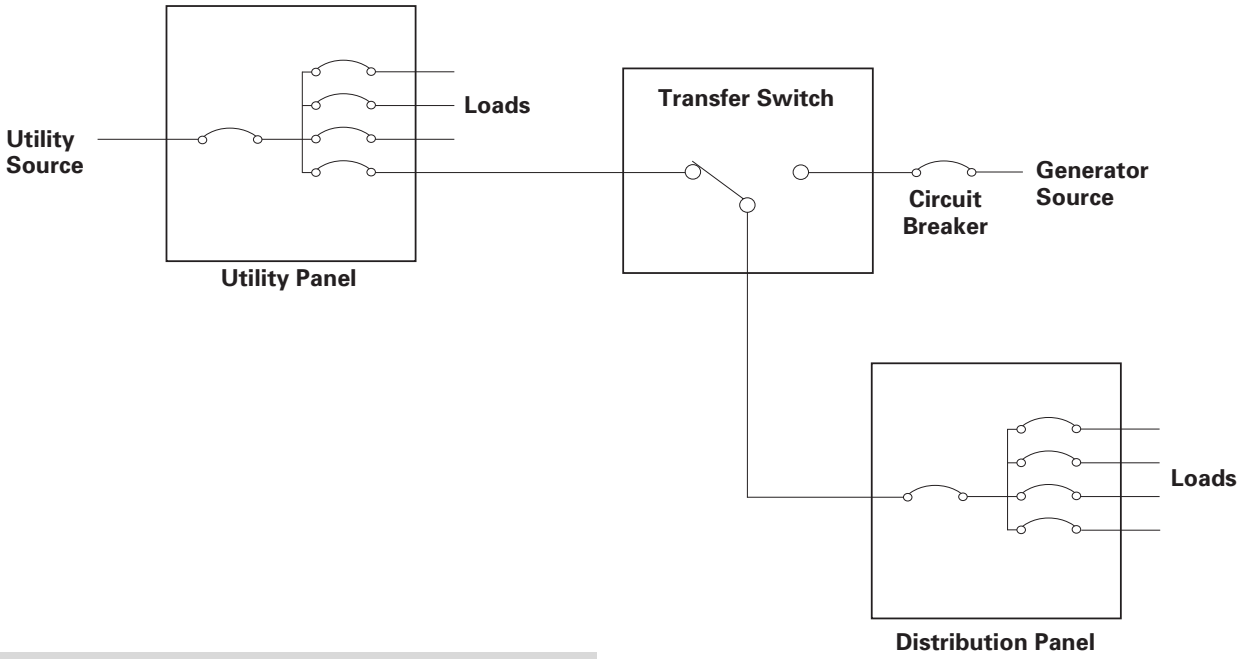
Generator Battery Input

This input is required to support the controller's operation.

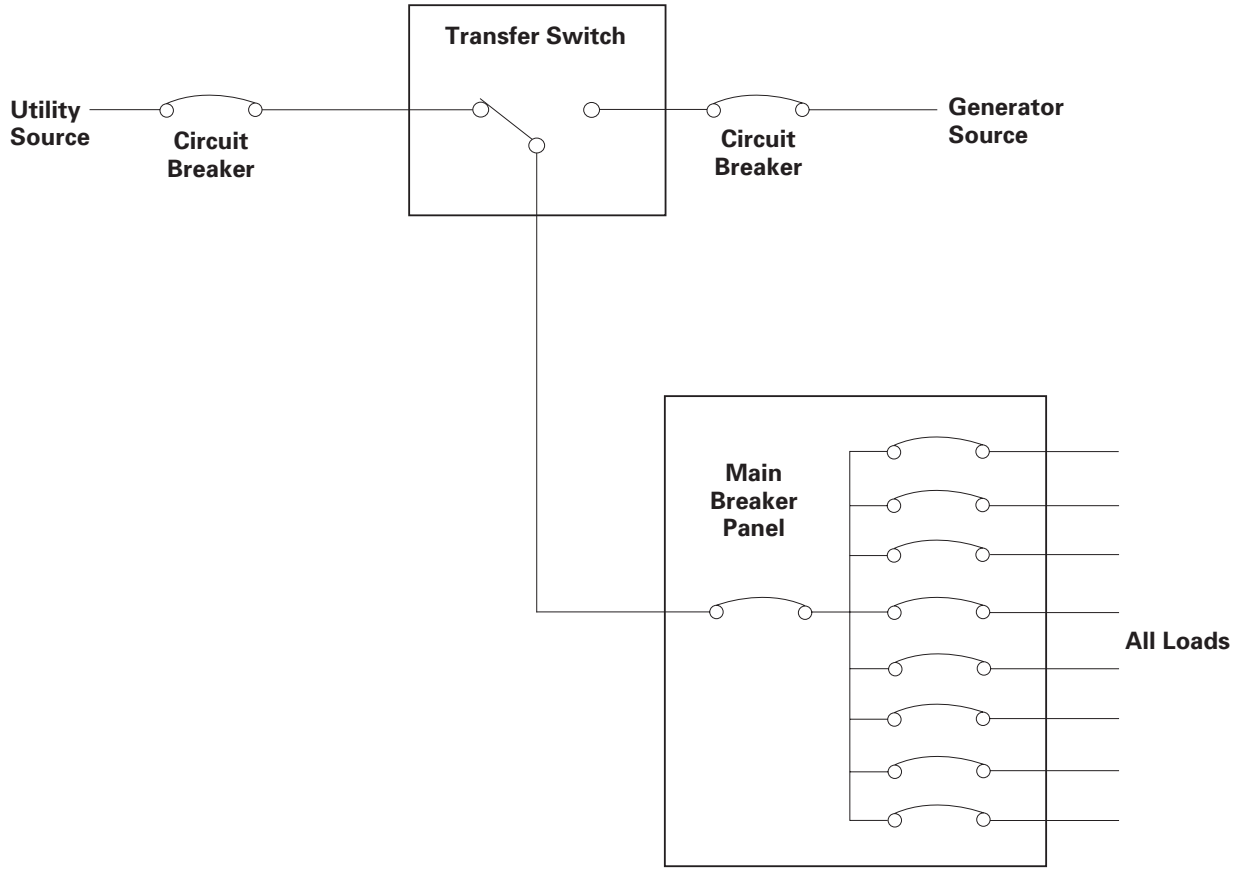


Example Systems

Partial Coverage System

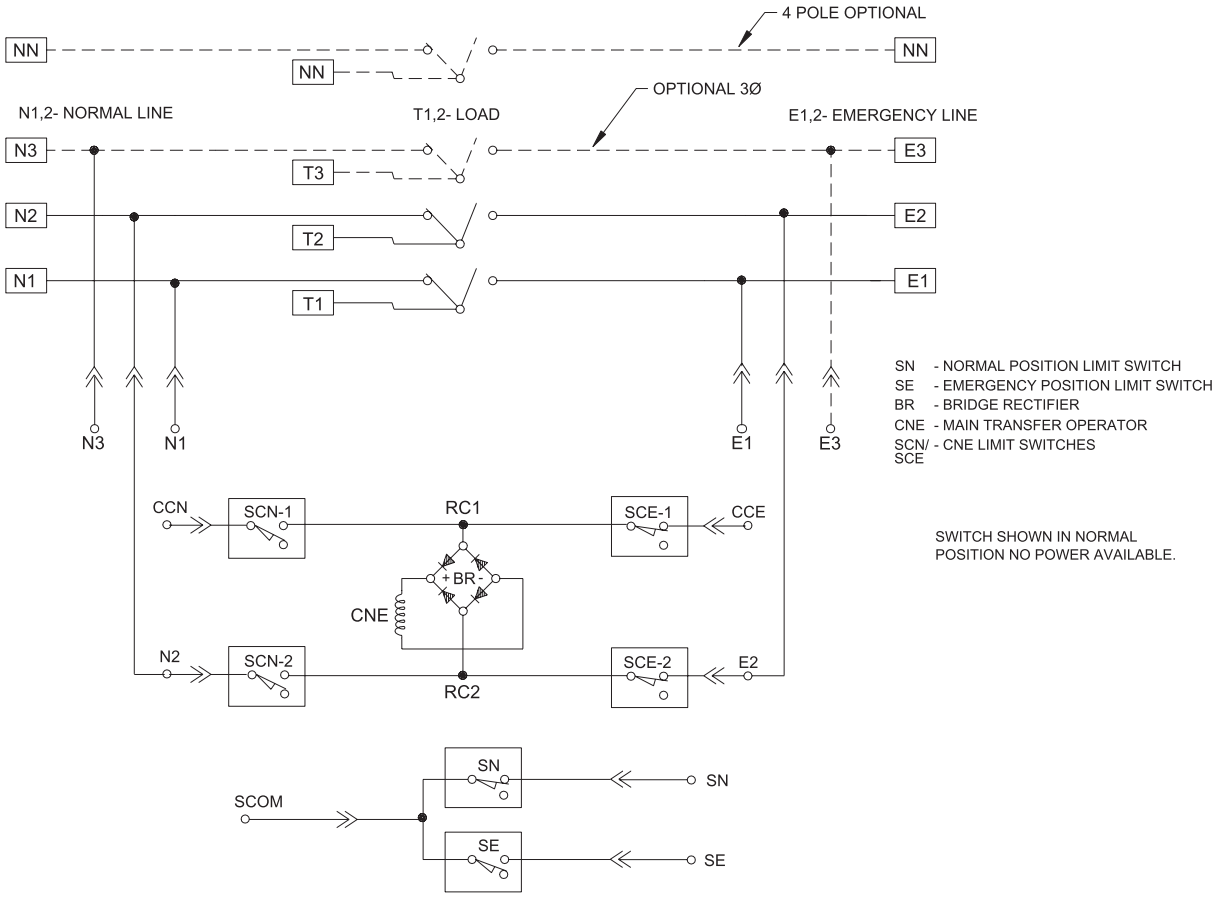


Total Coverage System

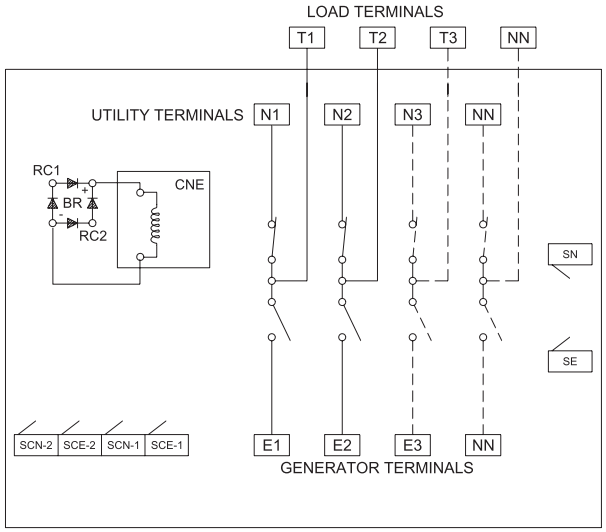


Typical Diagrams

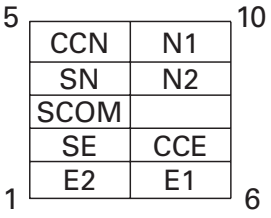
Power Circuit Schematic



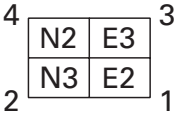
Power Panel Layout



Interconnect Plug



OPTIONAL 3Ø



Troubleshooting

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Service must be performed by qualified personnel.

Symptom	Possible Cause	Corrective Action
Generator will not start	**P** timer has not lapsed	See factory settings on Page 6
	Generator control switch not in Auto	Refer to generator instruction manual
	Engine Start contact not wired to generator	See Figure 3, Page 4
	Starter battery is dead	Refer to generator instruction manual
	No fuel	Refer to generator instruction manual
Transfer switch does not transfer to Utility	**T** timer has not lapsed	See factory settings on Page 6
	Exercise in progress	See Page 9
	Utility breaker open or tripped	Clear fault and reset
	Utility voltage out of range	Wait for utility to return to acceptable level. See factory settings on Page 6.
	Control harness unplugged	With all power disconnected, reconnect harness
Transfer switch does not transfer to Generator	**W** timer has not lapsed	See factory settings on Page 6
	Generator breaker open or tripped	Refer to generator instruction manual
	Generator voltage out of range	Refer to generator instruction manual
	Control harness unplugged	With all power disconnected, reconnect harness
Generator will not stop	**U** timer has not lapsed	See factory settings on Page 6
	Exercise in progress	See page 9
	Engine control switch in run position	Refer to generator instruction manual
All LEDs off	Keypad cable unplugged	With all power disconnected, reconnect harness
	Sources unavailable and/or source breakers tripped or open	Clear fault and reset breakers and/or check source availability

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Service must be performed by qualified personnel.

Generator Fault Flash Table	
Generator Failed to Start (GFS Timeout)	2 Flashes + 2 Missing
Generator Under-Speed Fault	3 Flashes + 2 Missing
Generator Over-Speed Fault	4 Flashes + 2 Missing
Generator Over-Temperature Fault	5 Flashes + 2 Missing
Generator Low-Oil-Pressure Fault	6 Flashes + 2 Missing

NOTE: Faults that trigger the "original" SAG timer (emergency source not available for longer than the GS timer interval) will continue to be indicated on the "Emergency Source" LED at the original continuous 5 Hz rate.



GE Zenith Controls

GE Industrial Systems –
Power Equipment Business
830 W. 40th Street, Chicago, IL 60609 USA
773 299-6600, Fax: 630 850-6899
www.zenithcontrols.com

GE Zenith Controls

ZTX Series Automatic Transfer Switches
40-400 Amps



72R-1000
9/05

Operation and Maintenance Manual

Authorized Service

For GE parts and service, call: 773 299-6600

Table of Contents

	Page
Introduction	ii
Installation	1
Equipment Inspection and Storage	1
Final Equipment Inspection	1
Mounting	1
Power Connections	2
Engine Start Control Connections	3
Exerciser Option	4
Functional Test	5
Jumper Positions	6
Control Interface	7
Indicator LED's	7
Pushbuttons	7
Using the Keypad Controls	8
Automatic Generator Exerciser	9
In-Phase Monitor Operation	10
Example Systems	11
Partial Coverage Systems	11
Total Coverage Systems	11
Typical Diagrams	12
Power Circuit Schematic	12
Power Panel Layout	12
Interconnect Plug	12
Replacement Parts	13
Standard Transition 40-200 Amps	13
Standard Transition 225-400 Amps	14
Troubleshooting	15

Introduction

GE Zenith Transfer Switches are used to provide a continuous source of power for lighting and other critical loads by automatically transferring from source 1 power to source 2 power in the event that source 1 voltage falls below preset limits.

Voltage sensing and system control is performed via a state-of-the-art microcontroller located on the cabinet door. It is designed to give highly accurate control of the transfer switch system.

All GE Zenith transfer switches are designed for use on emergency or standby systems, and are rated for total system or motor loads. Transfer switches are UL Listed under Standard 1008 and CSA Certified under Standard C22.2 No. 178 and IEC Listed under Standard 947.

NOTES: A protective device such as a molded case circuit breaker or fused disconnect switch MUST be installed on both sources of incoming power for circuit protection and as a disconnection device.

All references made within this manual about the term "S1" or "Source 1" relate to a Normal Power Source. All references made about the term "S2" or "Source 2" relate to an Emergency or Alternative Power Source.

Installation

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

The safe operation of your switch is GE Zenith's focus. The proper storage, installation, operation and maintenance will help increase the life of the switch.

⚠ CAUTION ⚠

Due to hazardous voltage and current, GE Zenith recommends that a GE Zenith Certified technician or a qualified electrician must perform the installation and maintenance of the switch.

Equipment Inspection and Storage

Once you have received the transfer switch, inspect it for any damage. This includes damage to the enclosure, power panel, control panel and wiring harness. If any damage is found or suspected, file a claim as soon as possible with the carrier and notify the nearest GE Zenith representative.

Before installation, it is necessary to store the transfer switch in a clean dry place, protected from dirt and water. Provide ample air circulation and heat, if necessary, to prevent condensation.

Storage Temperature	Operating Temperature (Ambient):	Humidity
-30°C to +75°C (-22°F to +167°F)	-20°C to +65°C (-4°F to +149°F)	5% to 95% (non-condensing)

Final Equipment Inspection

Prior to energizing the transfer switch:

1. Remove any debris incurred, with a vacuum, due to shipment or installation.

⚠ WARNING ⚠

Do not use a blower since debris may become lodged in the electrical and mechanical components and cause damage.

2. Verify that all cabled connections are correct.
3. Check engine start connections and verify the correct connection of all control wires.
4. Check the lug torque values of the power connections.

   NOTE: Lug torque values are specified in the power panel manual.

5. Make sure that all covers and barriers are installed and properly fastened.

   NOTE: Power panels ship from GE Zenith in the Normal Position.

Each GE Zenith transfer switch is factory wired and tested. A complete information package is furnished with each switch which includes:

a. Sequence of operation.
b. Description and operation of all accessories supplied.
c. Power panel connection diagram and schematic.
d. Description and identification of all customer field connections.

Installation of GE Zenith transfer switches includes:

a. Mounting the transfer switch cabinet.
b. Connection of all Normal, Emergency, and Load cables or bus bars.
c. Connection of external control circuits as required.

Mounting

Enough room should be allowed to open the cabinet doors fully for inspection and servicing of the switch per NEC and local codes.

NOTE: When lifting the switch using a spreader bar, height H must be equal to half of distance D.

⚠ CAUTION ⚠

Before drilling conduit entry holes or any accessory mounting holes, cover and protect the switch and control panel to prevent dirt and metal fragments from entering the mechanical and electrical components.

Failure to do so may result in damage and malfunction of the switch.

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Power Connections

GE Zenith transfer switches are supplied with UL listed solderless screw type terminals as standard for the Normal, Emergency and Load power connections. *Table 1* lists the number and sizes of cable lugs supplied as standard for each switch amp rating.

Connect the Normal, Emergency, and Load conductors to the clearly marked terminals on the transfer switch. Remove surface oxides from cables by cleaning with a wire brush. Verify that all connections are correct before tightening the lugs. All cable lug connections must be tightened to the proper torque values as shown in *Table 2*.

NOTE: Do not run cables or wiring behind front-connected transfer switches.

Screw Type Terminals for External Power Connections

Switch Size (Amps)	*Utility, Generator and Load Terminals*		*Fully Rated Neutral Bar (When Required)*	
	Cable Per Pole	*Range of Wire Sizes*	*No. of Cables*	*Range of Wire Sizes*
40	1	#8 to 3/0 AWG	3	#8 to 1/0 AWG
80	1	#8 to 3/0 AWG	3	#8 to 1/0 AWG
100	1	#8 to 3/0 AWG	3	#8 to 1/0 AWG
150	1	#8 to 3/0 AWG	3	#8 AWG to 300 MCM
200, 225, 250*	1	#6 AWG to 250 MCM	3	#6 AWG to 300 MCM
300, 400	1	#4 AWG to 600 MCM	3	#4 AWG to 300 MCM

Table 1

* IEC Rating Only

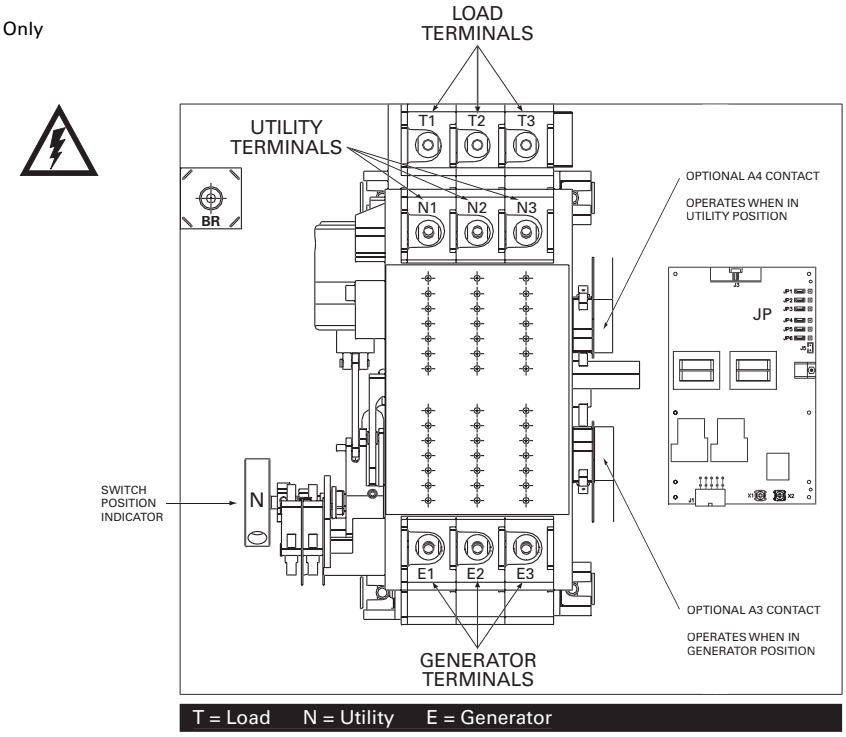


Figure 1 - Power Panel

Tip!

Install load cables first.

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Control Connections

Connecting Engine Start may cause Generator to start. Before connecting, turn Generator OFF.

With the Generator breaker open and the Generator control switch off, install the Generator start connections.

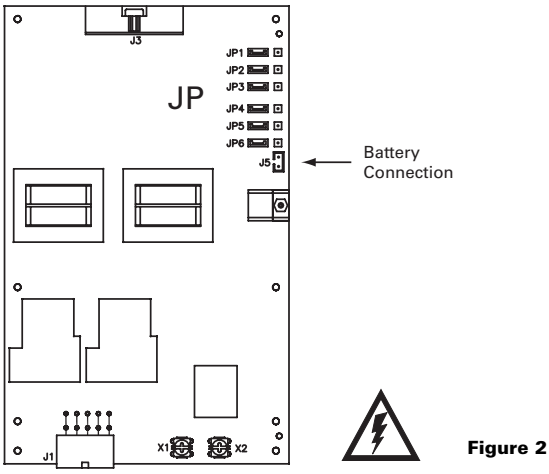


Figure 2

The engine-start terminals are clearly identified by a label on the microcontroller backplate. In the case of manual transfer switches, or in other applications not requiring the microprocessor, clearly marked terminal blocks are provided in the upper left corner of the control panel for the engine start control wires.

Terminals for field connections to the A3 Emergency auxiliary contacts and the A4 Normal auxiliary contacts are also provided. These terminals are clearly marked and appear on the side of the power panel. On 400 amp metal frame units these terminals appear on the bracket above the operator handle.

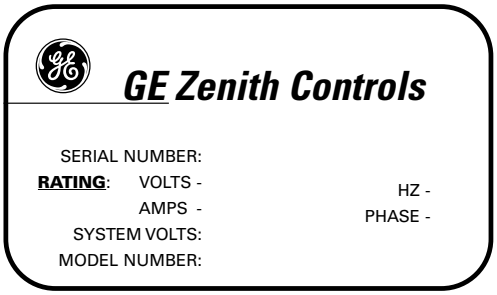


Figure 3

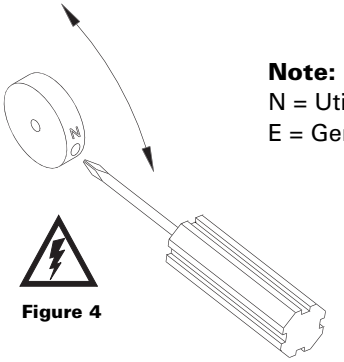


Figure 4

Note:
N = Utility Position
E = Generator Position

Manual operation is possible for maintenance purposes only. Manual operation of the switch can be checked before it is operated electrically.

With all power off, insert a Phillips screwdriver or equivalent size tool into the manual operator socket and operate the transfer switch between the Utility and Generator positions. The transfer switch should operate smoothly without binding. Return the switch to the Utility position, remove the screwdriver.

Tightening Torque for Lugs

Socket Size Across Flats	Torque	
	Lb. - In.	Lb. - Ft.
1/8	45	4
5/32	100	8
3/16	120	10
7/32	150	12
1/4	200	17
5/16	275	23
3/8	375	31
1/2	500	42
9/16	600	50

Table 2

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

ATTENTION!

This applies only to the switches with the RM4-CAT exerciser option:

Only after ATS installation, connect a commercial-grade alkaline 9V battery to the MX60 controller via the harness connected to the controller. The battery should be placed in the holder installed just above the controller. The battery is used to maintain the exerciser function in the event of power outage. The battery should be replaced at least once a year. If the battery is not installed and/or replaced as recommended, an exerciser set from the front panel will lose its settings during power outages and the exerciser will not work. **Note: Battery life if reduced if neither source is available. Typical battery life when both sources are unavailable is 21 days.**

Should the battery connection become disconnected in shipping, take the controller cover off and plug the harness into the receptacle in the top right corner of the MX controller as shown in figure 2 and 5. Reinstall the cover and connect the battery.



Figure 5

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Functional Test

Functional testing of the automatic transfer switch (ATS) is described in this section. Before proceeding, read and understand all instructions and review the operation of all accessories provided.

To begin the test, close the Utility source circuit breaker. Referring to Figure 7, **the controller will illuminate the Utility Available LED when proper voltage is sensed. If the ATS mechanism is set on S1, the S1 position LED will also light..** Verify the phase to phase voltages at the Utility line terminals.

Next, close the Generator source breaker and start the engine generator. **The S2 (Generator) Available LED will illuminate when proper voltage and frequency levels are sensed.** After both sources have been verified, shut down the engine generator, and put the generator's start control in the automatic position. Complete the visual inspection of the transfer switch, and replace the cabinet cover **(or close the cabinet door)**.

Simulate a utility outage by opening the S1 Utility side breaker. The delay to engine start timer (P) begins its timing cycle. After the P timer has completed its timing cycle, the engine start contacts close to start the generator.

When generator voltage and frequency reach the preset restore points (see Table 4) **the S2 Available LED illuminates.** Simultaneously, the delay to generator timer (W) begins its timing cycle. When the W time delay is completed the ATS will transfer to Generator, t**he S1 position LED goes off, and the S2 position LED illuminates.**

Reclose the Utility breaker to retransfer to utility. The delay to utility timer (T) begins its timing cycle (Table 3). When the T timer has completed its timing cycle, the ATS will transfer. **The optional S2 position LEDs go off, and the S1 position LED illuminates.** The delay engine stop timer (U) begins its timing cycle. The generator runs unloaded for the duration of the U timing cycle. When the timer completes its timing cycle, the generator will stop. **The S2 Available LED goes off.**

ATS Timing Cycle

Action	P Timer	W Timer	T Timer	U Timer
S1 Fail or Test or Exerciser	P - 5 sec.	W - 20 sec.	T - 5 min.	U - 5 min.
	Time Delay S2 Start	Time Delay S2 Stable	Time Delay S1 Stable	Time Delay S2 Stop
	→	→	→	
	Transfer to S2		Retransfer to S1	Engine Cool-Down
	S1 returns or Test/Exerciser Ends			

Table 3

Preset Settings

Utility		Generator	
S1 Fail Voltage	80% Nominal Line Voltage	S2 Fail Voltage	80% Nominal Line Voltage
S1 Restore	90% Nominal Line Voltage	S2 Restore Voltage	90% Nominal Line Voltage
S1 Fail Frequency	80%	S2 Fail Frequency	90%
S1 Restore Frequency	90%	S2 Restore Frequency	95%
Timers			
P Timer	W Timer	T Timer	U Timer
P - 5 sec.	W - 20 sec.	T - 5 min.	U - 5 min.

Table 4

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

System Voltage Settings

ZTX controller boards are preconfigured to the system voltages specified at the time of order. Exact system voltages are normally set at the factory, however, depending on the actual application and system nominal voltage, ZTX control boards are capable of being adjusted slightly, to meet different source characteristics for voltage as well as frequency. (See Table 5)

Figure 6 (on right) shows the variations each of the 3 basic types of controllers can be adjusted to within its nominal voltage range. Position Jumpers JP1 and JP2, as needed for voltage. Position JP3 for frequency. As with any other Jumper setting, always remove power completely from the controller before making changes.

Note: Do not change voltage Jumper positions without consulting service or technical support. Arbitrarily changing voltage jumpers can adversely affect ATS operation.

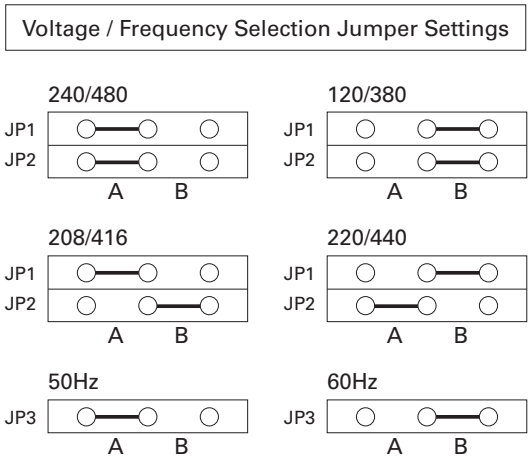


Figure 6

Type 1		Type 2			Type 3			Type 4			Frequency	
120V		208 - 240VAC			380 - 416VAC			440 - 480VAC				
JP1	JP2		JP1	JP2		JP1	JP2		JP1	JP2		JP3
B	B	208	A	B	380	B	B	440	B	A	50 Hz	A
-	-	220	B	A	416	A	B	480	A	A	60 Hz	B
-	-	240	A	A	-	-	-	-	-	-	-	-

Table 5

Control Interface

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Indicator LEDs

A	S1 (Utility) Available Green LED.	When on, indicates source is acceptable.
B	S1 (Utility) Position Green LED.	When on, indicates ATS is connected to Utility
C	S2 (Generator) Available Red LED.	When on, indicates source is acceptable.
D	S2 (Generator) Position Red LED.	When on, indicates ATS is connected to Generator.
E	Timing/In-phase Amber LED.	When blinking, indicates the ATS is timing a Delay When on steady, indicates the ATS is waiting for both sources to synchronize with each other.

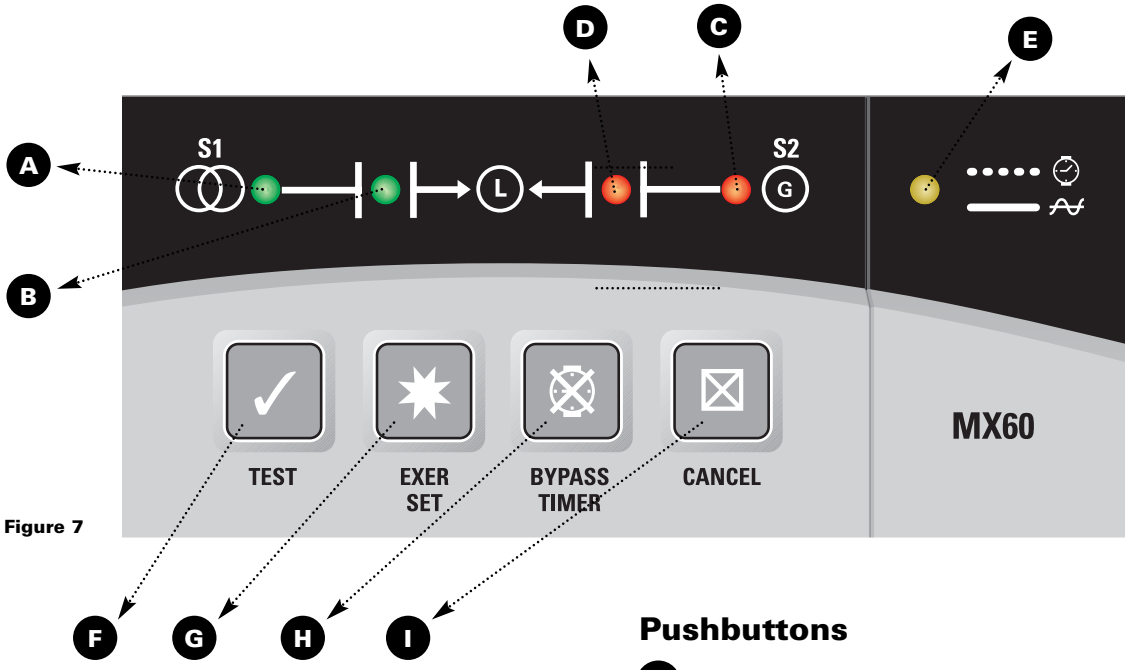


Figure 7

Pushbuttons

F	TEST - Pressed and held for 1 second Simulates a power outage, starts the Generator and transfers the ATS to S2.
G	EXER SET - Sets an Automatic Exerciser
H	BYPASS TIMER - Pressed while E is blinking bypasses any remaining countdown Timer
I	CANCEL - Depending on the current state of ATS operation, ends specific functions or indications

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Using the Keypad Controls

TEST KEY

The TEST KEY initiates a transfer sequence to S2 and holds the ATS in that mode until either the CANCEL key is pressed or, a situation arises to cause the ATS to go back to S1(ie, S2 actually fails).

In order to perform a TEST, the ATS must be on S1 and S1 must qualify as a "good source" by being above the FAIL thresholds for both Voltage and Frequency (see Table 2).

Once the TEST KEY is pressed for at least 1 Sec, the ATS will begin the Timer Sequence (see figure 5), attempt to start S2 generator source, and if S2 qualifies as a "good source", transfer the load to S2. (There is no P-Time in a test)

The TEST key is typically used to perform a system operational or maintenance test or, to purposely cause and hold the Load off of S1. If during the TEST, S2 fails and S1 is available, the TEST will be cancelled and the Load will be immediately retransferred to S1.

EXER SET

Whenever it is required to have a regular test performed automatically on a repeating basis, the Automatic Exerciser function can be setup using this key.

Depending on the jumper settings shown in Figure 8, the ATS can be programmed to perform a repeating 7, 14, 21 or 28 day exercise at a particular time of day.

To initiate an Automatic Exercise, the EXER SET key is pressed and held for at least 1 Sec. at the desired exercise time. The ATS will begin the Timer Sequence, attempt to start S2 generator source and if S2 qualifies as a good source, transfer the Load to S2 for the duration of the Generator Run-Time. After the Generator Run-time has expired, the timing sequence will restart and the Load will be transferred back to S1, after T-time, ending by running the U-time and finally ending the call for S2.

TIMER BYPASS

This key is used to bypass (truncate), any of the running timers shown in Table 3. Whenever the Timing/ Inphase LED is blinking, pressing the TIMER BYPASS will end that particular delay and cause the ATS controller to immediately jump to the next sequence step.

Note: The BYPASS key cannot be used to truncate an In-phase transfer sequence, or the P-Timer.

CANCEL

The CANCEL key performs 3 different cancel actions depending on the ATS current state of operation:

1. If the ATS is currently performing a TEST, the CANCEL key will cancel the test.
2. If an Automatic Exerciser has been set, pressing and holding the CANCEL key for 10 Sec. will cancel (and remove), the set exercise
3. If after in-phase monitor has passed 1 minute, waiting for sources to synchronize, will cause transfer immediatly (which may result in an out-of-phase transfer).

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Automatic Generator Exerciser

The ZTX automatic generator Exerciser can perform a pre-scheduled repeating test of the generator and/or the ATS mechanism depending on which jumpers are selected on the controller board. Additionally, the ATS can be preset to perform the exercise every 7, 14, 21 or 28 days. Regardless of which interval is selected, all exercisers have a preset run-duration of 10 minutes.

Selection of the exerciser interval is through three jumpers located on the controller board as shown in Figure 6. The Exerciser comes from the factory preset at 28 days and is not active. To change the exerciser interval, remove power from the controller completely, and move the jumpers at positions jp4 and jp5 to match the selected repeat-cycle from the configurations shown in Figure 7.

Selecting Exerciser with or without Load Transfer

The Exerciser function can be programmed to perform either a Load-transfer or a non-Load transfer. Selecting either is done by changing the Jumper JP6 as shown in Figure 8. To change between a Load-transfer or no-Load transfer, remove power from the controller completely and move the jumper at position JP6.

Setting and Canceling an Exerciser

In order to set an automatic Exerciser, choose the exerciser interval and whether a Load-transfer or no-Load transfer is desired as stated above. An exercise can only be set if S1 is available and the ATS (and Load), is on S1 source.

To establish an Exerciser

At the exact time desired, press and hold the EXER SET key for at least 1 second. The ATS will immediately start an initial exercise by attempting to start the generator, running through the Timers (figure 3) and will either only start the generator, or, will start the generator and transfer the Load from S1 to S2, for the time duration of the exerciser interval, 10 minutes. Once the Exercise is completed, the ATS will continue the timing sequence and retransfer the Load back to S1, cool down the generator and terminate until the next scheduled interval time. Any time an Exerciser has been established and is scheduled, the S2 Available and S2 position LEDs quickly blink approximately every 4 seconds as a reminder. However, if S2 source becomes available during the time the ATS is waiting for the next impending exercise, the ATS will not show a blinking indication but instead will show the S2 Available LED as solidly on to indicate the true condition of S2. Any Exercise event can be prematurely canceled by pressing the CANCEL key.

Note: pressing the CANCEL key in the middle of an scheduled event does not cancel a set Exerciser, but only cancels the current event.

To completely clear an already-set Exerciser

A set Exerciser can be completely cleared out of memory by pressing and holding the CANCEL key for at least 10 Seconds causing the blink indication to stop.

If S2 fails to meet the criteria for a good source, during an Exercise attempt, the Controller will continue to hold the P-contacts closed for the duration of the Runtime timer then wait for the next scheduled exercise. If S2 fails during an Exercise, the Controller will abort that exercise and wait till then next scheduled exercise.

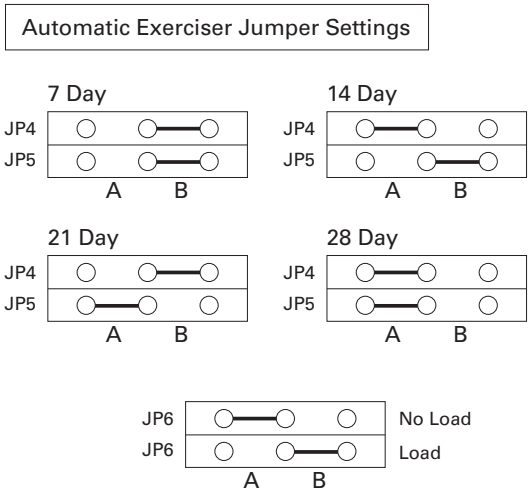


Figure 8

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

In-Phase Monitor

ZTX ATS senses when the sources are as far out as 2 Hz or as close as .01Hz in frequency differential of each other and transfers the load to and from either source in-phase. If turned on, R50 In-Phase monitor tracks the frequency of both the Utility and Generator sources allowing a smooth, synchronous transfer of the load, which is especially beneficial where conveyors, pumps and other motor loads are involved. ZTX indicates it is waiting for the sources to synchronize by holding the Timer/In-Phase LED on. When both sources have synchronized, the ATS will transfer the Load (within 20° of each other, if sources are within 2Hz differential), and the Timer/In-Phase LED will turn off. If the sources fail to synchronize, after 1 minute, the controller will blink the Timer/In-Phase LED once, alerting the operator that the In-Phase monitor function can be bypassed by pressing the CANCEL key, causing an immediate transfer (see Cancel Key function). If the CANCEL key is not pressed, the ZTX will continue to wait for an in-Phase condition to occur.

In a typical ATS application, one source is on the utility and one source is a backup system such as a gas or diesel generator. Because sources have a slight frequency difference, sources come in and out of phase. If ZTX In-Phase Monitor is on, The ZTX ATS Controller monitors both sources and transfers the Load at the ideal time to minimize back-EMF conditions.

In the case of both sources coming from the same source, or, one configured as WYE and the other as DELTA, the frequency difference is fixed at the same frequency or fixed but 30 degrees out of phase. In those cases, In-Phase Monitor can be turned off.

In-Phase Monitor is turned on as default from the factory. To turn In-Phase Monitor OFF or ON, take the following steps:

Turn In-Phase Monitor OFF:

1. Remove all power, (both S1 and S2) from the controller. Wait at least 20 seconds.
2. From the keypad, hold both the BYPASS and CANCEL keys down while energizing either source. If In-Phase Monitor was on, the Timer / In-phase LED will flash once for 1 second, then go out. The In-Phase Monitor is now off.

Turn In-Phase Monitor ON:

1. Remove all power, (both S1 and S2) from the controller. Wait at least 20 seconds.
2. From the keypad, hold both the BYPASS and CANCEL keys down while energizing either source. If In-Phase Monitor was off, the Timer/In-Phase LED will light and remain lit until the keys are released. The In-Phase Monitor is now on.

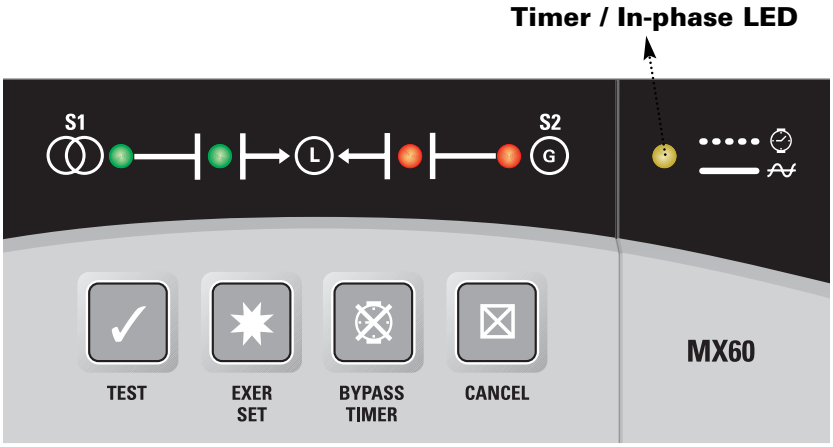
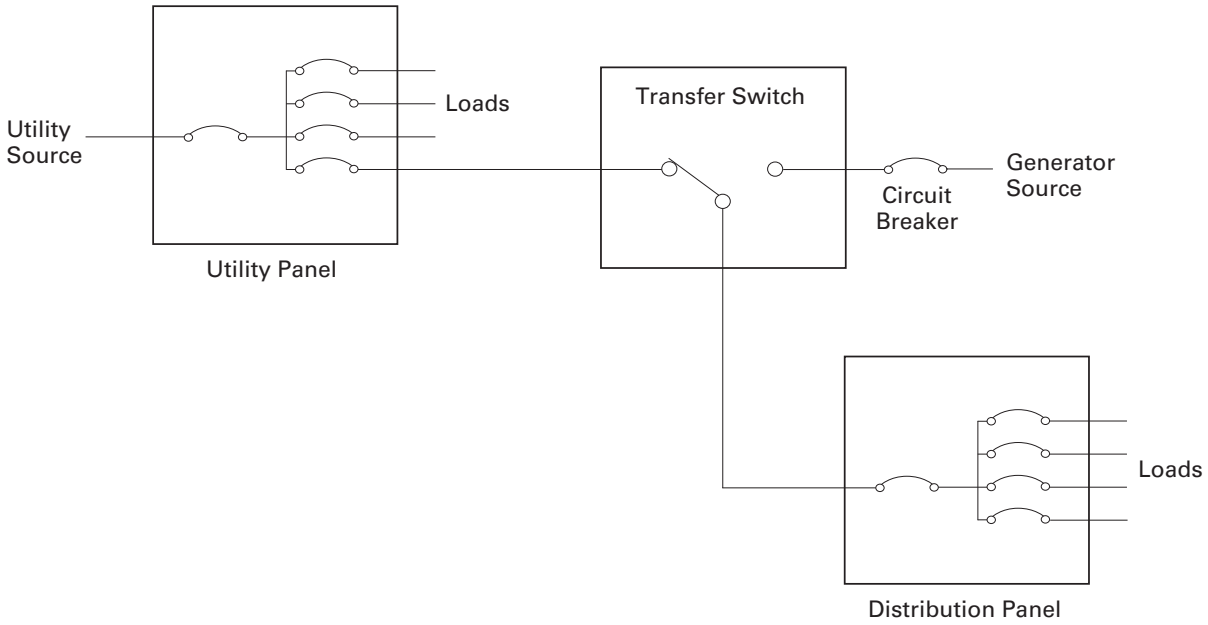


Figure 9

Example Systems

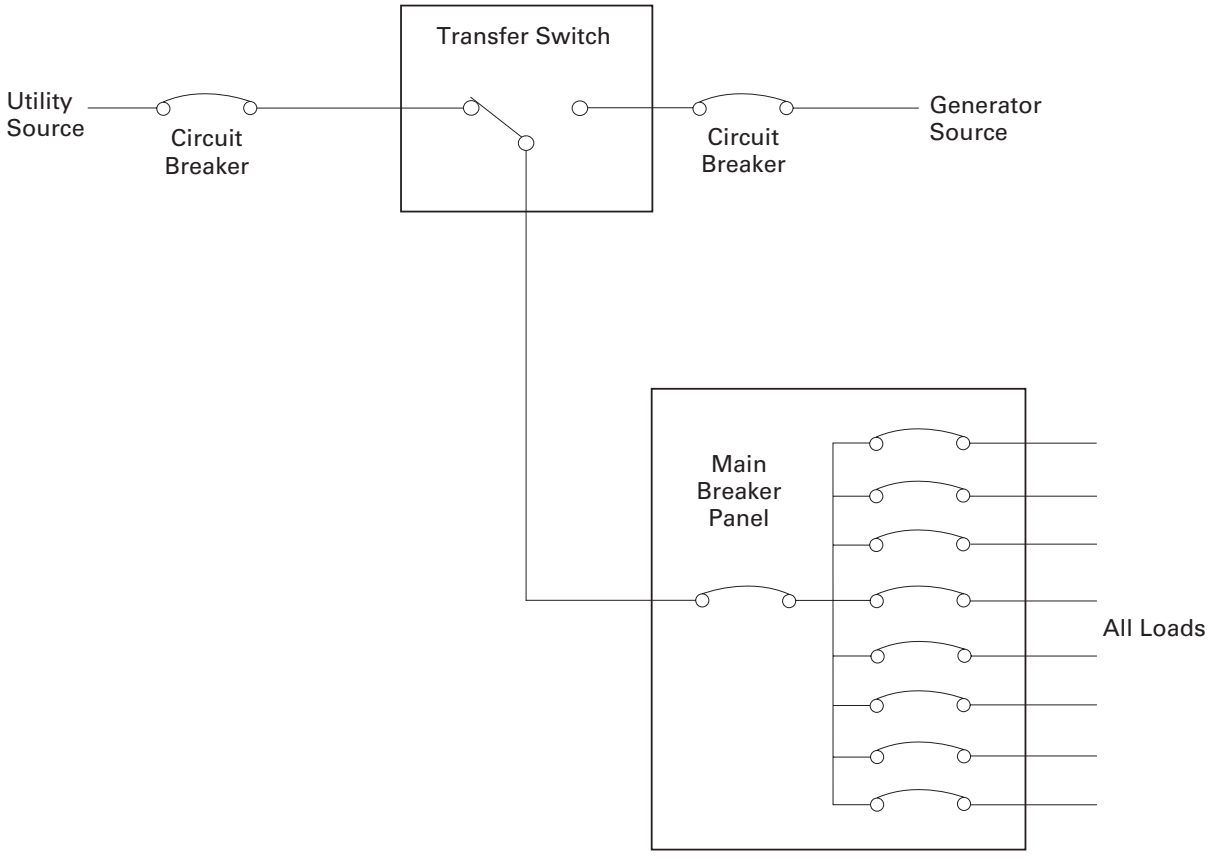
Partial Coverage System

Figure 9



Total Coverage System

Figure 10



Typical Diagrams

Power Circuit Schematic 40-240 Amps

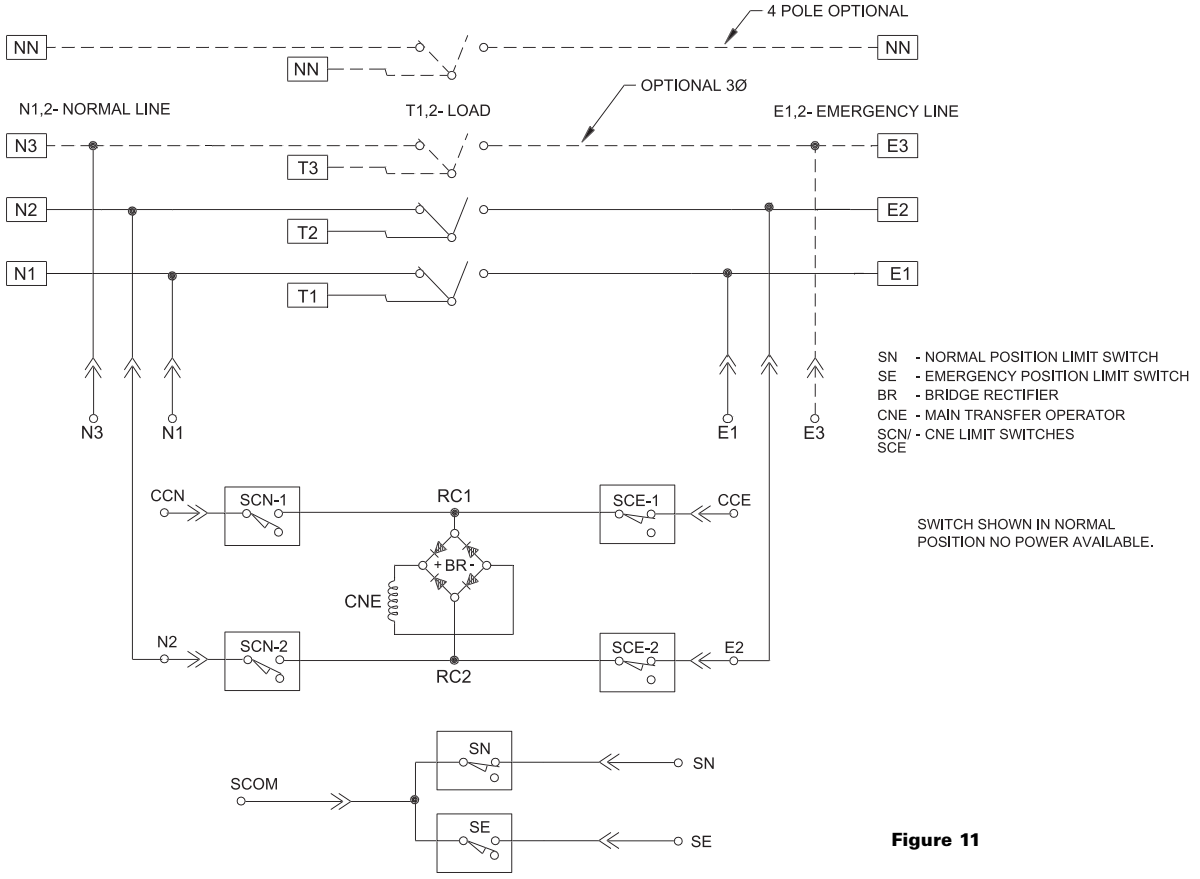


Figure 11

Power Panel Layout

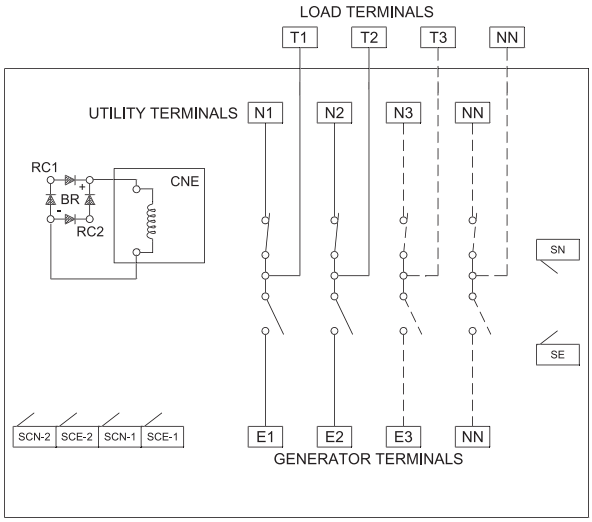
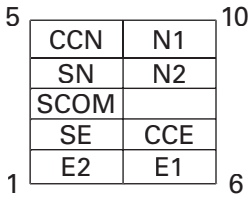


Figure 12

Interconnect Plug



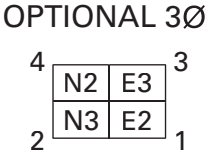


Figure 13

Standard Transition — 40 to 200 Amps

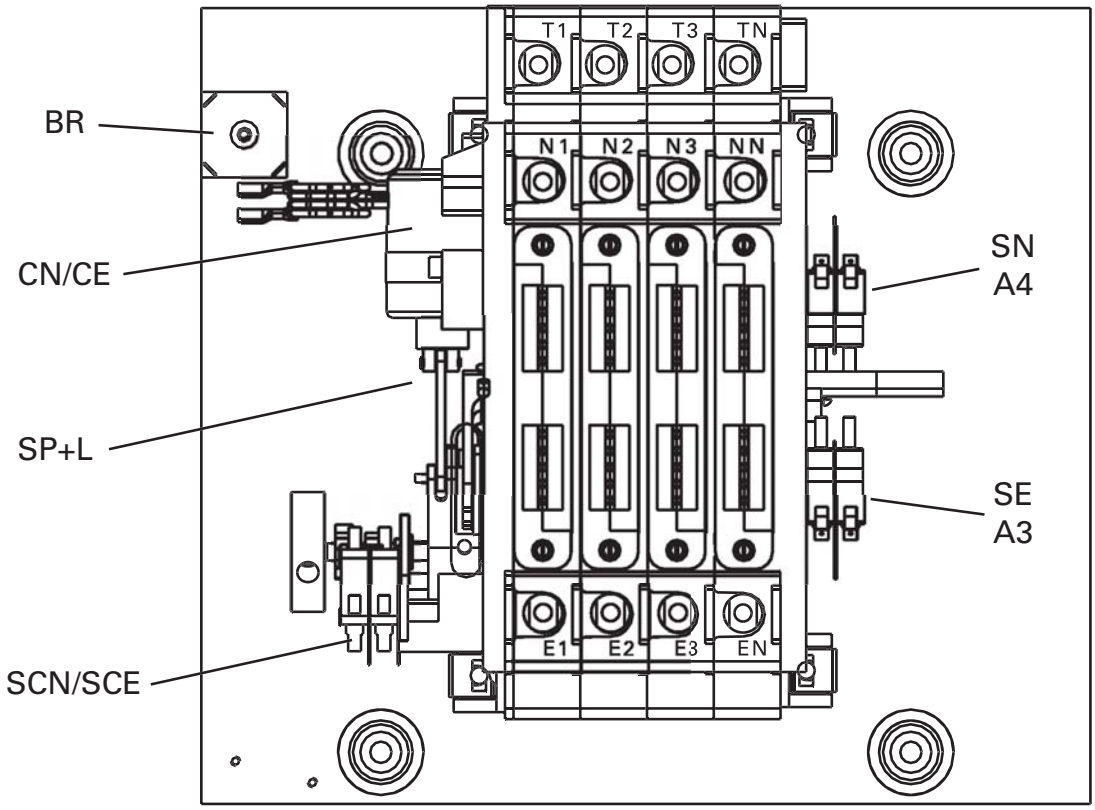


Figure 14

TAG	DESCRIPTION	VOLTAGE	40 TO 200 AMPS
CN/CE	Solenoid	120 208 220 240 380/416 440/480	K-2207 K-2208 K-2208 K-2228 K-2212 K-2209
	Solenoid Plunger and Link	ALL	57P-1030
SCN/SCE	Coil Cutout Switch	120-480V	L-3078
SCN/SCE	Coil Cutout Switch	600V	L-4027
BR	Rectifier	ALL	PS-5076
A3/A4	Auxiliary Contacts		L-3078

Table 7

Standard Transition - 225 to 400 Amps

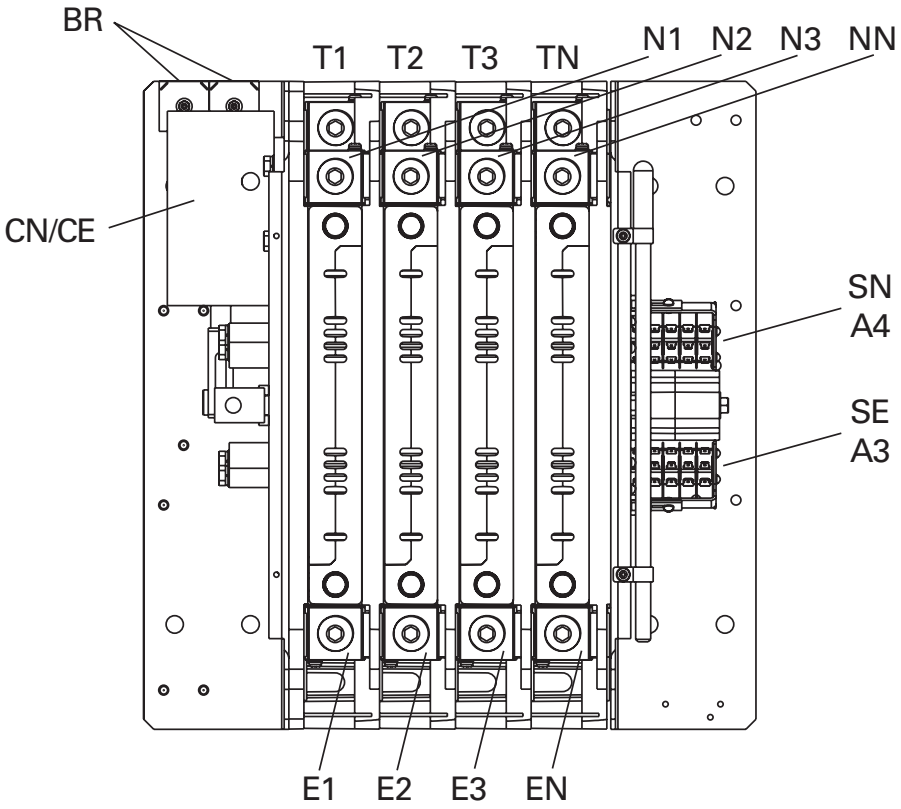


Figure 15

Tag	Description	Recommended as Spares	Stock Numbers by Amperage		
			225, 250*	260, 300*	400
N 1,2,3 N E 1,2,3 N T 1,2,3 N	Cable Connection Lug		S-2701	S-2701	S-2701
	Wire Size		#6-250 MCM	#4-600 MCM	#4-600 MCM
			Coil Volts		
CN/CE	Solenoid	*	208/220/240	K-2246B	
SN/SE	Position Sense Limit Switch		L-3078		
A3/A4	Auxiliary Contacts				
BR	Rectifier	*	PS-5076		

Table 8

Troubleshooting

⚠ DANGER ⚠

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Service must be performed by qualified personnel.

Symptom	Possible Cause	Corrective Action
S1 or S2 Available LED not lit	Sources either fully or partially unacceptable S1 or S2 breakers open	Check for under voltage Check for missing phase (s) Check for under frequency
ATS will not retransfer Load back to Utility	T - Timer has not expired Automatic Exerciser is in process S1 Utility fully or partially unacceptable	
ATS does not transfer Load to S2 (generator)	S2 Generator fully or partially unacceptable Motor loads on system creating enough back-EMF to keep missing phase from falling below Fail setpoint.	Set motor-saver to dropout below ATS Fail setpoint
S2 Generator will not start	X1 or X2 not connected	Check Generator Start wiring
S2 Generator will not shut down	U - Timer not expired Automatic Exerciser in process	Wait for U timer to expire
All LEDs off	Keypad connector unplugged at Controller Both source breakers open	
ATS will not transfer in-phase	In-Phase monitor not on Frequency difference between S1 and S2 greater than 2Hz.	Turn on In-Phase monitor Adjust Generator governor to hold freqency closer to Utility
ATS will not retain a Set Automatic Exerciser	Battery dead or missing	Replace battery with a fresh industrial grade Alkaline battery
Timer/In-Phase LED constantly on	Both sources locked in frequency or one source greater than 20° out of phase	Turn In-Phase monitor off
S1 and S2 LEDs Blinking	Phase Rotation Mis-match between sources	Rewire sources to be same rotation
S1 Position LED Blinking	SN limit switch bad or intermittent	Check connection or SN limit switch
S2 Position LED Blinking	SE Limit switch bad or intermittent	Check connection or SE limit switch
Both S1 and S2 Positioin LEDs Blinking	Solenoid bad or disconnected ATS contactor in mid-position	Requires CANCEL key to clear - check Solenoid Requires CANCEL key to clear - Check both limit switches

Table 9

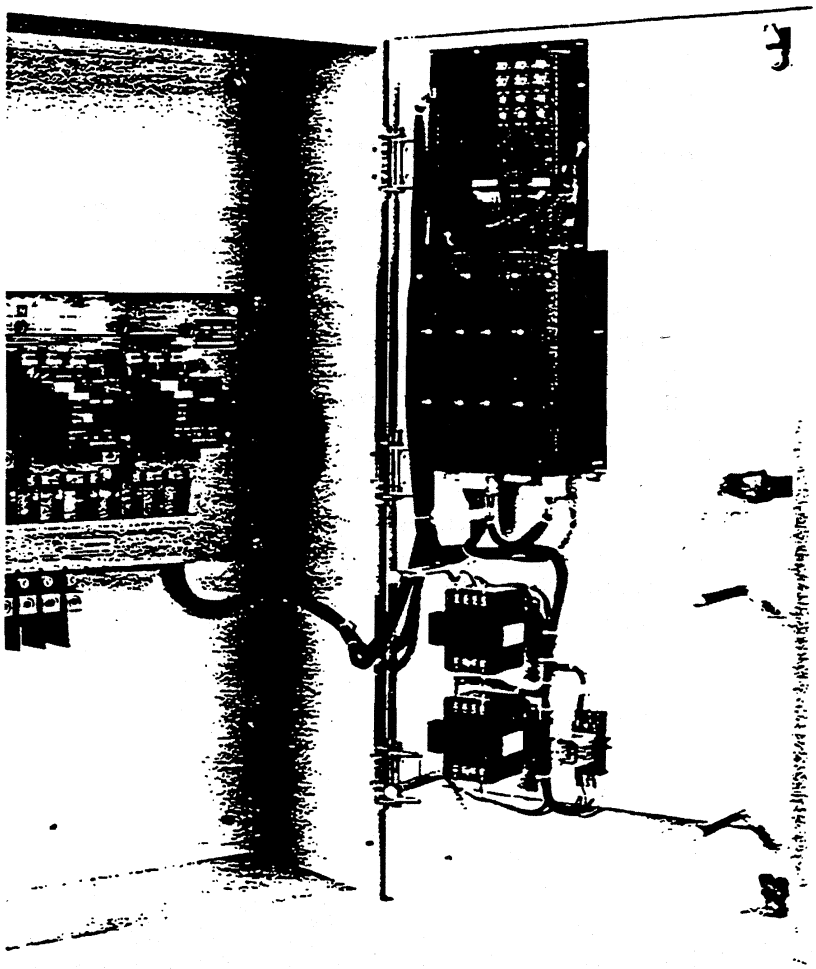


GE Zenith Controls

A Product of GE Consumer & Industrial
General Electric Company
830 West 40th Street, Chicago, IL 60609 USA
773 299-6600, Fax: 773 247-7805
www.geelectrical.com

ZENITH
CONTROLS, INC.

OPERATION AND MAINTENANCE MANUAL
40 - 1250 AMPS
ZTC SERIES POWER PANEL



ISO 9001

51R-1000C
REV 1/97

INTRODUCTION

Zenith transfer switches are used to provide a continuous source of power for lighting and other critical loads by automatically transferring from the normal source of power to an emergency source of power in the event that the normal source voltage falls below preset limits.

All Zenith transfer switches are designed for use on emergency or standby generator systems, are 100% load applied, and rated for total system load or motor loads.

Zenith ZTC Transfer switches are

- **UL Listed under Standard 1008**
- **cUL Listed for Canadian Standard number C22.2 # 178**
- **IEC 947 rated for World Wide Application**

This manual provides information on the installation, operation, and maintenance of the switch. In addition, a complete information package is supplied with each transfer switch which details the features and accessories provided on that switch. The information package and this instruction manual should be kept in a readily accessible location to provide complete reference information on this critically important piece of equipment.

Complete information package includes:

- **Power Panel Operation and Maintenance Manual**
- **Control Panel Operation and Maintenance Manual**
- **Specific drawings supplied with the transfer switch**

CE

UL Underwriters Laboratories Inc.® LISTED

c UL

IEC

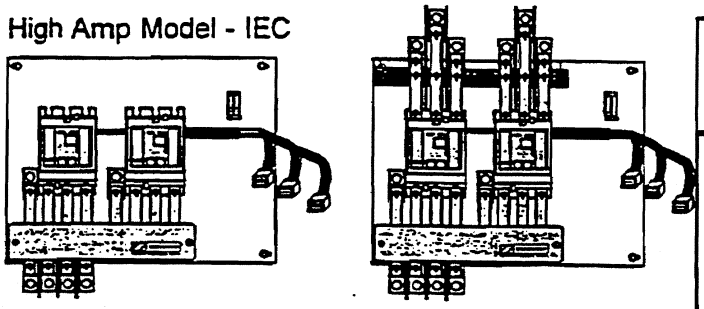
c

ADDENDUM ZTC
(51R-1000)

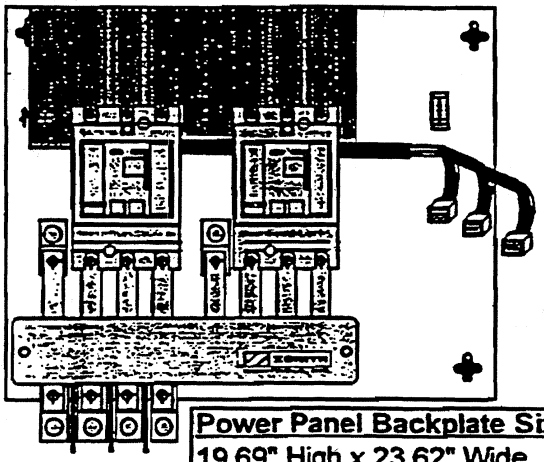
ZTC MODELS AND IDENTIFICATION
(Typical Construction; some models may vary)

High Amp Model - UL
with Line Bus Extensions

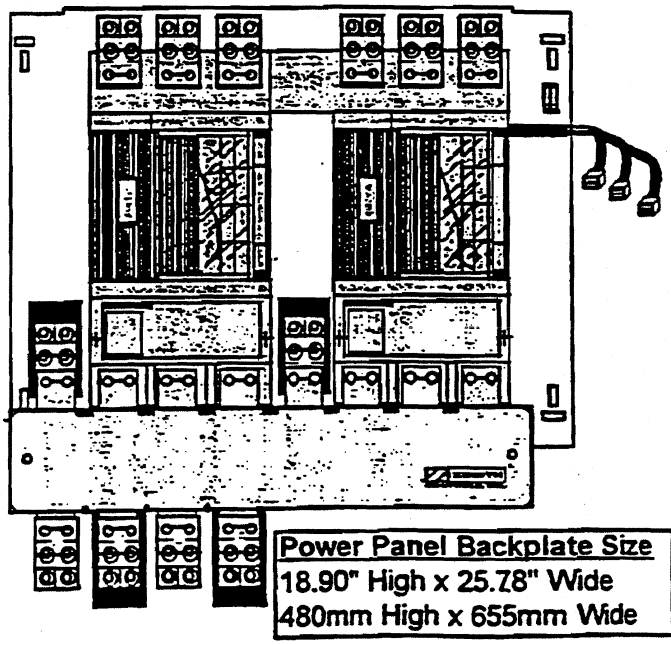
High Amp Model - IEC



Power Panel Backplate Size
14.76" High x 19.69" Wide
375mm High x 500mm Wide



Power Panel Backplate Size
19.69" High x 23.62" Wide
500mm High x 600mm Wide

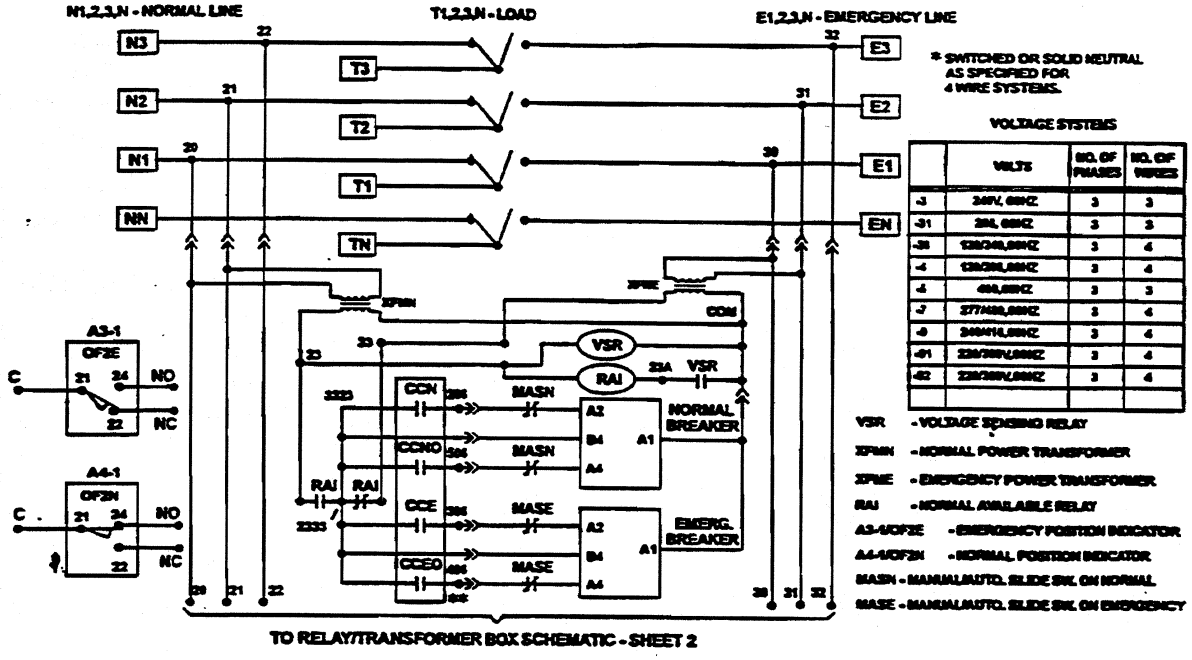


Power Panel Backplate Size
18.90" High x 25.78" Wide
480mm High x 655mm Wide

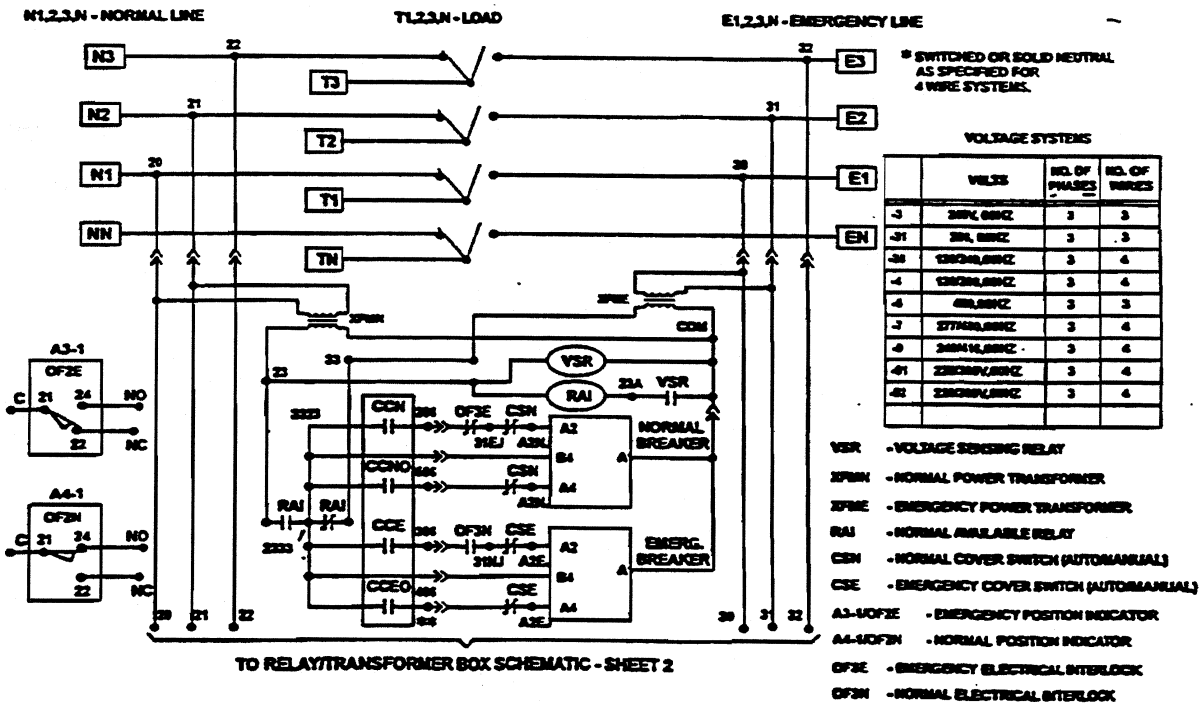
Zenith FRAME	AMPS	
	UL, cUL	IEC
Frame Z1	40-125 Cable Bus Assembly 150-225* *UL/cUL with Line Bus Extensions	40-160 Cable Bus Assembly 175-250 with Epoxy Load Bus
Frame Z2	300-400	300-630
Frame Z3	600-1000	800-1250

SECTION II - TYPICAL SCHEMATIC DIAGRAMS

POWER CIRCUIT SCHEMATIC - Frame Z1 and Frame Z2



POWER CIRCUIT SCHEMATIC - Frame Z3



NOTE: ZTC shown in Normal position.
No Power Available, in the Automatic Mode.

TABLE OF CONTENTS

Section I — Installation

1. Equipment Inspection & Storage 2
2. Mounting 2
3. Power Connections 2
   Models and Identification 3
   Installation and Phasing Diagrams 4
   ZTC Lug Information 5
4. Control Connections 6
5. Final Equipment Inspection 7
6. Functional Test 7

Section II — Operation and Features

1. Sequence Of Operation (Automatic Switches in Automatic Mode) 9
   Typical Schematic Diagrams 10
2. Sequence Of Operation (Automatic Switches in Manual Mode) 11
   Motor Mechanism 12
3. Sequence Of Operation (Manual Transfer Switches) 13
4. Sequence Of Operation (Resetting Mechanisms After Tripping) 14
5. Power Panel Accessories 15

Section III — Maintenance and Testing

1. Inspection and Cleaning 16
2. Servicing 16
3. Testing 16
4. Troubleshooting 17
5. Recommended Maintenance and Service 21
6. Recommended Practices 22

Section IV — Adjustments and Settings

1. Frame Z1: Thermal Magnetic Trip Unit "TM" 24
2. Frame Z2: Solid State Trip Unit "STR23S" 25
3. Frame Z3: Solid State Trip Unit "STR25DP" 26
4. Frame Z3: Solid State Trip Unit "STR55UPT" (Ground Fault Systems) 27
5. Frame Z3: Neutral Sensors for "STR55UPT" 28
6. Frame Z3: Solid State Trip Unit "STR25DE" 28

Appendix A - Maintenance and Testing Field Notes 29

ZTC Terminology and Nomenclature ..... **Back Cover**

⚠ DANGER

HAZARDOUS VOLTAGE.
CAN CAUSE SEVERE INJURY OR DEATH.
Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Each transfer switch is factory wired and tested. A complete information package is furnished with each switch which includes:

a. Sequence of operation.
b. Description and operation of all accessories supplied.
c. Power panel connection diagram and schematic.
d. Description and identification of all customer field connections (such as Engine Start contacts).

Installation of Zenith transfer switches includes:

a. Mounting the transfer switch cabinet.
b. Connection of all Normal, Emergency, and Load cables or bus bars.
c. Connection of external control circuits as required.

1. EQUIPMENT INSPECTION & STORAGE

Immediately inspect the transfer switch when received to detect any damage which may have occurred during transit. If damage is found or suspected, file claims as soon as possible with the carrier and notify the nearest Zenith representative.

Before installation, it is necessary to store the transfer switch in a clean dry place, protected from dirt and water. Provide ample air circulation and heat, if necessary, to prevent condensation.

Storage Temperature:
-40°C to +70°C (-40°F to +158°F)
Humidity:
5% to 95% (non-condensing)
Operating Temperature:
-20°C to +60°C (-4°F to +140°F)
(All units must be derated above 40°C; see Application Guide O-5104)

2. MOUNTING

Adequate lifting means must be used to mount the transfer switch into place. The recommended method for moving the transfer switch using the lifting eyes and a spreader bar is illustrated in *Figure 1* at right. Enough room should be allowed to open the cabinet doors fully for inspection and servicing of the switch per national and local electrical codes.

⚠ CAUTION

Before drilling conduit entry holes or any accessory mounting holes, cover and protect the switch and control panel to prevent dirt and metal fragments from entering the mechanical and electrical components. Failure to do so may result in damage and malfunction of the switch.

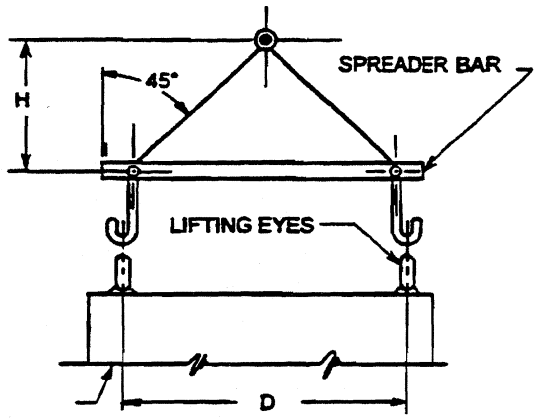


Figure 1: Preferred Method of Lifting

NOTE: When lifting the switch using a spreader bar, Height H must equal half of the distance D.

3. POWER CONNECTIONS

⚠ WARNING

To ensure against shock or accident hazard, disconnect all sources of supply before servicing.

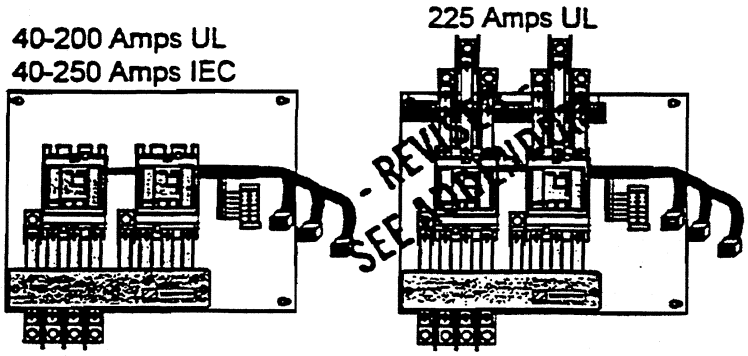
Before installation, check the equipment rating nameplate on the transfer switch to verify the correct system voltage. An example of the equipment rating nameplate is shown in *Figure 2* below:

ZENITH CONTROLS, INC.

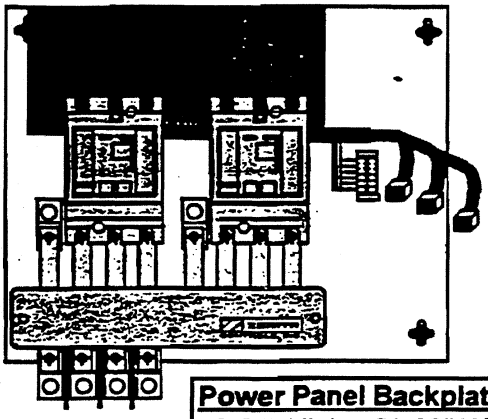
SERIAL NUMBER: Z960521
RATING: VOLTS - UL=480, IEC=690 HZ - 50
AMPS -400 Amps MAX. PHASE - 3φ4W
SYSTEM VOLTS: 380Y220
MODEL NUMBER: ZTCSAK40EC120-92

Figure 2: Sample Nameplate

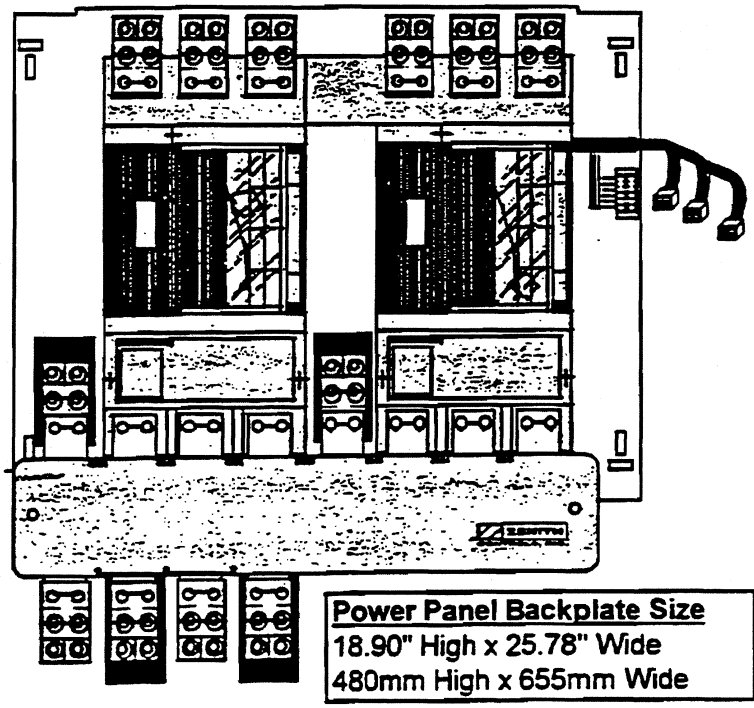
ZTC MODELS AND IDENTIFICATION
(Typical Construction; some models may vary)



Power Panel Backplate Size
14.76" High x 19.69" Wide
375mm High x 500mm Wide



Power Panel Backplate Size
19.69" High x 23.62" Wide
500mm High x 600mm Wide



Power Panel Backplate Size
18.90" High x 25.78" Wide
480mm High x 655mm Wide

Zenith FRAME	AMPS	
	UL, cUL	IEC
Frame Z1	40-225* *225 Amps rated UL/cUL with Line Bus Extensions	40-250
Frame Z2	300-400	300-630
Frame Z3	600-1000	800-1250

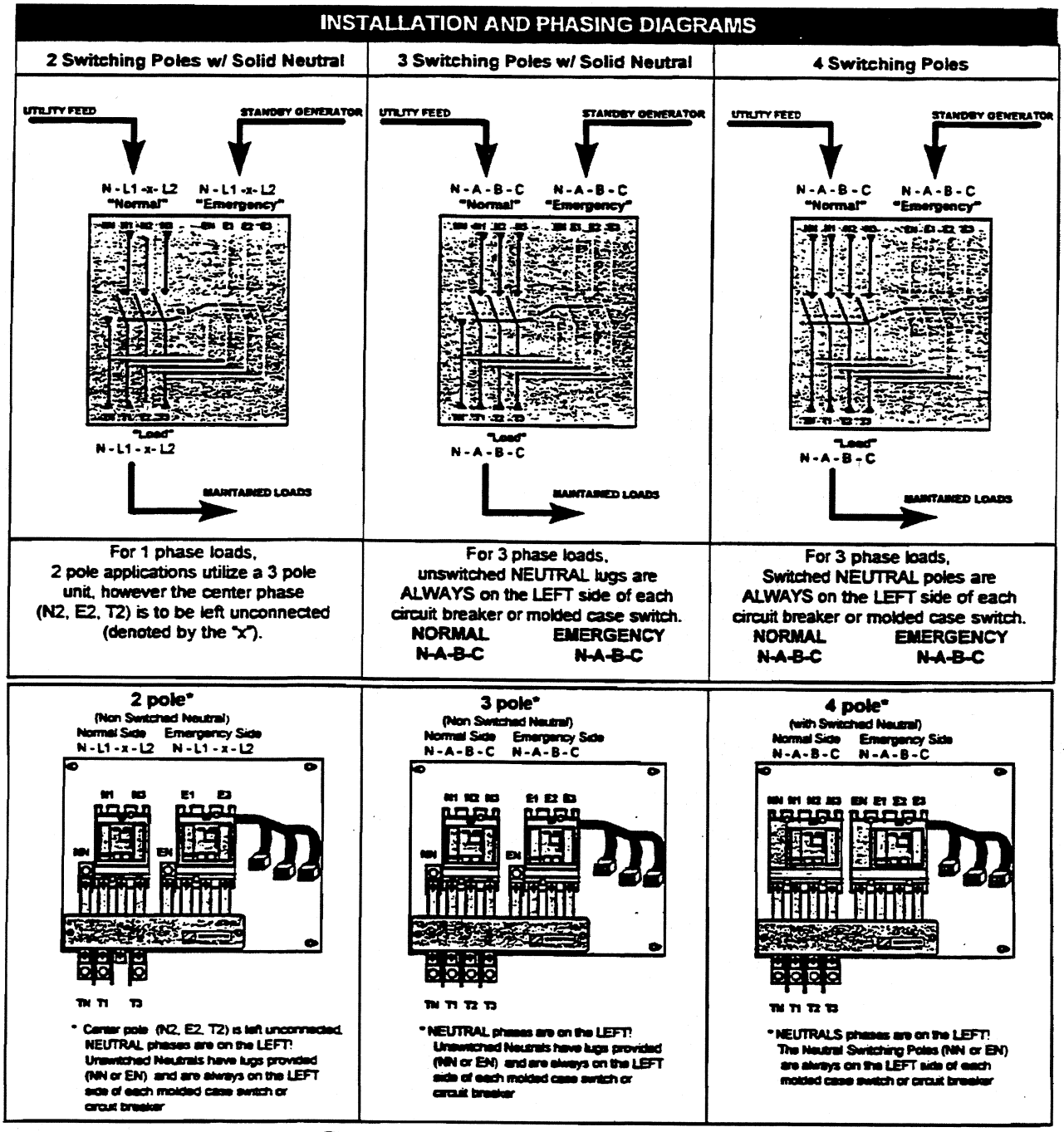


Figure 3: Installation and Phasing Diagrams

Connect the Normal, Emergency, and Load conductors to the marked terminals on the transfer switch. Verify that all connections are correct before tightening the lugs. All cable lug connections must be tightened to the proper torque values as shown in *Table 1.*

Do not run cables or wiring behind front-connected transfer switches.

Zenith transfer switches are supplied with UL Listed solderless screw type terminals as standard for the Normal, Emergency, and Load power connections. *Table 1* lists the number and size of the cable lugs supplied as standard for each switch amp rating.

If ZTC transfer switches are incorporated into switchboards via bussed connections, please refer to *Table 2* which lists the tightening torque for bus bar connections.

ZTC Series Lug Information (all Lugs are 75°C Rated)

Line Side Lug Information (Power Conductors and Switched Neutrals)

Ampacity Amps	Size Frame	Lugs Cat. #	Number of Cables	Wire Range AWG or kcmil (mm²)	Suitable Cables	Tightening Torque LB-in (N-m)
40-125	Z1	PS-4679F	1	#14 - #2/0 (2.1-67.4)	CU/AL	120 (13.6)
150-175	Z1	PS-4679F	1	#14 - #2/0 (2.1-67.4)	CU Only	120 (13.6)
150-200	Z1	PS-4418R	1	#6 - 250 (13.3 -127)	CU/AL	275 (31.0)
225	Z1	PS-4420R	1	#6 - 350 (13.3 -177)	CU/AL	375 (42.3)
250 (IEC)	Z1	PS-4664 (Aluminum)	1	250 - 350 (127-177)	CU/AL	225 (25.4)
	Z1	PS-4680 (Steel)	1	#4/0 - 350 (95-185)	CU/AL	132 (15.0)
300-400	Z2	PS-4665	1	#2 - 600 (33.6 -304)	CU/AL	275 (31.1)
630 (IEC)	Z2	PS-4668	2	#3/0 - 500 (53.5 - 253)	CU/AL	275 (31.1)
600-800	Z3	PS-4662	1 or 2	#2/0 - 400 (67.4 - 203) or	CU	275 (31.1)
			1 to 3	#2/0 - 300 (67.4 - 152) or	CU	275 (31.1)
			1 to 3	#4/0 - 400 (107 - 203)	AL	275 (31.1)
1000	Z3	PS-4663	1 to 4	#3/0 - 500 (85 - 253) or	CU or	375 (42.3)
			1 to 4	#4/0 - 500 (107 - 253)	AL	375 (42.3)
	Z3	PS-4675	1 to 3	250 - 600 (127 - 304)	CU/AL	375 (42.3)
1250 (IEC)	Z3	PS-4663	1 to 4	#3/0 - 500 (85 - 253) or	CU or	375 (42.3)
			1 to 4	#4/0 - 500 (107 - 253)	AL	375 (42.3)
	Z3	PS-4675	1 to 3	250 - 600 (127 - 304)	CU/AL	375 (42.3)

Load Side Lug Information (Power Conductors and Unswitched Neutrals)

Ampacity Amps	Size Frame	Lugs Cat. #	Number of Cables	Wire Range AWG or kcmil (mm²)	Suitable Cables	Tightening Torque LB-in (N-m)
40-125	Z1	PS-4679F	1	#14 - #2/0 (2.1-67.4)	CU/AL	120 (13.6)
150-175	Z1	PS-4679F	1	#14 - #2/0 (2.1-67.4)	CU Only	120 (13.6)
150-200	Z1	PS-4418R	1	#6 - 250 (13.3 -127)	CU/AL	275 (31.0)
200	Z1	PS-4418R	1	#6 - 250 (13.3 -127)	CU/AL	275 (31.0)
225	Z1	PS-4420R	1	#6 - 350 (13.3 -177)	CU/AL	375 (42.3)
250 (IEC)	Z1	PS-4420R	1	#6 - 350 (13.3 -177)	CU/AL	375 (42.3)
300-400	Z2	PS-4661	1	#4 - 600 (21.1 - 304) or	CU/AL	500 (56.5)
			2	#1/0 - 250 (53.5 - 127)	CU/AL	500 (56.5)
630 (IEC)	Z2	PS-4661	1	#4 - 600 (21.1 - 304) or	CU/AL	500 (56.5)
			2	#1/0 - 250 (53.5 - 127)	CU/AL	500 (56.5)
600-800	Z3	PS-4662	1 or 2	#2/0 - 400 (67.4 - 203) or	CU	275 (31.1)
			1 to 3	#2/0 - 300 (67.4 - 152) or	CU	275 (31.1)
			1 to 3	#4/0 - 400 (107 - 203)	AL	275 (31.1)
1000	Z3	PS-4663	1 to 4	#3/0 - 500 (85 - 253) or	CU	375 (42.3)
			1 to 4	#4/0 - 500 (107 - 253)	AL	375 (42.3)
		PS-4675	1 to 3	250 - 600 (127 - 304)	CU/AL	375 (42.3)
1250 (IEC)	Z3	PS-4663	1 to 4	#3/0 - 500 (85 - 253) or	CU	375 (42.3)
			1 to 4	#4/0 - 500 (107 - 253)	AL	375 (42.3)
		PS-4675	1 to 3	250 - 600 (127 - 304)	CU/AL	375 (42.3)

SUPPLIED BY ARBITRATED INSIDE LINE

Equipment Ground Lug Information

Ampacity Amps	Size Frame	Lugs Cat. #	Number of Cables	Wire Range AWG or kcmil (mm²)	Suitable Cables	Tightening Torque LB-in (N-m)
40 - 225	Z1	PS-4423F, PS4439	1	#14 - #1/0 (2.1-53.5)	CU/AL	50 (5.5)
250 (IEC)	Z1	PS-4423F, PS4439	1	#14 - #1/0 (2.1-53.5)	CU/AL	50 (5.5)
300-400	Z2	PS-4423F, PS4439	1	#14 - #1/0 (2.1-53.5)	CU/AL	50 (5.5)
630 (IEC)	Z2	PS-4423F, PS4439	1	#14 - #1/0 (2.1-53.5)	CU/AL	50 (5.5)
600-1000	Z3	PS4418R, PS4440R	1	#6 - 350 (13.3 -177)	CU/AL	375 (42.3)
1250 (IEC)	Z3	PS4418R, PS4440R	1	#6 - 350 (13.3 -177)	CU/AL	375 (42.3)

Table 1: Lug and Torque Information

⚠CAUTION

All torques must be performed with a calibrated tool on DE-ENERGIZED equipment.

Tightening Torque for Bus Bars			
Bolt Thread Size	Torque Bolt (Grade 5 min.) Lb.-In.	Lb.-Ft.	Torque Bolt (Grade 5 min.) N-m
1/4"-20	72	6	8
5/16"-18	132	11	15
3/8"-16	228	19	26
1/2"-13	720	60	81
M8	132	11	15
M10	443	37	50

Table 2: Bus Bar Tightening Torques

Frame Z3 Terminal Shroud Covers and Cable Strip Lengths

1. Remove front terminal cover
2. Connect cables to pressure terminals (lugs) and tighten to the required torque (see *Table 1*)
3. Replace front terminal cover and tighten to 9 Lb-in (.10 N-m)

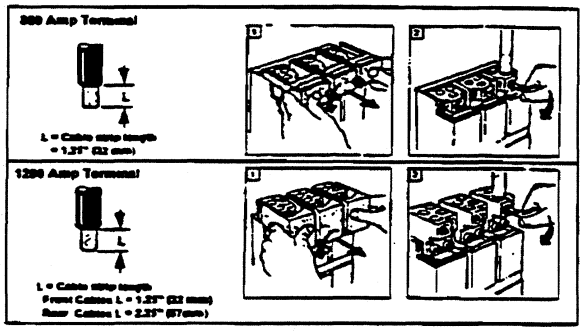


Figure 4 : Frame Z3 Cabling Diagram

POWER CONNECTION CHECK LIST:

⚠CAUTION

In using a 3 phase, 4 wire delta power supply (usually 120/240 volts, sometimes listed as 120/208 volts) with one leg having a grounded center tap, one line will be 160 to 208 volts to ground. When such a system is used it is necessary to connect the high leg to N2.

Do not connect 120 volt load circuit to the high leg.

1. On three phase units, verify that phase sequencing is identical:

   Normal N-A-B-C = Emergency N-A-B-C

2. On single phase units where the Emergency source is a utility line, connect emergency line so that minimum voltage is measured from N1 to E1.

3. On single phase (2 pole) units, the center pole is not supplied.

⚠CAUTION

Do not damage control wiring while tightening lugs!

4. A grounding terminal (GND) is provided. When installing open type switches, connect this to the metal enclosure or conduit.

4. CONTROL CONNECTIONS

(Automatic Transfer Switches with MX Controller)

A complete information package is furnished with each transfer switch including a connection diagram and schematic which details all necessary control circuit field connections.

The engine start control wires connect to the terminals specified typically in the lower left corner of the control panel. *Figure 5* below shows the location of these terminals on the standard MX controller on the inside of the door. These terminals are clearly identified.

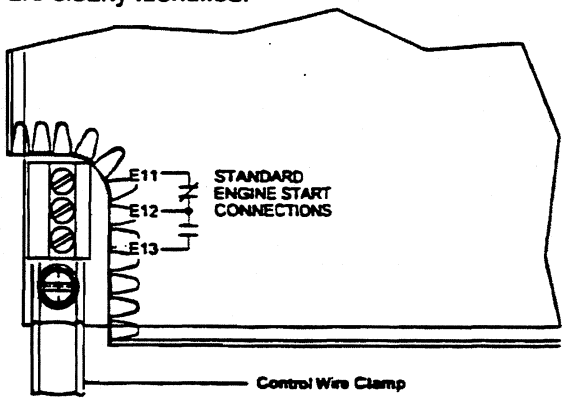


Figure 5: MX Engine Start Contacts

Terminals for field connection to the A3 Emergency Auxiliary contacts and the A4 Normal Auxiliary contacts are also provided. These terminals are clearly marked and appear on the right side of the power panel.

Contact Designations and Ratings	
CONTACT	RATING
E	5 AMP @ 250 VAC 5 AMP @ 30 VDC
A3, A4	6 AMP @ 480 VAC Maximum 2.5 AMP @ 30 VDC Maximum 10mA @ 24 VDC Minimum

Table 3

Make all other necessary external control connections to the appropriate terminal blocks located on the control panel. Ensure that all connections are tightened to the torque specified in *Table 4* below.

Contact Wire Connections			
Wire Size		Torque	
AWG	(mm^2)	Lb.-In.	(N-m)
18 - 16	(.82 - 1.3)	19	(2.1)
14 - 8	(2.1 - 8.37)	19	(2.1)
6 - 4	(13.3 - 21.1)	36	(4.1)

Table 4

5. FINAL EQUIPMENT INSPECTION

Prior to energizing the transfer switch:

1. Remove any packing material used in shipment or installation. CAUTION: DO NOT use a blower since debris may become lodged in the electrical and mechanical components and cause damage. Use of a vacuum is recommended.

2. Verify both operators (Normal and Emergency) are placed in the AUTO position.

3. Verify all harnesses are plugged in.

4. Verify both sources of power are available and maintain at least 90% of nominal voltage.

5. Check engine start connections and verify the correct connection of all control wires. Verify Engine Start Contacts are properly terminated on the controller connections E11 and E12.

⚠ WARNING

Engine will start if Utility is not available or Engine Stop is timing out.

⚠ CAUTION

Do not damage control wiring while tightening lugs!

6. On three phase units, verify that phase sequencing is identical:
   Normal N-A-B-C = Emergency N-A-B-C

7. Make sure the switch is properly grounded via the ground terminal (GND) provided.

8. Check the integrity of power connections by verifying actual lug torque values as specified in *Table 1*.

9. Check settings of all timers and adjust as necessary. Also adjust any optional accessories as required.

10. Be sure all tools have been removed prior to energizing transfer switch.

⚠ WARNING

Make sure that all covers, barriers, and terminal shrouds are installed and properly fastened.

6. FUNCTIONAL TEST

The functional testing of the transfer switch consists of manual and electrical tests described in this section. Before proceeding, refer to Section II of this manual for Automatic and Manual operation of this transfer switch. Read and understand all instructions and review the operation of all accessories provided.

First, close the upstream Normal source circuit breaker. The *Normal Source Available* LED (green) indicator will illuminate. Verify the phase to phase voltages at the Normal line terminals of the ATS. Next, close the upstream Emergency source breaker and start the engine generator. The *Emergency Source Available* LED (red) indicator will illuminate. Check the phase to phase voltages at the Emergency line terminals. Also, verify that the phase rotation of the Emergency source is the same as the phase rotation of the Normal source.

After the sources have been verified, shut down the engine generator, and put the motor operators in the automatic position. Complete the visual inspection of the transfer switch, and close and lock the cabinet door.

Initiate the electrical transfer Load Test by pressing the TEST button on the front of the door for approximately 10 seconds or until transfer occurs. The microprocessor will activate the internal P engine start timing cycle.

NOTE: User-set timer adjustment parameters are incorporated into this test circuit. The ATS commits to transfer if the TEST button has been pressed longer than the combined P and W timer parameters.

If user preset time delays are long, the TEST switch must be pressed for a period greater than or equal to the selected time delay for the switch to operate.

If the switch fails to respond to the test cycle within 10 seconds, adjust the P and W timers downward to accomplish testing sooner.

After the P timer has completed its timing cycle, the engine start contact will close and signal the engine generator to start. When the engine starts and voltage and frequency are within user-set limits, the *Emergency Source Available* LED (red) indicator illuminates. The Normal side will open and the Emergency side will close, transferring to the Emergency source after the time delay of the W timer.

Once this has occurred, the TEST button can be released. The switch will retransfer to the Normal source after the time delay of the T timer. The U engine over-run timer allows the engine generator to run unloaded for a preset cool-down time period.

The user-adjustable time delays and pickup settings should be set to desired values and the values recorded.

⚠ NOTICE

A periodic test of the transfer switch under load conditions is recommended to insure proper operation in accordance with United States National Electric Code articles 700 and 701.

KEY	
P	Solid state adjustable timer "Time Delay to Engine Start." The contact closes to start the engine generator. Adjustable from 0 - 10 seconds.
T	Solid state adjustable timer "Time Delay to Normal" which initiates retransfer to Normal source after restoration of power. Adjustable 0 - 30 minutes with expanded low end range.
U	Solid state adjustable timer "Time Delay Engine Over-run" for engine cool down after the engine generator is signaled to shut down. Adjustable from 0 - 5 minutes.
W	Solid state adjustable timer "Delay to Emergency" to initiate transfer to Emergency source after Normal source failure. Adjustable from 0 - 15 seconds.

SECTION II - OPERATION AND FEATURES

1. SEQUENCE OF OPERATION
Automatic Transfer Switches in AUTOMATIC MODE

The sequence for load transfer to the Emergency source begins automatically when any phase of the Normal source falls below the preset dropout point and this undervoltage failure condition is detected by the MX controller.

Upon Normal Voltage Failure:
The MX controller initiates the engine start timer P to begin its timing cycle. This P time delay is provided to override momentary outages and to prevent nuisance starting of the engine generator. If the Normal source voltage returns before the P timing cycle has finished timing, the transfer to Emergency is aborted.

If the Normal source voltage does not return before the P time delay is completed, the P timer sends a starting signal to the engine generator. The MX controller monitors the voltage and frequency of the Emergency source. When both the voltage and the frequency of the Emergency source reach the preset pickup points, the Emergency source available indicator illuminates. The MX controller initiates transfer to the Emergency source and internal timer W begins its timing cycle. The W timer provides an adjustable transfer delay to the Emergency source as required.

When the W time delay is completed, the MX controller energizes the power relay CCNO. The power relay applies voltage from the Emergency source to the Normal motor operator causing the switch to open and charge (Z1 or Z2 frames only). The DW timer initiates a delay of 2 to 10 seconds (user adjustable), after which the MX controller energizes the power relay CCE, sending a signal to the Emergency switch to close. This completes the transfer to the Emergency source. The switch is mechanically locked in the Emergency position. The control power relays and motor operators are de-energized by internal limit switches.

For more detailed information on the MX microprocessor controller (timers, settings, adjustments), please see control manual enclosed with switch.

Normal Voltage Restoration:
The sequence for retransfer to the Normal source begins automatically when the voltage on all phases of the Normal source reach the preset pickup point and this condition is detected by the MX controller. The Normal source available indicator illuminates; the internal circuit of the MX controller initiates retransfer of the switch to the Normal source by energizing internal timer T and beginning its timing cycle. The T timer provides an adjustable delay to insure that the Normal source has stabilized before reconnection to the load. If the Normal source fails before the T time delay is completed, the microprocessor aborts the transfer.

When the T time delay is completed, the MX controller energizes the power relay CCEO. The power relay applies voltage from the Normal source to the Emergency motor operator causing the switch to open and charge (Z1 or Z2 frames only). The DT timer initiates a delay of 2 to 10 seconds (user adjustable), after which the MX controller energizes and picks up the power relay CCN, sending a signal to the Normal motor operator to close. This completes the retransfer of the switch contacts to the Normal source. The switch is mechanically locked in the Normal position. All power relays and motor operator are de-energized by internal limit switches. The internal engine over-run timer U begins its timing cycle. The timer provides a period for the engine generator to run without load and cool before shutdown. After the U time delay is completed, the engine generator is shutdown.

⚠ NOTICE

Z1 and Z2 motor operators are two-step stored energy mechanisms that must be charged before closing can occur; closed switches can always be opened without charging. The charging operation is normally done as each motor operator opens.

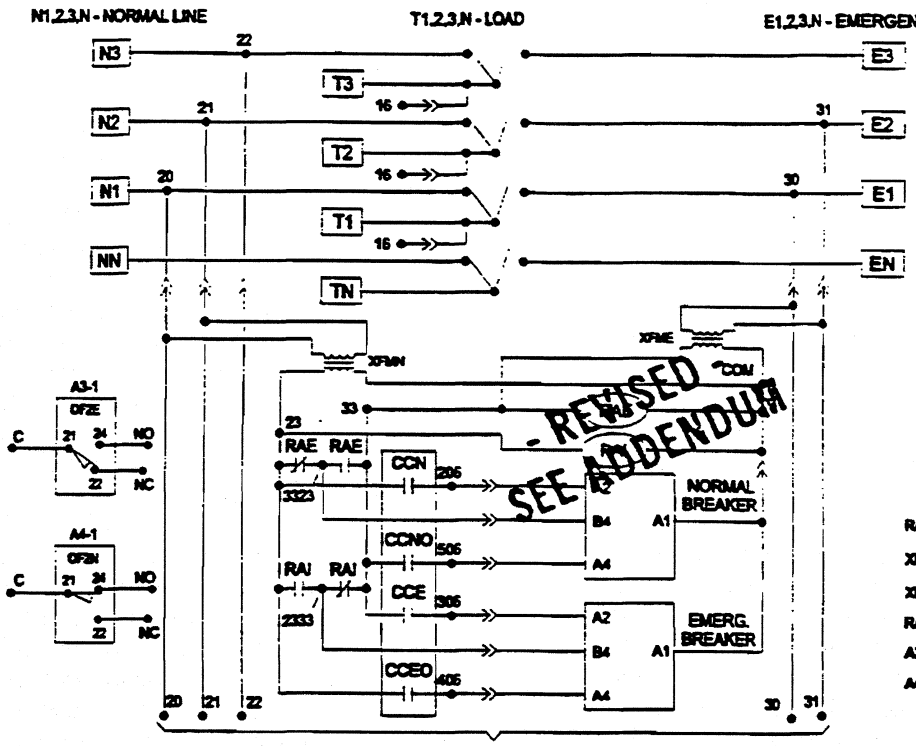
SWITCH STATUS AND POSITION INDICATORS:
Under NORMAL Operating Conditions, the Z1 and Z2 frame motor operators display the following indicators:

POSITION	STATE	DISPOSITION
Unit is OFF and ready to close	OFF	Charged
Unit is ON	ON	Discharged

Under ABNORMAL Operating Conditions, the Z1 and Z2 frame motor operators display the following indicators:

POSITION	STATE	DISPOSITION
Unit is TRIPPED	OFF	Discharged

POWER CIRCUIT SCHEMATIC - Frame Z1 and Frame Z2



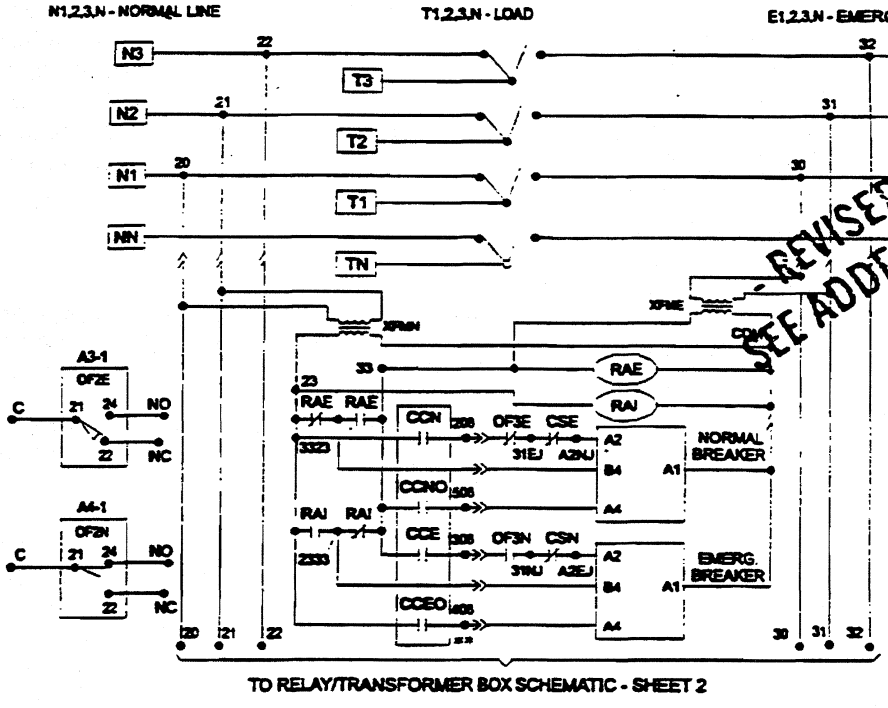
* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEMS.

VOLTAGE SYSTEMS

	VOLTS	NO. OF PHASES	NO. OF WIRES
-3	240V, 60HZ	3	3
-31	208, 60HZ	3	3
-38	120/240,60HZ	3	4
-4	120/208,60HZ	3	4
-5	480,60HZ	3	3
-7	277/480,60HZ	3	4
-9	240/416,60HZ	3	4
-91	220/380V,60HZ	3	4
-92	220/380V,50HZ	3	4

RAE - EMERGENCY AVAILABLE RELAY
XFMN - NORMAL POWER TRANSFORMER
XFME - EMERGENCY POWER TRANSFORMER
RAI - NORMAL AVAILABLE RELAY
A3-1/OF2E - EMERGENCY POSITION INDICATOR
A4-1/OF2N - NORMAL POSITION INDICATOR

POWER CIRCUIT SCHEMATIC - Frame Z3



* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEMS.

VOLTAGE SYSTEMS

	VOLTS	NO. OF PHASES	NO. OF WIRES
-3	240V, 60HZ	3	3
-31	208, 60HZ	3	3
-38	120/240,60HZ	3	4
-4	120/208,60HZ	3	4
-5	480,60HZ	3	3
-7	277/480,60HZ	3	4
-9	240/416,60HZ	3	4
-91	220/380V,60HZ	3	4
-92	220/380V,50HZ	3	4

RAE - EMERGENCY AVAILABLE RELAY
XFMN - NORMAL POWER TRANSFORMER
XFME - EMERGENCY POWER TRANSFORMER
RAI - NORMAL AVAILABLE RELAY
CSN - NORMAL COVER SWITCH
CSE - EMERGENCY COVER SWITCH
A3-1/OF2E - EMERGENCY POSITION INDICATOR
A4-1/OF2N - NORMAL POSITION INDICATOR
OF3E - EMERGENCY ELECTRICAL INTERLOCK
OF3N - NORMAL ELECTRICAL INTERLOCK

NOTE: ZTC shown in Normal position.
No Power Available.

2. SEQUENCE OF OPERATION
Automatic Transfer Switches in MANUAL MODE

⚠ WARNING

To reduce risk of injury to persons, disconnect all sources of supply before servicing.

Automatic Transfer Switches normally respond to electrical inputs by energizing electrical operators to open or close contacts.

All Zenith ZTC Automatic Transfer Switches can be operated manually for maintenance and servicing purposes by following these steps:

(This procedure assumes that the ATS is closed in the Normal position.)

1. **Open upstream circuit breakers or switches to disconnect ATS from both sources. This will be detected as a Normal source failure; the engine generator should start.**

2. **Open the cabinet door and locate manual operating push-buttons or handles.**

3. **Place both operators in the MANUAL mode**. This is done by either:
a) Moving the small Selector switch to the "MANU" setting (for Frame Z1 and Frame Z2 only) or
b) Opening the clear doors and exposing the gray handles (for Frame Z3 only).

Once this is done, the unit will no longer respond to electrical inputs.

4. **OPEN the NORMAL (left) side** (assuming the Normal side was closed). This is done by:
a) Pressing the "OFF" push-button (Frame Z1 and Frame Z2) or
b) moving the gray handle downward from the top to the bottom (for Frame Z3 only).

HINT: A removable black handle extension is provided - it slips over the top of the gray handle and makes operating the handle much easier. When done, the handle extension is stowed in the top of the handle compartment area.

*The Normal side contacts are now open; as the Emergency side contacts are also open, the load is now disconnected and isolated from both sources, **but the line side terminals of the ATS are still energized.***

⚠ CAUTION

Manual operating provisions are for Maintenance and Servicing purposes only.

Do not switch manually with load connected.

5. **Close the EMERGENCY (right) side**. This is done by:
a) Pressing the "Push On" push-button (for Frame Z1 and Frame Z2 sizes) or
b) Moving the gray handle upward from bottom to top (for Frame Z3).

The Emergency side contacts are now closed. To connect the load to the Emergency source, reclose the upstream Emergency circuit breaker or switch.

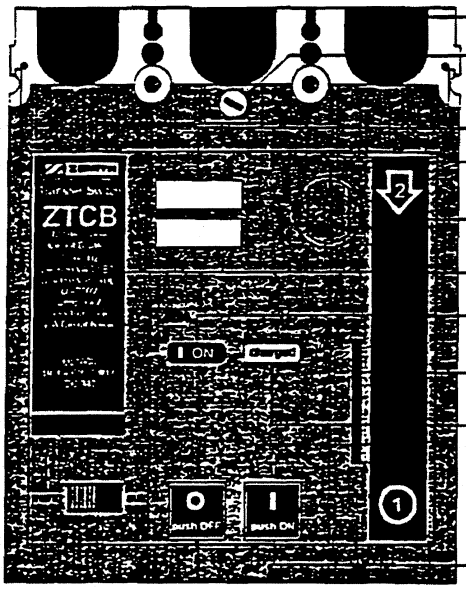
6. **To restore the Normal Source, one must work in reverse.**
a) Open the upstream Emergency circuit breaker or switch.
b) Open the Emergency side (by pushing the OFF push-button or moving the gray handle downward)
c) Close the Normal side by:
   1) Manually charging the mechanism by pumping the handle several times until "OFF-CHARGED" indicator appears (see diagram next page) and then pressing the "Push On" push-button (Frame Z1 and Frame Z2 only) or
   2) Moving the gray handle upward into the On position. Replace black handle extension in its storage location.
d) Return both sides to the automatic mode by:
   1) lifting the selector switch to move it into the auto position and manually pump both operators until "OFF-CHARGED" indicator appears (Frame Z1 and Frame Z2 only)
   2) Closing the clear doors on each motor operator

The unit is now fully charged and will respond automatically to electrical inputs via the microprocessor controller.

7. **Restore any covers that may have been removed; remove tools. Close the cabinet door and lock it.**

8. **Reclose upstream devices to restore power.**

ZTC Motor Mechanism
(Frame Z1 and Frame Z2)



The motor operator mechanism module can be used to open and close the circuit breaker and charge the operating mechanism spring via electrical signals.
Its position and small dimensions leave trip unit settings visible and accessible. It can be tipped forward for access to connections and auxiliaries (voltage releases, indication switches).

(1) Main Contacts Position Indicator

I ON **closed**

O OFF **open/isolated**

Isolation is guaranteed when the indicator signals OFF.

(2) Mechanism Status Indicator

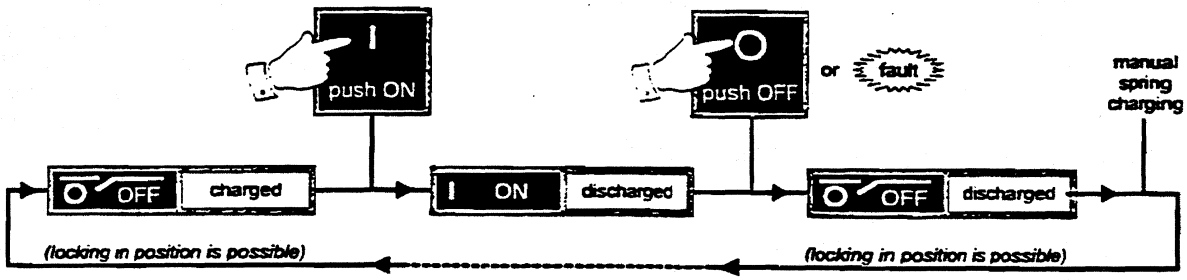
charged **spring charged**

discharged **spring discharged**

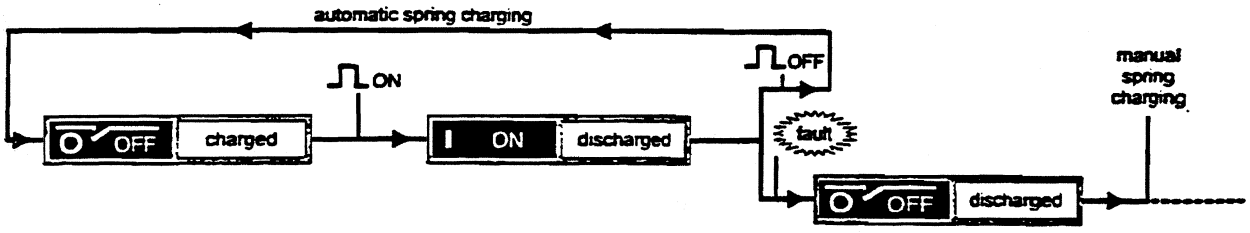
(3) Manual/Automatic Operation Selector

- in manual mode, electrical control signals are inhibited,
- in automatic mode, only electrical control signals are executed.

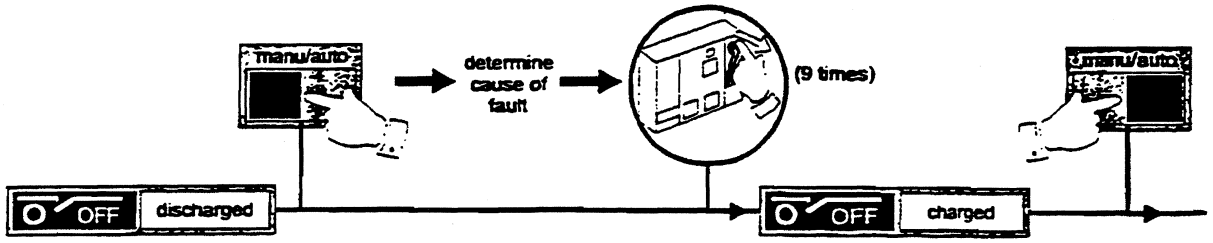
Operation Cycle In MANUAL Mode



Operating Cycle In AUTOMATIC Mode



Manual Spring Charging



3. SEQUENCE OF OPERATION MANUAL TRANSFER SWITCHES

⚠ WARNING

To reduce risk of injury to persons, disconnect all sources of supply before servicing.

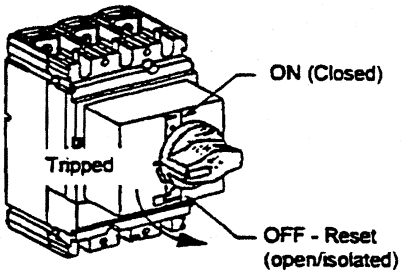
⚠ CAUTION

Manual operating provisions are for Maintenance and Servicing purposes only.

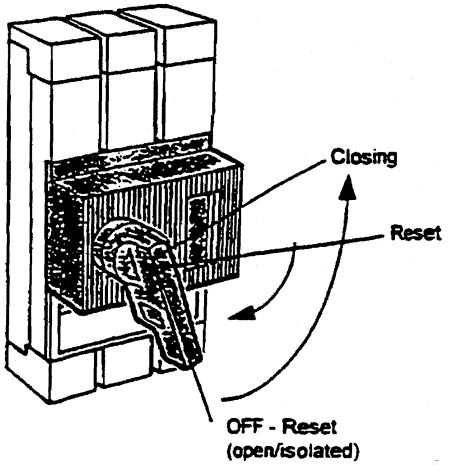
DO NOT SWITCH MANUALLY WITH LOAD CONNECTED.

All Zenith ZTC Manual Transfer Switches operate similarly to the automatic switches. Each frame size can be operated independently via rotary operators. See diagrams below:

Manual Operation and Trip Indication via the Rotary Handle



Frame Z1 and Z2



Frame Z3

The manual operation is as follows:

1. Open the Normal (left) source operator
   a) by rotating handle from the ON position to the OFF position
   b) by moving the handle downward from the ON position to the OFF position

2. Close the Emergency (right) source operator
   a) by rotating handle from the OFF position to the ON position
   b) by moving the handle upward from the OFF position to the ON position

To restore power to the Normal source:

1. Open the Emergency (right) source operator
   a) by rotating handle from the ON position to the OFF position
   b) by moving the handle downward from the ON position to the OFF position

2. Close the Normal (left) source operator
   a) by rotating handle from the OFF position to the ON position
   b) by moving the handle upward from the OFF position to the ON position

4. SEQUENCE OF OPERATION
Resetting of Mechanisms after Tripping

⚠ NOTICE

All Zenith ZTC Transfer Switches utilize Molded Case Switches or Circuit Breakers that have the ability to TRIP open on overcurrents!

⚠ CAUTION

All ZTC mechanisms MUST be reset manually after a trip condition. Automatic Transfer switches will not respond to electrical inputs until the device is reset!

⚠ WARNING

To reduce risk of injury to persons, disconnect all sources of supply before servicing.

⚠ CAUTION

If a Breaker or Switch trips open: Please refer to Section III of this manual for more information on TROUBLESHOOTING tripped systems.

- **A CIRCUIT BREAKER OR SWITCH MUST NEVER BE RESET BEFORE IDENTIFYING AND ELIMINATING THE CAUSE OF THE TRIP!**
- **Depending on the cause of the trip and prior to restarting the installation, certain precautions must be taken, namely insulation and dielectric tests on the installation, in part or in whole. These checks must be carried out by qualified personnel.**

⚠ CAUTION

Manual operating provisions are for Maintenance and Servicing purposes only.

DO NOT SWITCH MANUALLY WITH LOAD CONNECTED.

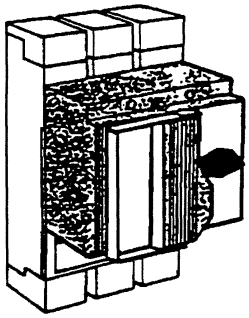
Tripping Indication:
Tripping is indicated on the MX controller by signaling a prolonged OPEN position, even though the LED indicators state that a source is available. Visually, a tripped condition is observed on the front of the ZTC operator.

Note that all ZTC transfer switches have three clearly marked positions visible on the front of the switch:

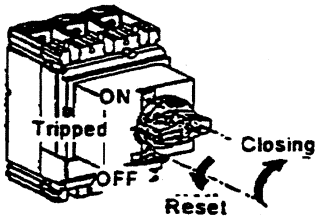
1.	**ON**	(Ready to open)	Position **UP**
2.	**Tripped**	(Must be manually reset)	Position **MIDDLE**
3.	**OFF**	(Ready to Close)	Position **DOWN**

Resetting Operators after Trip
(Rotary Operators versus Spring Charged Operators)

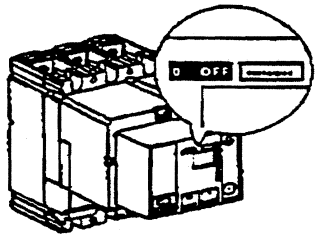
Rotary Motor Operator
Frame Z3 (ATS)



Rotary Manual Operator
Frames Z1, Z2, Z3 (MTS)



Spring Charged Motor Operator
Frames Z1, Z2, Z3 (ATS)



Frame Z3 ATS

To reset these devices, first remove the black handle extension and place it over the exposed handle. Rotate the handle from the center "Tripped" downward to the bottom "OFF" position; then move the handle upward to the "ON" position. Return the handle extension to stowage area.

⚠ CAUTION

Close both clear doors to place the ATS in the automatic mode!

Frames Z1, Z2, Z3 MTS

Manual Transfer Switches are equipped with similar mechanically interlocked rotary operators.
To reset these devices, rotate the handle from the center "Tripped" position downward to the bottom "OFF" position; then move the handle into the top "ON" position.

Frames Z1, Z2 ATS

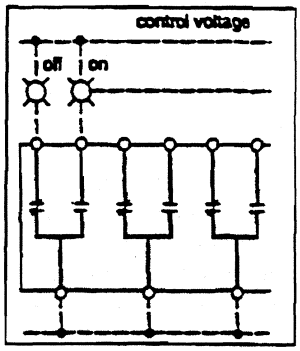
These ATS devices are reset by manually pumping of the charging handle (right side; #1 to expose, #2 to pump) until the "OFF-CHARGED" indicator appears. Then place both units in AUTO position (Lift the selector button and move to the right); this allows the ATS to operate automatically via the MX controller.

5. ZENITH ZTC POWER PANEL ACCESSORIES
Manual and Automatic Transfer Switches

All ZTC internal accessories are wired to clearly marked terminal blocks on the right side of the power panel. These include Auxiliary Contacts, Shunt Trip and Overcurrent Trip Alarm Switch.

A3, A4 Auxiliary Switches

Auxiliary switches (A3, A4) consist of SPDT contacts and provide remote information of the switch position and status. These switches indicate whether each power switching component is in either OPEN or CLOSED positions.



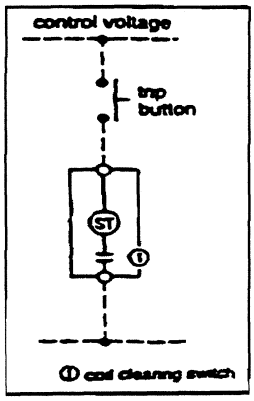
A3 Auxiliary contact closes when the switch is in the Emergency position. SPDT (1-NC & 1-NO)

A4 Auxiliary contact closes when the switch is in the Normal position. SPDT (1-NC & 1-NO)

One set is provided as standard on all Automatic Transfer Switches (designation A3 and A4). An optional set can be installed into all Manual Transfer Switches.

STN, STE Shunt Trip

The shunt trip (ST) is used to electrically trip open the circuit breaker or switch; it is intermittently rated with a series normally open contact. AC shunt trips can be operated at 55% of their rated voltage, making them suitable for use with ground fault protection devices.



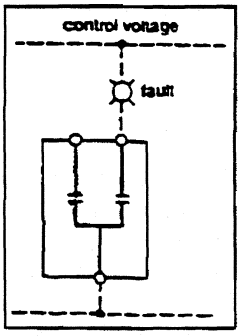
A Shunt Trip can be installed into all frame sizes (Frames Z1, Z2 and Z3). It can be installed into either Normal (STN) or Emergency (STE) or both (STN, STE) sides.

Minimum operating voltage:
AC: 55% of rated voltage
DC: 75% of rated voltage

The shunt trip must operate at 75% of its rated voltage (except that shunt trip devices for use with ground fault protection shall operate at 55%).

ALN, ALE Overcurrent Trip Alarm Switch

The overcurrent trip alarm switch consists of a SPDT contact that can be wired to a user's pilot light, horn or building automation system. The contact closes when the breaker operates through the trip unit (overcurrent or ground fault). It does <u>not</u> operate if tripping is by shunt trip, or push-to-trip button.



An Overcurrent Trip Switch can be installed into all frame sizes (Frames Z1, Z2 and Z3). It can be installed into either Normal (ALN) or Emergency (ALE) or both (ALN, ALE) sides.

SE UL Service Entrance Equipment

This option allows a ZTC transfer switch to meet the requirement of the United States National Electrical Code article 230; included are neutral bonding provisions, deadfront trim, ability to disconnect both sources simultaneously, improved dielectric clearances and necessary labeling.

This option is only available on ZTCB transfer switches that utilize circuit breakers for complete overcurrent protection. It is available for automatic transfer switches of all frame sizes. The standard SE package does <u>not</u> include ground fault protection.

SE-GFP UL Service Entrance with Ground Fault Protection

This option combines a complete Ground Fault Protection (GFP) system with UL service entrance rated equipment; it additionally meets the United States National Electrical Code article 230-95. This accessory package includes GFP on the <u>Normal</u> source with neutral sensing, tripping means and trip indication via trip unit LED annunciator.

If Ground Fault Protection is also desired on the Emergency source, please consult Zenith factory.

This option is only available on Frame Z3 ZTCB transfer switches. See Section IV for schematics.

SECTION III - MAINTENANCE AND TESTING

⚠DANGER

HAZARDOUS VOLTAGE.
CAN CAUSE SEVERE INJURY OR DEATH.
Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

A preventive maintenance program will insure high reliability and long life for the transfer switch. The preventive maintenance program for the transfer switch should include the following items.

1. INSPECTION AND CLEANING

Before doing any work on the transfer switch, de-energize all sources of power. The switch should be inspected for any accumulation of dust, dirt, or moisture, and should be cleaned by vacuuming or wiping with a dry cloth or soft brush. DO NOT use a blower since debris may become lodged in the electrical and mechanical components and cause damage.

A general inspection of the mechanical integrity should be made to include loose, broken, or badly worn parts.

2. SERVICING

All worn or inoperative parts must be replaced using Zenith recommended replacement parts. When ordering parts, provide the model number or serial number from the transfer switch rating nameplate. Contact Zenith Controls for replacement part information.

3. TESTING

Manual operating provisions are supplied with the transfer switch for maintenance purposes only. Manual operation of the switch must be checked before it is operated electrically. Both power sources MUST be disconnected before manual operation of the switch. Operate the transfer switch (See Section II - 2) between the Normal and Emergency positions. The transfer switch should operate smoothly without binding. Return the switch to the Normal position, then return both sides to the AUTO mode.

After completing the inspection, cleaning and servicing of the transfer switch, reinstall any barriers or covers, and close and lock the cabinet door. Reclose the upstream circuit breakers that feed the utility and generator sources to the switch.

The MX controller provides a convenient way to electrically test the operation of the automatic transfer switch by pressing the local TEST switch on the front of the MX controller. To initiate an automatic test, press and hold the TEST button.

A complete transfer cycle will occur automatically. Upon conclusion of the test, the automatic transfer switch is returned to the AUTOMATIC position.

4. TROUBLESHOOTING

⚠ WARNING

To reduce risk of injury to persons, disconnect all sources of supply before servicing.

⚠ CAUTION

Manual operating provisions are for Maintenance and Servicing purposes only.

DO NOT SWITCH MANUALLY WITH LOAD CONNECTED.

Before beginning any troubleshooting activity, refer to the MX Controller information package supplied with the transfer switch and review the description and operation of all accessories supplied. Also refer to Section II of this manual, Operation and Features. The following is indicative for MX100 controllers.

This section is divided into seven parts; each section is designed to easily identify probable causes based on symptoms exhibited. Problems may be one of two types - Power Panel related or MX Controller related. Below is a list of possible power panel conditions. Please refer to the MX Controller manual for possible microprocessor conditions.

INDEX OF TROUBLESHOOTING SECTIONS

General Troubleshooting Overview:

- *General Advice, Initial Checkpoints and LED Confirmation* — *See Part A*
- *ATS Will Not Transfer To EMERGENCY* — *See Part B*
- *ATS Will Not Transfer To NORMAL* — *See Part C*
- *No Engine START* — *See Part D*
- *No Engine STOP* — *See Part E*
- *ATS or MTS Remains OPEN* — *See Part F*
- *ATS or MTS Closes and Transfers But Trips Repeatedly:* — *See Part G*

The following tables do not list all the possibilities, but can assist in troubleshooting and providing corrective action. If, however, the problem persists, consult Zenith Technical Services support department.

⚠ WARNING

For an MX100 controlling a ZTC type Automatic Transfer Switch, annunciation of the availability of either source along with a prolonged OPEN position indicator without any timing annunciation may indicate a TRIPPED condition.

INVESTIGATE REASONS FOR TRIPPING PRIOR TO RESETTING!

⚠ NOTICE

When either of the ATS motor operators is left in the MANUAL position, that motor operator will not respond to electrical input signals from the MX controller.

⚠ NOTICE

ZTC series Automatic Transfer Switches may require the MX controller to be reset via de-energizing the controller to allow the controller to re-initialize and attempt a transfer that was previously unsuccessful. If de-energization is required, either:

- **disconnect both sources for 30 seconds (or until the LED's extinguish) or**
- **unplug the J5 plug for 30 seconds (or until the LED's extinguish)**

4. TROUBLESHOOTING

A. General Troubleshooting: Initial Checkpoints and Procedures

It is recommended that before troubleshooting, please review the Installation Checklist in Section I - 5; it contains many basic points to verify prior to diagnostic troubleshooting. Before proceeding, please verify proper LED indication as described in Section 1-6. If differences exist, refer to the charts below:

Initial Installation Confirmation of LED Indication

Symptom	Annunciation	Possible Causes	Corrective Action
NORMAL and/or EMERGENCY AVAILABLE LEDs responding improperly	Neither source available LEDs illuminate, position LEDs only	MX100 PC board may be configured for wrong frequency (60Hz vs. 50Hz)	1) Verify source voltage and frequency 2) Consult Zenith Controls for information to reconfigure hardware
	NORMAL and/or EMERGENCY AVAILABLE LEDs on when frequeny is below the preset pick up value	MX100 PC board may be configured for wrong frequency (50Hz vs. 60Hz)	1) Verify source voltage and frequency 2) Consult Zenith Controls for information to reconfigure hardware

B. ATS Will Not Transfer To EMERGENCY

Symptom	Annunciation	Possible Cause	Corrective Action
ATS will not transfer to Emergency	EMERGENCY AVAILABLE LED off	Emergency voltage or frequency not within acceptable parameters	Check Engine Start Connections, Generator Breaker, Generator output, and Engine Control Switch
	NORMAL POSITION LED flashing and EMERGENCY AVAILABLE LED on	Normal Operator Selector in manual	Put Operator Selector(s) in Auto, unplug the harness (18 pin) and then plug harness in again
	OPEN POSITION and EMERGENCY AVAILABLE on LED	ZTC tripped	Examine load for fault
	None	Power supply harness unplugged	Plug in harness
	NORMAL POSITION, EMERGENCY POSITION and OPEN POSITION LED flashing	Limit switch harness unplugged	Plug in harness
	DELAY TO OPEN NORMAL LED on	W timing cycle not complete	Check W Timer setting
	DELAY TO EMERGENCY LED on	DW timing cycle not complete	Check DW Timer setting

4. TROUBLESHOOTING

C. ATS Will Not Transfer To NORMAL

Symptom	Annunciation	Possible Cause	Corrective Action
ATS will not transfer to Normal	NORMAL AVAILABLE LED off	Normal voltage or frequency not within acceptable parameters	Check Utility and Utility breakers
	EMERGENCY POSITION LED flashing and NORMAL AVAILABLE LED on	Normal Operator Selector in manual	Put Operator Selector(s) in Auto, unplug the harness (18 pin) and then plug harness in again
	OPEN POSITION and NORMAL AVAILABLE LED on	ZTC tripped	Examine load for fault
	None	Power supply harness unplugged	Plug in harness
	NORMAL POSITION, EMERGENCY POSITION and OPEN POSITION LEDs flashing	Limit switch harness unplugged	Plug in harness
	DELAY TO OPEN EMERGENCY LED on	T timing cycle not complete	Check T Timer setting.
	DELAY TO NORMAL LED on	DT timing cycle not complete	Check DT Timer setting.

D. Engine does Not START

Symptom	Annunciation	Possible Cause	Corrective Action
No engine Start	EMERGENCY AVAILABLE LED off	Engine start wires not terminated properly.	Check Engine Start Connections
		Generator in "OFF" position	Investigate why Engine Control Switch was turned off

E. Engine does Not STOP

Symptom	Annunciation	Possible Cause	Corrective Action
No engine Stop	DELAY TO ENGINE STOP LED on	U timing cycle not complete	Check U Time setting.
	NORMAL AVAILABLE, NORMAL POSITION, and EMERGENCY AVAILABLE LEDs on	Engine start wires not terminated correctly.	Check Engine Start Connections
		Generator in "Manual"	Investigate why the Engine Control Switch was put in manual

4. TROUBLESHOOTING

F. ATS Remains OPEN

Symptom	Annunciation	Possible Cause	Corrective Action
ATS remains open	OPEN POSITION LED flashing	Operator Selector(s) in manual	Put Operator Selector(s) in Auto, unplug the harness (18 pin) and then plug harness in again
	NORMAL AVAILABLE and EMERGENCY AVAILABLE LEDs off	Neither source within acceptable parameters.	Check power sources
		Shunt Trip Release is energized (optional feature)	Determine cause of power being applied to Shunt Trip Release coil

G. Diagnostic Troubleshooting: ATS or MTS Transfers but Trips Repeatedly:

Symptom	Annunciation	Possible Cause	Corrective Action
Repeated tripping; ZTCS/ZTCB is open or tripped and not trying to transfer to either available source	Solid OPEN POSITION annunciator with one or both sources available while no timers are annunciating	Protection settings are incorrect	Check the rated current of the supply network and set the proper value Check the setting for overload protection
		Inadvertent powering of shunt trip release	Determine the causes of the powering
		Ambient temperature too high	Ventilate the room or de-rate the device
		Ground fault pick-up settings are incorrect	Verify and reset Ground Fault settings
		Insulation fault	Check the insulation of the protected circuit

5. RECOMMENDED MAINTENANCE AND SERVICE

⚠ WARNING

Molded case circuit breakers and switches cannot be field repaired. In the case of malfunction, the entire Power Panel Assembly should be replaced or repaired at the Zenith factory, or by an authorized representative.

Since molded case circuit breakers and switches contain factory-sealed and calibrated elements, it is essential that the seal not be broken and the circuit breaker or switch not be tampered with.

A BROKEN SEAL VOIDS THE WARRANTY!

⚠ DANGER

All inspections and maintenance must be on circuit breakers or switches, including those installed in switchboards, which have been DE-ENERGIZED, and disconnected so as to prevent accidental contact with live parts.

RECOMMENDED PRACTICES AND INSPECTION INTERVALS

Zenith transfer switches are designed to be maintenance-free. However, all equipment with moving parts requires periodic inspection to ensure optimum performance and reliability. We recommend that the circuit breakers or switches be routinely inspected by qualified personnel at six months after installation, followed by annual inspections. Intervals can vary depending on your particular experience.

A general check requires only a few minutes and eliminates any risks of incorrect operation due to error or neglect.

	Procedure or Test Recommended								
Frequency of Occurrence	A	B	C	D	E	F	G	H	I
Prior to initial commissioning	●	●	●	●	●	●	●	●	?
6 Months after commissioning	●	●			●	●	●		?
Periodically during service life (annually or as required)					●	●		●	?
Following servicing of the equipment		●	●	●	●	●		●	?
Periodically during extended shutdown		●			●		●		?
Following an extended shutdown		●	●		●	●	●	●	?
Following equipment modification	●	●	●	●	●	●	●	●	?

Where

●	=	Recommended
?	=	May be necessary if problems persist
A	=	Routine Electrical Tests
B	=	Enclosure and Environment Inspection and Cleaning
C	=	Insulation Resistance Tests
D	=	Conformity with Diagram
E	=	Inspection of Connections and Device Mounting
F	=	Auxiliaries (Mounting and Operation)
G	=	Mechanical Operation
H	=	Operation of Electronic Trip Units and Ground Fault Systems
I	=	Supplemental Electrical Tests (Optional Diagnostic Tests)

Please see the following page for descriptions of each of these recommended procedures.

6. RECOMMENDED PRACTICES

A. Routine Electrical Tests:

Basic electrical operating tests, continuity tests, insulation, and dielectric withstand capacity tests were performed at Zenith prior to shipping. These tests should be re-performed as part of a preventive maintenance program with the results recorded. These tests must always be carried out by an authorized specialist.

B. Enclosure and Environment Inspection:

Check that the circuit breakers are installed in a clean environment, free of dust and all installation debris (tools, wiring, chips, metal particles, etc.). Remove the dust and dirt that have accumulated on the circuit breaker surface and terminals.

C. Insulation Resistance Tests *(Disconnect Control Panel Prior to Performing Test!)*:

When breakers are subjected to severe operating conditions, insulation resistance tests should be performed as indicated in NEMA standard publication number AB2-1980. An insulation resistance test is used to determine the quality of the insulation between phases and phase to ground. The resistance test is made with a DC voltage higher than the rated voltage, to determine the actual resistance of the insulation. The most common method employs a "megger" type instrument. A 1000V instrument will provide a more reliable test because it is capable of detecting tracking on insulated surfaces. Resistance values below 1 mega-ohm are unsafe and should be investigated. An insulation test should be made:

1. Between line and load terminals of individual poles with the circuit breaker or switch contacts open;
2. Between adjacent poles and from poles to the metallic supporting structure with the circuit breaker or switch contacts closed. The latter test may be done with the circuit breaker in place after the line and load conductors have been removed, or with the circuit breaker bolted to a metallic base which simulated the in-service mounts.

D. Compliance With Diagram:

Check the conformity of devices with the installation diagram: Ratings and breaking capabilities indicated on the rating plates, trip unit identification (type, rating), presence of additional functions (ground fault protection, motor mechanism, rotary handle, auxiliaries, indication and measurement modules), protection and settings (overload, short circuit, ground fault) and outgoing circuit identification on the front of devices.

E. Inspection of Connections and Device Mounting:

Connections to circuit breaker (or switch) terminals should be inspected regularly. If there is discoloration due to overheating, the joint should be disassembled and the surface cleaned before reinstallation. It is essential that electrical connections be made carefully in order to prevent overheating. Check for terminal tightness. Check the device mounting and securement. In switchboard applications, check the tightness of bussed connections. Check that all terminal shields, covers and barriers are installed.

F. Check that Auxiliaries and Accessories Are Correctly Installed:

Check the proper installation of motor operator mechanism or rotary handles, accessories (terminal shields, door escutcheons, etc.) and connection of auxiliary circuits.

G. Mechanical Operation:

Check the mechanical operation of devices (manually or electrically): verify contact opening, contact closing. It is recommended that transfer switches be exercised regularly. Normal transfers as well as load tests satisfy this requirement for mechanical operation.

H. Operation of the Electronic Trip Units and Ground Fault Systems:

Check the electronic trip units using the mini test kit or calibration test kit; consult Zenith Field Service for availability of field test kits and procedures.

I. Supplemental Electrical Tests (Optional Diagnostic Tests):

These tests require equipment for conducting pole resistance, overcurrent and instantaneous tripping, in accordance with NEMA standard publication number AB 2. They are not within the scope of normal field operation. If these tests are to be performed, please consult Zenith Field Service for recommended procedures and equipment needed.

SECTION IV - ADJUSTMENTS AND SETTINGS

NOTE: This section will focus on the Power Panel Adjustments ONLY. Please refer to MX Controller Manual for detailed information on Microprocessor adjustments.

⚠ WARNING

All trip unit adjustments should be made by qualified personnel who consult published trip curves for maximum coordination.

Please refer to ZTC Application Guide (Publication #0-5104).

NOTE: All Power Panel trip unit adjustments are always preset at the factory in the minimum position for maximum safety protection. These adjustments may need to be raised to higher levels to match installation conditions.

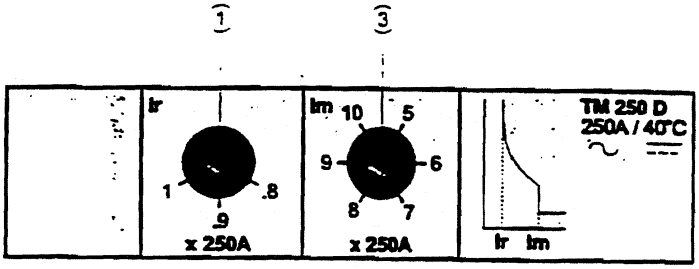
ZTC Transfer Switches are available in two versions:

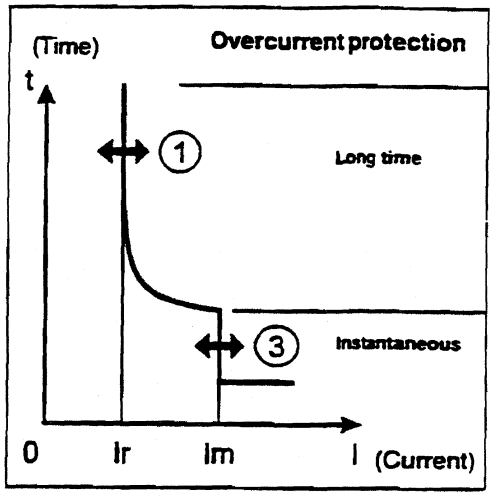
ZTCS Molded Case Switch (MCSw)	ZTCB Molded Case Circuit Breaker (MCCB)
No thermal (overload) protection	Complete thermal overload protection (Long-time tripping)
Inherent Short Circuit Self Protection (High level instantaneous trip)	Reflexive or Magnetic Short Circuit Protection (Instantaneous tripping)
All ZTC Transfer Switches using molded case switches have automatic high level trip systems to protect themselves against damaging short circuits. This high level instantaneous trip setting is FIXED and NON ADJUSTABLE.	All ZTC Transfer Switches using molded case circuit breakers utilize adjustable trip units to vary the degree of protection. In all cases, both the thermal (long-time) and magnetic (instantaneous) portions of the trip curve are ADJUSTABLE.
There are NO trip adjustments.	There are SEVERAL adjustment provisions. Please refer to the following pages for adjustment of your ZTCB trip unit TRIP UNIT Frame Z1 TM16D to TM250D (General Use UL & IEC) Frame Z2 STR23SP (General Use UL & IEC) STR23SE (General Use IEC only) Frame Z3 STR25DP (General Use UL & IEC) STR25DE (General Use IEC only) STR55UPT (UL Ground Fault Systems) with Neutral Sensor Diagram

1. Circuit Breaker Trip Units
Frame Z1 Power Panel: 40-225 Amps UL or 40-250 Amps IEC
Trip Unit TM16D to TM250D (Thermal Magnetic General Use)

The following adjustments are possible with ZTCB (Circuit Breaker) Trip Units:

Thermal Magnetic Trip unit TM





Protection

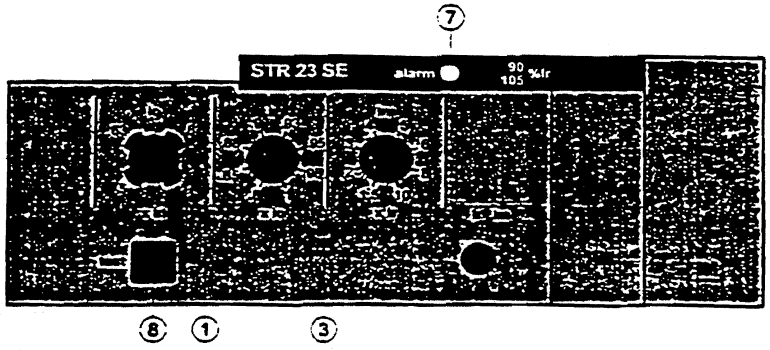
① ■ Adjustable-threshold thermal protection against overloads or fixed thermal trip rating seal;

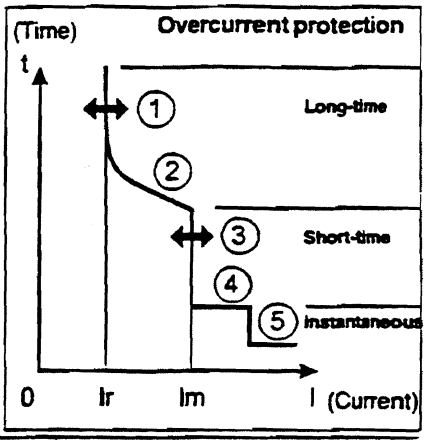
③ ■ Adjustable or fixed threshold (depending on ratings) magnetic protection against short-circuits.

Trip Units for ZTCB Frame Z1		TM16D to TM250D										
		Rated Amps	40	80	100	125	150	160	175	200	225	250
Rating (A)	In	40 °C	40	80	100	125	150	160	175	200	225	250
		50 °C	38	76	95	119	143	152	166	190	214	238
		60 °C	36	72	90	113	135	144	158	180	203	225
For all Z1 Frame ZTCB circuit breaker types: N, H, L			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Overload Protection (Thermal or Long Time = LT)												
Tripping Threshold (A)	Ir		adjustable 0.8 to 1 x In									
Neutral Protection (A)	4P 3d		no protection									
Short-Circuit Protection (Magnetic or Instantaneous = INST)												
Tripping Threshold (A)	Im		fixed						adjustable			
	ZTCB (40-250 Amps)		500	650	800	1000	1179	1250	5 to 10 x In			

2. Circuit Breaker Trip Units
Frame Z2 Power Panel: 300 - 400 Amps UL or 300 - 630 Amps IEC
Trip Unit: STR23SP (Solid State General Use UL & IEC at 300-400 Amps)
STR23SE (Solid State General Use IEC at 630 Amps)

The following adjustments are possible with ZTCB (Circuit Breaker) Trip Units:





Protection

- ■ LT (Long Time) overload protection via rms current sensing. Adjustable threshold:
- ① ■ six Io (1) base settings (0.5, 0.63, 0.7, 0.8, 0.9, 1),
- ② ■ fine adjustment Ir with eight settings ranging from 0.8 to 1;
- ③ ■ ST (Short-Time) short-circuit protection, adjustable threshold Im;
- ④ ■ INST (Instantaneous) short-circuit protection, fixed threshold.

Other functions

Indications

⑦ Load indication (LED) in front:
- ■ lit at 90% of Ir setting;
- ■ flashing at 105% or more of Ir setting.

Test

Test connector in front for connection to ⑥ a mini test kit or consult Zenith Field Service.

Notes

■ Electronic trip units adapt to both 3P and 4P circuit breakers. 4P circuit breakers are equipped as standard with a three-position neutral protection setting: 4P 3d (neutral unprotected).

Trip Units for ZTCB Frame Z2			STR23SP 300-400 Amps	STR23SE 630 Amps
Rating (A)	In	40 °C	No De-rating Necessary	No De-rating Necessary
		50 °C	No De-rating Necessary	5% De-rating Necessary
		60 °C	5% De-rating Necessary	10% De-rating Necessary
For All Z2 Frame ZTCB circuit breaker types: N H L			✓	✓
Overload Protection (Thermal or Long Time = LT)				
Tripping Threshold (A)	Ir		adjustable (32 Settings) 0.4 to 1 x In	adjustable (32 Settings) 0.4 to 1 x In
Neutral Protection (A)	4P 3d		no protection	no protection
Tripping Time (s)	Ir		fixed	fixed
at 1.5 x Ir	Minimum to Maximum		135 - 205	135 - 205
at 6.0 x Ir	Minimum to Maximum		6 - 7.5	6 - 7.5
at 7.2 x Ir	Minimum to Maximum		3.8 - 5.2	3.8 - 5.2
Short-Circuit Protection (Short Time = ST)				
Tripping Threshold (A)	Im		adjustable (8 Settings) 1.5 to 10 x Ir	adjustable (8 Settings) 1.5 to 10 x Ir
	Accuracy		± 15%	± 15%
Time Delay (ms)	Max. overcurrent		fixed	fixed
	Time before tripping		≤ 40	≤ 40
	Total breaking time		≤ 60	≤ 60
Short-Circuit Protection (Magnetic or Instantaneous = INST)				
Tripping Threshold (A)	I		fixed ≥ 11 x In	fixed ≥ 11 x In

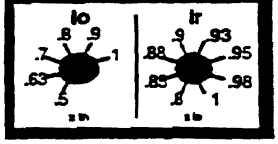
Setting example

What is the overload protection threshold of a 400 amp ZTCB Frame Z2 equipped with trip unit STR23SE where Io = 0.5 and Ir = 0.8?

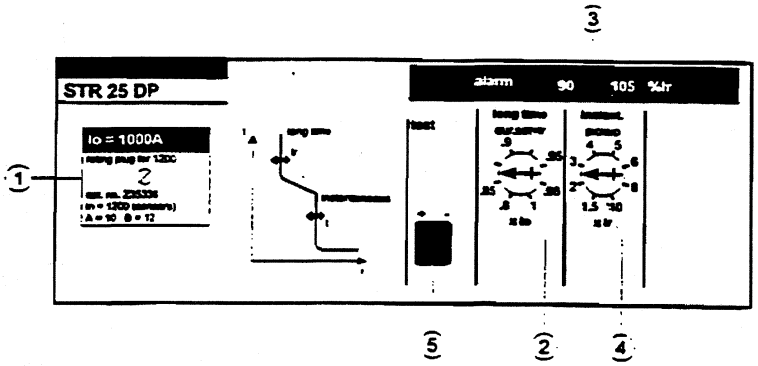
Answer:
In x Io x Ir
= 400 x 0.5 x 0.8
= 160 A

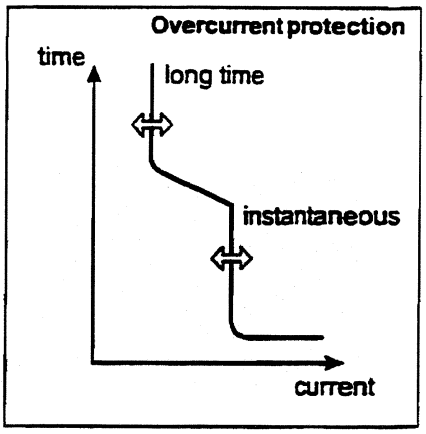
The same trip unit with the same settings, mounted on a 630 amp ZTCB Z2 will have the following tripping threshold:

In x Io x Ir
= 630 x 0.5 x 0.8
= 250 A



3. Circuit Breaker Trip Units
Frame Z3 Power Panel: 600 - 1000 Amps UL or 800 - 1000 Amps IEC
Trip Unit STR25DP (Solid State General Use UL & IEC)
(This is used on systems without Ground Fault Protection)





Protection

- LT (Long Time) overload protection via rms current sensing. Rating Plug supplied; adjustable threshold:
- ② fine adjustment Ir with eight LT base settings (0.8, 0.85, 0.875, 0.90, 0.925, 0.95, 0.975, 1.0)
- INST (Instantaneous) short-circuit protection, adjustable pickup threshold.
- ④ adjustment I with eight INST base settings (1.5, 2, 3, 4, 5, 6, 8, 10)

Other functions

Indications

③ Load indication (LED) in front:
- fixed light at 90% of Ir setting;
- flashing at 105% or more of Ir setting.

Test

⑤ Test connector in front for connection to a mini test kit or consult Zenith Field Service.

Notes

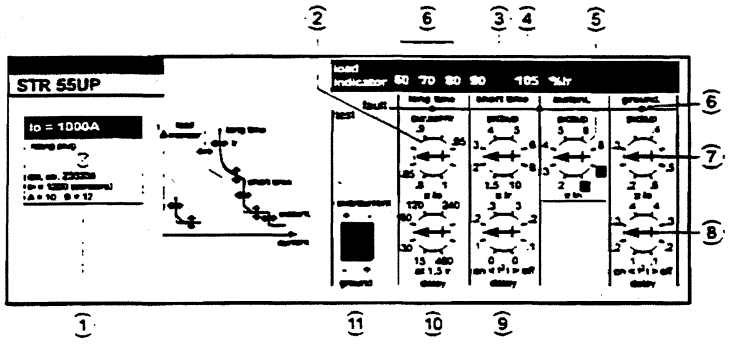
- Rating Plugs ① are supplied to fix current carrying capacity; adjustments are provided to dial down settings to better match equipment loads.

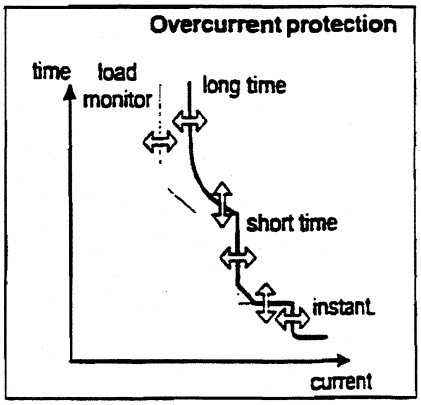
Rating plugs are interchangeable; please consult Zenith Field Service for selection and availability

Overcurrent RMS protection: STR25DP			
Rating Plug	**breaker**	**sensor**	**plug rating**
	ZTCB 60-80	800A	400-500-600-700-800A
	ZTCB 100	1200A	600-700-800-900-1000A
Long Time	current setting	0.8 to 1 x plug rating	
	delay	at 1.5 x current setting:	min. 96 sec. - max. 120 sec.
		at 6.0 x current setting:	min. 6.0 sec. - max. 7.5 sec.
		at 7.2 x current setting:	min. 4.2 sec. - max. 5.2 sec.
	off	long time off with rating plug cat. no. Z35300	
Instantaneous	ZTCB 80: 1.5 to 10 times current setting		
	ZTCB 100: 1.5 to 10 times current setting with a max of 8 times		
Test Receptacle	for overcurrent testing	(Consult Zenith Field Service)	
Fault Indicators			
	local	by trip indication of the operating handle	
	remote	by alarm and overcurrent trip switch	

4. Circuit Breaker Trip Units
Frame Z3 Power Panel: 600 - 1000 Amps UL or 800 - 1000 Amps IEC
Trip Unit STR55UPT (Solid State UL with Ground Fault Protection)
(This is only used on UL Service Entrance ZTCB ATS with Ground Fault)

The following adjustments are possible with ZTCB (Circuit Breaker) Trip Units:





Protection

■ LT (Long Time) overload protection via rms current sensing. Rating Plug supplied; adjustable pickup threshold:

② ■ fine adjustment Ir with eight LT base settings (0.8 to 1.0)

④ ■ corresponding **LT Delay** adjustment (15 to 480)

④ ■ **ST** (Short-Time) short-circuit protection, adjustable pickup threshold Im; eight base settings (1.5 to 10)

⑤ ■ corresponding **ST Delay** adjustment; eight base settings (0 to .3 each I²t On and I²t Off)

■ **INST** (Instantaneous) short-circuit protection, adjustable pickup threshold.

⑤ ■ adjustment I with eight **INST** base settings (2 to 15 or 2 to 8 times sensors; see below)

Other functions

Indications

③ Load Alarm indication (LED) in front:
- ■ fixed light at 90% of Ir setting;
- ■ flashing at 105% or more of Ir setting.

⑥ Local fault and load indicators:
Consisting of built-in light emitting diodes:
- ■ fault indicators that discriminate the 3 causes of tripping: overload, short circuit and ground fault if any
- ■ bargraph indicating the load in steps of 60, 70, 80% of the current setting

Test

(11) Test connector in front for connection to a mini test kit or consult Zenith Field Service.

Notes

Ground Fault Pickup ❍

⑦ ■ adjustable **GF Pickup** adjustment; eight base settings (0.2 to 0.6)

Ground Fault Time Delay

④ ■ corresponding **GF Delay** adjustment; eight base settings (0.1 to 0.4 each I²t On and I²t Off)

① ■ Rating Plugs are supplied to fix current carrying capacity; adjustments are provided to dial down settings to better match equipment loads.

Overcurrent RMS Protection: STR55UPT Trip Unit

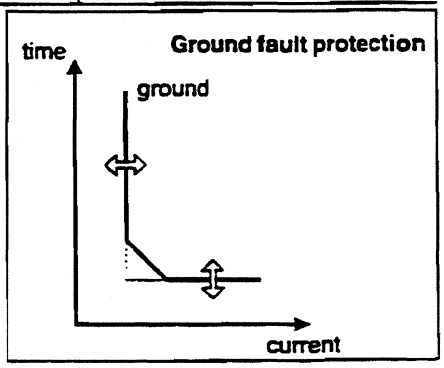
Rating Plug	breaker	sensor	plug rating					
	ZTCB 60-80	800A	400♦-500♠-600-700-800A					
	ZTCB 100	1200A	600♦-700♠-800-900-1000A					
Long Time	current setting	0.8 to 1 x plug setting						
	delay	delay band		15	30	60	120	240	480
		at 1.5 x cur. set.	min.	12	24	48	96	192	384
			max.	15	30	60	120	240	480
		at 6.0 x cur. set.	min.	0.75	1.50	3.00	6.0	12	24
			max.	0.94	1.88	3.75	7.5	15	30
		at 7.2 x cur. set.	min.	0.52	1.04	2.08	4.2	8.3	16.7
			max.	0.65	1.30	2.60	5.2	10.4	20.8
Short Time	pickup	1.5 to 10 x current setting							
	delay bands	0 - 0.1 - 0.2 - 0.3							
Instantaneous	ZTCB 60 - ZTCB 80	2 to 15 times the current sensors							
	ZTCB 100	2 to 8 times the current sensors							
Test Receptacle	for overcurrent and ground fault testing	(Consult Zenith Field Service)							

Ground Fault Protection ❍

pickup	0.2 to 0.6 times the current sensors
delay band	0.1 - 0.2 - 0.3 - 0.4

Fault and Load Indicators

Not discriminated	local	by trip indication of the operating handle
	remote	by alarm and overcurrent trip switch



Footnotes and Explanations

♦♠ The lowest pickup setting of the inverse time alarm Ic2 may not work properly if the long time current setting and/or the load decreases below 80% x this plug rating

Plug Rating	min. Ic2 pickup setting
♦	0.8 to 1 x current setting
♠	0.6 to 1 x current setting

❍ Ground Fault Protection: Residual scheme. The maximum ground fault pickup meets 1991 National Electrical Code paragraph 230-95(a).

5. Circuit Breaker Trip Units
Frame Z3 Power Panel: 600-1000 Amps UL with Ground Fault Protection
Neutral Sensors and Connections Used in Conjunction with STR55UPT Trip Units

Neutral Current Sensor

Ground fault protection may be applied on 3Ø4W or 3Ø3W circuits. On 3Ø4W an external neutral sensor must be used. **The following are Neutral Current Sensor catalog numbers for use with ZTCB breakers equipped with STR55UPT trip units (please note phase sensors may be different from current rating):**

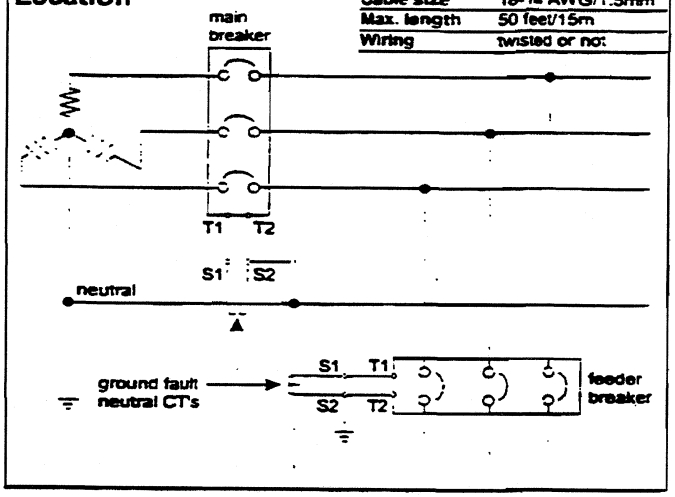
Amp Rating	ZTCB	Phase Sensors	Neutral Sensor #
600A MAX.	ZTCB50 - 60	800A	Z35701
1000A MAX.	ZTCB80 - 100	1200A	Z35703

Wiring
As indicated in opposite figure and on the neutral sensor label. Observe control wiring (terminal S1-S2, T1-T2).

Terminals
- terminals S1-S2 (neutral sensor) are of "quick-connect" type (1/4" female tab socket are supplied with current sensors),
- terminals T1-T2 (circuit breaker) are pressure type terminal blocks. These terminals are intended for use with 18 to 14 AWG stranded copper wire.

Location

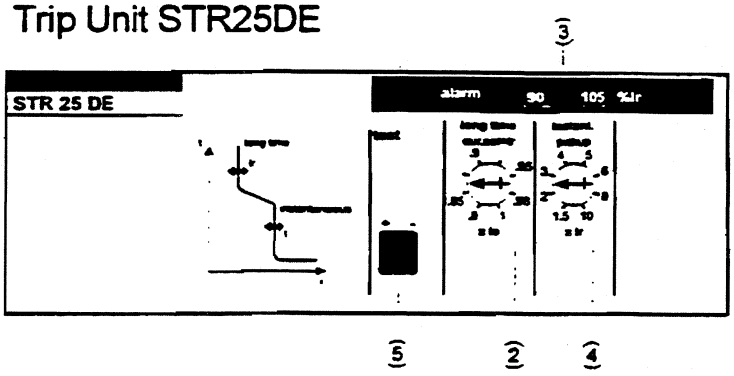
Cable size	18-14 AWG/1.5mm²
Max. length	50 feet/15m
Wiring	twisted or not

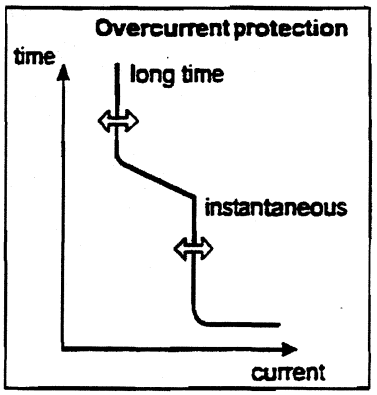


6. Circuit Breaker Trip Units
Frame Z3 Power Panel: 1250 Amps IEC
Trip Unit STR25DE (Solid State IEC General Protection)

The following adjustments are possible with ZTCB (Circuit Breaker) Trip Units:

Trip Unit STR25DE





Overcurrent RMS Protection: STR25DE Trip Unit			
Rating Plug	None		
Long Time (LT)	current setting	Ir = In x	0.4 to 1
		Tripping between	1.05 - 1.20 x Ir
	delay	at 1.5 x current setting:	min. 96 sec. - max. 120 sec.
		at 6.0 x current setting:	min. 6.0 sec. - max. 7.5 sec.
		at 7.2 x current setting:	min. 4.2 sec. - max. 5.2 sec.
Instantaneous		1.5 to 10 times current setting	
Test Receptacle	for overcurrent testing	(Consult Zenith Field Service)	
Fault Indicators			
	local	by trip indication of the operating handle	
	remote	by alarm and overcurrent trip switch	

The STR25DE control unit, for general purpose, offers two levels of protection:
- adjustable long time protection against overload;
- adjustable instantaneous protection against short circuit. The thresholds are given for 2 or 3 poles on load.

See page 26 for explanations of Trip Unit items ②③④⑤

FIELD NOTES

Model Number _____

Serial Number _____

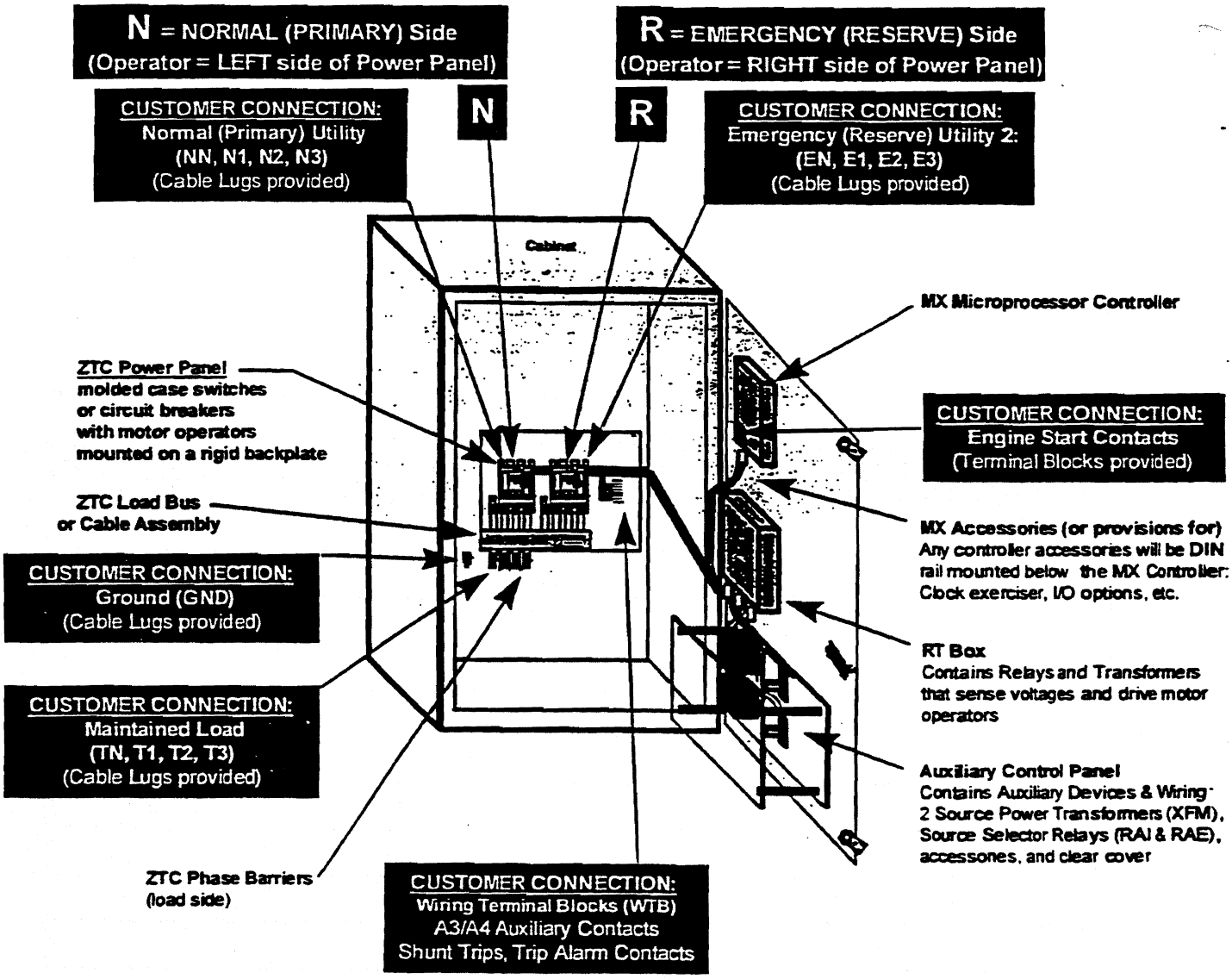
Date Shipped _____

Start-Up Date _____

Drawings Supplied _____

TEST AND MAINTENANCE NOTES			
DATE	TEST	OBSERVATIONS	NOTES

ZTC Transfer Switches: Terminology and Nomenclature



ZENITH CONTROLS, INC.

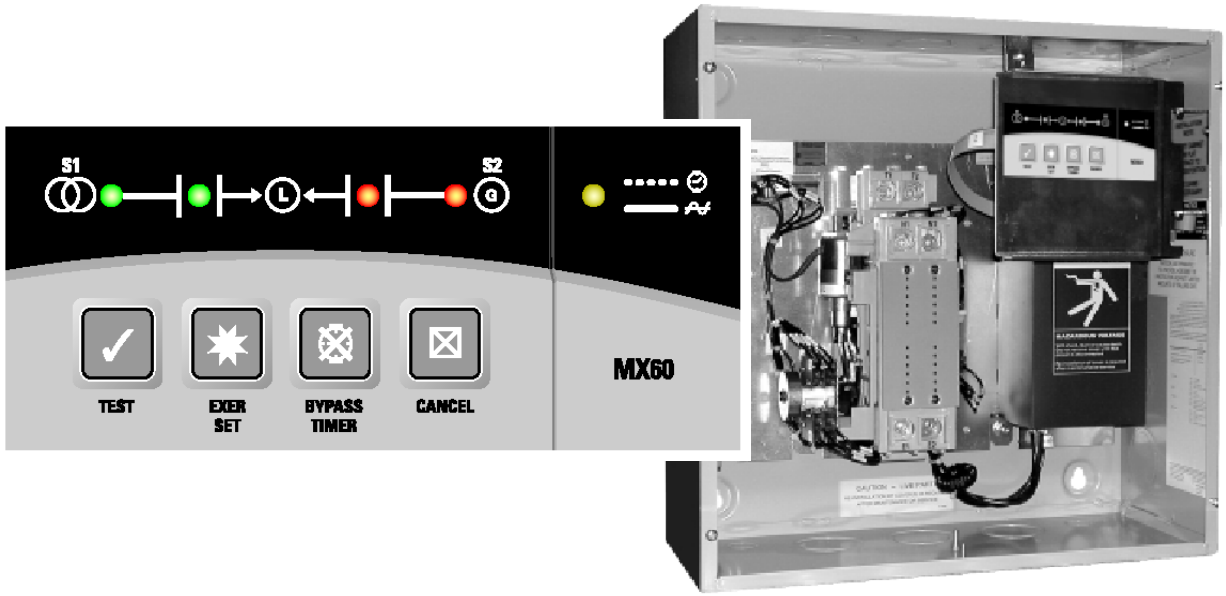
830 West 40th Street
Chicago, IL 60609
USA

Phone: 312 247-6400
FAX: 312 247-7805

PLEASE NOTE
NEW AREA CODE
773
EFFECTIVE
OCT. 12, 1996

© 1996 Zenith Controls, Inc.

MX60 ATS Controller



Contents

1. Introduction
2. Features
3. Configuration Jumpers
4. MX60 Assemblies
5. Differences between MX60 and MX50
6. ZTX Cabinets
7. MX60 Controller Replacement Kits
8. ZTX Field Retrofit Door Kits
9. Part Number Cross Reference
10. Controller Replacement Method
11. Overall Installation – F17 ZTX
12. Overall Installation – F14 ZTX
13. Frequently Asked Questions (FAQ)

1. Introduction

ZTX/MX60 designed for:

- residential light industrial
- Non-life safety application

Agency Certification

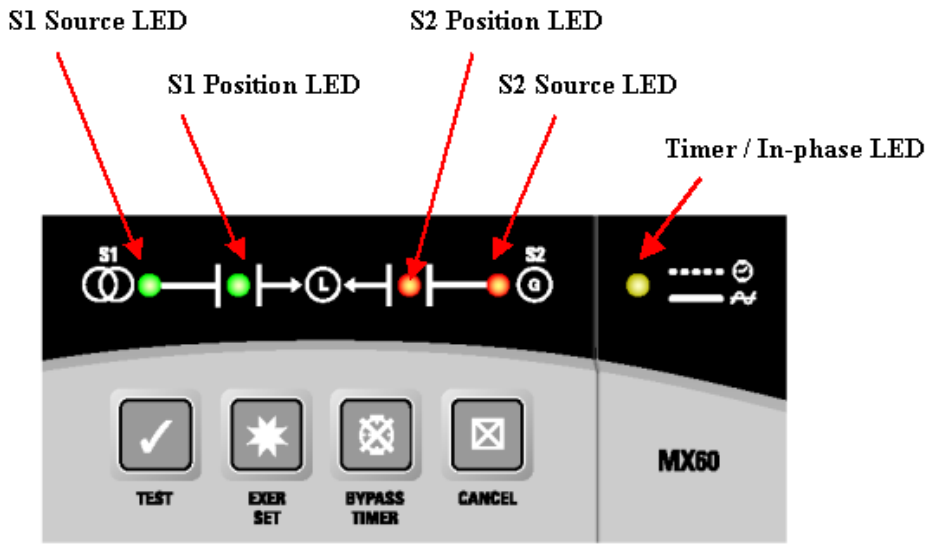
- UL1008
- CSA C22.2
- IEC61000 series

2. Features

- Support voltage and Frequency ranges:
  - 120V, 208/220/240V, 380/416V, or 440/480V
  - 50/60 Hz
- Phase Type – Single or three-phase
- Exerciser: 7/14/21/28 days
- Test: No-load or Load
- In-phase Monitor (R50)
- Top-down Configurable Jumpers

2. Features (cont.)

- Keypad (or HMI) –
- Indicator LEDs
- Pushbuttons – better feel
- Keypad Controls
- Automatic Generator Exerciser
- In-Phase Monitor Operation



3. Configurable Jumpers

In MX50

A – Timers

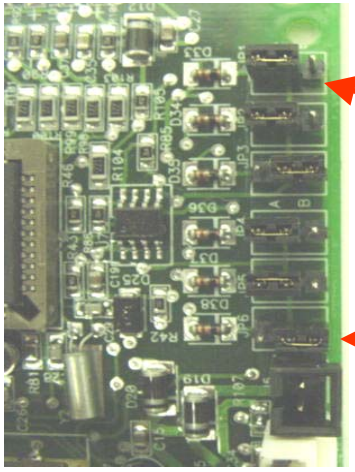
B -- Test

MX60 JUMPERS SELECTION

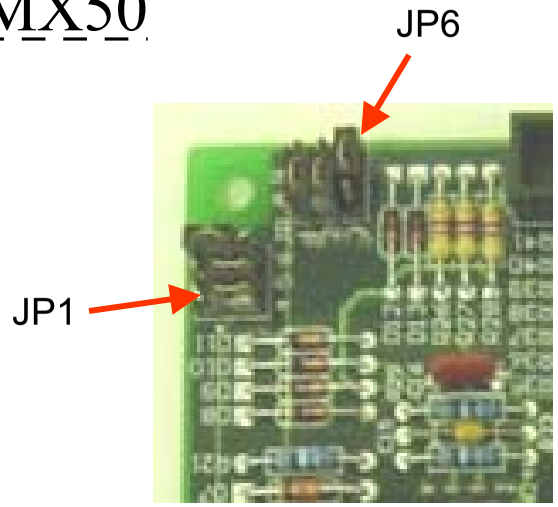
VOLTAGE	JP1	JP2	FREQUENCY	JP3	CDT PERIOD	JP4	JP5	TRANSFER	JP6
120V/380V	B	B	50HZ	A	7 DAYS	B	B	NO LOAD	A
208V/415V	A	B	60HZ	B	14 DAYS	A	B	LOAD	B
220V/440V	B	A			21 DAYS	B	A		
240V/480V	A	A			28 DAYS	A	A		

MX60

Top-down Configurable Jumpers !



MX50

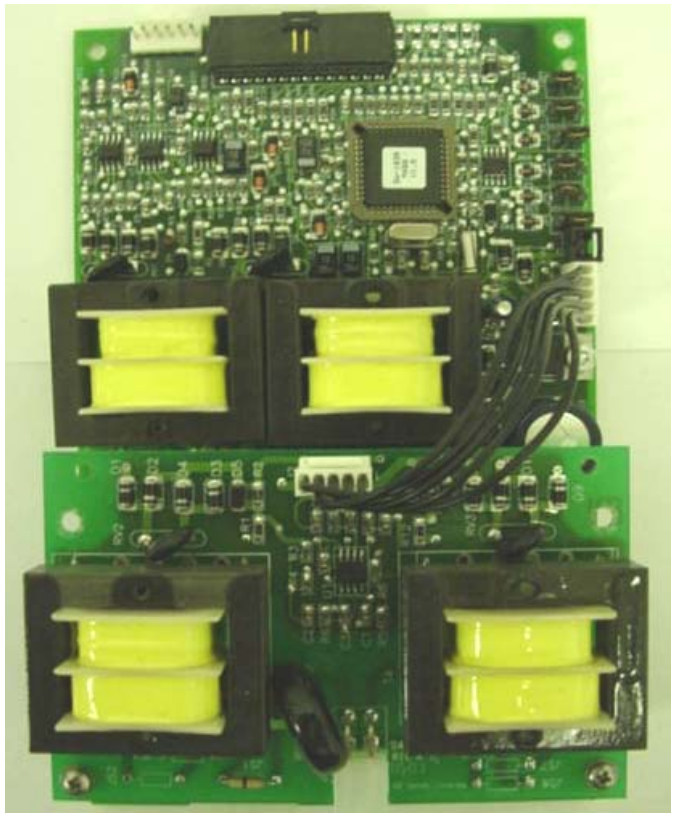


4. MX60 Assemblies

Phase Type	GEZC Part Number	Board Type
Single-Phase	50P-3000	208/220/240V, 50/60Hz, 1ϕ PCB Assembly
	50P-3001	380/416V, 50/60Hz, 1ϕ PCB Assembly
	50P-3002	440/480V, 50/60Hz, 1ϕ PCB Assembly
	50P-3003	120V, 50/60Hz, 1ϕ PCB Assembly
Three-Phase	50P-3031	208/220/240V, 50/60Hz, 3ϕ PCB Assembly
	50P-3032	380/416V, 50/60Hz, 3ϕ PCB Assembly
	50P-3033	440/480V, 50/60Hz, 3ϕ PCB Assembly

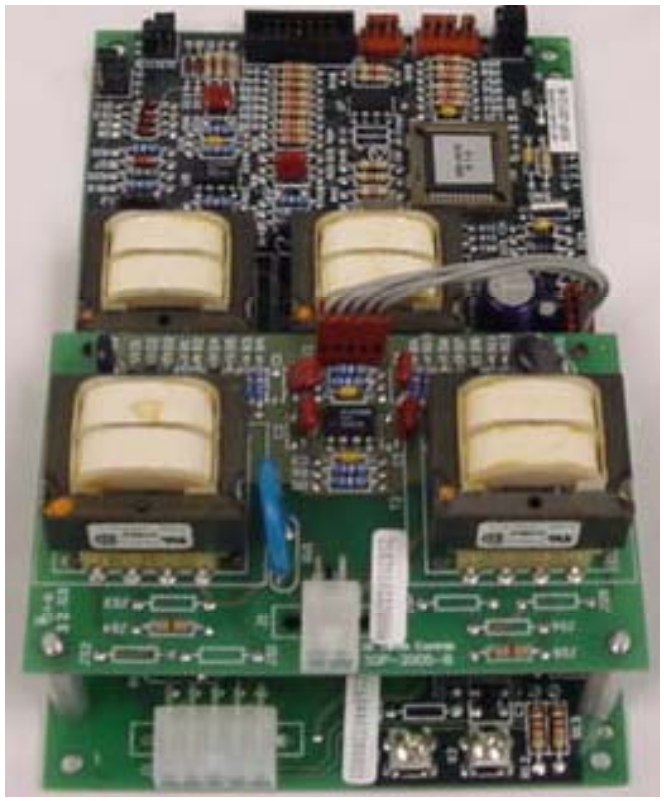
5. Differences in 3-Phase PCB Assy.

MX60



50P-3031, 50P-3032, 50P-3033

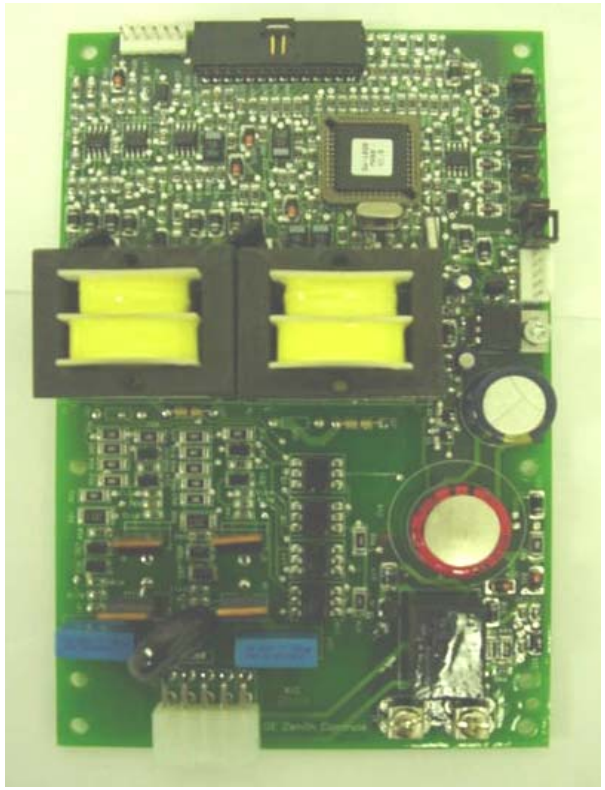
MX50



50P-2021, 50P-2022, 50P-2023

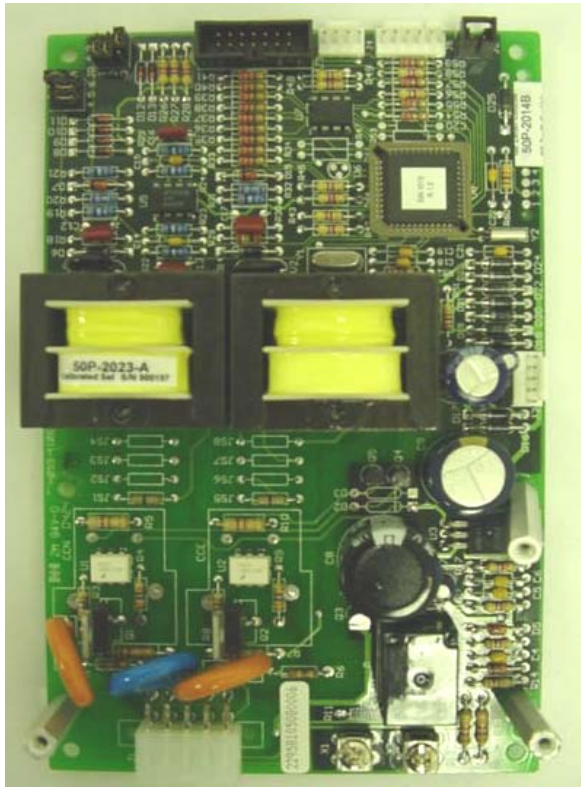
5. Differences in Single-Phase PCB Assy.

MX60



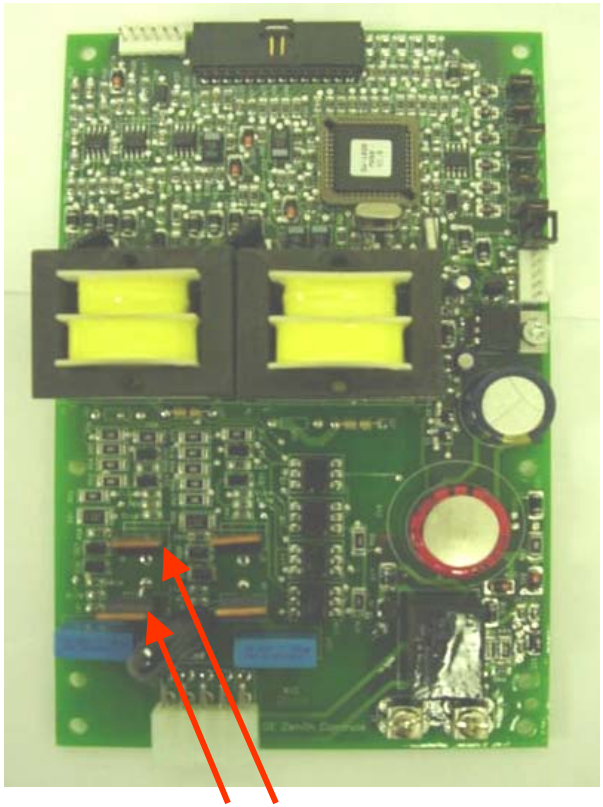
50P-3000, 50P-3001, 50P-3002, 50P-3003

MX50



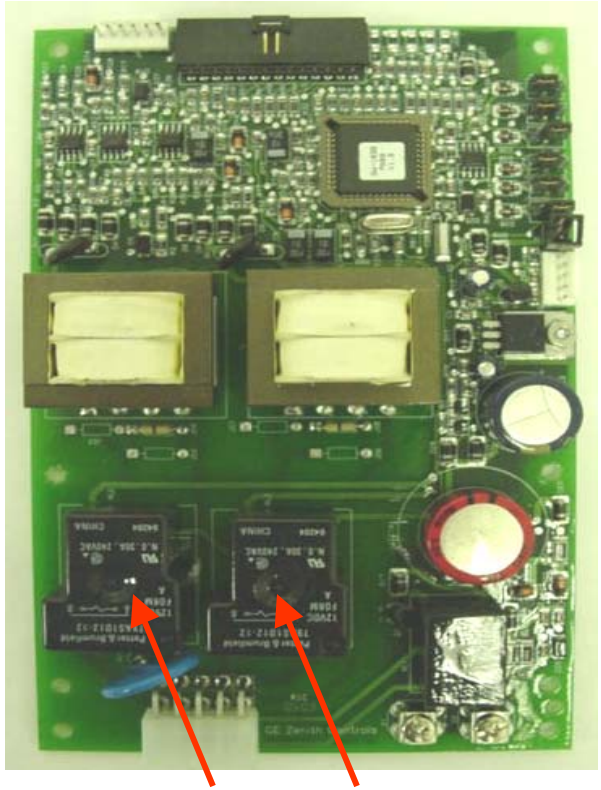
50P-2000, 50P-2006, 50P-2008. 50P-2011

5. Differences in MX60 PCB Assy.



SCR Type

50P-3001, 50P-3002, 50P-3032, 50P-3033



Relay Type

50P-3000, 50P-3003, 50P-3031

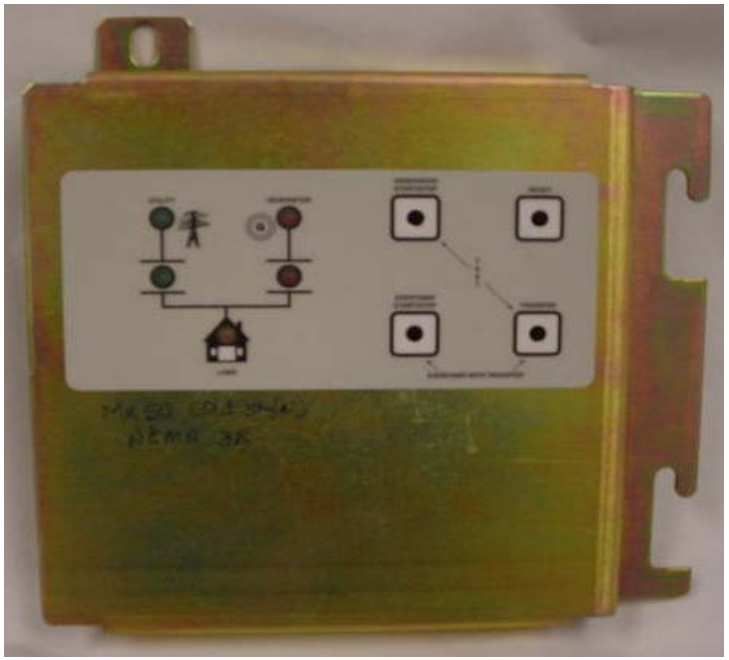
5. Differences in ZTX F17 Key pad

MX60



57P-1158

MX50



57C-1013

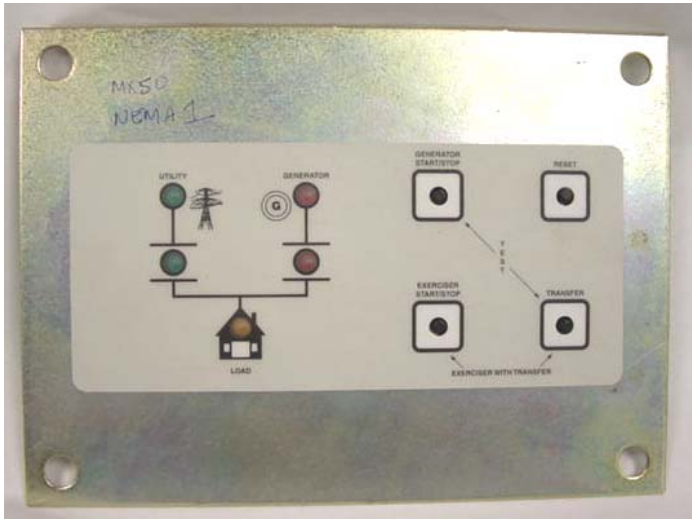
5. Differences in ZTX F14 Key pad

MX60



58P-1207

MX50



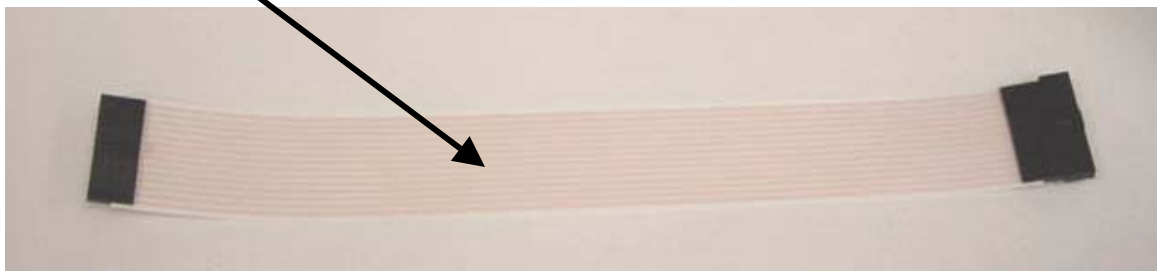
58C-1009

5. Differences in Keypad Extension cable

MX60

50W-1214

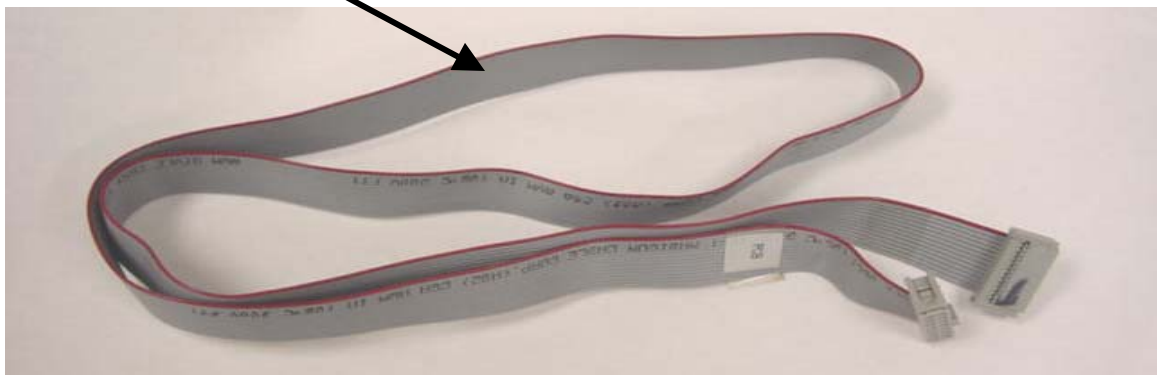
End-to-end length = 12 inches



MX50

57W-1026

End-to-end length = 32 inches



6. ZTX Cabinets

8 different types of ZTX cabinets:

ZTX type	Part number	Description	Dimension (in inches)
F17	F-1551F	Nema-1	24x18x10
	F-1552F	Nema-1	18x18x8
	F-1553F	Nema-3R	24x18x10
	F-1554F	Nema-3R	18x18x8
F14	F-1555F	Nema-1	46x24x14
	F-1556F	Nema-3R	46x24x14
F17	F-1557F	Nema-1	36x24x14
	F-1558F	Nema-3R	36x24x14

6. ZTX Cabinets (cont.)





Nema-1

Nema-3R

7. MX60 Controller Replacement Kits

14 different types of MX60 controller replacement kits:

Phase Type	ATS Type	GEZC Part Number	Description
Three-Phase	F17 (40-225 Amps)	50P-3016-RPL	Replacement kit for 440/480V, 50/60Hz, 3ϕ
		50P-3017-RPL	Replacement kit for 380/416V, 50/60Hz, 3ϕ
		50P-3018-RPL	Replacement kit for 208/220/240V, 50/60Hz, 3ϕ
	F14 (225-400 Amps)	50P-3019-RPL	Replacement kit for 440/480V, 50/60Hz, 3ϕ
		50P-3020-RPL	Replacement kit for 380/416V, 50/60Hz, 3ϕ
		50P-3021-RPL	Replacement kit for 208/220/240V, 50/60Hz, 3ϕ
Single-Phase	F17 (40-225 Amps)	50P-3022-RPL	Replacement kit for 440/480V, 50/60Hz, 1ϕ
		50P-3023-RPL	Replacement kit for 380/416V, 50/60Hz, 1ϕ
		50P-3024-RPL	Replacement kit for 208/220/240V, 50/60Hz, 1ϕ
		50P-3025-RPL	Replacement kit for 120V, 50/60Hz, 1ϕ
	F14 (225-400 Amps)	50P-3026-RPL	Replacement kit for 440/480V, 50/60Hz, 1ϕ
		50P-3027-RPL	Replacement kit for 380/416V, 50/60Hz, 1ϕ
		50P-3028-RPL	Replacement kit for 208/220/240V, 50/60Hz, 1ϕ
		50P-3029-RPL	Replacement kit for 120V, 50/60Hz, 1ϕ

50P-3016-RPL	440/480V 50/60Hz 3Ph kit
	Parts required:
Qty 1	50P-3033 – MX60 Controller
2	50W-1214 – HMI Ext cable
1	57P-1158 – HMI Mini door Assy. (F17)
6	PS-7400 – Cable clip for HMI
1	72R-1000 – O & M manual
1	O-4065 – MX60 ATS Controller & Replacement Instructions
1	PS-8706 – Protective Cover

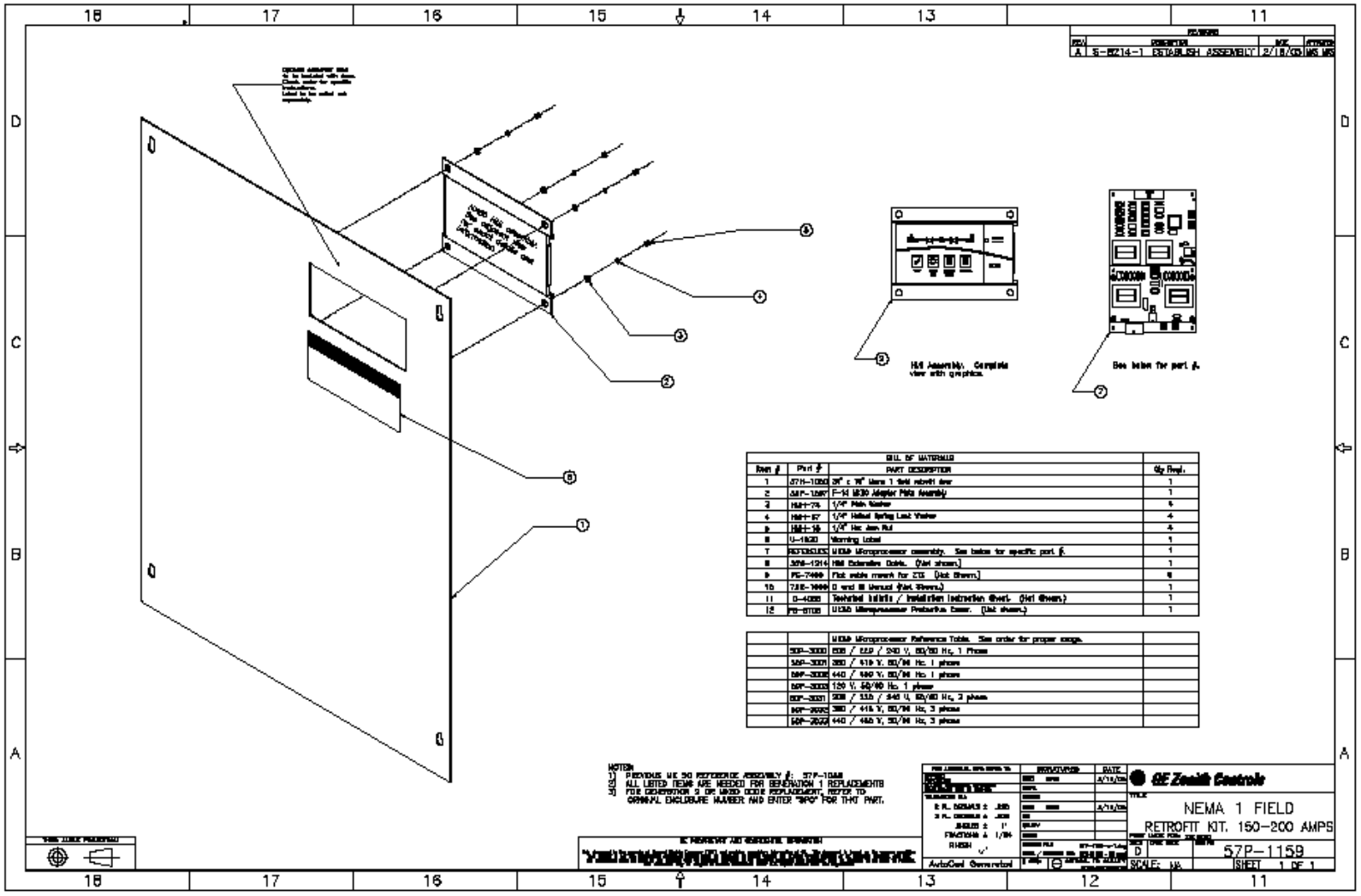
Note: Refer to document O-4065 for complete information

8. ZTX Field Retrofit Door Kits

Part number	Description
57P-1159	MX60 Retrofit Kit 1 for Door Assy Cabinet (F1552F) -- ZTX 40-100A, Nema 1
57P-1160	MX60 Retrofit Kit 2 for Door Assy Cabinet (F1551F) -- ZTX 150-200A, Nema 1
57P-1161	MX60 Retrofit Kit 3 for Door Assy Cabinet (F1554F) -- ZTX 40-100A, Nema 3R
57P-1162	MX60 Retrofit Kit 4 for Door Assy Cabinet (F1553F) -- ZTX 150-200A, Nema 3R
57P-1163	MX60 Retrofit Kit 5 for Door Assy Cabinet (F1557F) -- ZTX 225A, Nema 1
57P-1164	MX60 Retrofit Kit 6 for Door Assy Cabinet (F1558F) -- ZTX 225A, Nema 3R
58P-1213	MX60 Retrofit Kit 7 for Door Assy Cabinet (F1555F) -- ZTX 300-400A, Nema 1
58P-1214	MX60 Retrofit Kit 8 for Door Assy Cabinet (F1556F) -- ZTX 300-400A, Nema 3R

Note: Refer to drawings for detail information

8. ZTX Field Retrofit Door Kits (cont.)

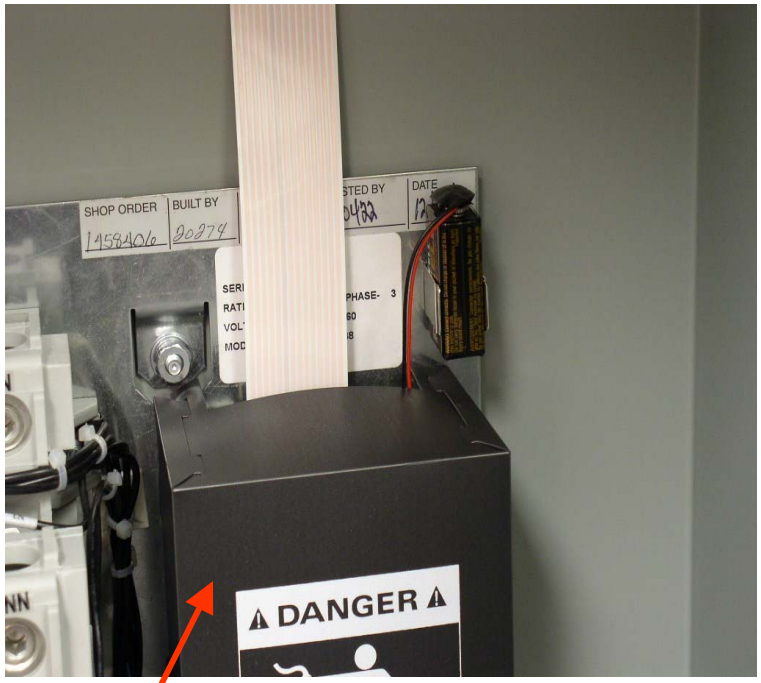


9. Part Number Cross Reference

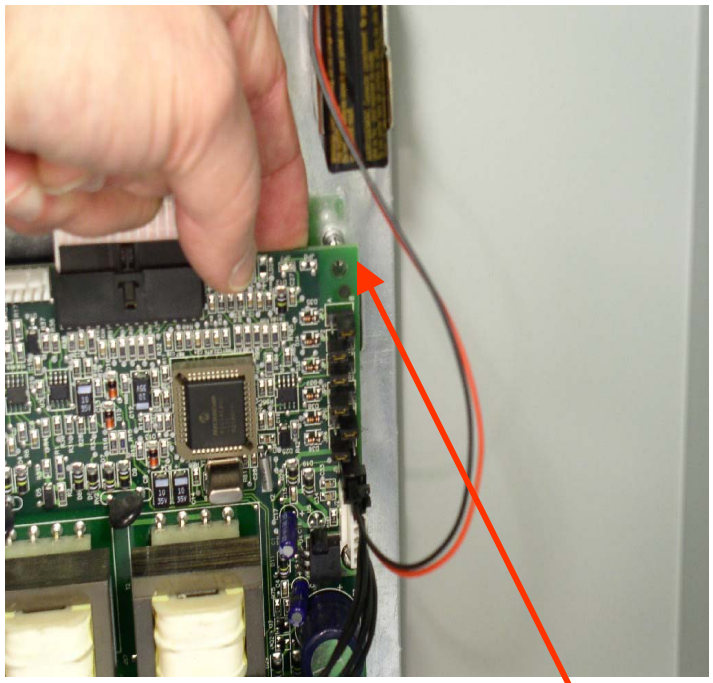
Changes in parts from MX50 to MX60:

MX50 Part Number	MX60 Part Number	Description of Parts
50P-2000	50P-3000	208/220/240V, 50/60Hz, 1ϕ PCB Assembly
50P-2006	50P-3001	380/416V, 50/60Hz, 1ϕ PCB Assembly
50P-2008	50P-3002	440/480V, 50/60Hz, 1ϕ PCB Assembly
50P-2011	50P-3003	120V, 50/60Hz, 1ϕ PCB Assembly
50P-2021	50P-3031	208/220/240V, 50/60Hz, 3ϕ PCB Assembly
50P-2022	50P-3032	380/416V, 50/60Hz, 3ϕ PCB Assembly
50P-2023	50P-3033	440/480V, 50/60Hz, 3ϕ PCB Assembly
57W-1026	50W-1214	HMI Extension Cable
62R-2000	72R-1000	O&M Manual
57C-1013	57P-1158	HMI Mini Door Assy. For F17 ZTX
58C-1009	58P-1207	HMI Adapter Plate Assy. For F14 ZTX

10. Controller Replacement Method



Remove protective cover



Lift each corner of circuit board to remove MX60 controller

Note: Refer to document O-4065 for complete information

11. Overall Installation – F17 ZTX

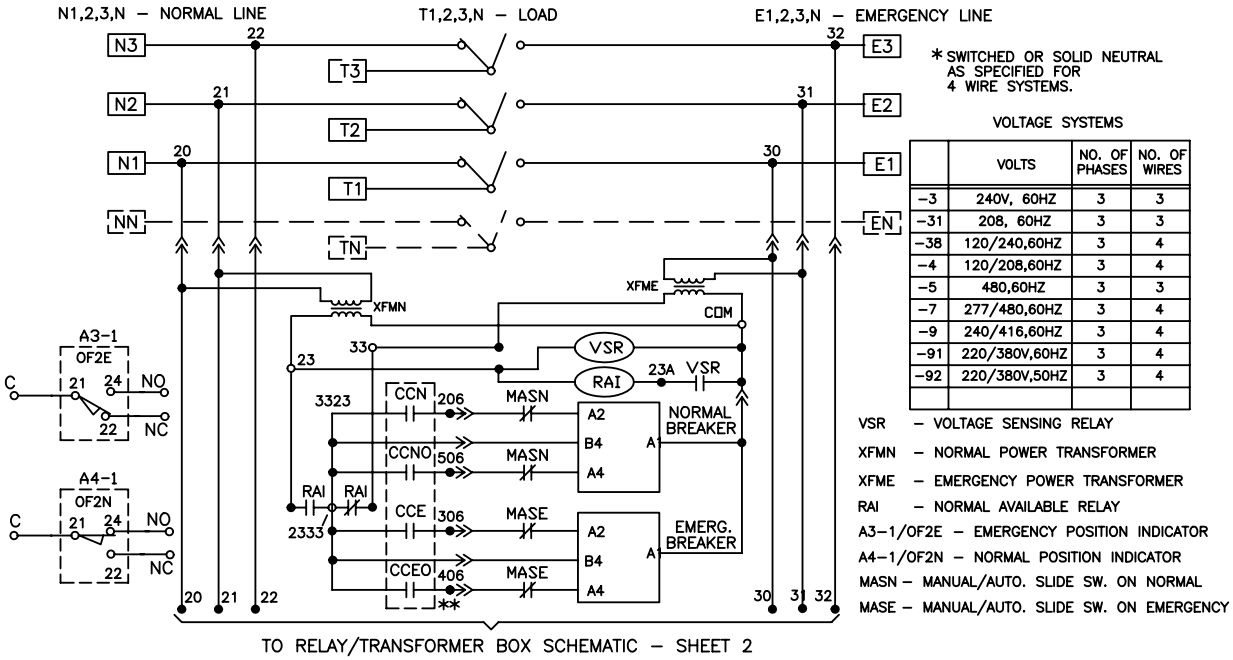


12. Overall Installation – F14 ZTX



13. FAQ

POWER CIRCUIT SCHEMATIC



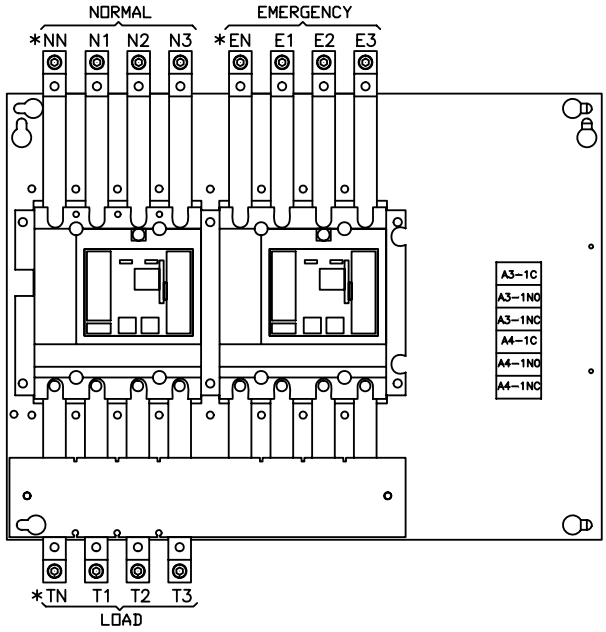
* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEMS.

VOLTAGE SYSTEMS

	VOLTS	NO. OF PHASES	NO. OF WIRES
-3	240V, 60HZ	3	3
-31	208, 60HZ	3	3
-38	120/240,60HZ	3	4
-4	120/208,60HZ	3	4
-5	480,60HZ	3	3
-7	277/480,60HZ	3	4
-9	240/416,60HZ	3	4
-91	220/380V,60HZ	3	4
-92	220/380V,50HZ	3	4

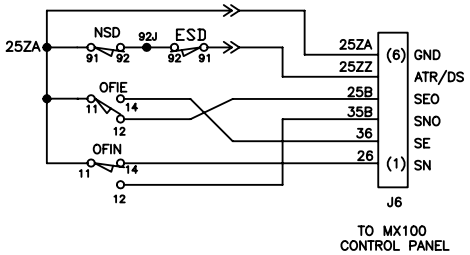
VSR – VOLTAGE SENSING RELAY
XFMN – NORMAL POWER TRANSFORMER
XFME – EMERGENCY POWER TRANSFORMER
RAI – NORMAL AVAILABLE RELAY
A3-1/OF2E – EMERGENCY POSITION INDICATOR
A4-1/OF2N – NORMAL POSITION INDICATOR
MASN – MANUAL/AUTO. SLIDE SW. ON NORMAL
MASE – MANUAL/AUTO. SLIDE SW. ON EMERGENCY

POWER PANEL LAYOUT



NOTE: LINE BUS REQUIRED 225 AMP ONLY

LIMIT SWITCH SCHEMATIC



ATR/DS – ENABLE INPUT
SE – EMERGENCY POSITION INPUT
SN – NORMAL POSITION INPUT
SNO – NORMAL OPEN POSITION INPUT
SEO – EMERGENCY OPEN POSITION INPUT
OFIE – EMERGENCY POSITION INDICATOR
ESD – EMERGENCY TRIP INDICATOR
OFIN – NORMAL POSITION INDICATOR
NSD – NORMAL TRIP INDICATOR

LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —○— WIRE ON TERMINAL BLOCK —≫— WIRE IN INTERCONNECT PLUG * OPTIONAL ** LOCATED ON RELAY/ TRANSFORMER BOX	LEGEND, OPERATION, AND ACCESSORIES: 51A-0900 FOR PRODUCTION ONLY: R/T BOX AND PLUGS – SHEET 2 OF 2 MX100 CONTROLLER – 51A-3000	ZTC SHOWN IN NORMAL POSITION, NO POWER AVAILABLE IN THE AUTOMATIC MODE.

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
A	S-6141-2	05/09/95	BRB	JC
B	S-6141-2	11/16/95	RMC	SB
C	S-6141-A	01/12/96	SDW	SB
D	S-6523	07/16/96	ALA	WPP

ZENITH CONTROLS, INC.

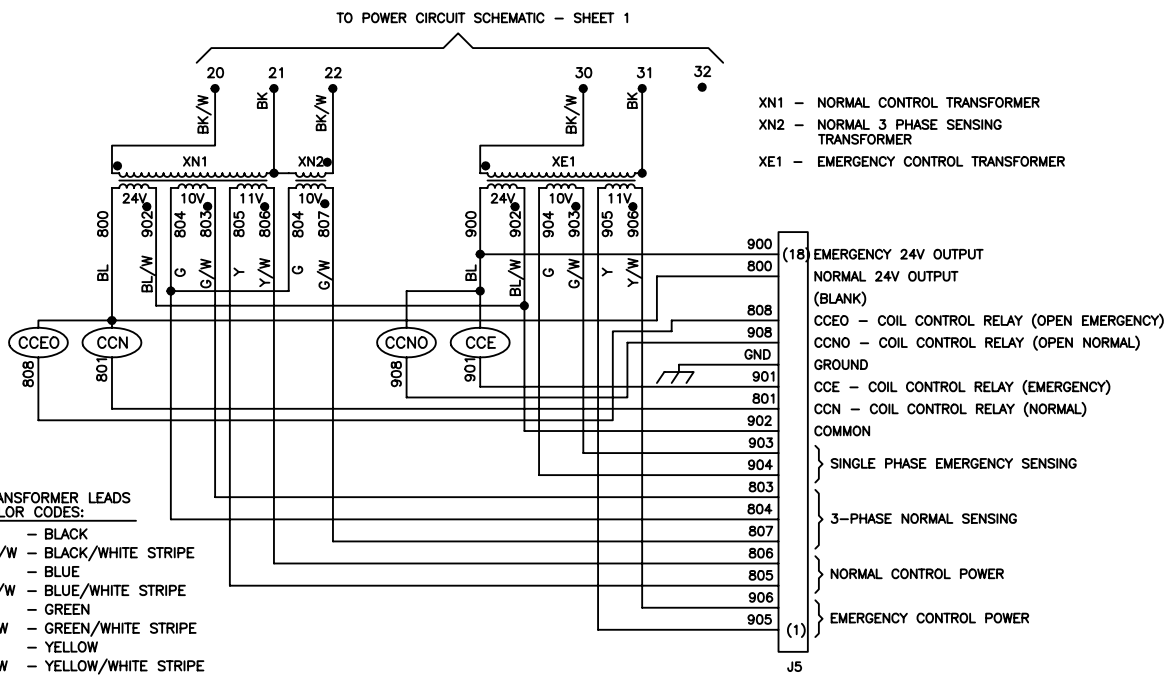
TITLE: POWER CIRCUIT & LIMIT SWITCHES
MODEL: ZTC (40-400 AMP UL)(40-630 AMP IEC)

DRFT: BRB	DATE:	SCALE:	CHK:	APPD:
ENGR: JC	05/09/95	N/A		

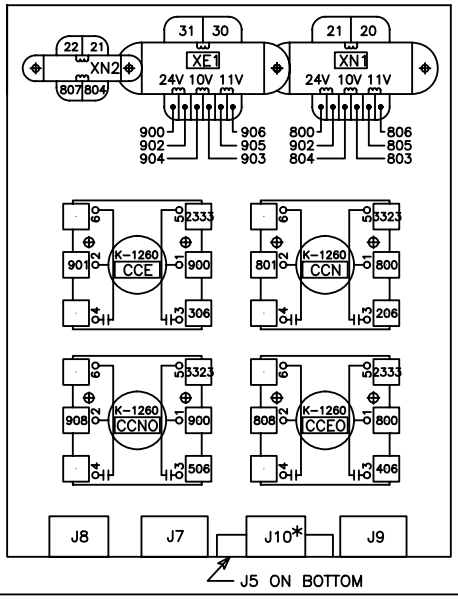
DWG NO.: 51A-1000 REV D
CADD: S5K SHT. 1 OF 2

ORIGINAL

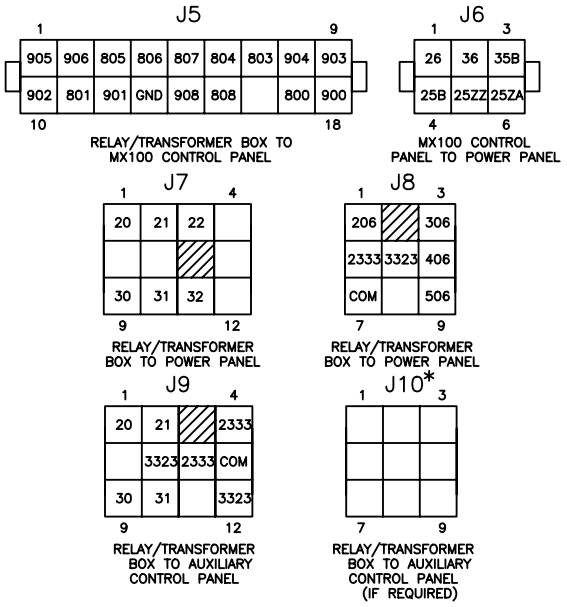
RELAY/TRANSFORMER BOX SCHEMATIC



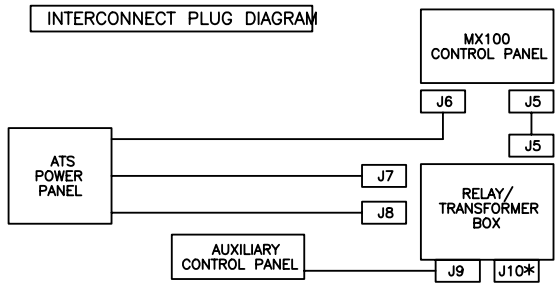
RELAY/TRANSFORMER BOX



INTERCONNECT PLUGS



INTERCONNECT PLUG DIAGRAM



LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —○— WIRE ON TERMINAL BLOCK —≫— WIRE IN INTERCONNECT PLUG * OPTIONAL		

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
A	S-6141-2	05/09/95	BRB	JC
B	S-6141-2	11/16/95	RMC	SB
C	S-6141-A	01/12/96	SDW	SB
D	S-6523	07/16/96	ALA	WPP

ZENITH CONTROLS, INC.

TITLE: RELAY/XFR. BOX & INTERCONNECT PLUGS

MODEL: ZTC (40–400 AMP UL)(40–630 AMP IEC)

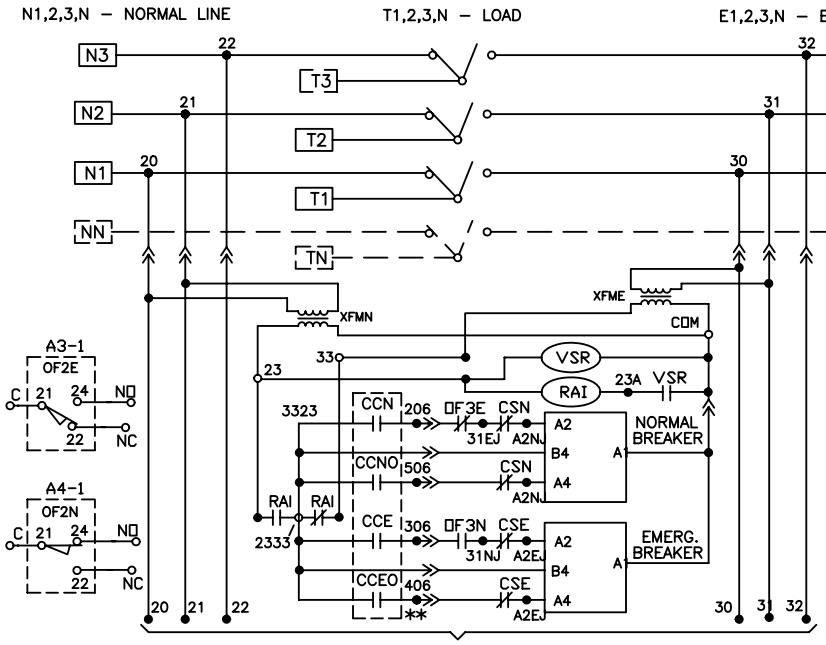
DRFT: BRB	DATE:	SCALE:	CHK:	APPD:
ENGR: JC	05/08/95	N/A		

DWG NO.: 51A–1000 REV: D

CADD: S5K SHT. 2 OF 2

ORIGINAL

POWER CIRCUIT SCHEMATIC



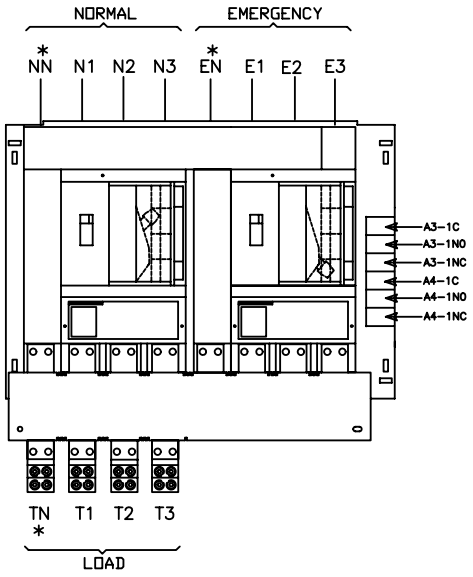
* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEMS.

VOLTAGE SYSTEMS

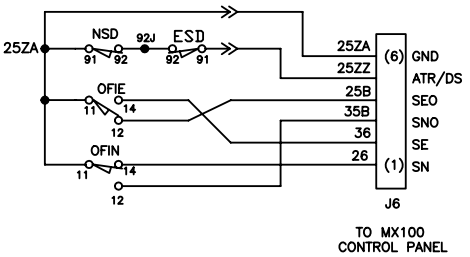
	VOLTS	NO. OF PHASES	NO. OF WIRES
-3	240V, 60HZ	3	3
-31	208, 60HZ	3	3
-38	120/240,60HZ	3	4
-4	120/208,60HZ	3	4
-5	480,60HZ	3	3
-7	277/480,60HZ	3	4
-9	240/416,60HZ	3	4
-91	220/380V,60HZ	3	4
-92	220/380V,50HZ	3	4

VSR – VOLTAGE SENSING RELAY
XFMN – NORMAL POWER TRANSFORMER
XFME – EMERGENCY POWER TRANSFORMER
RAI – NORMAL AVAILABLE RELAY
CSN – NORMAL COVER SWITCH (AUTO/MANUAL)
CSE – EMERGENCY COVER SWITCH (AUTO/MANUAL)
A3-1/OF2E – EMERGENCY POSITION INDICATOR
A4-1/OF2N – NORMAL POSITION INDICATOR
OF3E – EMERGENCY ELECTRICAL INTERLOCK
OF3N – NORMAL ELECTRICAL INTERLOCK

POWER PANEL LAYOUT



LIMIT SWITCH SCHEMATIC



ATR/DS – ENABLE INPUT
SE – EMERGENCY POSITION INPUT
SN – NORMAL POSITION INPUT
SNO – NORMAL OPEN POSITION INPUT
SEO – EMERGENCY OPEN POSITION INPUT
OFIE – EMERGENCY POSITION INDICATOR
ESD – EMERGENCY TRIP INDICATOR
OFIN – NORMAL POSITION INDICATOR
NSD – NORMAL TRIP INDICATOR

LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —○— WIRE ON TERMINAL BLOCK —≫— WIRE IN INTERCONNECT PLUG * OPTIONAL ** LOCATED ON RELAY/ TRANSFORMER BOX	LEGEND, OPERATION, AND ACCESSORIES: 51A-0900 FOR PRODUCTION ONLY: R/T BOX AND PLUGS – SHEET 2 OF 2 MX100 CONTROLLER – 51A-3000	ZTC SHOWN IN NORMAL POSITION, WITH NO POWER AVAILABLE.

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
A	S-6141-2	05/09/95	BRB	JC
B	S-6141-2	11/16/95	RMC	SB
C	S-6141-A	01/12/96	SDW	SB
D	S-6141	03/25/96	ALA	WPP
E	S-6523	07/11/96	ALA	WPP

ZENITH CONTROLS, INC.

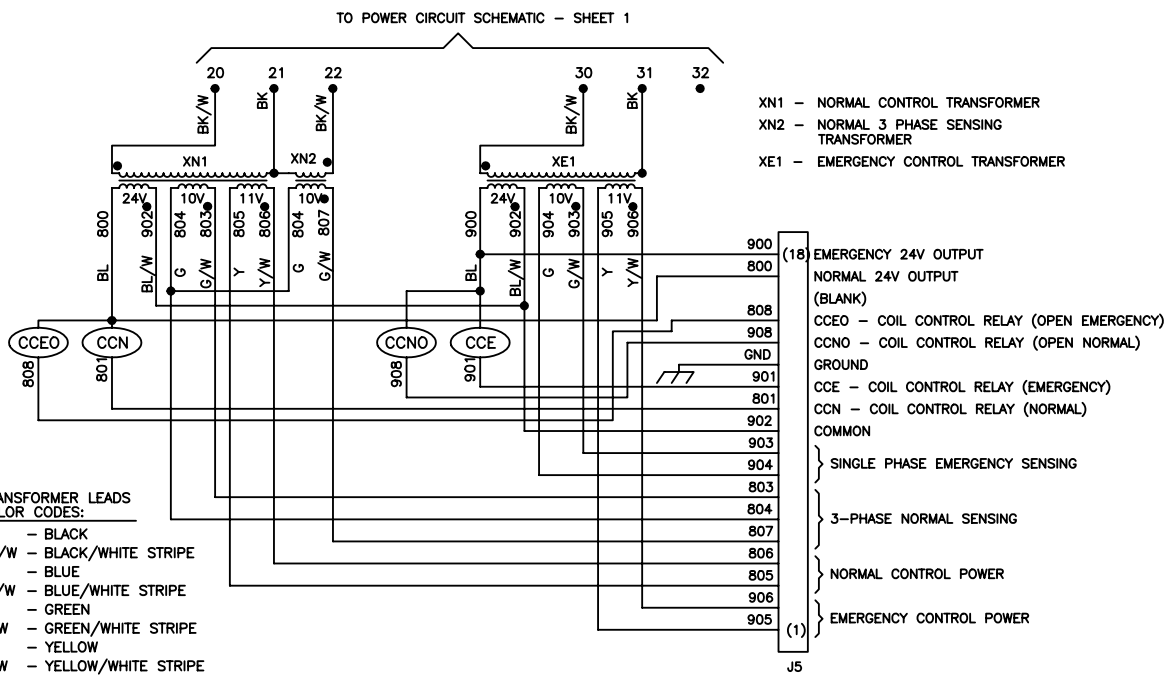
TITLE: POWER CIRCUIT & LIMIT SWITCHES
MODEL: ZTC (500-1000 AMP UL)(700-1250 AMP IEC)

DRFT: BRB	DATE:	SCALE:	CHK:	APPD:
ENGR: JC	05/09/95	N/A		

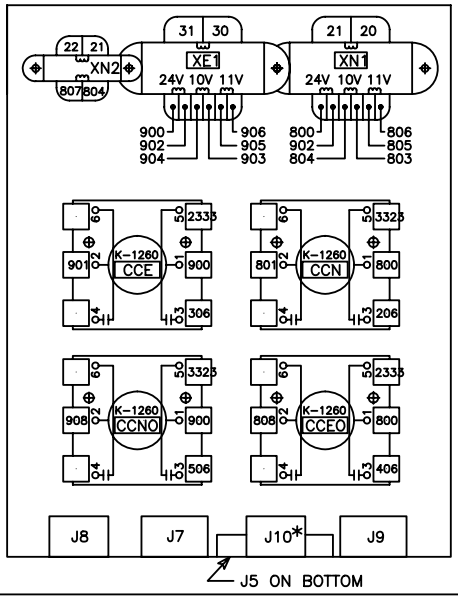
DWG NO.: 51A-2000 E
CADD: S5K SHT. 1 OF2 REV

ORIGINAL

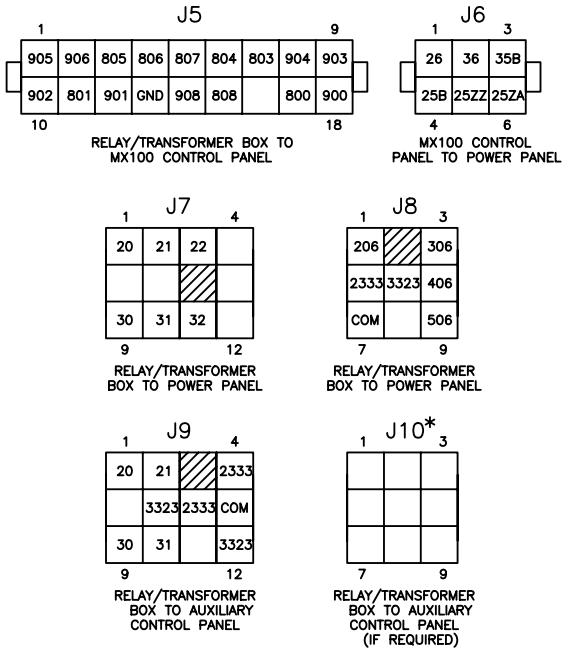
RELAY/TRANSFORMER BOX SCHEMATIC



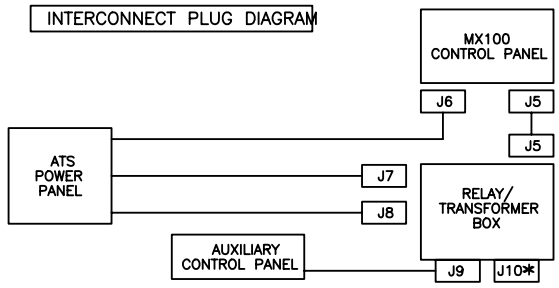
RELAY/TRANSFORMER BOX



INTERCONNECT PLUGS



INTERCONNECT PLUG DIAGRAM



LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —○— WIRE ON TERMINAL BLOCK —≫— WIRE IN INTERCONNECT PLUG * OPTIONAL		

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
A	S-6141-2	05/09/95	BRB	JC
B	S-6141-2	11/16/95	RMC	SB
C	S-6141-A	01/12/96	SDW	SB
D	S-6141	03/25/96	ALA	WPP
E	S-6523	07/11/96	ALA	WPP

ZENITH CONTROLS, INC.

TITLE: RELAY/XFR. BOX & INTERCONNECT PLUGS

MODEL: ZTC (500–1000 AMP UL)(700–1250 AMP IEC)

DRFT: BRB	DATE:	SCALE:	CHK:	APPD:
ENGR: JC	05/09/95	N/A		

DWG NO.: 51A–2000 REV: E

CADD: S5K SHT. 2 OF 2

ORIGINAL

Model ZTSSL
Closed Transition Soft Load Transfer Switches



GE Zenith ZTSSL Series Transfer Switches combine traditional switching of the utility supply to a backup generator source with the capability for soft load transfers between the sources and continuous paralleling of the generator set to the utility supply. The ZTSSL transfers power using proven GE Zenith Closed-Transition Transfer Switches (ZTSCT).

Traditional transfer switch functionally with soft load return to utility.

The ZTSSL is normally set for Automatic Mains Failures (AMF) mode. In this mode of operation, the switch will monitor the utility supply and automatically connect the load to the generator supply in the event of a utility supply outage. When utility power returns, the ZTSSL will automatically transfer the load back to the utility supply using a programmed soft transfer operation, with no block unloading of the generator set and no power quality transients inherent to traditional open or quick make-before-break closed transition switching.

Continuous Utility Paralleling

In continuous parallel mode the ZTSSL has the capability of connecting a generator set to the utility supply for long-term parallel operation, or transferring load seamlessly between the utility supply and the generator. The ZTSSL can be configured for either continuous **base loading** of the generator set or **variable loading** of the generator set to maintain a pre-set utility import or export kW value. The generator set can be used to supply peak loads and reduce high electrical demand charges that can occur if a facility has periods of high kW demand. The ZTSSL and generator set can also be used to supply the entire switch load, completely isolated from the utility supply, for storm anticipation or required maintenance of the utility supply equipment.

Fast Utility Approval

As local utility company approval is often required when generators are paralleled with the utility for any sustained period of time, the GE Zenith ZTSSL comes standard with a utility-grade GE Multilin protective relay package that has broad capabilities for tailoring to local utility requirements and is pre-approved by many utility companies.

Proven Technology

The ZTSSL utilizes a Woodward GCP-32 Integrated Softload Control module for active synchronization and loading control of the generator set. Woodward's 75 years of experience in governing systems, combined with GE Zenith's 80 years of power switching experience come together in a highly functional yet easy-to-operate configuration specifically tailored to the requirements of utility and industrial peak shaving applications.

Available Remote Monitoring

The ZTSSL can be coupled with GE Zenith's EnerVista™ Viewpoint Monitoring™ software for local or remote monitoring and essential control of transfer switch operations. EnerVista™ Viewpoint is a powerful monitoring package providing access to detailed metering parameters, harmonics, and even waveform captures during outage and fault events. In addition to GE Zenith controllers, EnerVista™ Viewpoint provides single-click monitoring of all GE Multilin devices, EPM meters, and GE MicroVersa Breaker Trip Units and third-party devices.

Description and Operation

ZTSSL Closed Transition Soft Load switches have four modes of operation.

Auto Mains Failure (AMF):
During a failure of the utility supply, the ZTSSL operates as a standard open transition switch, starting the generator set and connecting the load to the generator supply. Upon return of the utility supply, the ZTSSL initiates a closed transition, soft-ramp retransfer of the load back to the utility supply. The ZTSSL accomplishes retransfer by actively synchronizing the generator set to the utility, closing the utility supply to the generator, then soft transferring the load to the utility supply. When the generator load reaches a preset minimum value, the ZTSSL disconnects the load from the generator supply to permit supply of the load exclusively from the utility supply. The ZTSSL initiates cool-down mode and shuts down the generator in readiness for the next operation.

Soft Load Transfer to Gen:
With utility supply present, the ZTSSL starts the generator set, synchronizes it to the utility supply, and parallels the generator set to the utility. The ZTSSL then performs a soft transfer of the load from the utility supply to the generator set, at an adjustable rate, until the kW supplied by the utility reaches a programmed preset value, typically 5%-10% of the load rating. Upon reaching this set point, the ZTSSL disconnects from the utility supply to permit supply of the load exclusively from the generator set. Upon deactivation of the Soft Load Transfer to Gen mode, the ZTSSL re-synchronizes the generator with the utility supply, parallels to the utility, and transfers the load back to the utility supply in a soft, controlled ramp fashion.
After load retransfer, the ZTSSL initiates cool-down mode and shuts down the generator in readiness for the next operation.

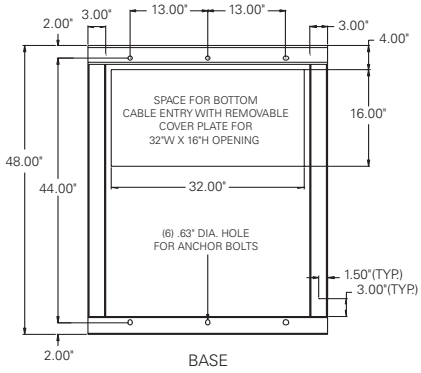
Continuous Utility Parallel - Base Load
With the utility supply present, the ZTSSL starts the generator set, synchronizes it to the utility supply, and parallels the generator set to the utility. The ZTSSL ramp-loads the generator set, at programmable rate, to the utility supply until the load on the generator set reaches the preset programmed Base Load setting, typically 80%-100% of the generator set's rating. Upon deactivation of the Base Load mode, the ZTSSL ramp-unloads the generator set to a preset programmed minimum value. Upon reaching this set point, the ZTSSL disconnects the generator from the utility supply. After load retransfer, the ZTSSL initiates cool-down mode and shuts down the generator set in readiness for the next operation.

Continuous Utility Parallel - Import/Export
Similar to the Base Load mode, with the difference that when both sources are paralleled the ZTSSL actively controls the load of the generator set to maintain a programmed preset import (kW flow from utility to load) or export (kW flow through the utility supply) level.

Application Information:

- ZTSSL switches are compatible with generator sets that include an engine governing system capable of receiving a +/- 20mA, +/- 10VDC, or PWM speed/power bias command from the ZTSSL.
- Includes standard key-operated mode switches for:
  - Transition Mode Selector (TMS), 3 Position:
    (Open, Closed, Softload): Selects re-transfer mode to utility supply & transfer mode to to/from generator set during Test with Load operations.
  - System Mode(SMS), 3 Position:
    (Manual Transfer to Gen, Auto, Manual Peak Shave): Manual Transfer to Gen - Transfer entire Load to Genset (using transfer mode selected using TMS), and isolate from utility supply. Auto - Auto Start/Connect to Genset on Loss of Utility. Manual Peak Shave - Start/Sync/Connect and Maintained Parallel of Genset with Utility Supply.
  - Reset Pushbutton: Momentary Pushbutton Unlatches the Engine Summary Shutdown and Summary Warnings indicating lights (alarm signals from generator set control panel).
  - Peak Shave Mode Switch (PSM), 2 position:
    (Gen Base Load, Import/Export): Gen Base Load - Genset carries pre-set kW/Base Load (setpoint via GCP Keypad) Import/Export - Genset load varies to keep Utility supply kW at preset Import or Export setpoint (setpoint via GCP Keypad).
- Optional control switches and functions include:
  - Local/Remote Switch, 3 position: (Remote, Local, Lockout) Remote - Enables local customer control contacts and remote activation (via Enervista Viewpoint Monitoring) of System Mode (Xfer to Gen, Peak Shave Base Load, Peak Shave I/E). Local - Disables local customer control contacts and remote activation of System modes. Lockout - Locks out engine generator set. Inhibits starting of Generator in all modes.
  - Auto Peak Shave Mode Switch, 2 position:
    (On/Enable, Off/Disable): Auto Start of Gen for Gen Base or Import/Export Control (depending on Peak Shave Mode Switch position). Utility import kW set in Multilin G30 Relay.
- Includes standard 5-point LED annunciator for Utility supply:
  - Red - Utility Failure
  - Green - Utility Available
  - Green - Timing to Re-Transfer
  - Red - Utility Connected
  - Red - Utility Lockout
- Includes standard 5-point LED annunciator for the Generator supply:
  - Red - Generator Common Shutdown
  - Amber - Generator Common Alarm
  - Green - Generator Available
  - Red - Generator Connected
  - Red - Generator Not in Auto
- Includes standard Utility Grade protective relaying and metering for both the utility supply and generator source via GE Multilin G30 Generator Protection System relay.
- Includes GE EnerVista™ LaunchPad software for G30 relay setup and programming.
- Optional Hardwired Genset Alarm Interface Module (GIF1), Displays the following engine alarms on LCD display of GCP-32 (requires 1 form-A dry contact from engine control panel for each alarm point).
  [NOTE: Used for Cat EMCP 3.3 systems]
  - Engine Summary Shutdown & Pre-Alarm
  - Engine Not In Auto
  - Engine Running
  - High Engine Temperature (Shudown and Pre-alarm)
  - Low Oil Pressure (2 stage, alarm & Shutdown)
  - Engine Overcrank
  - Engine Overspeed
  - Low Fuel Main Tank
  - Low Battery Voltage
  - Battery Charger AC Failure
  - Emergency Stop
  - Air Shutdown Damper

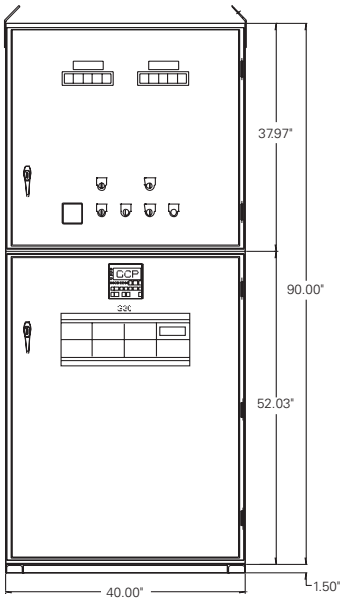
  (Specify mouting within GE Zenith panel or ship loose for mouting on Genset (reduced hardwiring from Genset to GE Zenith control panel).



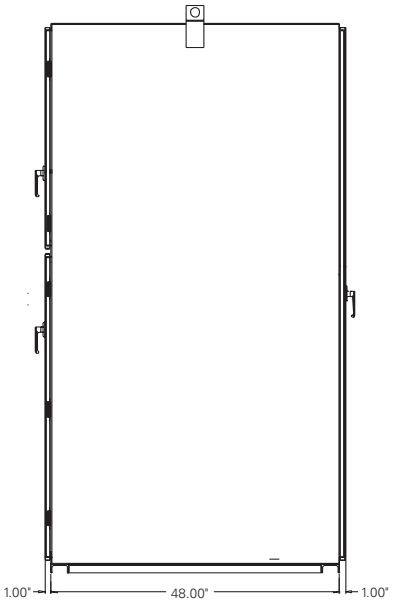
BASE

Application Notes:

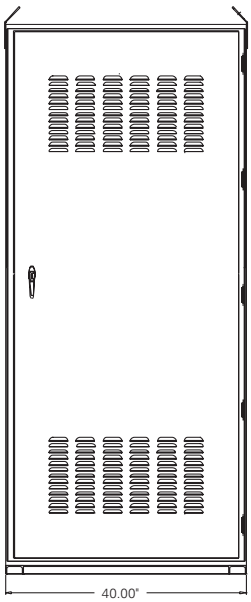
1. Louvers opening shall not permit the entrance of a rod having a diameter greater than 1/2".
2. Cabinet shall be NEMA-1 type enclosure painted with ANSI 61 grey.
3. ID nameplates provided on front door of cubicle and attached to the panel with two screws.
4. Front doors will have 1 handle each with 2-point latch, rear door with 3-point latch, keyed alike.
5. All nameplates shall have white lettering on a black phenolic background.
6. Cabinet to be listed under UL891.
7. All bus bars shall be silver-plated.



FRONT VIEW



RIGHT SIDE



REAR VIEW

Application Information *(continued)*:

- Optional Network Genset Alarm Interface Module (GIF2), Displays above engine alarms from Catarpillar Communications Control Module (CCM). CCM Provided by others. [Use for Cat EMCP2].
- Optional Engine Exerciser Module (EXE1), GE Grasslin talento™ 892
  - 2 channel, electronic time switch
  - Channels for Test No Load (Gen Start/Stop) and Test With Load.
  - Capable of 400 programmed events.
  - Each time switch offers daily, weekly or annual programming capability, with up to 99 separate holiday periods of any duration and priority.
  - Automatic or user selectable daylight savings time change-over shall be incorporated through the year 2095.
  - Includes LCD Display indicating current time, date, switch contact status and program schedule.

AL-CU UL Listed Solderless Screw-Type Terminals for External Power Connections

Switch Size Amps	Normal, Emergency, & Load Terminals		Switch Size Amps	Normal Emergency, & Load Terminals	
	Cables/ Pole	Wire Ranges		Cables/ Pole	Wire Ranges
600	2	#2 AWG to 600MCM	1600	5	#2 AWG to 600 MCM
800	3	#2 AWG to 600 MCM	2000	6	#2 AWG to 600 MCM
1000	3	#2 AWG to 600 MCM	3000	8	#2 AWG to 600 MCM
1200	4	#2 AWG to 600 MCM			

Withstand Closing Rating @ 480V (UL)

Amperage	Coordinated Breaker	Any Breaker
600, 800	65	50
1000, 1200	85	50
1600-3000	100	100

Electrical Ratings

- Ratings 600 to 3000 amperes
- 3 or 4 Poles
- Available in Transfer Switch (ZTSSL) or Transfer/Bypass Switch (ZBTSSL) styles
- Suitable for emergency and standby applications on all classes of load,
- UL 1008 listed at 480 VAC
- CSA certified at 600 VAC
- IEC listed at 480 VAC

Performance Features

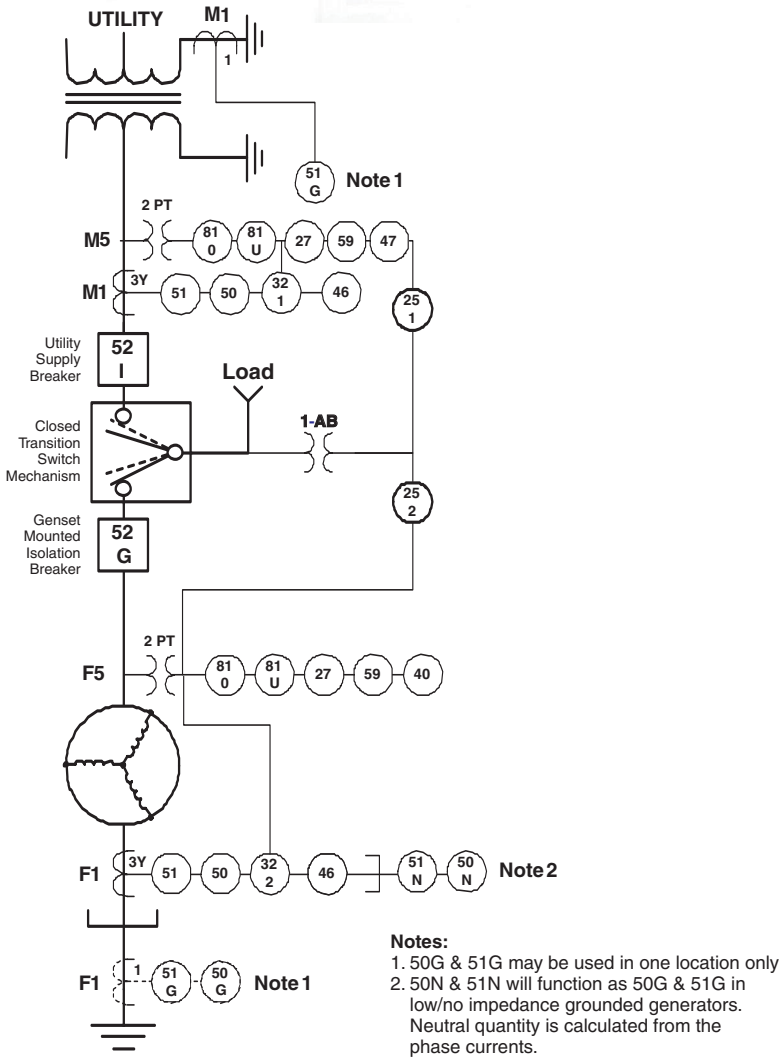
- Auto Mains Failure (AMF) auto start/stop
- Utility grade protective relaying with 0.25%-0.5% voltage and current metering accuracy
- Active synchronization and sync check functionality
- Closed-loop control of Generator speed, voltage, kW, pF via digital or analog bias output.
- Communication with GE EnerVista™ Viewpoint Monitoring software.

Design and Construction Features

- Electrically operated, mechanically held
- Segmented silver tungsten alloy contacts with separate arcing contacts on all sizes
- Arc quenching grids, enclosed arc chambers, and wide contact air gap
- Components accessible for inspection and maintenance without removal of the switch or the power conductors
- Standard LED annunciation and optional EnerVista™ Viewpoint™ Monitoring software package for remote monitoring and control
- Active control of the generator governor utilizing a Woodward GCP-32 integrated control module.

Model ZTSSL
Multilin G30 Utility Grade Protective Relay Scheme





Notes:
1. 50G & 51G may be used in one location only
2. 50N & 51N will function as 50G & 51G in low/no impedance grounded generators. Neutral quantity is calculated from the phase currents.

Key Features and Benefits

Utility Grade Protection
For both generator and utility supply.

Full Source Metering
Current, voltage, power, energy, frequency for both sources.

Waveform Capture
3840 samples per second eliminates need for digital fault recorders

Event Recording
Up to 1024 time tagged events, with fast 0.5ms recording accurracy.

Data Logging
Up to 16 channels with user selectable sampling rates from 1 second to 1 hour.

Fault Reports
User programmable

Customized Protection
Protection and control functions set rhough flexible programming tools (FlexLogix™, FlexCurves™ and FlexElements™)

Simple Setup and Calibration
Using Enervista Launchpad™ programming software.

GE Consumer & Industrial

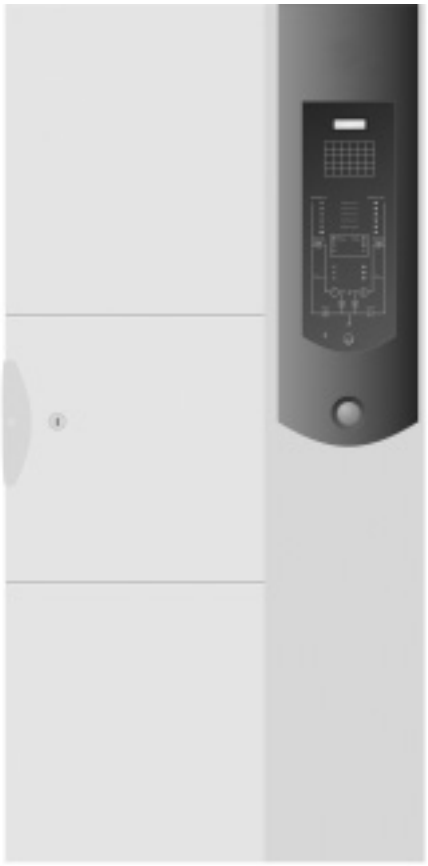
Zenith Controls Product Team - General Electric Company
701 E 22nd Street, Lombard, IL 60148 USA
773 299-6600, Fax: 630 652-4501
www.geelectrical.com
Contents contained in this document are subject to change without notice. Contact GE to verify details.

GE Zenith Controls

Product Bulletin

LVSTS Series
Low Voltage Subcycle Transfer Switch
100 - 600A, 208 - 480VAC

The GE Zenith family of Low Voltage Static Transfer Switches (LVSTS) are designed to provide the highest quality in safe, fast transfer of source power. Inside the LVSTS, you'll find Silicon Power's world class thyristors. This ensures you'll get the most advanced technology and the highest quality in solid-state switching. Our engineers have taken every step to ensure that your processes are not interrupted by problems on the power lines, so that expensive downtime can be virtually eliminated.



Our subcycle transfer switches meet UL 1008, and are designed to withstand normal operating overload conditions and fault conditions up to 100 kA. Availability of top and bottom cable access eases installation, resulting in lower total cost for incorporating transfer switch equipment.

Our small footprint and advanced styling allow for easy incorporation into your existing facility. Convection cooling in our 100-400A units minimizes workplace noise, while optional redundant-fan forced air-cooling offers a reduced footprint. Integrated circuit breakers provide internal backup protection, eliminating costly fuses, and allowing for quick, easy system restoration after circuit faults up to 100 kA. Following an overload or circuit fault condition, only a simple reset is needed to return the LVSTS to full service, protecting your equipment. This capability, combined with superior maintenance access, provides you with a ***reduced total cost of ownership***.

EMPOWERED BY SILICON POWER

Assuring Continuous Power Quality for:

- Internet Facilities
- Data Centers
- Hospitals
- Emergency Services (911) Centers
- Transportation Signaling and Control
- Chemical/Pharmaceutical Manufacturing
- Food Processing
- Semiconductor Manufacturing
- OEM Applications
- Your own mission-critical application

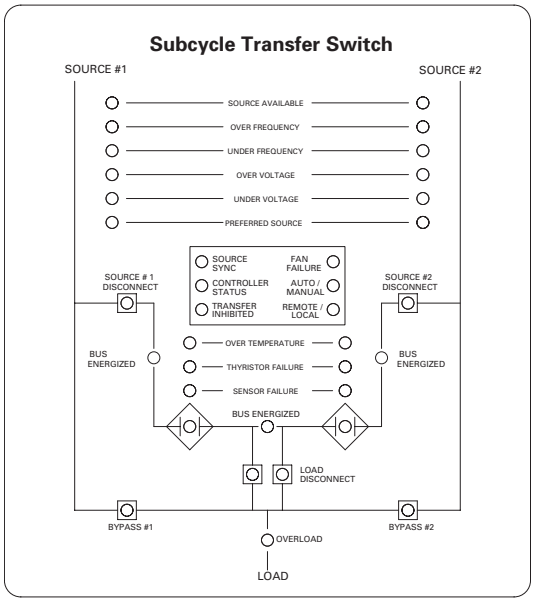
Specifications

Electrical and Mechanical

- Voltages:
  208/220/230/240/380/480/600VAC,
  3-phase, 3- or 4-wire; 3- or 4-pole switching
  - Other voltages and power distribution options also available; consult factory
- Current ratings – 100A, 225A, 400A, 600A, 800A, 1200A, 1600A, 2000A, 3000A, 4000A
- Static Switch fully rated at 100% continuous current
- Repeatable withstand ratings exceed UL 1008 requirements*
  - Standard repeatable withstand of 22 kA minimum, maximum withstand up to 100 kA
  - Higher repeatable withstand ratings to 65 kA and above also available; consult factory
- Source sees open-transition transfer (load sees closed-transition per ITIC curve) – sources are never interconnected
- Operates with any power factor
- Efficiency of 99.5% at 0.8 power factor
- Meets UL 1008, CE, CSA, cUL, NEMA, OSHA, FCC, and NEC specifications
- 50Hz and 60Hz models
- Operating temperature – 0°- 55°C
- Sense and transfer time ≤ ¼ cycle (4 ms)
- Circuit breaker configurations (plug-in):
  - 5 circuit breakers
  - 6 circuit breakers – redundant load break
  - LSIG protection available

** Lower fault withstand ratings at 50 Hz*

Subcycle Transfer Switch Schematic



Communications

- RS-485
- RS-232
- SCADA
- TCP/IP Ethernet

Physical Specifications

- ***3-Pole Switching***

Convection Cooled

	100A	225A	400A
Weight (lbs.)	1360	1400	1500
Width (in.)	36	36	36
Depth (in.)	36	36	36
Height (in.)	74	74	74
SCR Heat (BTU/hr)	1125	2532	4501

Forced Air Cooled

	100A	225A	400A	600A
Weight (lbs.)	1250	1300	1400	1500
Width (in.)	30	30	30	36
Depth (in.)	30	30	30	36
Height (in.)	74	74	74	74
Fans (HP)	1 x ¼	2 x ¼	2 x ¼	2 x ¼
SCR Heat (BTU/hr)	1125	2532	4501	6751

Features	Benefits
Silicon Power SCR/thyristors	Superior technology and the highest quality in solid-state switching; excellent thermal response characteristics ensures highest withstand and reliability available anywhere.
SCRs/thyristors and breakers fully rated for load	No “upsizing” required due to device derating
Control power UPS	Enhanced control reliability
Plug-in circuit breaker protection	Additional fault protection; isolate thyristors when required
100% duty cycle rated circuit breakers	Circuit breakers are rated at 100% – no false tripping
Kirk key interlocks for bypass	Allows maintenance while keeping downstream loads energized; prevents source-to-source interconnection
Front panel touch screen with mimic bus	User-friendly control interface
Top, bottom or side cable access	We fit your installation requirements, not vice-versa
Front, rear and side service access	I/R scan friendly, reduced maintenance time
Redundant fan cooling with alarm	Ensures safe, consistent operation
Custom door style, paint color and labeling available	Customize the LVSTS appearance to complement and match existing equipment
Meets UL 1008, CE, CSA, CUL	Full agency approvals for international use
Optional N+1 redundant SCR modules	Provides enhanced reliability for the most demanding ultra-mission critical commercial, government and military applications
Optional transient voltage surge protection	Added protection against severe transients

LVSTS Ordering Data

ZLS– A 6 H 3 S 5 N 1 B B

4 5 6 7 8 9 10 11 12 13

DIGIT 4

Voltage	Digit Code
208	A
220	B
380	C
400	D
480	E
575	F
600	G

DIGIT 5

Freq.(Hz.)	Digit Code
60	6
50	5

DIGIT 6

Current	Digit Code
100	H
225	I
400	J
600	K
800	L
1200	M
1600	N
2000	P
3000	Q
4000	R

DIGIT 7

Poles	Digit Code
3	3
4	4

DIGIT 8

Withstand	Digit Code
Standard	S
High	H

DIGIT 9

Breaker Config.	Digit Code
5	5
6	6

DIGIT 10

Cooling	Digit Code
Natural	N
Forced	F

DIGIT 11

Enclosure	Digit Code
1	1
3R	3

DIGIT 12

Color	Digit Code
Dark Gray	B
Custom	C

DIGIT 13

Options	Digit Code
RS-485	B
Dry Contacts	C
Ethernet/TCP/IP	D
LSIG Breakers	L
Stylized Front Cover	P
TVSS	S

GE Zenith Controls

GE Industrial Systems – Power Equipment Business
General Electric Company
830 West 40th Street, Chicago, IL 60609 USA
773 299-6600, Fax: 630 850-6899
www.zenithcontrols.com

ZENITH CONTROLS, INC.

SERVICE MANUAL INDEX

(Blue Tab)

A.	Index General Information			
B.	ZTSH	40-260 AMPS	47A-1005	A.T.S.
C.	ZTSH	400 AMPS	47A-1000	A.T.S.
D.	ZTSH	600-1200 AMPS	43A-1000	A.T.S.
E.	ZTSH	1600-4000 AMPS	43A-3000	A.T.S.
F.	ZTSDH	100-260 AMPS	47A-1005	A.T.S. Delayed
G.	ZTSDH	400 AMPS	47A-3000	A.T.S. Delayed
H.	ZTSDH	600-1200 AMPS	43A-5000	A.T.S. Delayed
I.	ZTSDH	1600-4000 AMPS	43A-5000	A.T.S. Delayed
J.	ZBTSH	100-400 AMPS	46A-1001	Bypass Isolation
K.	ZBTSH	600-1200 AMPS	46A-2000	Bypass Isolation
L.	ZBTSH	1600-4000 AMPS	46A-3000	Bypass Isolation
M.	ZBTSDH	100-400 AMPS	46A-5000	Bypass/Delayed
N.	ZBTSDH	600-1200 AMPS	46A-5003	Bypass/Delayed
O.	ZBTSDH	1600-4000 AMPS	46A-5001	Bypass/Delayed
P.	ZTSCTH	100-400 AMPS	47A-7000	Closed Transition
Q.	ZTSCTH	600-1200 AMPS	43A-7000	Closed Transition
R.	ZTSCTH	1600-4000 AMPS	43A-7001	Closed Transition
S.	ZBTSCTH	100-400 AMPS	46A-7001	Bypass/Closed Transition

T.	ZBTSCTH	600-1200 AMPS	46A-7001	Bypass/Closed Transition
U.	ZBTSCTH	1600-4000 AMPS	46A-7002	Bypass/Closed Transition

V. Reference Material

OPERATION AND MAINTENANCE MANUAL
AUTOMATIC TRANSFER SWITCH
ZTSH SERIES
30 - 4000 AMPS

ZENITH®
CONTROLS, INC.

ISO 9001

43R-1000E
1/99

Table of Contents

Page

Introduction 1
Installation 2
- Equipment Inspection and Storage 2
- Mounting 2
- Power Connections 3
- Control Connections 3
- Final Equipment Inspection 4
- Functional Test 6

Operation and Features 7
- Sequence of Operation 7
- Zenith Module 9 Accessory Package 8
- Zenith Optional Accessories 9

Maintenance and Testing 10
- Inspection and Cleaning 10
- Servicing 10
- Testing 10
- Troubleshooting 12

Adjustments and Settings 10
- Solid State Timers 10
- Voltage/Frequency Sensor VFSM 10
- Solid State Phase Relays 10
- Electronic Exercise Clock Z1000-1A 12
- Electronic Exercise Clock Z2000-2A 12

Appendix A—Typical Schematic Diagrams 12
- 40 to 150 Amp, Series 2, ZTSH Switches 12
- 40 to 260 Amp Switches 12
- 400 Amp Switches 12
- 600 to 1200 Amp Switches 12
- 1600 to 4000 Amp Switches 12

Appendix B—Replacement Parts 12
- Power Panel 40 to 150 Amp, Series 2, ZTSH Switches 12
- Power Panel 40 to 260 Amp Switches 12
- Power Panel 400 Amp Switches 12
- Power Panel 600 to 1200 Amp Switches 12
- Power Panel 1600 to 3000 Amp Switches 12
- Power Panel 4000 Amp Switches 12
- Standard Control Panel SSRCP 12
- Optional Control Panel 12
- Cabinet Door Pivot Devices 12

Introduction

Zenith Transfer Switches are used to provide a continuous source of power for lighting and other critical loads by automatically transferring from the normal source of power to an emergency source of power in the event that the normal source voltage falls below preset limits.

All Zenith transfer switches are designed for use on emergency or standby systems, and are rated for total system or motor loads. Transfer switches are UL Listed under Standard 1008 and CSA Certified under Standard C22.2 No. 178.

This manual provides information on the installation, operation and maintenance of the switch. In addition, a complete information package is supplied with each transfer switch which details the features and accessories provided on that switch. The information package and the instruction manual should be kept in a readily accessible location to provide complete reference information on this critically important piece of equipment.

Installation

⚠ DANGER

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Each Zenith transfer switch is factory wired and tested. A complete information package is furnished with each switch which includes:

a. Sequence of operation.
b. Description and operation of all accessories supplied.
c. Power panel connection diagram and schematic.
d. Description and identification of all customer field connections.

Installation of Zenith transfer switches includes:

a. Mounting the transfer switch cabinet.
b. Connection of all Normal, Emergency, and Load cables or bus bars.
c. Connection of external control circuits as required.

Equipment Inspection and Storage

Immediately inspect the transfer switch when received to detect any damage which may have occurred during transit. If damage is found or suspected, file claims as soon as possible with the carrier and notify the nearest Zenith representative.

Before installation, it is necessary to store the transfer switch in a clean dry place, protected from dirt and water. Provide ample air circulation and heat, if necessary, to prevent condensation.

Storage Temperature:	-30° C to + 85° C (-22° F to +185° F)
Operating Temperature (Ambient):	-20° C to +75° C (-4° F to +167° F) [30-260 Amps] -20° C to +40° C (-4° F to +140° F) [400-800 Amps]
Humidity:	5% to 95% (non-condensing)

Mounting

Adequate lifting means must be used to mount the transfer switch into place. The recommended method for moving the transfer switch using the lifting eyes, where supplied, and a spreader bar is illustrated in *Figure 1*. Enough room should be allowed to open the cabinet doors fully for inspection and servicing of the switch per NEC and local codes.

Before drilling conduit entry holes or any accessory mounting holes, cover and protect the switch and control panel to prevent dirt and metal fragments from entering the mechanical and electrical components. Failure to do so may result in damage and malfunction of the switch.

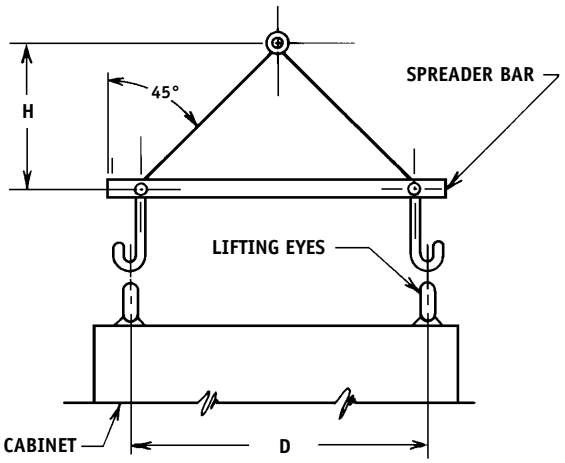


Figure 1

⚠ NOTICE

When lifting the switch using a spreader bar, height H must be equal to half of distance D.

Power Connections

Zenith transfer switches are supplied with UL listed solderless screw type terminals as standard for the Normal, Emergency and Load power connections. *Table 1* lists the number and sizes of cable lugs supplied as standard for each switch amp rating.

Connect the Normal, Emergency, and Load conductors to the clearly marked terminals on the transfer switch. Remove surface oxides from cables by cleaning with a wire brush. Verify that all connections are correct before tightening the lugs. All cable lug connections must be tightened to the proper torque values as shown in *Table 2*.

Do not run cables or wiring behind front-connected transfer switches.

In cases where the Normal, Emergency and Load connections are made to a rear connected bus bar, a compression washer, flat washer, and a minimum grade 5 bolt must be used and torqued to the values in *Table 3*.

Tightening Torque for Lugs

Socket Size Across Flats	Torque	
	Lb. - In.	Lb. - Ft.
1/8	45	4
5/32	100	8
3/16	120	10
7/32	150	12
1/4	200	17
5/16	275	23
3/8	375	31
1/2	500	42
9/16	600	50

Table 2

Tightening Torque for Bus Bars

Bolt Size	Torque Bolt (Grade 5)	
	Lb. - In.	Lb. - Ft.
1/4-20	72	6
5/16-18	132	11
3/8-16	300	25
1/2-13	720	60

Table 3

Screw Type Terminals for External Power Connections				
Switch Size (Amps)	Normal, Emergency & Load Terminals		Fully Rated Neutral Bar (When Required)	
	Cable Per Pole	Range of Wire Sizes	No. of Cables	Range of Wire Sizes
40	1	#8 to 2 AWG	3	#8 to 1/0 AWG
80	1	#8 to 1/0 AWG	3	#8 to 1/0 AWG
100	1	#8 to 1/0 AWG	3	#8 to 1/0 AWG
150	1	#8 to 3/0 AWG	3	#6 AWG to 300 MCM
225	1	#6 AWG to 250 MCM	3	#6 AWG to 300 MCM
260	1	#6 AWG to 350 MCM	3	#6 AWG to 300 MCM
400	1	#4 AWG to 600 MCM	4	#2 AWG to 600 MCM
600	2	#2 AWG to 600 MCM	8	#2 AWG to 600 MCM
800	4	#2 AWG to 600 MCM	12	#2 AWG to 600 MCM
1000	4	#2 AWG to 600 MCM	12	#2 AWG to 600 MCM
1200	4	#2 AWG to 600 MCM	12	#2 AWG to 600 MCM
1600 2000 3000 4000	Line and load terminals are located in rear and arranged for bus bar connection.		12 12 12 12	3/0 AWG to 750 MCM 3/0 AWG to 750 MCM 3/0 AWG to 750 MCM 3/0 AWG to 750 MCM

Table 1

Control Connections

A complete information package is furnished with each transfer switch including a complete connection diagram and schematic which details all necessary control circuit field connections.

The engine start control wires connect to the terminals specified in the upper left corner of the control panel. *Figure 2* shows the location of these terminals on the standard SSRCP printed circuit board mounted on the steel backplate. These terminals are clearly identified by a preprinted label attached to the steel control panel. In the case of manual transfer switches, or in other applications not requiring the standard control panel, clearly marked terminal blocks are provided in the upper left corner of the control panel for the engine start control wires.

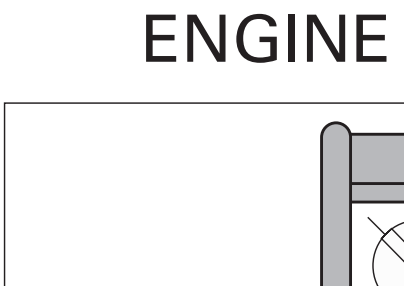


Figure 2

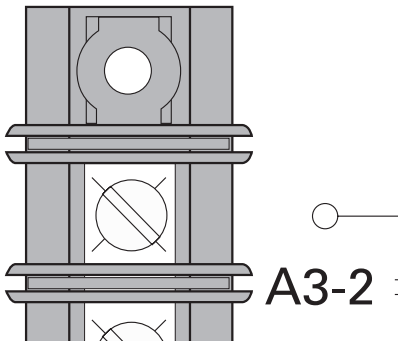


Figure 3

Terminals for field connections to the A3 Emergency auxiliary contacts and the A4 Normal auxiliary contacts are also provided. These terminals are clearly marked and appear on the side of the power panel. On 400 amp units these terminals appear on the disconnect switch bracket above the operator handle, and are marked as illustrated in *Figure 3*.

Make all other necessary external control connections to the appropriate terminal blocks located on the control panel. Insure that all connections are tightened to the torque specified in *Figure 4*.

Control Wire Connections	
Wire Size (AWG)	**Torque Lb. - In.**
18-16	19
14-8	19
6-4	36

Figure 4

Final Equipment Inspection

Prior to energizing the transfer switch:

a. Remove any debris incurred due to shipment or installation. **DO NOT** use a blower since debris may become lodged in the electrical and mechanical components and cause damage. Use of a vacuum is recommended.
b. Verify that all cabled connections are correct and that phase rotation of both sources match.
c. Check engine start connections and verify the correct connection of all control wires.
d. Check settings of all timers and adjust as necessary. Also adjust any optional accessories as required.
e. Check the integrity of power connections by verifying actual lug torque values as specified in this manual.
f. Make sure that all covers and barriers are installed and properly fastened.

Functional Test

The functional testing of the transfer switch consists of manual and electrical tests described in this section. Before proceeding, refer to the information package supplied with the transfer switch. Read and understand all instructions and review the operation of all accessories provided.

A manual operator handle is provided with the transfer switch for maintenance purposes only. Manual operation of the switch must be checked before it is operated electrically. Both power sources **MUST** be disconnected before manual operation of the switch. Insert the handle and operate the transfer switch between the Normal and Emergency positions. The transfer switch should operate smoothly without binding. Return the switch to the Normal position, remove the handle, and return it to the holder provided.

Before starting the electrical operation test, check the equipment rating nameplate on the transfer switch to verify the correct system voltage. An example of the equipment rating nameplate is shown in *Figure 5*.

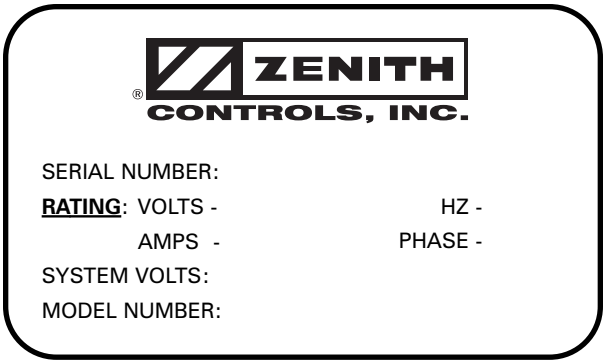


Figure 5

First, close the Normal source circuit breaker. The phase relays B1, B2, and B3 will pick up and the LED indicators will be illuminated. Verify the phase to phase voltages at the Normal line terminals.

Next, close the Emergency source breaker and start the engine generator. The VFSM relay will pick up and the LED indicator will be illuminated. Check the phase to phase voltages at the Emergency line terminals. Also, verify that the phase rotation of the Emergency source is the same as the phase rotation of the Normal source.

After the sources have been verified, shut down the engine generator, and put the starting control in the automatic position. Complete the visual inspection of the transfer switch, and close and lock the cabinet door.

Initiate the electrical transfer test by activating the TS test switch. The CR control relay will drop out and the P1 engine start timer will start its timing cycle.

After the P1 timer has completed its timing cycle, the engine start contact will close and signal the engine generator to start. The VFSM relay will energize. The switch will transfer to the Emergency source after the time delay of the W timer.

Deactivating the test switch will start retransfer to the Normal source. The switch will retransfer to the Normal source after the time delay of the T timer. The U engine over-run timer allows the engine generator to run unloaded for a preset cool down time period.

⚠ NOTICE

A periodic test of the transfer switch under load conditions is recommended to insure proper operation. (See National Electric Code articles 700 and 701).

Operation and Features

Sequence of Operation

Figure 6 is a typical schematic diagram of a Zenith transfer switch with a Module 9 accessory package. The information package supplied with the transfer switch includes a schematic diagram and description of operation of all accessories provided.

The sequence for load transfer to the Emergency source begins automatically when any phase of the Normal source falls below the preset dropout point and this undervoltage failure condition is detected by the solid state phase relays B1, B2, B3.

The phase relays drop out, de-energizing the normal control relay CR, and engine start timer P1 begins its timing cycle. The P1 time delay is provided to override momentary outages and to prevent nuisance starting of the engine generator. If the Normal source voltage returns above the pickup setting of the phase relays, the P1 timing cycle is reset to zero by the re-energization of the CR relay.

If the normal source voltage does not return before the P1 time delay is completed, the P1 timer drops out and sends a starting signal to the engine generator. An emergency voltage and frequency sensing relay VFSM monitors the voltage and frequency of the Emergency source. When both the voltage and the frequency of the Emergency source reach the preset pickup points, the VFSM relay initiates the transfer to the Emergency source and timer W begins its timing cycle. The W timer provides an adjustable transfer delay to the Emergency source as required.

When the W time delay is completed, the Emergency control relay RT energizes and picks up the power relay, CE1 or CCE. The power relay connects voltage from the Emergency source to the Emergency switch operating circuit caaausing the switch to transfer its main contacts to the Emergency source. The switch is mechanically locked in the Emergency position. The power relay and Emergency operator are de-energized when the SE limit switch is activated by the operator. The SN limit switch is deactivated at the same time, readying the Normal control circuit for retransfer when the Normal source is restored.

The sequence for retransfer to the Normal source begins automatically when the voltage on all phases of the Normal source reach the preset pickup point and this condition is detected by the solid state phase relays.

When the Normal source restores, the solid state phase relays B1, B2, B3 pick up and initiate retransfer of the switch to the Normal source by energizing timer T and beginning its timing cycle. The T timer provides an adjustable delay to ensure that the Normal source has stabilized before reconnection to the load. If the Normal source fails before the T time delay is completed, the phase relays drop out and the T timing cycle is reset to zero.

When the T time delay is completed, the Normal control relay CR energizes and picks up the power relay, CN1 or CNN. The power relay connects voltage from the normal source to the Normal switch operating circuit causing the retransfer of the main switch contacts to the normal source. The switch is mechanically locked in the Normal position. The power relay and the Normal operator are de-energized when the SN limit switch is activated by the operator. The SN limit switch also energizes the engine over-run timer U and begins its timing cycle. The timer provides a period of timefor the engine generator to run without load and cooldown before shutdown. After the U time delay is completed, the P1 timer is energized and the engine generator is shutdown.

Typical Schematic Diagram

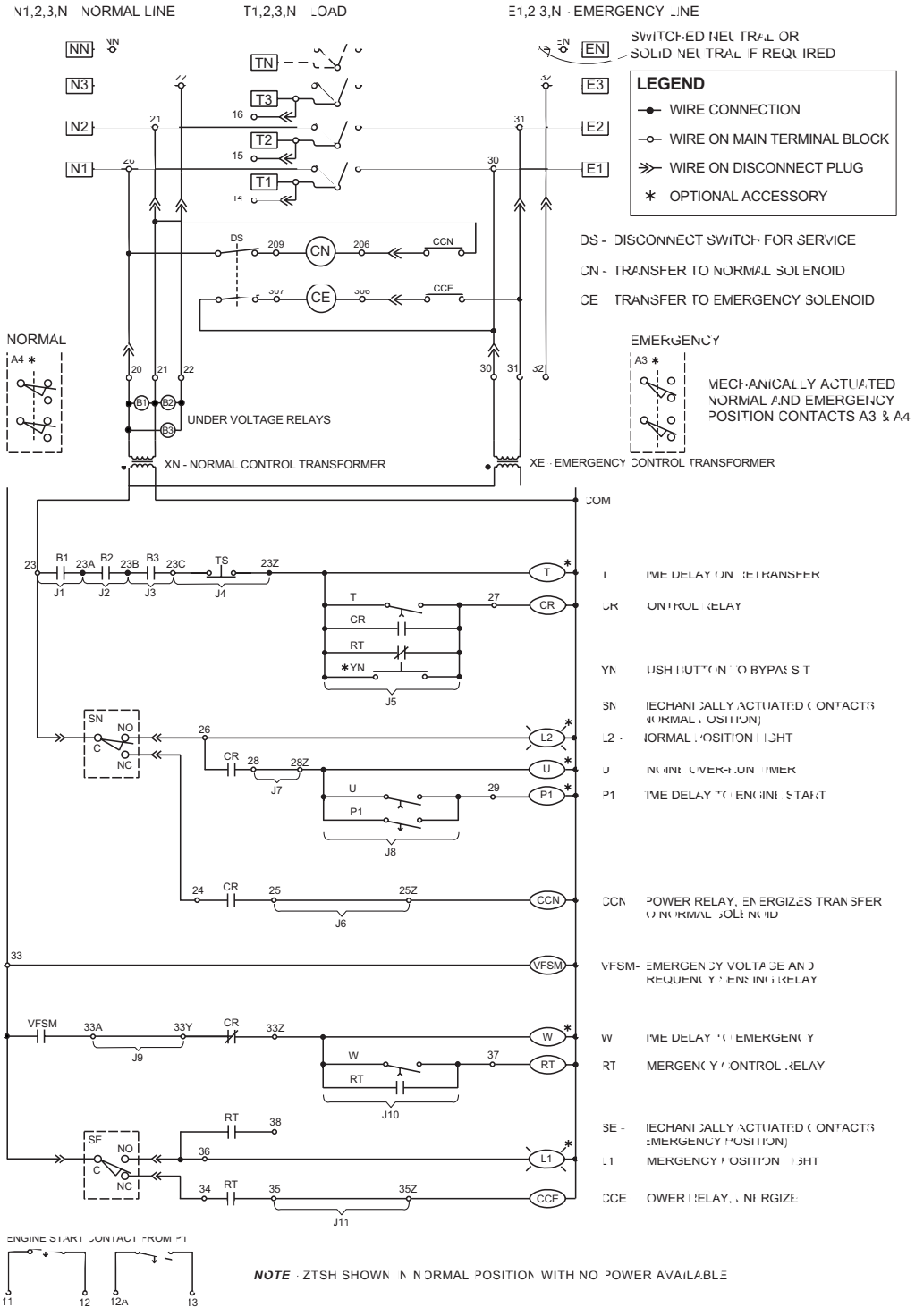


Figure 6

Zenith Module 9 Accessory Package

The Zenith Module 9 Accessory package includes nine of the commonly specified accessories. These accessories are:

A Auxiliary Contacts:

- A3 Closed when switch is in emergency position

L Indicating LED Pilot Lights:

- L1 Indicates switch in emergency position
- L2 Indicates switch in normal position

P1 Time Delay - Engine Start: Adjustable 0.5 to 6 seconds

T200 Time Delay on Retransfer to Normal: To delay retransfer to normal source (immediate retransfer on generator set failure); standard setting 30 minutes, adjustable 0-60 minutes.

T100 Time Delay on Retransfer to Normal: To delay retransfer to normal source (immediate retransfer on generator set failure); standard setting 30 min., adjustable 0-30 min.

T3/W3 Time Delays - Presignal for Auxiliary Control: Prior to transfer between two live sources in either direction, provides an adjustable (factory set at 20 second) presignal contact closure

U200 Time Delay for Engine Cooldown: Allows engine to run unloaded after switch retransfers to normal. Standard setting 5 min., adjustable 0-60 minutes.

U100 Time Delay for Engine Cooldown: Allows engine to run unloaded after switch retransfer to normal; standard setting 5 min., adjustable 0-5 min.

W200 Time Delay on Transfer to Emergency: To delay transfer to emergency after normal source failure; standard setting 1 sec., adjustable 0-5 minutes.

W100 Time Delay on Transfer to Emergency: To delay transfer to emergency after verifying emergency source available; standard setting 1 sec., adjustable 0-15 sec.

Zenith Optional Accessories

Many control accessories are available to meet specific requirements. Some of the more commonly specified accessories are:

A Auxiliary Contacts:

- A6 Deenergizes external motor control circuit5 seconds (adjustable) prior to transfer in either direction.

C Plant Exerciser (no load): Automatically starts the generator to run unloaded at selected intervals

C/D Plant Exerciser (Load/no load): Allows the generator to start and run unloaded or to simulate a power failure, start generator and run under load. Specify weekly, bi-weekly or calendar schedule

L Indicating LED Pilot Lights:

- L3 Indicates normal source available
- L4 Indicates emergency source available

P2 Time Delay - Engine Start: Adjustable 0.5 to 300 seconds

Q2 Peak Shave/Remote Load Test: Input for peakshave or remote load test; includes automatic return to normal if emergency source fails and normal is present; 120 VAC or 24 VDC

R4 In-Phase Monitor: Prevents transfer until two sources are in relative synchronism

R43 In-Phase Monitor: Prevents transfer until two sources are in relative synchronism

S1 Four-position selector switch (Stop - Hand Crank - Test - Automatic)

S2 Disconnect switch in series with accessory E to disconnect engine-starting circuit

S3 Source selector switch circuit; to select either source as primary

T3/W3 Time Delays - Presignal for Auxiliary Control: Prior to transfer between two live sources in either direction, provides an adjustable (factory set at 20 second) presignal contact closure

W100 Time Delay on Transfer to Emergency: To delay transfer to emergency after verifying emergency source available; standard setting 1 sec., adjustable 0-15 sec.

YEN Pushbutton Bypass of T&W Timers

Maintenance and Testing

A preventive maintenance program will insure high reliability and long life for the transfer switch. The preventive maintenance program for the transfer switch should include the following items:

⚠ DANGER

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Inspection and Cleaning

Before doing any work on the transfer switch, de-energize all sources of power. The switch should be inspected for any accumulation of dust, dirt, or moisture, and should be cleaned by vacuuming or wiping with a dry cloth or soft brush. **DO NOT** use a blower since debris may become lodged in the electrical and mechanical components and cause damage.

Remove the transfer switch barriers or arch chutes and check the condition of the contacts. Any surface deposits must be removed with a clean cloth (**DO NOT USE EMERY CLOTH OR A FILE**). If the contacts are worn excessively, they should be replaced. A general inspection of mechanical integrity should be made to include loose, broken or badly worn parts.

Servicing

All worn or inoperative parts must be replaced using Zenith recommended replacement parts. Appendix B at the back of this manual includes replacement part information for typical power and control panel configurations. When ordering parts provide the model number or serial number from the transfer switch rating nameplate.

Please refer to the Replacement Parts manual for specific part information and ordering procedures. Please contact the Zenith Technical Services Department for the Replacement Parts manual.

The operating mechanism of the transfer switch is lubricated with Lubriplate 105. The lubricant applied at the factory provides adequate lubrication for the lifetime of the switch. Should debris contaminate the mechanism, clean and apply additional Lubriplate.

Zenith can provide complete preventative maintenance services. Please contact the Zenith Technical Services Department for additional information.

Testing

A manual operator handle is provided with the transfer switch for maintenance purposes only. Manual operation of the switch must be checked before it is operated electrically. Both power sources **MUST** be disconnected before manual operation of the switch. Insert the handle and operate the transfer switch between the Normal and Emergency positions. The transfer switch should operate smoothly without binding. Return the switch to the Normal position, remove the handle, and return it to the holder provided.

After completing the inspection, cleaning and servicing of the transfer switch, reinstall the switch cover, and close and lock the cabinet door. Reclose the circuit breakers feeding the utility and generator sources to the switch.

Initiate the electrical transfer test by activating the TS test switch. P timer will time out and the microcontroller will send an engine start signal. When the W time has elapsed, the switch will complete its transfer by closing into the Emergency source.

Deactivating the test switch will start retransfer to the Normal source. The switch will complete its retransfer to Normal after the time delay of the T timer. The U engine overrun timer allows the engine generator to run unloaded for a preset cool down period.

⚠ NOTICE

A periodic test of the transfer switch under load conditions is recommended to insure proper operation. (See National Electric Code articles 700 and 701).

Troubleshooting

Before beginning any troubleshooting activity, refer to the information package supplied with the transfer switch and review the description and operation of all accessories supplied. Also refer to the Installation section of this manual.

Engine Does Not START

Annunciation	Possible Cause	Corrective Action
Emergency Available LED off	Engine start wires not terminated properly	Check Engine Start Connections
	Generator in "OFF" position	Investigate why Engine Control Switch was turned off

Engine Does Not STOP

Annunciation	Possible Cause	Corrective Action
Delay to Engine Stop LED on	**U** timing cycle not complete	Check **U** Timer setting
Normal Available, Normal Position, and Emergency Available LEDs on	Engine start wires not terminated correctly	Check Engine Start Connections
	Generator in "Manual"	Investigate why the Engine Control Switch was put in manual

ATS Will Not Transfer To EMERGENCY

Annunciation	Possible Cause	Corrective Action
Emergency Available LED off	Emergency voltage or frequency not within acceptable parameters	Check Engine Start Connections, Generator Breaker, Generator output, and Engine Control Switch
None	Power supply harness unplugged	Plug in harness
Normal Position and Emergency Position flashing	Limit switch harness unplugged	Plug in harness
Delay to Open Normal LED on	**W** timing cycle not complete	Check **W** Timer setting

ATS Will Not Transfer To NORMAL

Annunciation	Possible Cause	Corrective Action
Normal Available LED off	Normal voltage or frequency not within acceptable parameters	Check utility and utility breakers
None	Power supply harness unplugged	Plug in harness
Normal Position and Emergency Position LEDs flashing	Limit switches harness unplugged	Plug in harness
Delay to Open Emergency LED on	**T** timing cycle not complete	Check **T** Timer setting

Maintenance and Testing *(cont'd)*

Adjustments and Settings

Solid State Timers

Solid state timers are adjustable from 0.1 second to 100 hours. The red timing indicator in the upper left corner flashes as the timer progresses through the timing cycle. When the timing cycle is completed, the indicator remains illuminated. A flathead screwdriver is required to change the setting, as shown in *Figure 7*.

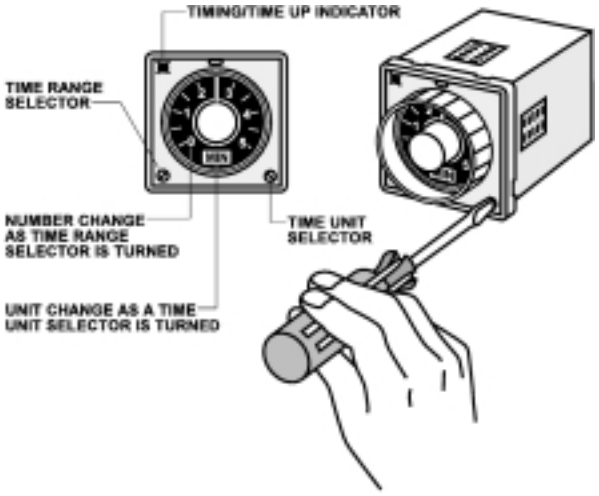


Figure 7

The time unit is selected by turning the rotary switch at the lower right of the timer. Four selections are available: “Seconds”, “Minutes”, “Hours”, “10 Hours”. The time unit selected is displayed in the window below the time setting dial.

The time range is selected by turning the rotary switch at the lower left of the timer. Four ranges are available: “0-0.5”, “0-1.0”, “0-5.0”, “0-10.0”. The dial digits appear in the windows around the time setting knob.

⚠ CAUTION

Do NOT change the setting while the timer is energized. Timer malfunction or damage may occur.

The factory setting of the solid state timers used in the Zenith standard package are shown in *Table 4*.

Timer	Factory Setting
T	30 minutes
U	5 minutes
W	1 second

Table 4

Voltage/Frequency Sensor (VSFM)

The pickup point may be adjusted by rotating the adjustment screw as shown in *Figure 8* below. Counter-clockwise rotation increases the pickup voltage.

Pickup Voltage (at 100% Frequency)
Adjustable: 80% to 95%
Factory Set: 90%

Pickup Frequency
Adjustable: 80% to 100%
Factory Set: 95%

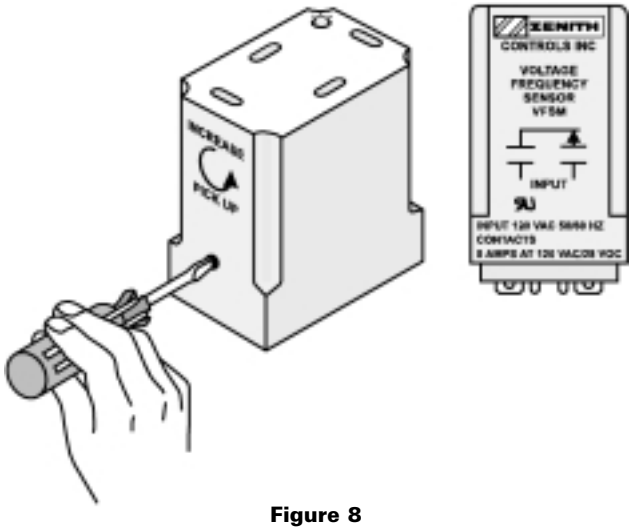


Figure 8

Adjustments and Settings *(cont'd)*

Solid State Phase Relay (ARSM)

The pickup and dropout points may be adjusted by using the following procedure. Use of a variable voltage supply (Variac) is required. The relay is illustrated in *Figure 9* below.

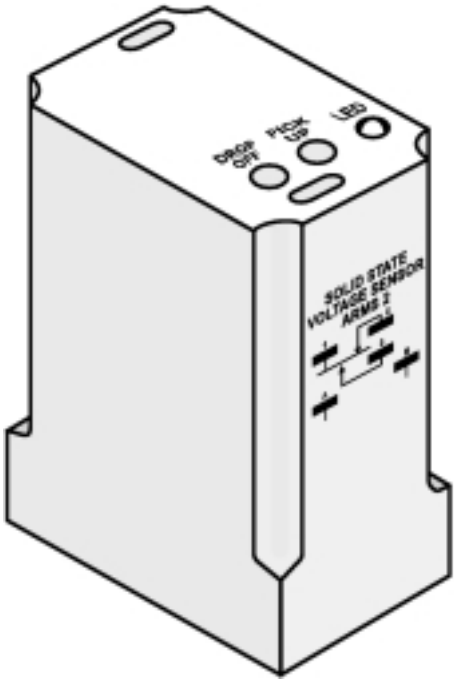


Figure 9

1. Turn the pickup adjustment fully clockwise.
2. Turn the dropout adjustment fully counter-clockwise.
3. Set Variac to the desired pickup voltage.
4. Rotate the pickup adjustment counterclockwise very slowly until the relay picks up. The LED will illuminate.
5. Set Variac to the desired dropout voltage.
6. Rotate the dropout adjustment clockwise very slowly until the relay drops out. The LED will go out.
7. Verify the setting by raising the voltage until the relay picks up and lowering the voltage until the relay drops out.

Pickup Voltage: 75% to 115% of Nominal
Factory Set: 90% of Nominal

Dropout Voltage: 55% to 105% of Nominal
Factory Set: 80% of Nominal

Electronic Time Switch Z1000-1A

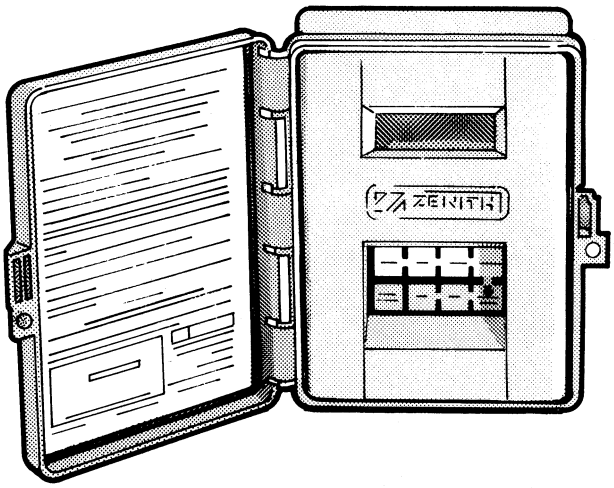


Figure 10

This time switch is used for either the C or C/D option (See page 7). Instructions for programming the switch are located inside the cover of the switch. An indicating light will appear in the left side of the display to indicate the time switch is in operation. If the time switch has a flashing display, it indicates that a power outage has occured. To restore the display, press the clock key and check the time of day. The battery should be checked and replaced if necessary

Due to the 10-year memory retention feature, cutting the power to the time switch will not erase the user's program. The user's settings can be changed or cleared st auny time. This feature eliminates the need for having to reprogram the time switch after long power outages.

The time switch will keep the clock running if power is lost by the installation of a 9 volt battery. It will not perform any of the programmed operations during a power outage.

5. ELECTRONIC TIME SWITCH Z2000-2A

This time switch is used for the C/D option (see page 7). Time switch Z2000-1A is used for the C option.

a. Setting Time and Day:

Press and hold "🕒" button during the Following adjustments:

1) Press "d" to set day pointer to correct day: 1 = Monday...7 = Sunday
2) Press "h" to set the hour. The time of day is expressed in 24-hour military time: 04:00 = 4 a.m.....20:00 = 8 p.m.
3) Press "m" to set minutes
4) Release "🕒" button. Clock is running

b. Programming:

Twenty-four total ON or OFF settings are available on one, several, or all days of the week.

1) Press Prog button. The blank program entry field will appear with two flashing points: "__:__"
2) Press either C1 or C2 depending on which channel you wish to program.
3) Next, select either ON or OFF by pressing C1 or C2 which toggles the ON/OFF mode.
4) You will now see the pointer flashing above 1 for Monday. To lock in Monday, press Prog. If you want to enter further days, press d then Prog to lock them in. Solid pointers must be displayed over each day that the switching command is required.
5) Once the days are selected, press h button to enter the desired hour and press m to enter the desired minutes. To enter the program into the time switch, press Prog. When the programming is complete, press "🕒" to return the clock run mode. If the "🕒" button is not depressed, it will switch to the clock run mode after 60 seconds.

c. Installation and Start-Up with Automatic Summer/Winter Time Adjustment

1) After applying A.C. power, press the "Res" button.
2) Press "C1" until dot 3 appears (see *Table 1*).
3) Press "Prog" to display 1997, press "d" until appropriate year is displayed.
4) Press "Prog" to display 01.01. month and day.
5) Press "m" to set the month and "d" to set the day. Then press the "Prog" button.
6) Press and hold the "🕒" button during the following adjustments:
   To set day, press "d" to position "▼" over correct day, (1=Monday,...7=Sunday).
   To set hour, press "h" to correct hour (AM or PM).
   To set minutes, press "m" to correct minute.
   Release "🕒" button. Clock is now running.

d. Programming

24 total "ON" and "OFF" settings are available on one, several or all days of the week. Press "Prog" button, see __:__ __ dissplay with two flashing points. This is the blank program entry field. Press "C1" or "C2" depending on which channel you will program first. Assume, for example, "C1" first. Select either "C1", "ON" or "OFF" by again pressing "C1" which toggles the ON/OFF mode. You will now see the pointer "▼" flashing above 1(Monday). If you wanted to enter a program starting Monday you would now press "Prog" to lock in Monday. If you wanted further days press "d" then "Prog" to lock them in. If the switching command was required Monday thru Friday, five solid pointers must be displayed over 1 thru 5; for the entire week, 1 thru 7. Once days are selected, press "h" to enter desired switching hour, then press "m" to enter desired switching minutes. Now to enter the program into the timer press "Prog". When programming is finished press "🕒" to return to clock run mode. If the "🕒" button is not pressed, the timer will switch to clock run mode after 60 seconds. After programming, recheck and reset the time of day, if necessary.

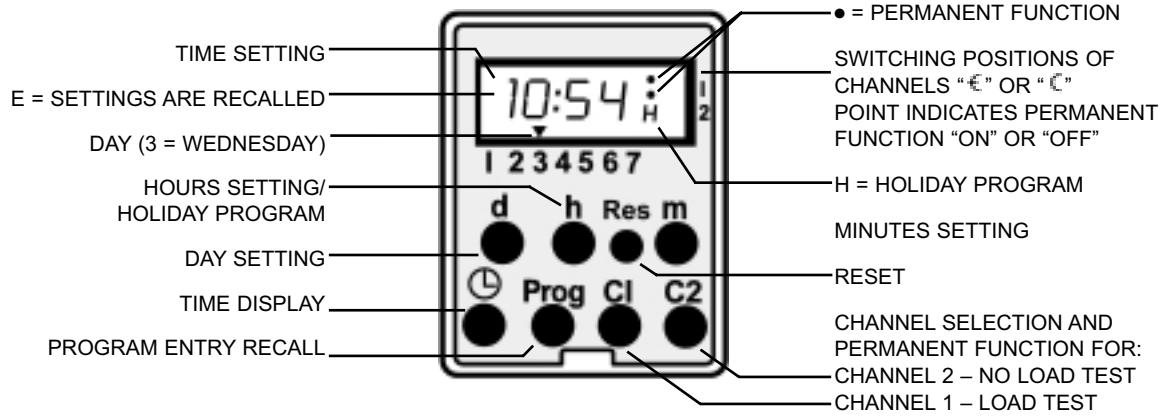


Figure 9

e. Program Recall/Review

Press “Prog” button repeatedly to recall and review the programmed “C1” and “C2” OFF/ON times. An “E” is displayed either when all 24 program positions are used or if the next available program position is not filled. Press “” to return to clock run mode.

f. Change or Clear Program

Press “Prog” button to reach program to be changed or cleared. Change the program by pressing “d”, “h” or “m” buttons as required. Clear the entire program by simultaneously pressing “h” and “m”.

g. Temporary Override

Each channel state (ON or OFF) can be manually changed before or after the program automatically changes by pressing “C1” or “C2”. The next counteracting program cancels the manual override and resumes previous programming.

h. Continuous Override

To contiuously override automatic programming, press “m” and “C1” or “m” and “C2”. The continous override “ON” or “OFF” state is preceded by a black dot on the display. To cancel press “m” and “C1” or “C2” until the dot disappears.

i. Holiday Program Override

The holiday program may be set up to 99 days in advance with a program range of 1 to 99 days. While holding down the “h” button, depress the “d” button to enter the number of days before the holiday begins (not including the present day). While holding down the “h” button, depress the “m” button to enter the number of days the holiday will be. During the holiday period the symbol “” will be displayed in the upper right hand corner of the display and the channel symbol “C” will be off. To manually cancel the holiday override, the buttons “h”, “d” and “m” must be used as described above to reset the holiday program to “00:00”. This results in the time switch checking the stored program and implementing the correct switching condition.

j. Programming Examples

EXAMPLE 1

Engine switches “ON” (Channel 1), after simulating normal power failure, at 7:15 a.m. and “OFF” at 7:45 p.m. every day of the week.

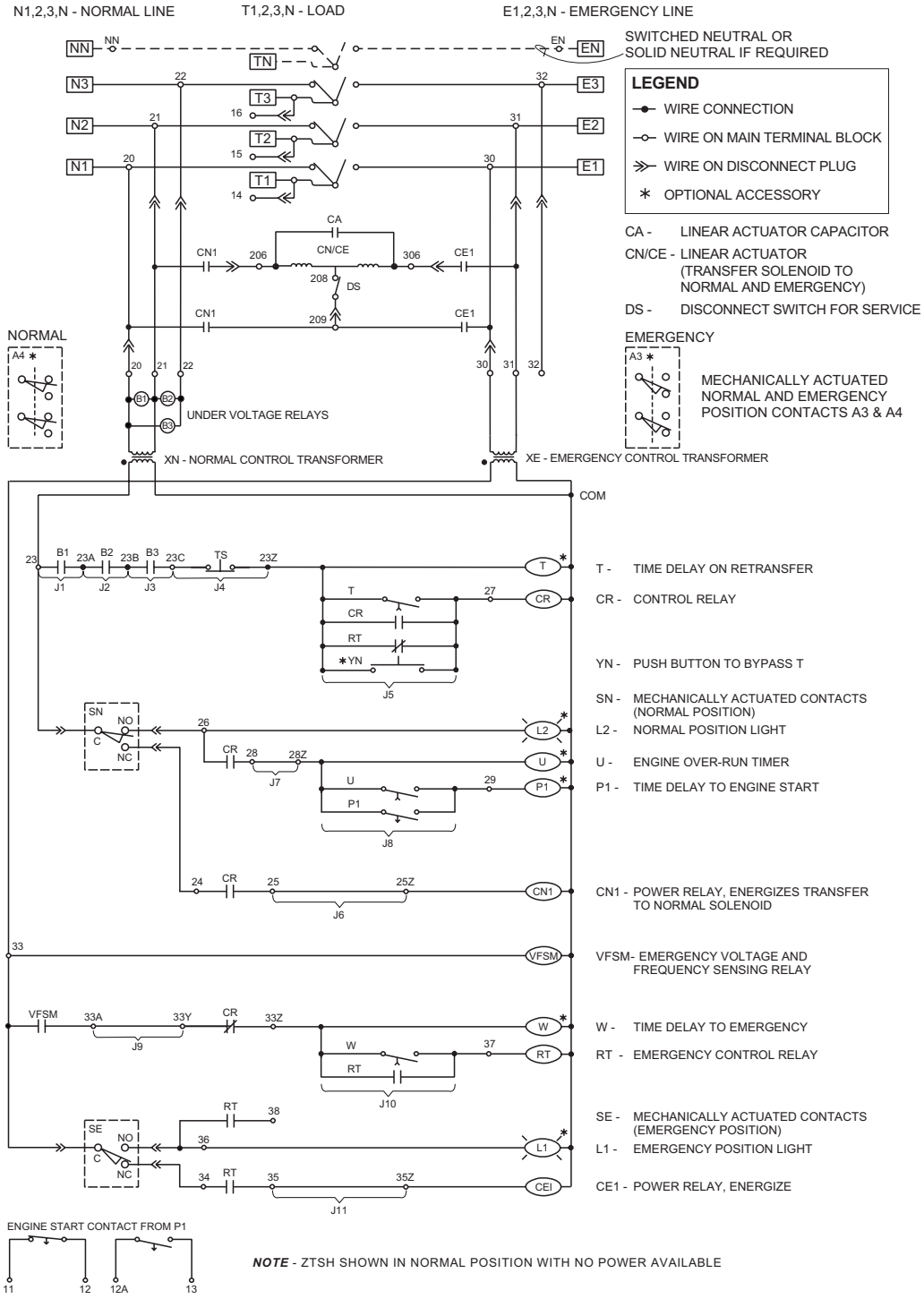
1. Press “Prog” once.
2. Press “C1” once (Start “ON” program).
3. Alternatively press “Prog”, “d”, “Prog”, “d”, “Prog”, “d”, “Prog”, “d”, “Prog”, “d”, “Prog”, “d”, “Prog”, AGAIN, Seven solid arrows will be displayed over 1 thru 7.
4. Press “h” to 7:00 a.m.
5. Press “m” to 7:15 a.m.
6. Press “prog” to enter the “ON” program into memory.
7. Press “C1” twice (Start “OFF” program).
8. Repeat Step 3.
9. Press “h” to 7:00 p.m.
10. Press “m” to 7:45 p.m.
11. Press “Prog” to enter the “OFF” program into memory.
12. Press.“” to return to clock run mode.

EXAMPLE 2

Engine switches “ON” (Channel C2) at 5:00 p.m. and “OFF” at 5:30 p.m. Monday thru Friday (no load test). Engine switches “ON” (Channel 1).after simulating normal power failure at 9:00 a.m. and “OFF” at 9:30 a.m. Saturday and Sunday.

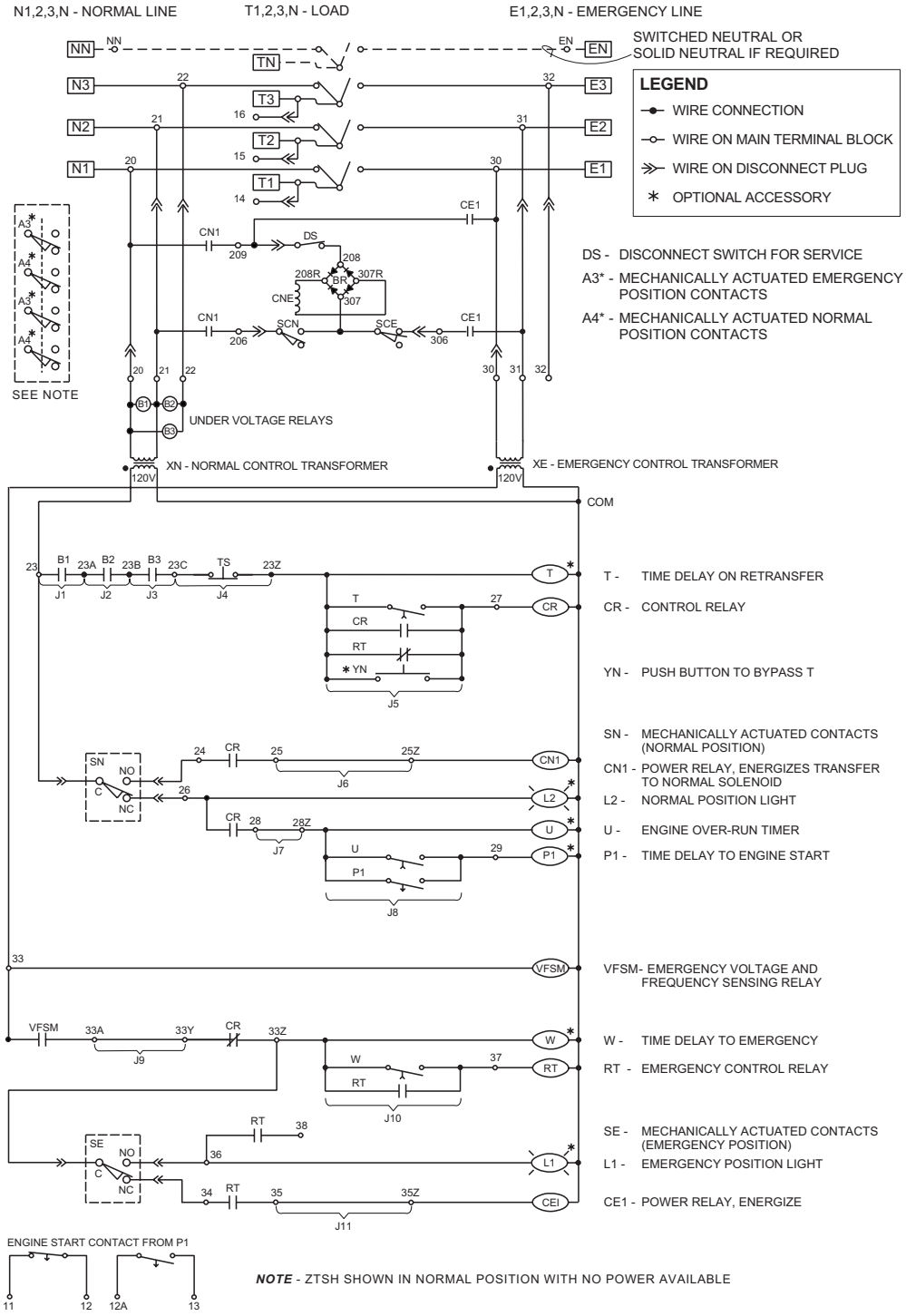
1. Press “Prog” once.
2. Press “C2” once (Start CH2 “ON” PGM).
3. Alternately press “Prog”, “d”, “Prog”, “d”, “Prog”, “d”, “Prog”, “d”, “Prog”, Five solid arrows should be displayed over 1 thru 5.
4. Press “h” to 5:00 p.m.
5. Press “Prog” to enter C2 “ON” program into memory.
6. Press C2 twice (Start CH2 “OFF” PGM).
7. Repeat Step 3.
8. Press “h” to 5:00 p.m.
9. Press “m” to 5:30 p.m.
10. Press “Prog” to enter C2 “OFF” PGM into memory.
11. Press “Prog” once.
12. Press “C1” once (Start CH1 “ON” PGM).
13. Press “d” five times, (blinking arrow over 6, Saturday).
14. Press “Prog”, “d”, “Prog”, (two solid arrows over 6 and 7).
15. Press “h” to 9:00 a.m.
16. Press “Prog” to enter C1 “ON” PGM into memory.
17. Press “C1” twice (Start C1 “OFF” PGM).
18. Repeat Step 13.
19. Repeat Step 14.
20. Press “h” to 9:00 a.m.
21. Press “m” to 9:30 a.m.
22. Press “Prog” to enter C1 “OFF” PGM into memory.
23. Press “” to return to clock run mode.

APPENDIX A - TYPICAL SCHEMATIC DIAGRAM 40 - 260 AMPS



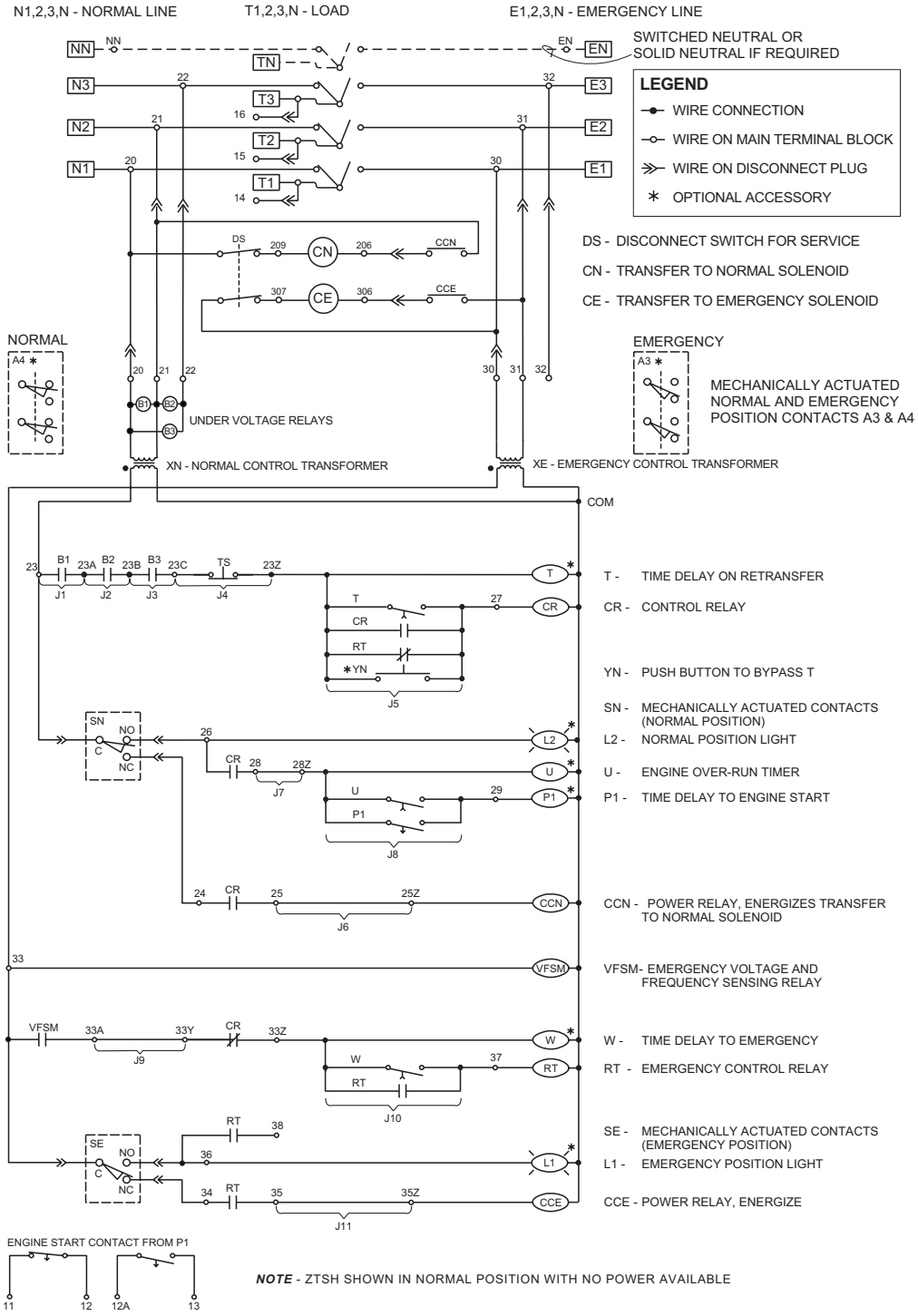
NOTE - ZTSH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE

APPENDIX A - TYPICAL SCHEMATIC DIAGRAM 40 - 260 AMPS



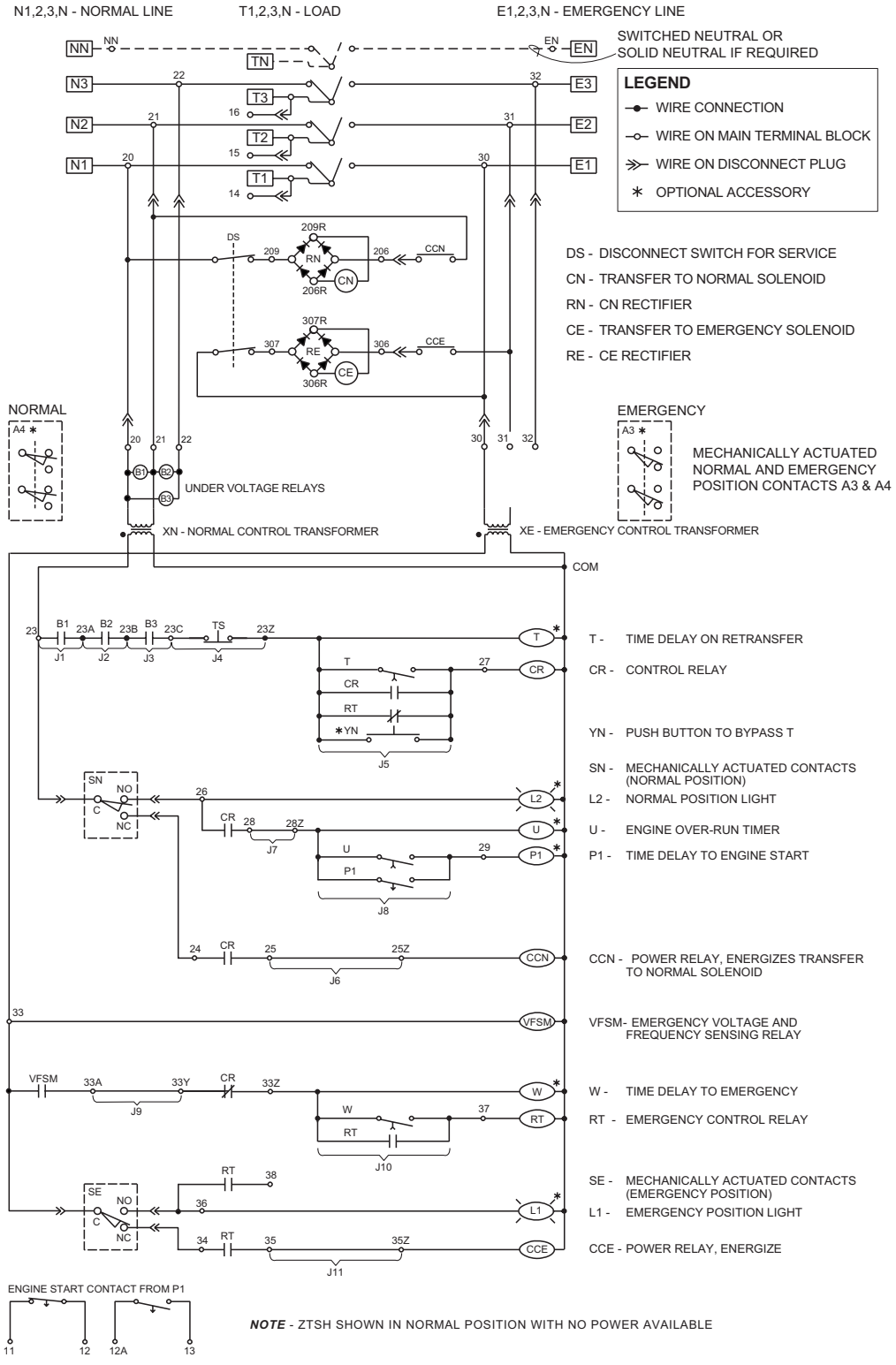
NOTE - ZTSH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE

APPENDIX A - TYPICAL SCHEMATIC DIAGRAM 40 - 260 AMPS

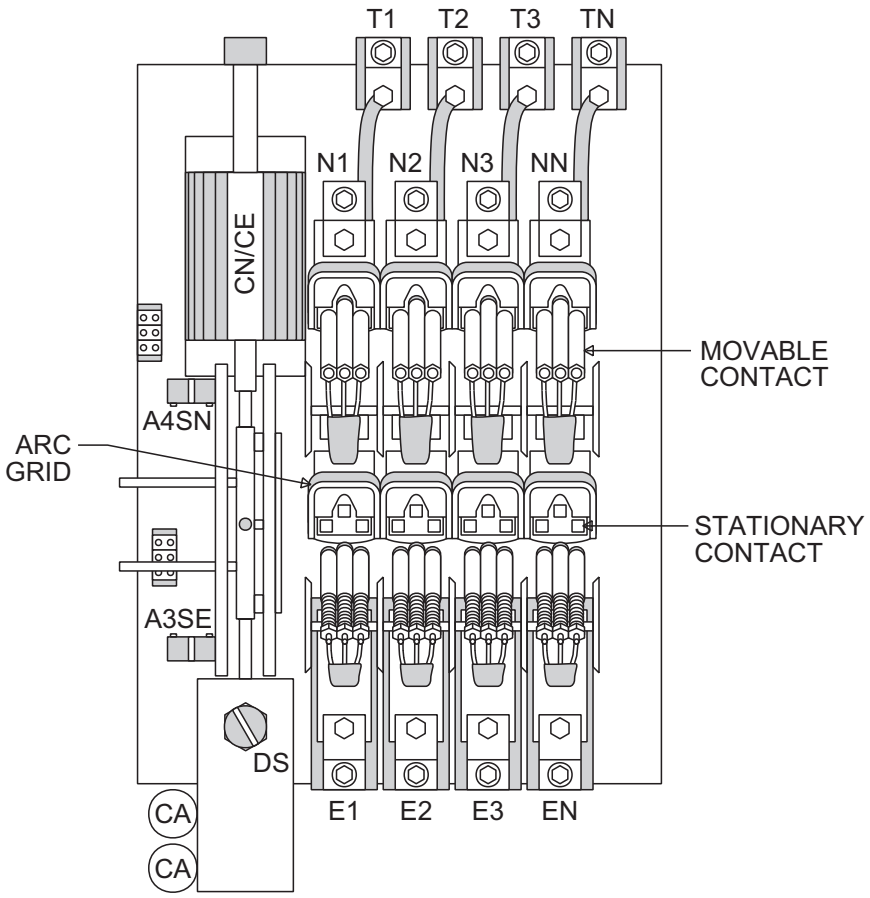


NOTE - ZTSH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE

APPENDIX A - TYPICAL SCHEMATIC DIAGRAM 40 - 260 AMPS

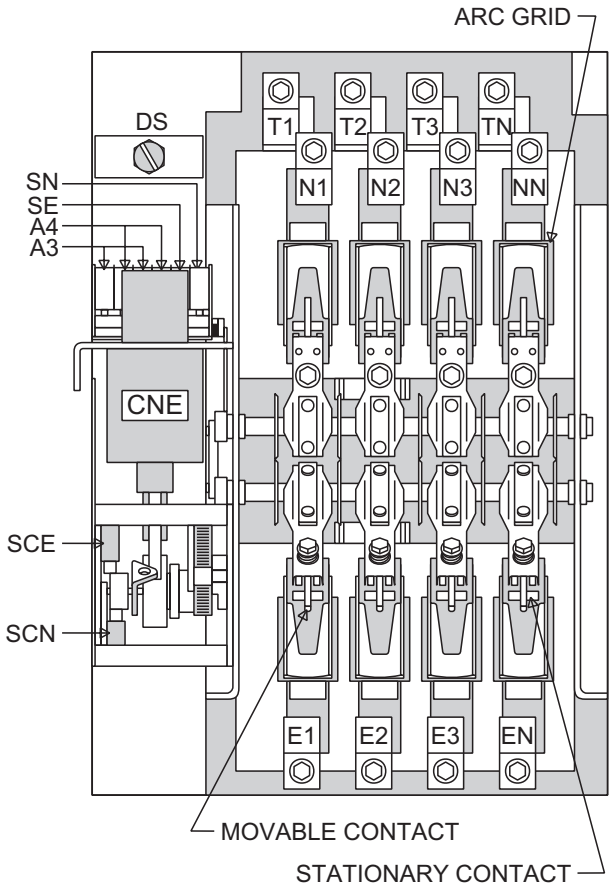


1. POWER PANEL - 40 TO 260 AMPS



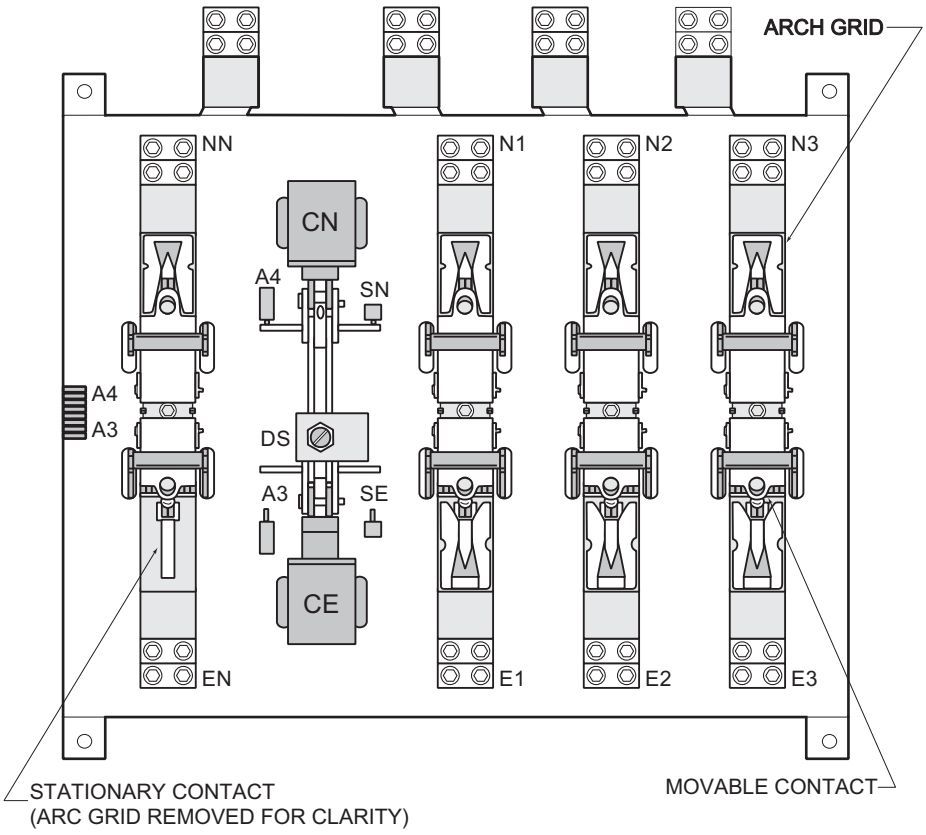
TAG	DESCRIPTION	STOCK NUMBERS BY AMPERAGE					
		40	80	100	150	225	260
N 1,2,3, N E 1,2,3, N T 1,2,3, N	Cable Connection Lug	PS-4419	PS-4423	PS-4423	27P-1128	27P-1126	27P-1127
	Wire Size	#14-2	#14-1/0	#14-1/0	#8-3/0	#6 to 250 MCM	#6 to 350 MCM
	Stationary Contact Assembly Kit	27P-1141	27P-1141	27P-1141	27P-1111	27P-1111	27P-1111
	Stationary Load Contact Assembly Kit	27P-1140	27P-1140	27P-1140	27P-1109	27P-1109	27P-1109
	Arc Grid Assembly Kit	27P-1014	27P-1014	27P-1014	27P-1014	27P-1014	27P-1014
	Movable Contact Assembly Kit	27P-1036	27P-1036	27P-1036	27P-1037	27P-1037	27P-1037
CN/CE, CA	Linear Actuator and Capacitors			CN/CE	CA (See Note)		
		Coil Volts	Poles		Quantity	Part	mf
	Note: 2S denotes two capacitors wired in series	120	2	K-2104PN	1	PS-4007	340-408
		240	2	K-2105PN	1	PS-4016	108-130
			3				
		208	3	K-2141PN	1	PS-4084	145-174
			4	K-2142PN	1	PS-4084	145-174
		575/600	3	K-2198PN	2S	PS-4083	36-43
			4	K-2197PN	2S	PS-4083	36-43
		480	3	K-2119PN	2S	PS-4008	72-86
			4	K-2111PN	2S	PS-4008	72-86
		416	3	K-2190PN	2S	PS-4008	72-86
SN	CN1 Cut-out Switch	L-5022					
SE	CE1 Cut-out Switch	L-5022					
A3	Emergency Position Auxiliary Contact	SPDT, L-5022; DPDT, L-5021					
A4	Normal Position Auxiliary Contact	SPDT, L-5022; DPDT, L-5021					
DS	Disconnect Switch	Operator I-4018; Contact Block L-1028					

2. POWER PANEL - 400 AMPS



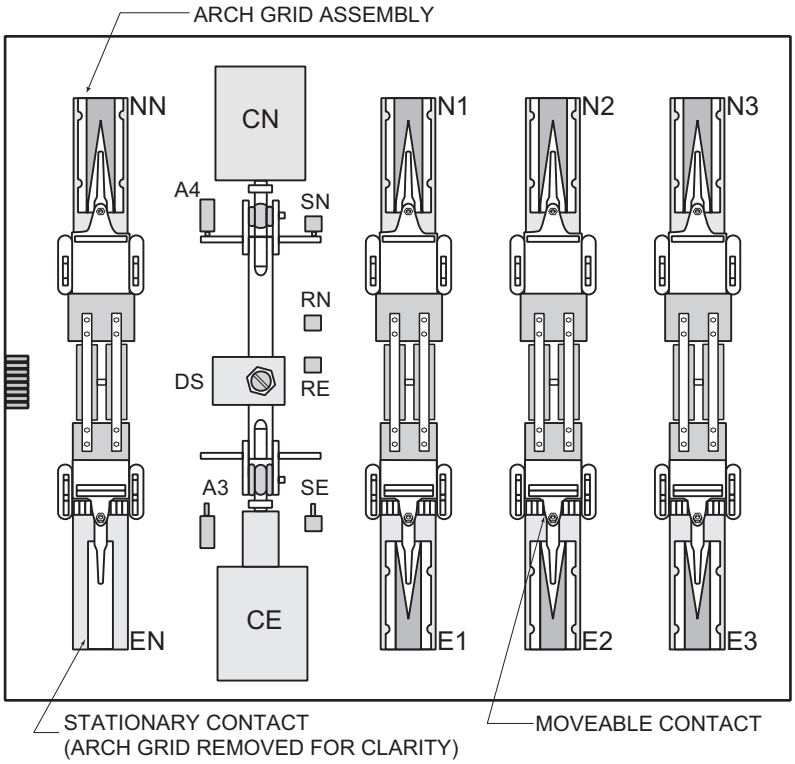
TAG	DESCRIPTION			PART NUMBER
N 1,2,3, N E 1,2,3, N	Normal Emergency	Cable Connection Lugs #4-600 MCM		PS1815F
T 1,2,3, N	Load			PS1815
	Stationary Contact Assembly Kit			
	Stationary Load Contact Assembly Kit			46P-1100E
	Arc Grid Assembly Kit			46P-1101E
	Movable Contact Assembly Kit			46P-1102E
	Linear Actuator and Capacitors			46P-1103E
	Linear Actuator and Capacitors			46P-1140
CNE	Main ATS Operating Coils	Coil Volts	Poles	
		120	2	K-2178
		240	3,4	K-2189
		208	3,4	K-2177
		575/600	3,4	K-2196
		480	3,4	K-2176
		416	3,4	K-2188
		380	3,4	K-2188
SN	CN1 Limit Switch			L-5021
SE	CE1 Limit Switch			
A3	ATS Emergency Position Switch			
A4	ATS Normal Position Switch			
SCN/SCE	CNE Limit Switches			L-3079
DS	ATS Solenoid Disconnect Switch			L-4018
	Operator 2 - Position Maintain			
	Contact Block N.C. (1)			L-1029
BR	Rectifier			PS-5076

4a. POWER PANEL - 600-1200 AMPS



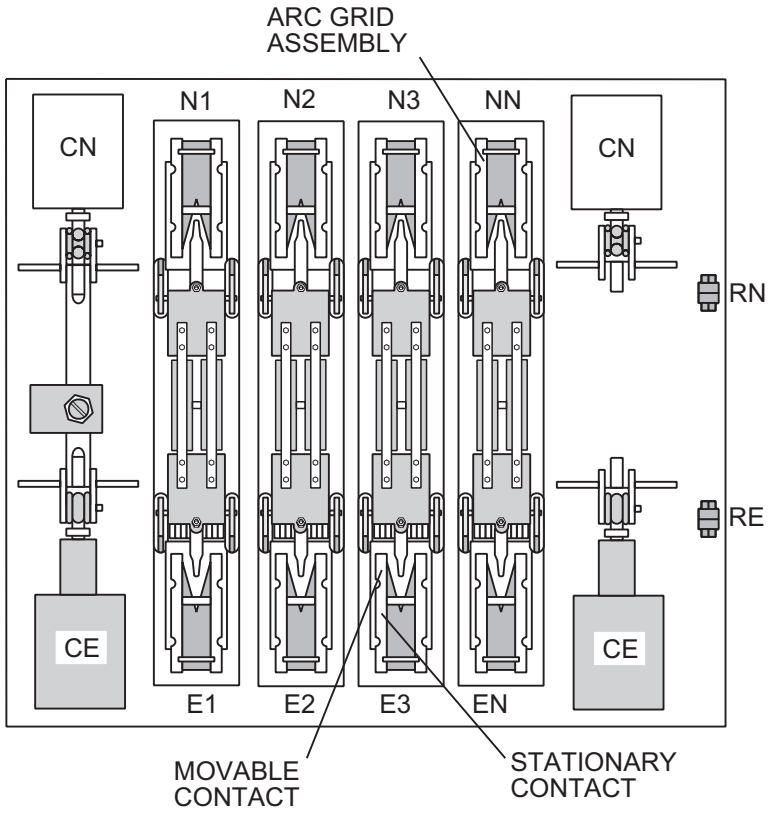
TAG	DESCRIPTION			STOCK NUMBERS BY AMPERAGE			
				600	800	1000	1200
N 1,2,3, N E 1,2,3, N T 1,2,3, N	Cable Connection Lug			S1393F (2)	S1392F (4)	S1392F (4)	S1392F (4)
	Wire Size			#2-600 MCM	#2-600 MCM	#2-600 MCM	#2-600 MCM
	Stationary Contact Assembly Kit			Consult Factory			
	Arc Grid Assembly Kit			23P-1366			
	Movable Contact Assembly Kit			Consult Factory			
CN/CE	Main Operating Coils	Coil Volts	Poles				
		120	2	K-2090F	K-2073F	K-2073F	K-2073F
		240	2	K-2092F	K-2070F	K-2070F	K-2070F
			3	K-2078F	K-2070F	K-2070F	K-2070F
			4	K-2091F	K-2074F	K-2074F	K-2074F
		208	3,4	K-2091F	K-2074F	K-2074F	K-2074F
		575/600	3,4	K-2095	K-2155	K-2155	K-2155
		480	3	K-2080F	K-2071F	K-2071F	K-2071F
			4	K-2079F	K-2071F	K-2071F	K-2071F
		416	3	K-2080F	K-2071F	K-2071F	K-2071F
SN	CCN Cut-out Switch		23P-1333				
SE	CCE Cut-out Switch		23P-1327	23P-1452			
A3	Emergency Position Aux Contact		(Qty 1) 23p-1327 (Qty 2) 23p-1328 (Qty 3) 23p-1334 (Qty 4) 23p-1336				
A4	Normal Position Aux Contact		(Qty 1) 23p-1333 (Qty 2) 23p-1334 (Qty 3) 23p-1328 (Qty 4) 23p-1330				
DS	Disconnect Switch		Operator L-4009; ; Contact Block L-1020				

4a. POWER PANEL - 1600-3000 AMPS



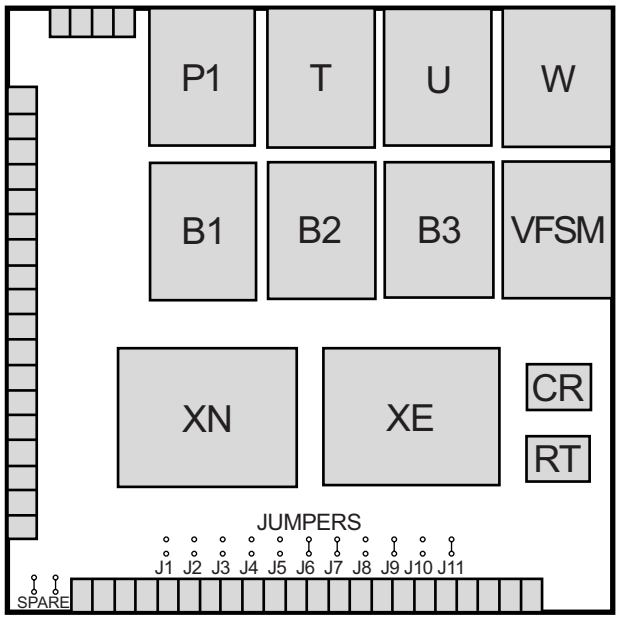
TAG	DESCRIPTION			STOCK NUMBERS BY AMPERAGE		
				1600	1600	1600
N 1,2,3, N E 1,2,3, N T 1,2,3, N	Cable Connection Lug			S1126F (2) Optional	S1126F (2) Optional	S1126F (2) Optional
	Wire Size			(8) #2-600 MCM	(8) #2-600 MCM	(8) #2-600 MCM
	Stationary Contact Assembly Kit			23P-1594	23P-1594	23P-1594
	Arc Grid Assembly Kit			23P-1171	23P-1171	23P-1171
	Movable Contact Assembly Kit			23P-1400	23P-1400	23P-1400
CN/CE	Main Operating Coils	Coil Volts	Poles			
		120	2	SPO	SPO	SPO
		240	2,3	K-2123F	K-2123F	K-2123F
			4	K-2127F	K-2127F	K-2127F
		208	3	K-2125F	K-2125F	K-2125F
			4	K-2128F	K-2128F	K-2128F
		575/600	3	K-2153F	K-2153F	K-2153F
			4	K-2154F	K-2154F	K-2154F
		480	3	K-2120F	K-2120F	K-2120F
			4	K-2130F	K-2130F	K-2130F
		416	3	K-2126F	K-2126F	K-2126F
SN	CCN Cut-out Switch		23P-1352			
SE	CCE Cut-out Switch		23P-1356			
A3	Emergency Position Aux Contact		(Qty 1) 23p-1356 (Qty 2) 23p-1357 (Qty 3) 23p-1353 (Qty 4) 23p-1355			
A4	Normal Position Aux Contact		(Qty 1) 23p-1352 (Qty 2) 23p-1353 (Qty 3) 23p-1357 (Qty 4) 23p-1359			
DS	Disconnect Switch		Operator L-4009; ; Contact Block L-1020			
RN, RE	Rectifier		23P-1473 (Up to 240V); 23P-1582 (Up to 600V)			

4a. POWER PANEL - 4000 AMPS



TAG	DESCRIPTION			STOCK NUMBERS
N 1,2,3, N E 1,2,3, N T 1,2,3, N	Cable Connection Lug			S1511F (3) Optional
	Wire Size			(12) #2-600 MCM
	Stationary Contact Assembly Kit			23P-1655
	Arc Grid Assembly Kit			23P-1171
	Movable Contact Assembly Kit			23P-1640
CN/CE	Main Operating Coils	Coil Volts	Poles	
		240	3	K-2219
			4	K-2219
		208	3	K-2226
			4	K-2226
		575/600	3	K-2221
			4	K-2221
		480	3	K-2218
			4	K-2218
		416	3	K-2220
SN	CCN Cut-out Switch		23P-1352	
SE	CCE Cut-out Switch		23P-1356	
A3	Emergency Position Aux Contact		(Qty 1) 23p-1356 (Qty 2) 23p-1357 (Qty 3) 23p-1353 (Qty 4) 23p-1355	
A4	Normal Position Aux Contact		(Qty 1) 23p-1352 (Qty 2) 23p-1353 (Qty 3) 23p-1357 (Qty 4) 23p-1359	
DS	Disconnect Switch		Operator L-4009; ; Contact Block L-1020	
RN, RE	Rectifier		23P-1473 (Up to 240V); 23P-1582 (Up to 600V)	

5. STANDARD CONTROL PANEL (SSRCP)

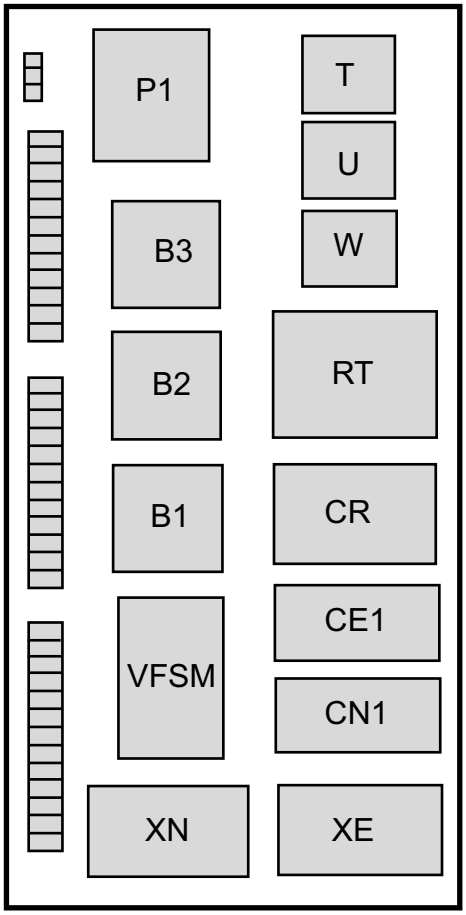


JUMPER	CONNECTS POINTS	REMOVE WHEN ACCESSORIES USED
J1	23, 23A	B1
J2	23A, 23B	B2
J3	23B, 23C	B3
J4	23C, 23Z	JIN, TS, C/D
J5	23Z, 27	T, YN
J6	25, 25Z	T3, R4
J7	28, 28Z	S1, C, C/D
J8	28Z, 29	P1 & U
J9	33A, 33Y	ER1, 2, 3, J1E
J10	33Z, 37	W
J11	35, 35Z	R4, W3

TAG	DESCRIPTION	VOLTAGE 50/60 HZ		PART NUMBER
XN, XE	Control Transformers (See Note 1)	120 V		K-3068
		208 V		K-3070
		240 or 480 V		K-3071
		416 V		K-3089
B 1, 2, 3	Phase Relays Solid State (See Note 1)	120 V		K-1185
		208 or 240 V		K-1186
		480 V		K-1186
VFSM	Voltage Frequency Sensor	120 V		K-1192
CR	Control Relay	120 V		K-1204
RT	Bypass T Relay	120 V		K-1204
CN1, CE1 or CCN, CCE	Transfer Relays (Mounted below SSRCP)	ZTSH 4-40, ZTSH 160-300	120 V	K-1120
		ZTSH 60-120	120 V	K-1095
T	Time Delay-to-Normal, Timer Solid State	0.1 sec. to 100 hours; adjustable	120 V	K-1230
U	Engine Cool Down, Timer Solid State	0.1 sec. to 100 hours; adjustable	120 V	K-1230
W	Time Delay Emergency, Timer Solid State	0.1 sec. to 100 hours; adjustable	120 V	K-1230
P1	Time Delay Engine Start Timer	0.5 sec. to 6 sec.; adjustable	120 V	K-1201
P2	Optional (Mounted below SSRCP)	0.5 sec. to 300 sec.; adjustable	120 V	K-1061
J1 - J11	Jumpers			PS-5067

NOTES: 1. If -6 voltage system (575/600V is supplied, then XN, XE is K-3087 and B1, 2, 3 is K-1185 (120V) supplied with XB (575-600V/120V) 3 phase transformer assembly.

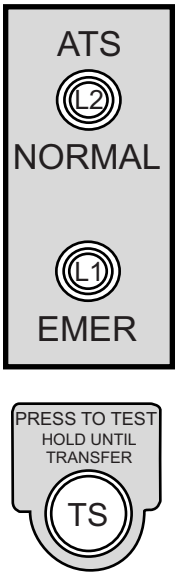
6. OPTIONAL CONTROL PANEL



TAG	DESCRIPTION	VOLTAGE 50/60 HZ		PART NUMBER
XN, XE	Control Transformers (See Note 1)	120 V		K-3068
		208 V		K-3053
		240 or 480 V		K-3041
		416 V		K-1055 (K-1185)
B 1, 2, 3	Phase Relays Electro-Mechanical-Standard Solid State (See Note 1)	120 V		K-1056 (K-1186)
		208 or 240 V		K-1058 (K-1188)
		480 V		K-1186
VFSM	Voltage Frequency Sensor	120 V		K-1192
CR	Control Relay	120 V		Y-260002
RT	Bypass T Relay	120 V		Y-260002
CN1, CE1 or CCN, CCE	Transfer Relays	ZTSH 4-40, ZTSH 160-300	120 V	K-1120
		ZTSH 60-120	120 V	K-1095
T	Time Delay-to-Normal, Timer Solid State	0.1 sec. to 100 hours; adjustable	120 V	K-1230
U	Engine Cool Down, Timer Solid State	0.1 sec. to 100 hours; adjustable	120 V	K-1230
W	Time Delay Emergency, Timer Solid State	0.1 sec. to 100 hours; adjustable	120 V	K-1230
P1	Time Delay Engine Start Timer	0.5 sec. to 6 sec.; adjustable	120 V	K-1201
P2	Optional	0.5 sec. to 300 sec.; adjustable	120 V	K-1061

NOTES: 1. If -6 voltage system (575/600V is supplied, then XN, XE is K-3059 and B1, 2, 3 is K-1155 (120V) supplied with XB (575-600V/120V) 3 phase transformer assembly.

6. OPTIONAL CONTROL PANEL



TAG	DESCRIPTION	PART NUMBER
L1 L2	ATS Emergency Position Indicator ATS Normal Position Indicator Lens (Normal) Lens (Emergency) Bulb Socket Emergency Bulb Normal Bulb	 PS-5048 (Green) PS-5047 (Red) PS-5046 (Incandescent) PS-5105 (Incandescent) PS-5105 (Incandescent)
TS	Test Switch Operator, Momentary Contact Block N.C. Contact Mounting Base	 L-1025 L-1029 PS-3473



830 West 40th Street
Chicago, IL 60609 USA

Phone: 773 247-6400
FAX: 773 247-7805
www.zenithcontrols.com
E-Mail: zenith@zenithcontrols.com

© 1997 Zenith Controls, Inc.

ZTSH SERIES
AUTOMATIC TRANSFER SWITCHES
40 TO 260 AMP
FOR USE ON EMERGENCY OR STANDBY SYSTEMS
RATED FOR TOTAL SYSTEM & MOTOR LOAD

A. LEGEND

N1,2,3,(N).....Normal Line _____
E1,2,3,(N).....Emergency Line _____
T1,2,3,(N).....Load Connections
B1,2,3.....Solid State Phase Relay(s)
Dropout _____%
Pickup _____%
CA.....CN/CE Capacitor
CE1.....CE Control Relay, Emergency
CN1.....CN Control Relay, Normal
CN/CE.....Main Transfer Operator
CR.....Normal Control Relay
DS.....Disconnect Switch
E.....Engine Start Contact
GND.....Ground
NB.....Neutral Bar (if required)
RT.....Emergency Control relay
SN.....Cutout Switch, Normal
SE.....Cutout Switch, Emergency
TS.....Test Switch,Momentary,Not Keyed
VFSM.....Emergency Volt–Freq. Relay
Pickup { 90% of rated Voltage, and / 95% of rated Frequency
XE.....Control Transformer, Emergency
XN.....Control Transformer, Normal

B. OPERATION

When the Normal Line falls below the preset dropout point, the phase relays will dropout disconnecting the CR relay.

When the Emergency Line voltage & frequency reach the preset pickup point, the VFSM relay picks up. RT relay picks up to operate the CE1 relay through the SE cutout switch, causing the main transfer operator CN/CE to operate. The load is now transferred to the Emergency Line. The SE limit switch operates to disconnect the CE1 relay and CN/CE main transfer operator. The transfer switch is now mechanically locked. Limit switch SN operates to complete the circuit for the next closing operation to Normal.

When the Normal Line voltage exceeds the preset pickup point, the phase relays, B1, B2 & B3 pick up. CR relay picks up to operate the CN1 relay through the SN cutout switch causing the main transfer operator CN/CE to operate. The load is now re–transferred back to the Normal Line. The SN limit switch operates to disconnect the CN1 relay and CN/CE main transfer operator. The transfer switch is now mechanically locked. Limit switch SE operates to complete the circuit for the next closing operation to Emergency.

DS – Disconnect Switch
When the Disconnect Switch is placed in the INHIBIT position the control circuits are opened and transfer cannot take place

TS – Test Switch
The Test Switch simulates a normal line failure when activated.
To test, activate the Test Switch allowing the transfer switch to transfer to the EMERGENCY position. De–activate the Test Switch. The transfer switch will reset to the NORMAL position. Testing at least once a month is recommended. For hospital emergency systems, test once a week.

NOTES:

1. ⚠CAUTION: In using a 3 phase, 4 wire delta or open delta power supply (usually 120/240 volts, sometimes listed as 120/208 volts) with one leg having a grounded center tap, one line will be 160 to 208 volts to ground. When such a system is used it is necessary to connect the high leg to N2.DO NOT CONNECT 120 VOLT LOAD CIRCUIT TO THE HIGH LEG.
2. GROUNDING TERMINAL: A grounding terminal (GND) is provided. When installing open type switches connect this to the metal enclosure or conduit.
3. ⚠ WARNING – TO ENSURE AGAINST SHOCK OR ACCIDENT HAZARD, DISCONNECT ALL SOURCES OF SUPPLY BEFORE SERVICING.
4. ON SINGLE PHASE UNITS WHERE THE EMERGENCY SOURCE IS A UTILITY LINE, CONNECT EMERGENCY LINE SO THAT MINIMUM VOLTAGE IS MEASURED FROM N1 TO E1.
5. ON SINGLE PHASE (2 POLE) UNITS, CENTER POLE AND PHASE RELAYS (B2,B3) ARE NOT SUPPLIED.

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S–5004	ESTABLISH DWG.		
B	S–7179	7/1/99	DF	SB

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION.
DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: LEGEND & OPERATION
JOB/MODEL: ZTSH4/26 (40–260 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	40R–0100

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
–	–	8/7/92	N/A	1 OF 1	B

ACCESSORIES

The ZTS series switches are wired so that accessories can be easily added to the switch. The following is a description of the basic accessories. Those checked are supplied on this unit, see additional pages for complete legend & operation.

☐ A1 Auxiliary contact, S.P.D.T., operates on normal line failure.

☐ A1E Auxiliary contact, S.P.D.T., operates on emergency line failure.

☐ A3 Auxiliary contact closes when the transfer switch is in the Emergency position.

☐ A4 Auxiliary contact closes when the transfer switch is in Normal position.

☐ A6 Motor Disconnect. To de–energize external motor control circuit 5 seconds (adjustable) prior to transfer in either direction.

☐ C Plant Exercisor. Automatically starts generator for selected time intervals.

☐ C/D Plant Exercisor. Automatically starts generator to run unloaded or simulate a power failure and starts generator to run under load.

☐ E Engine Start Contact: 1 Normally Open
1 Normally Closed.

☐ F Auxiliary Fan Contact, S.P.N.O. Closes when generator is running.

☐ H Time delay to engine start, non–adjustable. Factory set 1 or 3 seconds. When the Normal line fails the relay de–energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ J1 Adjustable under frequency sensor.

☐ J2 Adjustable over/under frequency sensor.

☐ K Frequency meter to indicate load frequency.

☐ L1 Pilot Light. Switch in Emergency Position.

☐ L2 Pilot Light. Switch in Normal Position.

☐ L3 Pilot Light. Normal source available.

☐ L4 Pilot Light. Emergency source available.

☐ M1 Ammeter; Single phase.

☐ M2 Ammeter; Three phase

☐ M3 Voltmeter; Single phase.

☐ M4 Voltmeter; Three phase.

☐ P1 Time Delay to Engine Start (solid state). Adjustable over time range .5 to 6 seconds. When the Normal line fails the relay de–energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ P2 Time Delay to Engine Start (Pneumatic). Adjustable over time range 1/6 to 300 seconds. When the Normal line fails, the relay de–energizes. After the set time delay its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ Q2 Connections for remote peak shave or area protection relays. Includes bypass for automatic return to Normal if Emergency line fails and Normal is present.

☐ R1 Solid State Adjustable Overvoltage Relay(s). Set at 110% of pickup, 105% of dropout of nominal Line rate, unless otherwise specified.

☐ R4 In–Phase monitor. Prevents transfer until two sources are in–phase. For use of isochronous governors.

☐ R43 In–phase monitor. Prevents transfer until two sources are in–phase. For use with mechanical. governors.

☐ S1 Four–position Engine Control Selector Switch. "STOP", "HAND CRANK", "TEST", "AUTOMATIC".

☐ T Time delay, re–transfer to Normal. When the Normal line restores and the phase relays operate, the T timer is energized. After the set time delay, its contacts close the circuit to the CR relay which operates to restore the load to the Normal line. RT relay is supplied to bypass T contacts if Emergency is de–energized during timing. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ T3 W3 Presignal auxiliary Contact, S.P.D.T: Operates 0–30 seconds (adjustable) prior to transfer in either direction.

☐ U Time delay, engine cool–down. When the transfer switch is restored to the Normal position and the engine is signaled to shut down, the U timer operates to maintain the engine start circuit closed. At the end of the set time, the engine contacts open to shut down the engine. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ W Time delay, transfer to Emergency. When the Normal line fails and the engine has started, the VFSM relay energizes. The W timer energizes. After the set time delay, its contacts close to energize the RT relay. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ YE Pushbutton, Transfer to Emergency. Provides manual control of transfer to emergency source. If time delay accessory W is supplied pushbutton bypasses time delay for immediate transfer; otherwise, transfer to emergency will be automatic after time delay. If time delay accessory W is not supplied, transfer will be non–automatic (by pushbutton only).

☐ YN Pushbutton, Retransfer to Normal. Provides manual control of retransfer to normal source. If time delay accessory T is supplied, pushbutton bypasses time delay for immediate retransfer; otherwise, retransfer to normal will be automatic after time delay. If time delay accessory T is not supplied, retransfer will be non–automatic (by pushbutton only).

☐ Other:_____

_____

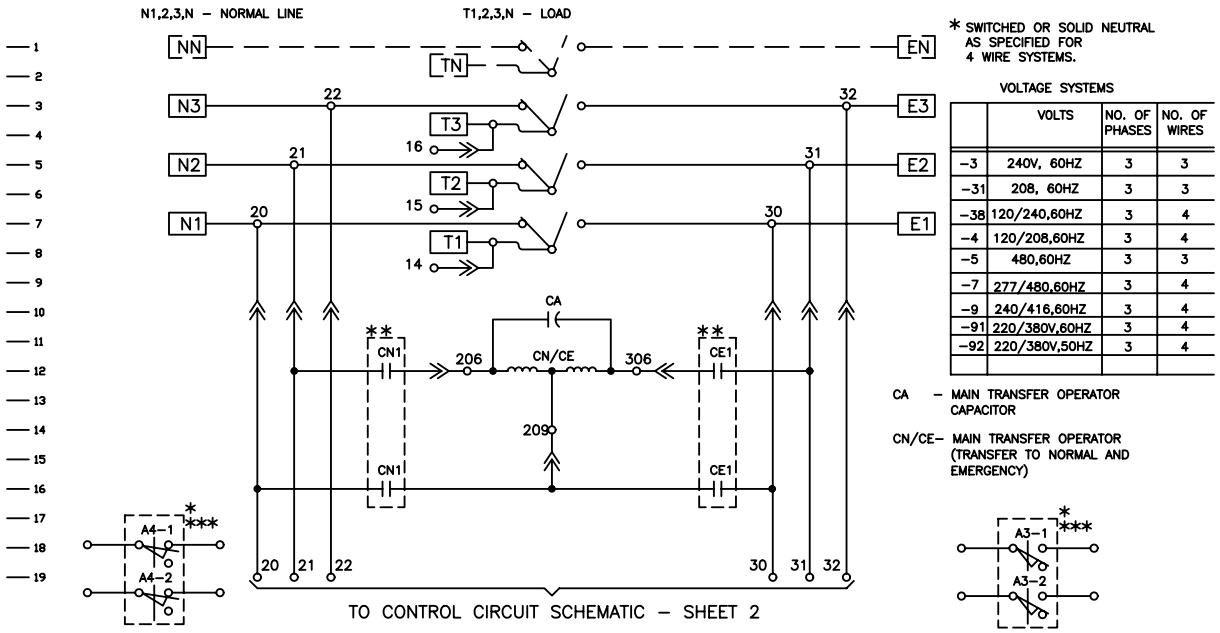
_____

ZENITH® CONTROLS, INC.

TITLE: ACCESSORIES

DRAWING NO.: 40R–0900 — REV

POWER CIRCUIT SCHEMATIC



* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEMS.

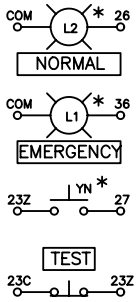
VOLTAGE SYSTEMS

	VOLTS	NO. OF PHASES	NO. OF WIRES
–3	240V, 60HZ	3	3
–31	208, 60HZ	3	3
–38	120/240,60HZ	3	4
–4	120/208,60HZ	3	4
–5	480,60HZ	3	3
–7	277/480,60HZ	3	4
–9	240/416,60HZ	3	4
–91	220/380V,60HZ	3	4
–92	220/380V,50HZ	3	4

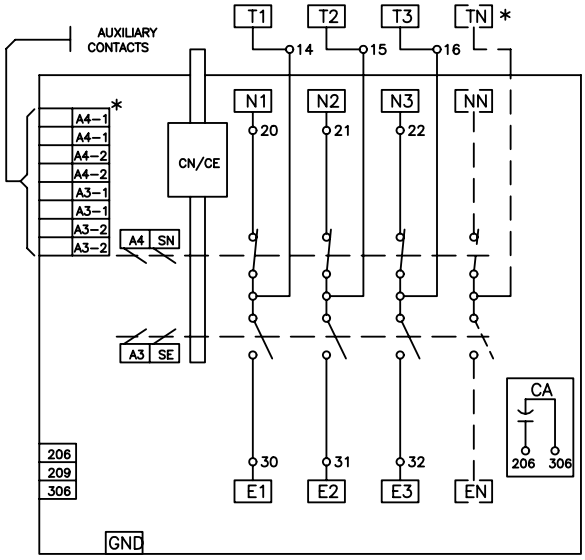
CA – MAIN TRANSFER OPERATOR CAPACITOR

CN/CE– MAIN TRANSFER OPERATOR (TRANSFER TO NORMAL AND EMERGENCY)

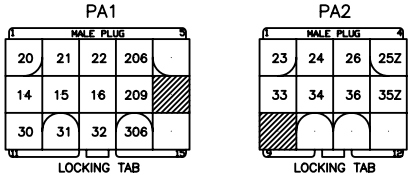
CABINET FRONT



POWER PANEL LAYOUT



INTERCONNECT PLUGS



LEGEND	REFERENCE	NOTES
●— WIRE CONNECTION —○— WIRE ON MAIN TERMINAL BLOCK —≫— WIRE IN DISCONNECT PLUG * OPTIONAL ** LOCATED ON CONTROL PANEL *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL	REFER TO 40R–0100 FOR LEGEND & OPERATION. FOR MANUFACTURING: SEE PAGE 3 FOR ENCLOSED UNIT CONTROL PANEL. SEE PAGE 4 FOR OPEN TYPE CONTROL PANEL. SEE 40R–0900 FOR ACCESSORIES.	1. ZTSH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE. 2. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3,A4,E,L1,L2,P,T,U,W) AND YN ACCESSORY. SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
–	–	ESTABLISH DWG.		
E	S–7179	6/28/99	DF	SB

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: POWER CIRCUIT & CABINET FEONT

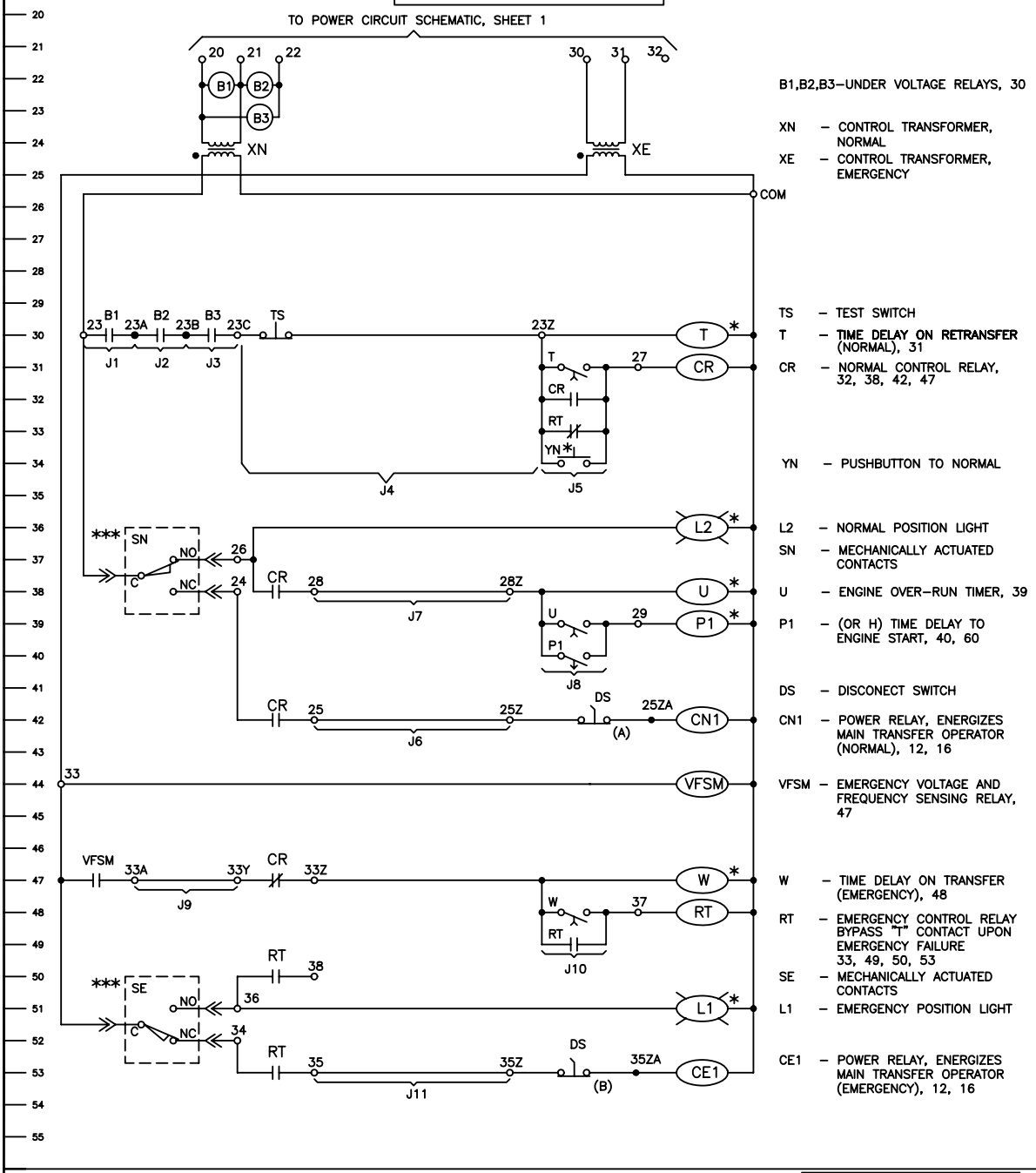
JOB/MODEL: ZTSH4/26 (40–260 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	47A–1005

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
FHB	–	07/22/94	–	1 OF 4	E

ORIGINAL

CONTROL CIRCUIT SCHEMATIC



B1,B2,B3–UNDER VOLTAGE RELAYS, 30

XN – CONTROL TRANSFORMER, NORMAL

XE – CONTROL TRANSFORMER, EMERGENCY

TS – TEST SWITCH

T – TIME DELAY ON RETRANSFER (NORMAL), 31

CR – NORMAL CONTROL RELAY, 32, 38, 42, 47

YN – PUSHBUTTON TO NORMAL

L2 – NORMAL POSITION LIGHT

SN – MECHANICALLY ACTUATED CONTACTS

U – ENGINE OVER–RUN TIMER, 39

P1 – (OR H) TIME DELAY TO ENGINE START, 40, 60

DS – DISCONECT SWITCH

CN1 – POWER RELAY, ENERGIZES MAIN TRANSFER OPERATOR (NORMAL), 12, 16

VFSM – EMERGENCY VOLTAGE AND FREQUENCY SENSING RELAY, 47

W – TIME DELAY ON TRANSFER (EMERGENCY), 48

RT – EMERGENCY CONTROL RELAY BYPASS "T" CONTACT UPON EMERGENCY FAILURE 33, 49, 50, 53

SE – MECHANICALLY ACTUATED CONTACTS

L1 – EMERGENCY POSITION LIGHT

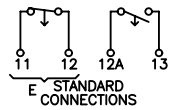
CE1 – POWER RELAY, ENERGIZES MAIN TRANSFER OPERATOR (EMERGENCY), 12, 16

CUSTOMER CONNECTIONS

A3, A4

SEE POWER CIRCUIT SCHEMATIC AND LAYOUT

ENGINE START



CONTACT RATING		
RELAY	CONTACT	RATING
H	E	10AMP @ 28VDC
P1	E	10AMP @ 32VDC
	A3, A4	20AMP, 125, 250 VAC

JUMPER	CONNECT POINTS	REMOVE JUMPER WHEN ACCESSORIES USED
J1	23,23A	B1
J2	23A,23B	B2
J3	23B,23C	B3
J4	23C,23Z	J1N,TS,C/D
J5	23Z,27	T,YN
J6	25,25Z	T3,R4
J7	28,28Z	C,C/D
J8	28Z,29	P1,U
J9	33A,33Y	J1E,ER1,2,3
J10	33Z,37	W
J11	35,35Z	W3,R4

LEGEND

- WIRE CONNECTION
- WIRE ON MAIN TERMINAL BLOCK
- WIRE IN DISCONNECT PLUG
- * OPTIONAL
- *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL

NOTES

1. ZTSH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.
2. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3,A4,E,L1, L2,P,T,U,W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S–5769	ESTABLISH DWG.		
F	S–7179	6/28/99	DF	SB

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

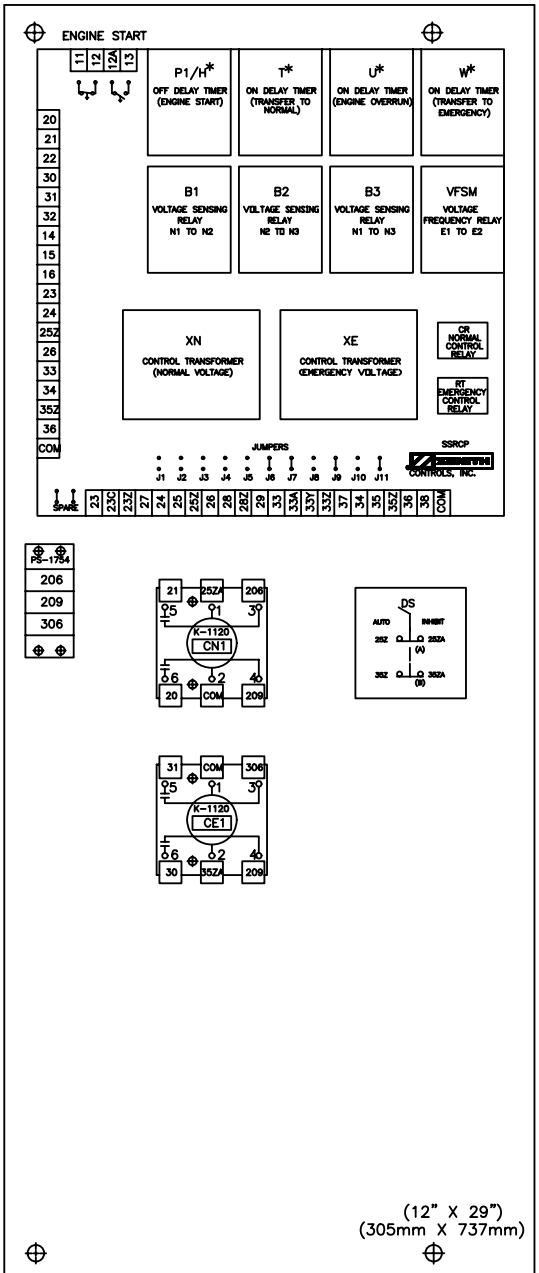
DWG TITLE: CONTROL CIRCUIT SCHEMATIC & CUSTOMER CONNECTIONS

JOB/MODEL: ZTSH4/26 (40–260 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	47A–1005

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
FHB	–	07/22/94	N/A	2 OF 4	E

CONTROL PANEL LAYOUT



(12" X 29")
(305mm X 737mm)

(12" X 41")
(305mm X 1041mm)

NOTE:
12" X 29"/12" X 41"
(305mm X 737mm)/
(305mm X 1041mm)
PANELS ARE STANDARD FOR ENCLOSED ZTSH 40–260 AMP.

REVISIONS				
REV	ECN NO.	DATE	DFT	ENG
–	–	ESTABLISH DWG.		
E	S–7179	6/28/99	DF	SB

NOTES

NOTES:

1. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3, A4, E, L1, L2, P, T, U, W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.
2. (※) OPTIONAL

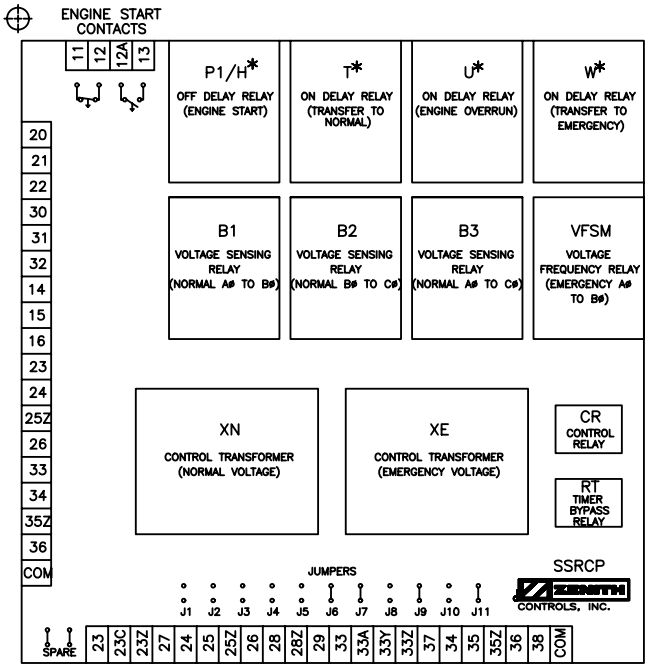
ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

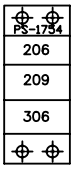
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

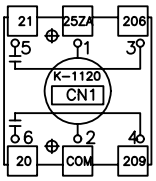
DWG TITLE: CONTROL PANEL LAYOUT						
JOB/MODEL: ZTSH4/26 (40–260 AMP)						
CHKD:	APPD:	CADD: ACAD	ORDER NUMBER: –		DRAWING NUMBER: 47A–1005	
		DRWN: FHB	ENGR: –	DATE: 07/22/99	SCALE: 3/8:1	SHEET: 3 OF 4	REV: E

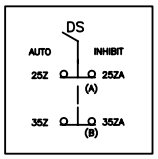
ORIGINAL

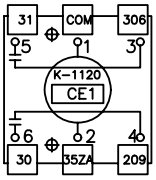
CONTROL PANEL LAYOUT











NOTE:
18" X 29"
(457mm X 737mm)
PANEL IS STANDARD FOR OPEN TYPE ZTSH 40–260 AMP.

(18" X 29")
(457mm X 737mm)

NOTES
1. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3, A4, E, L1, L2, P, T, U, W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.
2. (*) OPTIONAL

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
–	–	ESTABLISH DWG.		
E	S-7179	6/28/99	DF	SB

DWG TITLE: CONTROL PANEL LAYOUT
JOB/MODEL: ZTSH4/26 (40–260 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD –		47A–1005

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
FHB	–	07/22/99	1:2	4 OF 4	E

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED

ORIGINAL

ZTSH SERIES
AUTOMATIC TRANSFER SWITCHES
400 AMP
FOR USE ON EMERGENCY OR STANDBY SYSTEMS
RATED FOR TOTAL SYSTEM & MOTOR LOAD

A. LEGEND

N1,2,3,(N).....Normal Line_____
E1,2,3,(N).....Emergency Line_____
T1,2,3,(N).....Load Connections
B1,2,3.....Solid State Phase Relay(s)
Dropout _____%
Pickup _____%
BR.....Bridge Rectifier
CE1.....CE Control Relay, Emergency
CN1.....CN Control Relay, Normal
CNE.....Main Transfer Operator
CR.....Normal Control Relay
DS.....Disconnect Switch
E.....Engine Start Contact
GND.....Ground
NB.....Neutral Bar (if required)
RT.....Emergency Control Relay
SCN,SCE.....CNE Limit Switches
SE.....Cutout Switch, Emergency
SN.....Cutout Switch, Normal
TS.....Test Switch,Momentary,Not Keyed
VFSM.....Emergency Volt–Freq. Relay
Pickup { 90% of rated Voltage, and 95% of rated Frequency
XE.....Control Transformer, Emergency
XN.....Control Transformer, Normal

B. OPERATION

When the Normal Line falls below the preset dropout point, the phase relays will dropout disconnecting the CR relay.

When the Emergency Line voltage & frequency reach the preset pickup point, the VFSM relay picks up. RT relay picks up to operate the CE1 relay through the SE cutout switch, causing the main transfer operator CNE to operate. The load is now transferred to the Emergency Line. The SE limit switch operates to disconnect the CE1 relay and CNE main transfer operator. The transfer switch is now mechanically locked. Limit switch SN operates to complete the circuit for the next closing operation to Normal.

When the Normal Line voltage exceeds the preset pickup point, the phase relays, B1, B2 & B3 pick up. CR relay picks up to operate the CN1 relay through the SN cutout switch causing the main transfer operator CNE to operate. The load is now re–transferred back to the Normal Line. The SN limit switch operates to disconnect the CN1 relay and CNE main transfer operator. The transfer switch is now mechanically locked. Limit switch SE operates to complete the circuit for the next closing operation to Emergency.

DS – Disconnect Switch
When the Disconnect Switch is placed in the INHIBIT position the control circuits are opened and transfer cannot take place

TS – Test Switch
The Test Switch simulates a normal line failure when activated.
To test, activate the Test Switch allowing the transfer switch to transfer to the EMERGENCY position. De–activate the Test Switch. The transfer switch will reset to the NORMAL position. Testing at least once a month is recommended. For hospital emergency systems, test once a week.

NOTES:

1. ⚠ CAUTION: In using a 3 phase, 4 wire delta or open delta power supply (usually 120/240 volts, sometimes listed as 120/208 volts) with one leg having a grounded center tap, one line will be 160 to 208 volts to ground. When such a system is used it is necessary to connect the high leg to N2.DO NOT CONNECT 120 VOLT LOAD CIRCUIT TO THE HIGH LEG.
2. GROUNDING TERMINAL: A grounding terminal (GND) is provided. When installing open type switches connect this to the metal enclosure or conduit.
3. ⚠ WARNING – TO ENSURE AGAINST SHOCK OR ACCIDENT HAZARD, DISCONNECT ALL SOURCES OF SUPPLY BEFORE SERVICING.
4. ON SINGLE PHASE UNITS WHERE THE EMERGENCY SOURCE IS A UTILITY LINE, CONNECT EMERGENCY LINE SO THAT MINIMUM VOLTAGE IS MEASURED FROM N1 TO E1.
5. ON SINGLE PHASE UNITS, CONNECTION LUGS(N3,E3,T3) AND PHASE RELAYS (B2,B3) ARE NOT SUPPLIED.

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S–5104	ESTABLISH DWG.		
B	S–7179	7/1/99	DF	SB

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION.
DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: LEGEND & OPERATION
JOB/MODEL: ZTSH40 (400 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	40R–0101

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
–	–	8/7/92	N/A	1 OF 1	B

ACCESSORIES

The ZTS series switches are wired so that accessories can be easily added to the switch. The following is a description of the basic accessories. Those checked are supplied on this unit, see additional pages for complete legend & operation.

☐ A1 Auxiliary contact, S.P.D.T., operates on normal line failure.

☐ A1E Auxiliary contact, S.P.D.T., operates on emergency line failure.

☐ A3 Auxiliary contact closes when the transfer switch is in the Emergency position.

☐ A4 Auxiliary contact closes when the transfer switch is in Normal position.

☐ A6 Motor Disconnect. To de–energize external motor control circuit 5 seconds (adjustable) prior to transfer in either direction.

☐ C Plant Exercisor. Automatically starts generator for selected time intervals.

☐ C/D Plant Exercisor. Automatically starts generator to run unloaded or simulate a power failure and starts generator to run under load.

☐ E Engine Start Contact: 1 Normally Open
1 Normally Closed.

☐ F Auxiliary Fan Contact, S.P.N.O. Closes when generator is running.

☐ H Time delay to engine start, non–adjustable. Factory set 1 or 3 seconds. When the Normal line fails the relay de–energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ J1 Adjustable under frequency sensor.

☐ J2 Adjustable over/under frequency sensor.

☐ K Frequency meter to indicate load frequency.

☐ L1 Pilot Light. Switch in Emergency Position.

☐ L2 Pilot Light. Switch in Normal Position.

☐ L3 Pilot Light. Normal source available.

☐ L4 Pilot Light. Emergency source available.

☐ M1 Ammeter; Single phase.

☐ M2 Ammeter; Three phase

☐ M3 Voltmeter; Single phase.

☐ M4 Voltmeter; Three phase.

☐ P1 Time Delay to Engine Start (solid state). Adjustable over time range .5 to 6 seconds. When the Normal line fails the relay de–energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ P2 Time Delay to Engine Start (Pneumatic). Adjustable over time range 1/6 to 300 seconds. When the Normal line fails, the relay de–energizes. After the set time delay its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ Q2 Connections for remote peak shave or area protection relays. Includes bypass for automatic return to Normal if Emergency line fails and Normal is present.

☐ R1 Solid State Adjustable Overvoltage Relay(s). Set at 110% of pickup, 105% of dropout of nominal Line rate, unless otherwise specified.

☐ R4 In–Phase monitor. Prevents transfer until two sources are in–phase. For use of isochronous governors.

☐ R43 In–phase monitor. Prevents transfer until two sources are in–phase. For use with mechanical. governors.

☐ S1 Four–position Engine Control Selector Switch. "STOP", "HAND CRANK", "TEST", "AUTOMATIC".

☐ T Time delay, re–transfer to Normal. When the Normal line restores and the phase relays operate, the T timer is energized. After the set time delay, its contacts close the circuit to the CR relay which operates to restore the load to the Normal line. RT relay is supplied to bypass T contacts if Emergency is de–energized during timing. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ T3 W3 Presignal auxiliary Contact, S.P.D.T: Operates 0–30 seconds (adjustable) prior to transfer in either direction.

☐ U Time delay, engine cool–down. When the transfer switch is restored to the Normal position and the engine is signaled to shut down, the U timer operates to maintain the engine start circuit closed. At the end of the set time, the engine contacts open to shut down the engine. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ W Time delay, transfer to Emergency. When the Normal line fails and the engine has started, the VFSM relay energizes. The W timer energizes. After the set time delay, its contacts close to energize the RT relay. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ YE Pushbutton, Transfer to Emergency. Provides manual control of transfer to emergency source. If time delay accessory W is supplied pushbutton bypasses time delay for immediate transfer; otherwise, transfer to emergency will be automatic after time delay. If time delay accessory W is not supplied, transfer will be non–automatic (by pushbutton only).

☐ YN Pushbutton, Retransfer to Normal. Provides manual control of retransfer to normal source. If time delay accessory T is supplied, pushbutton bypasses time delay for immediate retransfer; otherwise, retransfer to normal will be automatic after time delay. If time delay accessory T is not supplied, retransfer will be non–automatic (by pushbutton only).

☐ Other:_____

_____

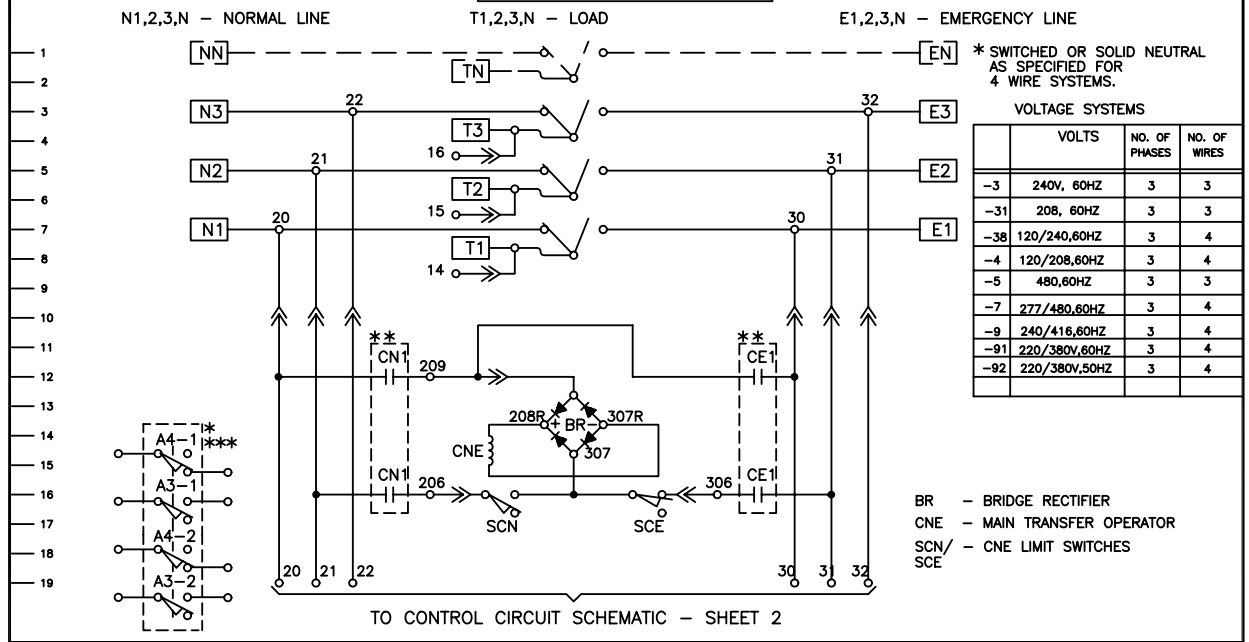
_____

ZENITH® CONTROLS, INC.

TITLE: ACCESSORIES

DRAWING NO.: 40R–0900 — REV

POWER CIRCUIT SCHEMATIC



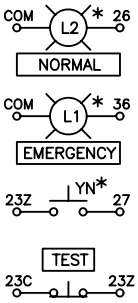
* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEMS.

VOLTAGE SYSTEMS

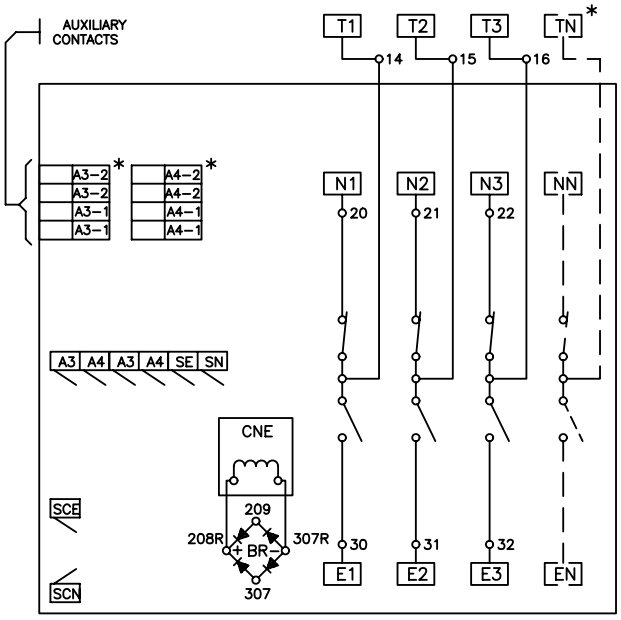
	VOLTS	NO. OF PHASES	NO. OF WIRES
–3	240V, 60HZ	3	3
–31	208, 60HZ	3	3
–38	120/240,60HZ	3	4
–4	120/208,60HZ	3	4
–5	480,60HZ	3	3
–7	277/480,60HZ	3	4
–9	240/416,60HZ	3	4
–91	220/380V,60HZ	3	4
–92	220/380V,50HZ	3	4

BR – BRIDGE RECTIFIER
CNE – MAIN TRANSFER OPERATOR
SCN/ SCE – CNE LIMIT SWITCHES

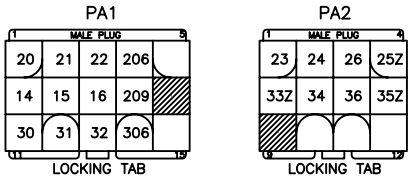
CABINET FRONT



POWER PANEL LAYOUT



INTERCONNECT PLUGS



LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —○— WIRE ON MAIN TERMINAL BLOCK —≫— WIRE IN DISCONNECT PLUG * OPTIONAL ** LOCATED ON CONTROL PANEL *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL	REFER TO 40R–0101 FOR LEGEND & OPERATION. FOR MANUFACTURING: SEE PAGE 3 FOR ENCLOSED UNIT CONTROL PANEL. SEE PAGE 4 FOR OPEN TYPE CONTROL PANEL. SEE 40R–0900 FOR ACCESSORIES.	1. ZTSH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE. 2. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3,A4,E,L1, L2,P,T,U,W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
–	–	ESTABLISH DWG.		
J	S–7179	6/30/99	DF	SB

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

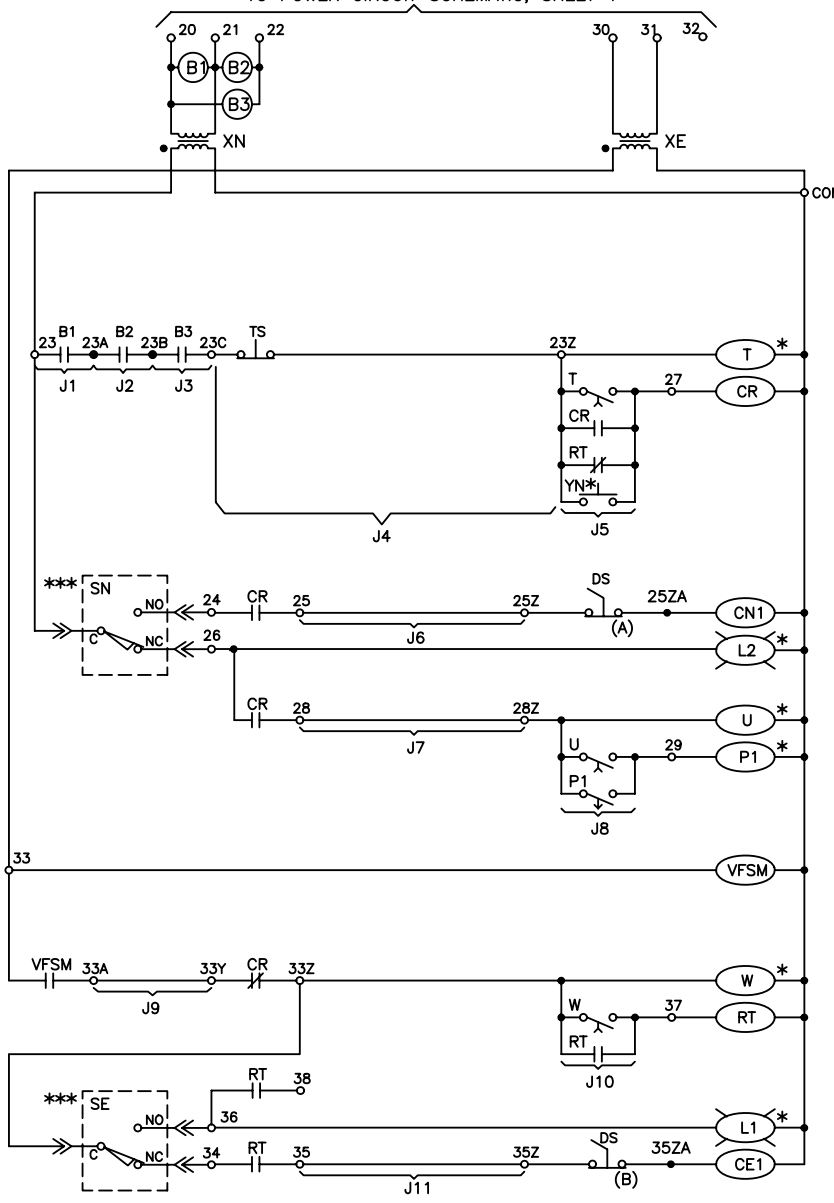
DWG TITLE: POWER CIRCUIT & CABINET FRONT
JOB/MODEL: ZTSH40 (400 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	47A–1000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
FHB	–	07/22/94	N/A	1 OF 4	J

CONTROL CIRCUIT SCHEMATIC

TO POWER CIRCUIT SCHEMATIC, SHEET 1



B1,B2,B3–UNDER VOLTAGE RELAYS, 30

XN – CONTROL TRANSFORMER, NORMAL

XE – CONTROL TRANSFORMER, EMERGENCY

TS – TEST SWITCH

T – TIME DELAY ON RETRANSFER (NORMAL), 31

CR – NORMAL CONTROL RELAY 32, 37, 42, 47

YN – PUSHBUTTON TO NORMAL

DS – DISCONNECT SWITCH

SN – MECHANICALLY ACTUATED CONTACTS

CN1 – POWER RELAY, ENERGIZES MAIN TRANSFER OPERATOR (NORMAL), 12, 16

L2 – NORMAL POSITION LIGHT

U – ENGINE OVER–RUN TIMER, 41

P1 – (OR H) TIME DELAY TO ENGINE START, 42, 60

VFSM – EMERGENCY VOLTAGE AND FREQUENCY SENSING RELAY, 47

W – TIME DELAY ON TRANSFER (EMERGENCY), 48

RT – EMERGENCY CONTROL RELAY BYPASS "T" CONTACT UPON EMERGENCY FAILURE, 33, 49, 50, 52

SE – MECHANICALLY ACTUATED CONTACTS

L1 – EMERGENCY POSITION LIGHT

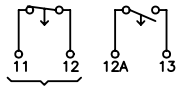
CE1 – POWER RELAY, ENERGIZES MAIN TRANSFER OPERATOR (EMERGENCY), 12, 16

CUSTOMER CONNECTIONS

A3, A4

SEE POWER CIRCUIT SCHEMATIC AND LAYOUT

ENGINE START



E STANDARD CONNECTIONS

CONTACT RATING		
RELAY	CONTACT	RATING
H	E	10AMP @ 28VDC
P1	E	10AMP @ 32VDC
	A3, A4	20AMP, 125, 250 VAC

JUMPER	CONNECT POINTS	REMOVE JUMPER WHEN ACCESSORIES USED
J1	23,23A	B1
J2	23A,23B	B2
J3	23B,23C	B3
J4	23C,23Z	J1N,TS,C/D
J5	23Z,27	T,YN
J6	25,25Z	T3,R4
J7	28,28Z	C,C/D
J8	28Z,29	P1,U
J9	33A,33Y	J1E,ER1,2,3
J10	33Z,37	W
J11	35,35Z	W3,R4

LEGEND

- WIRE CONNECTION
- WIRE ON MAIN TERMINAL BLOCK
- WIRE IN DISCONNECT PLUG
- * OPTIONAL
- ** LOCATED ON CONTROL PANEL
- *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL

NOTES

1. ZTSH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.
2. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3,A4,E,L1, L2,P,T,U,W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
–	–	ESTABLISH DWG.		
C	S-7179	6/30/99	DF	SB

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

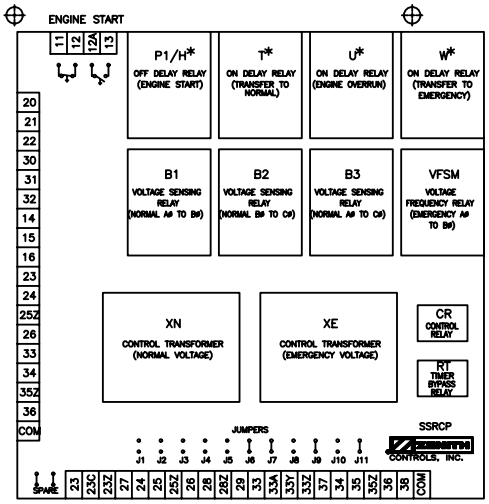
DWG TITLE: CONTROL CIRCUIT SCHEMATIC/CUSTOMER CONNECTIONS

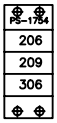
JOB/MODEL: ZTSH40 (400 AMP)

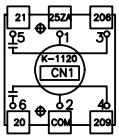
CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	47A–1000

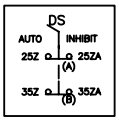
DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
FHB	–	07/22/94	N/A	2 OF 4	J

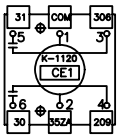
CONTROL PANEL LAYOUT











(12" X 29")
(305mm X 737mm)

(12" X 41")
(305mm X 1041mm)

NOTE:
12" X 41"
(305mm X 1041mm)
PANEL IS STANDARD FOR ENCLOSED ZTSH 400 AMP.

REVISIONS				
REV	ECN NO.	DATE	DFT	ENG
		ESTABLISH DWG.		
J	S-7179	06/30/99	DF	SB

NOTES

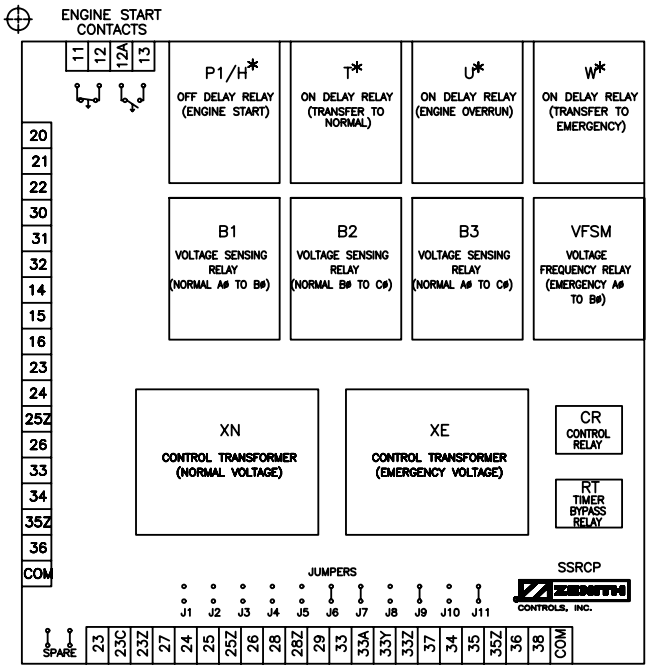
1. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3, A4, E, L1, L2, P, T, U, W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.
2. (*) OPTIONAL

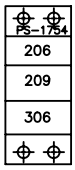
ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

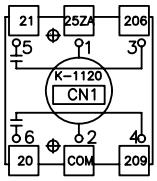
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION.
DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

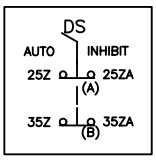
DWG TITLE: CONTROL PANEL LAYOUT						
JOB/MODEL: ZTSH40 (400 AMP)						
CHKD:	APPD:	CADD: ACAD	ORDER NUMBER: -		DRAWING NUMBER: 47A-1000	
		DRWN: FHB	ENGR: -	DATE: 07/22/94	SCALE: 3/8:1	SHEET: 3 OF 4	REV: J

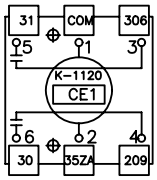
CONTROL PANEL LAYOUT











NOTE:
18" X 29"
(457mm X 737mm)
PANEL IS STANDARD FOR OPEN TYPE ZTSH 400 AMP.

(18" X 29")
(457mm X 737mm)

NOTES	REVISIONS					DWG TITLE: CONTROL PANEL LAYOUT							
1.DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3, A4, E, L1, L2, P, T, U, W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.	REV	ECN NO.	DATE	DFT	ENG	JOB/MODEL: ZTSH40 (400 AMP)							
	–	–	ESTABLISH DWG.			CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:			
	J	S-7179	06/30/99	DF	SB			ACAD	–	47A-1000			
								DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
2.(*) OPTIONAL								FHB		07/22/99	1:2	4 OF 4	J

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

ORIGINAL

ZTSH SERIES
AUTOMATIC TRANSFER SWITCHES
600 – 1200 AMP
FOR USE ON EMERGNECY OR STANDBY SYSTEMS
RATED FOR TOTAL SYSTEM & MOTOR LOAD

A. LEGEND

N1,2,3,(N).....Normal Line_____
E1,2,3,(N).....Emergency Line_____
T1,2,3,(N).....Load Connections
B1,2,3.....Solid State Phase Relay(s)
Dropout___ %
Pickup___ %
CCE.....CE Control Relay, Emergency
CCN.....CN Control Relay, Normal
CE.....Emergency Main Transfer Operator
CN.....Normal Main Transfer Operator
CR.....Normal Control Relay
DS.....Disconnect Switch
E.....Engine Start Contact
GND.....Ground
NB.....Neutral Bar (if required)
RT.....Emergency Control Relay
SE.....Cutout Switch, Emergency
SN.....Cutout Switch, Normal
TS.....Test Switch,Momentary,Not Keyed
VFSM.....Emergency Volt–Freq. Relay
Pickup { 90% of rated Voltage, and
95% of rated Frequency
XE.....Control Transformer, Emergency
XN.....Control Transformer, Normal

B. OPERATION

When the Normal Line falls to the preset dropout point, the phase relays will dropout disconnecting the CR relay.

When the Emergency Line voltage & frequency reach the preset pick up point, the VFSM relay picks up. RT relay picks up to operate the CCE relay through the SE cutout switch causing the emergency main transfer operator CE to operate. The load is now transferred to the emergency line supply. The SE limit switch operates to disconnect the CCE relay and CE emergency main transfer operator. The transfer switch is now mecha–nically locked. Limit switch SN operates to com–plete the circuit for the next closing operation to Normal.

When the Normal Line voltage exceeds the preset pick up point, the phase relays B1, B2 & B3 pick up. CR relay picks up to operate the CCN relay through the SN cutout switch, causing the main transfer operator CN to operate. The load is now re–transferred back to the Normal line. The SN limit switch operates to disconnect the CCN relay and CN normal main transfer operator. The transfer switch is now mechanically locked. Limit switch SE operates to complete the circuit for the next closing operation to Emergency.

DS – Disconnect Switch
When the Disconnect Switch is placed in the INHIBIT position the circuit to the main transfer operators CN and CE is opened and transfer cannot take place.

TS – Test Switch
The Test Switch simulates a normal line failure when activated.
To test, activate the Test Switch allowing the transfer switch to transfer to the EMERGENCY position. De–activate the Test Switch. The transfer switch will reset to the NORMAL position. Testing at least once a month is recommended. For hospital emergency systems, test once a week.

NOTES:

1. ⚠ CAUTION:In using a 3 phase, 4 wire delta or open delta power supply (usually 120/240 volts, sometimes listed as 120/208 volts) with one leg having a grounded center tap, one line will be 160 to 208 volts to ground. When such a system is used it is necessary to connect the high leg to N2.DO NOT CONNECT 120 VOLT LOAD CIRCUIT TO THE HIGH LEG.
2. GROUNDING TERMINAL: A grounding terminal (GND) is provided. When installing open type switches connect this to the metal enclosure or conduit.
3. ⚠ WARNING – TO ENSURE AGAINST SHOCK OR ACCIDENT HAZARD, DISCONNECT ALL SOURCES OF SUPPLY BEFORE SERVICING.
4. ON SINGLE PHASE UNITS WHERE THE EMERGENCY SOURCE IS A UTILITY LINE, CONNECT EMERGENCY LINE SO THAT MINIMUM VOLTAGE IS MEASURED FROM N1 TO E1.
5. ON SINGLE PHASE (2 POLE) UNITS, CENTER POLE AND PHASE RELAYS (B2,B3) ARE NOT SUPPLIED.

SG	AA	DWN	ENG
03/26/99	REDRAWN	DATE	DESCRIPTION
I		ECN NO.	
I		REV	

TOLERANCES: –
REF ASSY: –
FINISH: –
MATERIAL: –

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: LEGEND & OPERATION
JOB/MODEL: ZTSH60–120

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD		40R–0102

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
		08/07/92	–	1 OF 1	A

ACCESSORIES

The ZTS series switches are wired so that accessories can be easily added to the switch. The following is a description of the basic accessories. Those checked are supplied on this unit, see additional pages for complete legend & operation.

☐ A1 Auxiliary contact, S.P.D.T., operates on normal line failure.

☐ A1E Auxiliary contact, S.P.D.T., operates on emergency line failure.

☐ A3 Auxiliary contact closes when the transfer switch is in the Emergency position.

☐ A4 Auxiliary contact closes when the transfer switch is in Normal position.

☐ A6 Motor Disconnect. To de–energize external motor control circuit 5 seconds (adjustable) prior to transfer in either direction.

☐ C Plant Exercisor. Automatically starts generator for selected time intervals.

☐ C/D Plant Exercisor. Automatically starts generator to run unloaded or simulate a power failure and starts generator to run under load.

☐ E Engine Start Contact: 1 Normally Open
1 Normally Closed.

☐ F Auxiliary Fan Contact, S.P.N.O. Closes when generator is running.

☐ H Time delay to engine start, non–adjustable. Factory set 1 or 3 seconds. When the Normal line fails the relay de–energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ J1 Adjustable under frequency sensor.

☐ J2 Adjustable over/under frequency sensor.

☐ K Frequency meter to indicate load frequency.

☐ L1 Pilot Light. Switch in Emergency Position.

☐ L2 Pilot Light. Switch in Normal Position.

☐ L3 Pilot Light. Normal source available.

☐ L4 Pilot Light. Emergency source available.

☐ M1 Ammeter; Single phase.

☐ M2 Ammeter; Three phase

☐ M3 Voltmeter; Single phase.

☐ M4 Voltmeter; Three phase.

☐ P1 Time Delay to Engine Start (solid state). Adjustable over time range .5 to 6 seconds. When the Normal line fails the relay de–energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ P2 Time Delay to Engine Start (Pneumatic). Adjustable over time range 1/6 to 300 seconds. When the Normal line fails, the relay de–energizes. After the set time delay its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ Q2 Connections for remote peak shave or area protection relays. Includes bypass for automatic return to Normal if Emergency line fails and Normal is present.

☐ R1 Solid State Adjustable Overvoltage Relay(s). Set at 110% of pickup, 105% of dropout of nominal Line rate, unless otherwise specified.

☐ R4 In–Phase monitor. Prevents transfer until two sources are in–phase. For use of isochronous governors.

☐ R43 In–phase monitor. Prevents transfer until two sources are in–phase. For use with mechanical. governors.

☐ S1 Four–position Engine Control Selector Switch. "STOP", "HAND CRANK", "TEST", "AUTOMATIC".

☐ T Time delay, re–transfer to Normal. When the Normal line restores and the phase relays operate, the T timer is energized. After the set time delay, its contacts close the circuit to the CR relay which operates to restore the load to the Normal line. RT relay is supplied to bypass T contacts if Emergency is de–energized during timing. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ T3 W3 Presignal auxiliary Contact, S.P.D.T: Operates 0–30 seconds (adjustable) prior to transfer in either direction.

☐ U Time delay, engine cool–down. When the transfer switch is restored to the Normal position and the engine is signaled to shut down, the U timer operates to maintain the engine start circuit closed. At the end of the set time, the engine contacts open to shut down the engine. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ W Time delay, transfer to Emergency. When the Normal line fails and the engine has started, the VFSM relay energizes. The W timer energizes. After the set time delay, its contacts close to energize the RT relay. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ YE Pushbutton, Transfer to Emergency. Provides manual control of transfer to emergency source. If time delay accessory W is supplied pushbutton bypasses time delay for immediate transfer; otherwise, transfer to emergency will be automatic after time delay. If time delay accessory W is not supplied, transfer will be non–automatic (by pushbutton only).

☐ YN Pushbutton, Retransfer to Normal. Provides manual control of retransfer to normal source. If time delay accessory T is supplied, pushbutton bypasses time delay for immediate retransfer; otherwise, retransfer to normal will be automatic after time delay. If time delay accessory T is not supplied, retransfer will be non–automatic (by pushbutton only).

☐ Other:_____

_____

_____

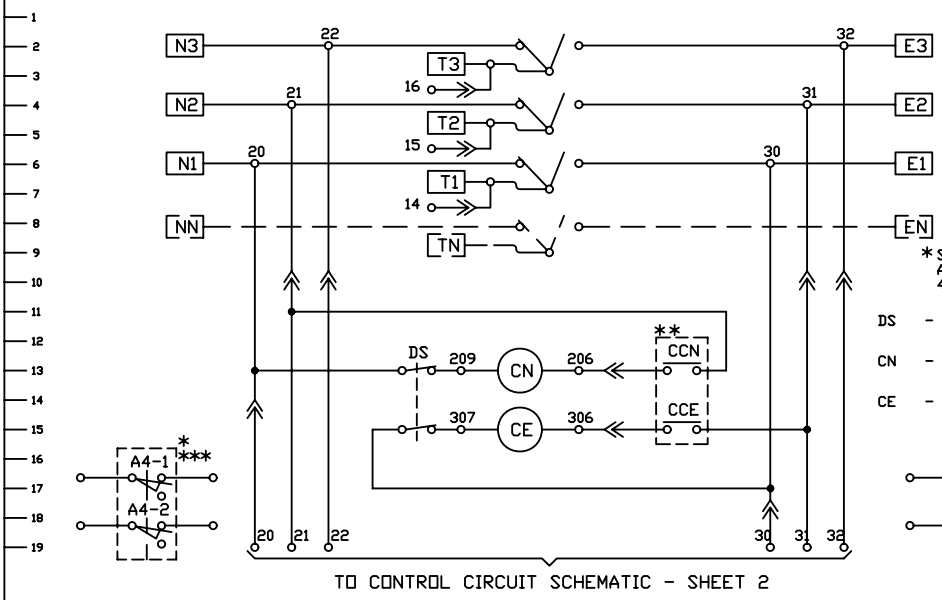
ZENITH® CONTROLS, INC.

TITLE: ACCESSORIES

DRAWING NO.: 40R–0900 — REV

POWER CIRCUIT SCHEMATIC

N1,2,3,N - NORMAL LINE T1,2,3,N - LOAD E1,2,3,N - EMERGENCY LINE



VOLTAGE SYSTEMS

	VOLTS	NO. OF PHASES	NO. OF WIRES
-3	240V, 60HZ	3	3
-31	208, 60HZ	3	3
-38	120/240,60HZ	3	4
-4	120/208,60HZ	3	4
-5	480,60HZ	3	3
-7	277/480,60HZ	3	4
-9	240/416,60HZ	3	4
-91	220/380V,60HZ	3	4
-92	220/380V,50HZ	3	4

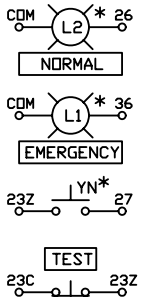
* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEMS.

DS - DISCONNECT SWITCH FOR SERVICING

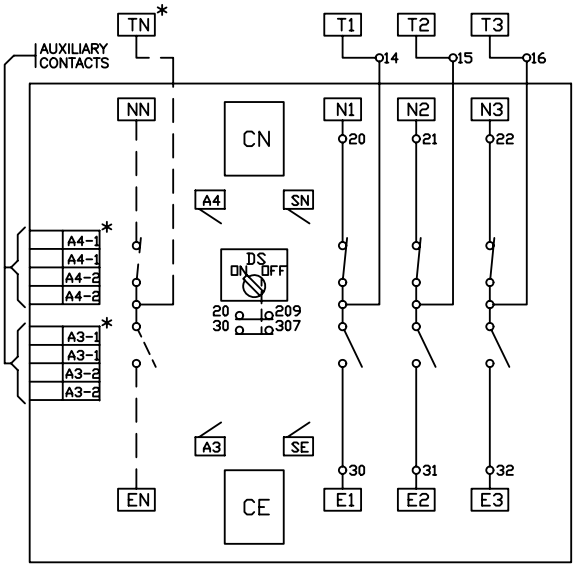
CN - NORMAL TRANSFER OPERATOR (TRANSFER TO NORMAL)

CE - EMERGENCY TRANSFER OPERATOR (TRANSFER TO EMERGENCY)

CABINET FRONT

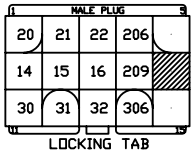


POWER PANEL LAYOUT



INTERCONNECT PLUGS

PA1



PA2



REVISIONS:
ECN S-5769

NOTES:
1. ZTSH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.
2. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3,A4,E,L1, L2,P,T,U,W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.

LEGEND
- WIRE CONNECTION
- WIRE ON MAIN TERMINAL BLOCK
- WIRE IN DISCONNECT PLUG
- * OPTIONAL
- ** LOCATED ON CONTROL PANEL
- *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL

REFER TO 40R-0102 FOR LEGEND & OPERATION

FOR MANUFACTURING:
SEE PAGE 3 FOR ENCLOSED UNIT CONTROL PANEL
SEE PAGE 4 FOR OPEN TYPE CONTROL PANEL
SEE 40R-0900 FOR ACCESSORIES

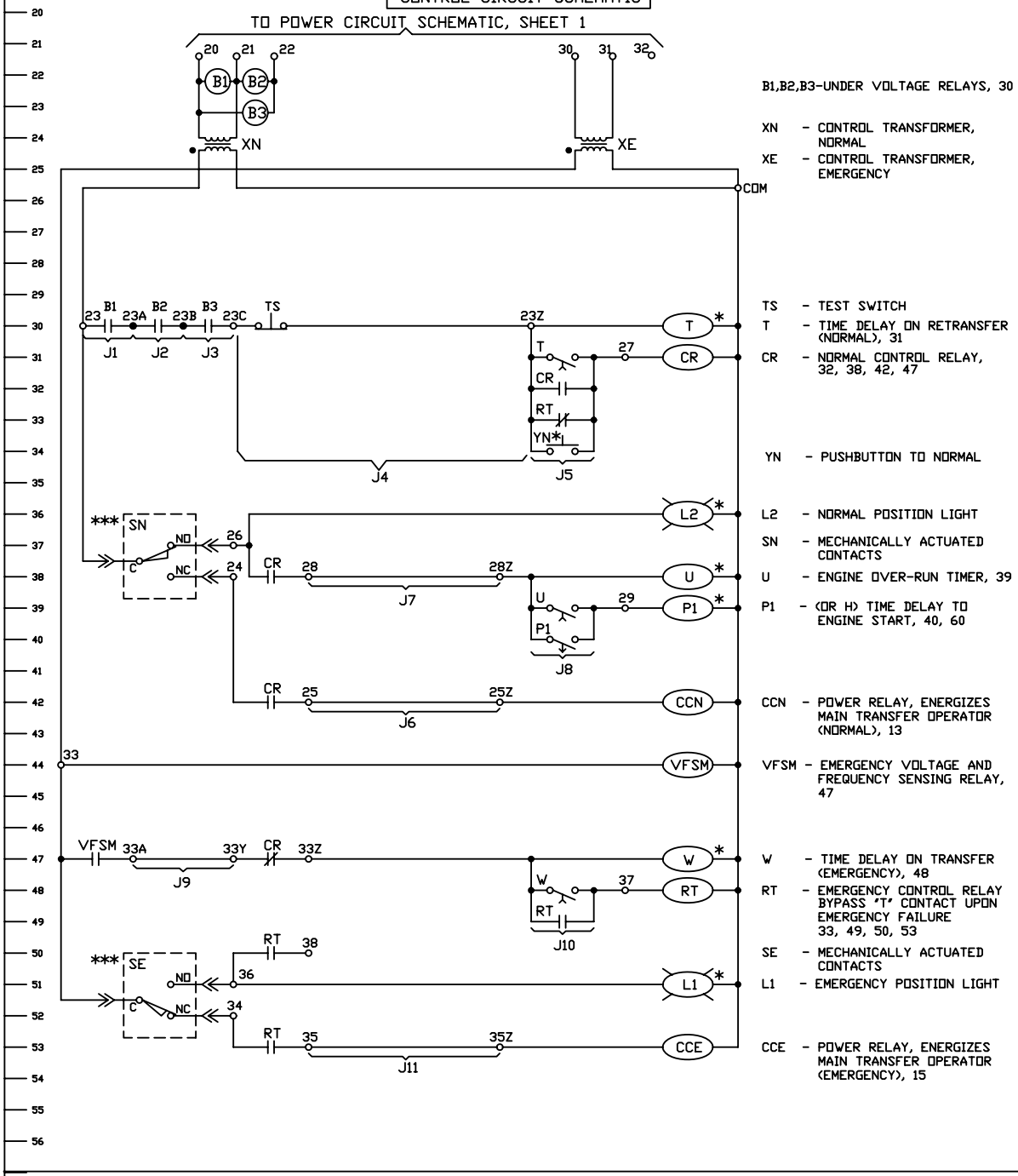
ZENITH CONTROLS, INC.

TITLE: POWER CIRCUIT & CABINET FRONT
MODEL: ZTSH60/120 (600-1200 AMP)
DRFT: FHB APP'D:
DATE: 07/22/94
DRAWING NO.: 43A-1000-3
SHEET 1 OF 4

ORIGINAL

CONTROL CIRCUIT SCHEMATIC

TO POWER CIRCUIT SCHEMATIC, SHEET 1



B1,B2,B3-UNDER VOLTAGE RELAYS, 30

XN - CONTROL TRANSFORMER, NORMAL

XE - CONTROL TRANSFORMER, EMERGENCY

TS - TEST SWITCH

T - TIME DELAY ON RETRANSFER (NORMAL), 31

CR - NORMAL CONTROL RELAY, 32, 38, 42, 47

YN - PUSHBUTTON TO NORMAL

L2 - NORMAL POSITION LIGHT

SN - MECHANICALLY ACTUATED CONTACTS

U - ENGINE OVER-RUN TIMER, 39

P1 - (OR H) TIME DELAY TO ENGINE START, 40, 60

CCN - POWER RELAY, ENERGIZES MAIN TRANSFER OPERATOR (NORMAL), 13

VFSM - EMERGENCY VOLTAGE AND FREQUENCY SENSING RELAY, 47

W - TIME DELAY ON TRANSFER (EMERGENCY), 48

RT - EMERGENCY CONTROL RELAY BYPASS "T" CONTACT UPON EMERGENCY FAILURE 33, 49, 50, 53

SE - MECHANICALLY ACTUATED CONTACTS

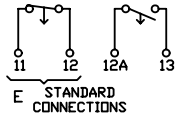
L1 - EMERGENCY POSITION LIGHT

CCE - POWER RELAY, ENERGIZES MAIN TRANSFER OPERATOR (EMERGENCY), 15

CUSTOMER CONNECTIONS

A3, A4
SEE POWER CIRCUIT SCHEMATIC AND LAYOUT

ENGINE START



CONTACT RATING		
RELAY	CONTACT	RATING
H	E	10AMP @ 28VDC
P1	E	10AMP @ 32VDC
	A3, A4	20AMP, 125, 250 VAC

JUMPER	CONNECT POINTS	REMOVE JUMPER WHEN ACCESSORIES USED
J1	23, 23A	B1
J2	23A, 23B	B2
J3	23B, 23C	B3
J4	23C, 23Z	J1N, TS, C/D
J5	23Z, 27	T, YN
J6	25, 25Z	T3, R4
J7	28, 28Z	C, C/D
J8	28Z, 29	P1, U
J9	33A, 33Y	J1E, ER1, 2, 3
J10	33Z, 37	W
J11	35, 35Z	W3, R4

NOTES:
1. ZTSH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.
2. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3, A4, E, L1, L2, P, T, U, W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.

LEGEND
- WIRE CONNECTION
- WIRE ON MAIN TERMINAL BLOCK
- WIRE IN DISCONNECT PLUG
- * OPTIONAL
- *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL

REVISIONS:
ECN S-5769

ZENITH CONTROLS, INC.

TITLE: CONTROL CIRCUIT SCHEMATIC & CUSTOMER CONNECTIONS

MODEL: ZTSH60/120 (600-1200 AMP)

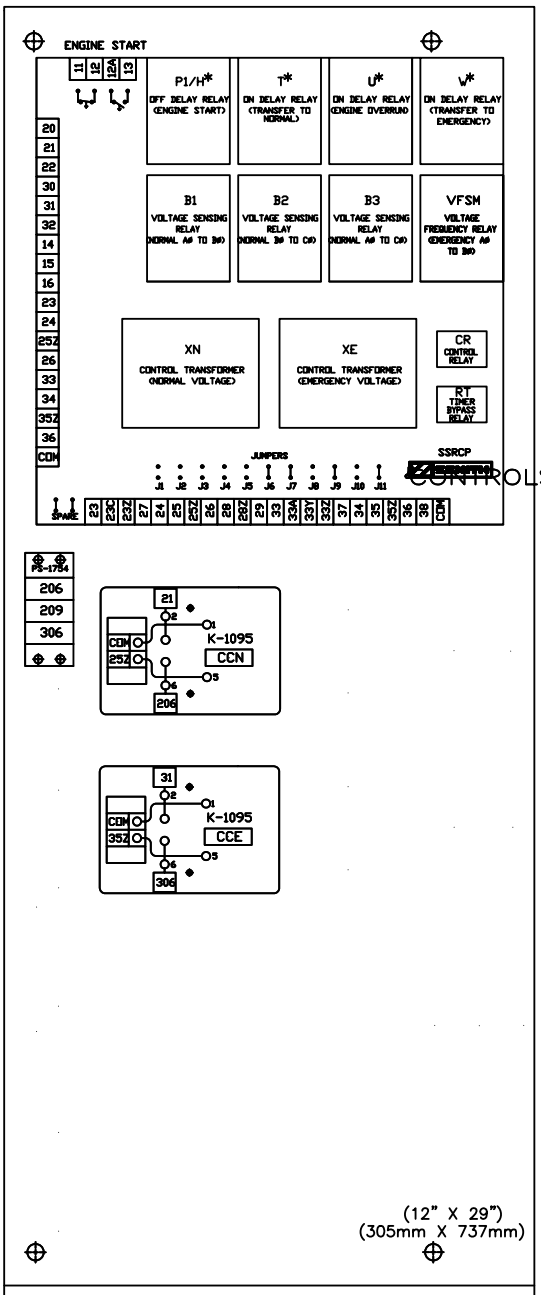
DRFT: FHB | APP'D:

DATE: 07/22/94

DRAWING NO.: 43A-1000-3 SHEET 2 OF 4

ORIGINAL

CONTROL PANEL LAYOUT



(12" X 29")
(305mm X 737mm)

(12" X 41")
(305mm X 1041mm)

NOTE:
12" X 41"
(305mm X 1041mm)
PANEL IS STANDARD FOR ENCLOSED ZTSH 600–1200 AMP.

REVISIONS:
ECN S-5769

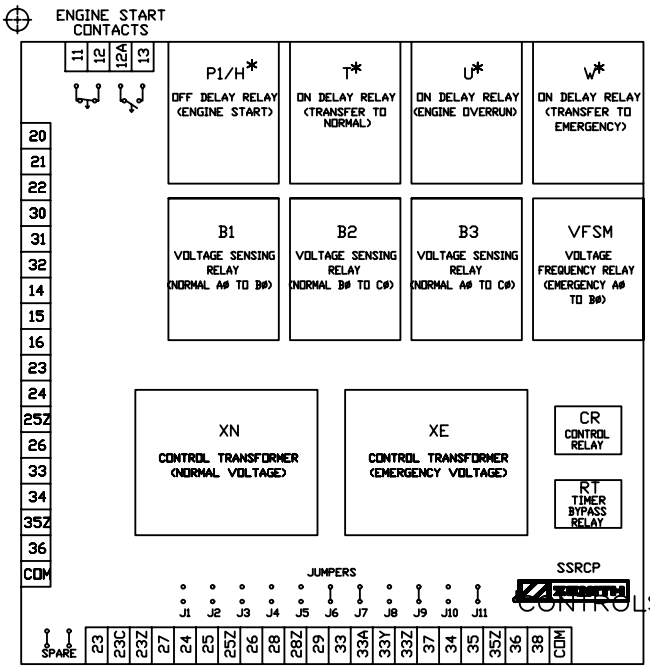
NOTES:
1. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3, A4, E, L1, L2, P, T, U, W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.
2. ( ) OPTIONAL

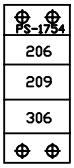
ZENITH CONTROLS, INC.

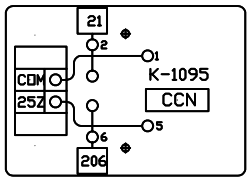
TITLE: CONTROL PANEL LAYOUT
MODEL: ZTSH60/120 (600-1200 AMP)
DRFT: FHB | APP'D:
DATE: 07/22/94
SCALE: 3/8 = 1
DRAWING NO.: 43A-1000-3
SHEET 3 OF 4

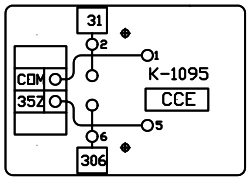
ORIGINAL

CONTROL PANEL LAYOUT









NOTE:
18" X 29"
(457mm X 737mm)
PANEL IS STANDARD FOR OPEN TYPE ZTSH 600–1200 AMP.

(18" X 29")
(457mm X 737mm)

REVISIONS: ECN S-5769	NOTES: 1.DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3, A4, E, L1, L2, P, T, U, W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES. 2.(✻ OPTIONAL	MODEL: ZTSH60/120 (600–1200 AMPS)	ZENITH CONTROLS, INC.
		DRFT: FHB / CHK'D:	TITLE: CONTROL PANEL LAYOUT
		DATE: 07/22/94 / APP'D:	DRAWING NO.: 43A-1000-3
		SCALE: 1/2 = 1	SHEET 4 OF 4

ORIGINAL

ZTSH SERIES
AUTOMATIC TRANSFER SWITCHES
1600 – 3000 AMP

FOR USE ON EMERGNECY OR STANDBY SYSTEMS
RATED FOR TOTAL SYSTEM & MOTOR LOAD

A. LEGEND

N1,2,3,(N)	Normal Line
E1,2,3,(N)	Emergency Line
T1,2,3,(N)	Load Connections
B1,2,3	Solid State Phase Relay(s)
	Dropout _____%
	Pickup _____%
CCE	CE Control Relay, Emergency
CCN	CN Control Relay, Normal
CE	Emergency Main Transfer Operator
CN	Normal Main Transfer Operator
CR	Normal Control Relay
DS	Disconnect Switch
E	Engine Start Contact
GND	Ground
NB	Neutral Bar (if required)
RE	Bridge Rectifier, Emergency
RN	Bridge Rectifier, Normal
RT	Emergency Control Relay
SE	Cutout Switch, Emergency
SN	Cutout Switch, Normal
TS	Test Switch, Momentary, Not Keyed
VFSM	Emergency Volt-Freq. Relay
	Pickup { 90% of rated Voltage, and 95% of rated Frequency
XE	Control Transformer, Emergency
XN	Control Transformer, Normal

B. OPERATION

When the Normal Line fails to the preset dropout point, the phase relays will dropout disconnecting the CR relay.

When the Emergency Line voltage & frequency reach the preset pick up point, the VFSM relay picks up. RT relay picks up to operate the CCE relay through the SE cutout switch causing the emergency main transfer operator CE to operate. The load is now transferred to the emergency line supply. The SE limit switch operates to disconnect the CCE relay and CE emergency main transfer operator. The transfer switch is now mechanically locked. Limit switch SN operates to complete the circuit for the next closing operation to Normal.

When the Normal Line voltage exceeds the preset pick up point, the phase relays B1, B2 & B3 pick up. CR relay picks up to operate the CCN relay through the SN cutout switch, causing the main transfer operator CN to operate. The load is now re-transferred back to the Normal line. The SN limit switch operates to disconnect the CCN relay and CN normal main transfer operator. The transfer switch is now mechanically locked. Limit switch SE operates to complete the circuit for the next closing operation to Emergency.

DS – Disconnect Switch
When the Disconnect Switch is placed in the INHIBIT position the circuit to the main transfer operators CN and CE is opened and transfer cannot take place.

TS – Test Switch
The Test Switch simulates a normal line failure when activated.
To test, activate the Test Switch allowing the transfer switch to transfer to the EMERGENCY position. De-activate the Test Switch. The transfer switch will reset to the NORMAL position. Testing at least once a month is recommended. For hospital emergency systems, test once a week.

NOTES:

1. ⚠CAUTION: In using a 3 phase, 4 wire delta or open delta power supply (usually 120/240 volts, sometimes listed as 120/208 volts) with one leg having a grounded center tap, one line will be 160 to 208 volts to ground. When such a system is used it is necessary to connect the high leg to N2. DO NOT CONNECT 120 VOLT LOAD CIRCUIT TO THE HIGH LEG.
2. GROUNDING TERMINAL: A grounding terminal (GND) is provided. When installing open type switches connect this to the metal enclosure or conduit.
3. ⚠ WARNING – TO ENSURE AGAINST SHOCK OR ACCIDENT HAZARD, DISCONNECT ALL SOURCES OF SUPPLY BEFORE SERVICING.
4. ON SINGLE PHASE UNITS WHERE THE EMERGENCY SOURCE IS A UTILITY LINE, CONNECT EMERGENCY LINE SO THAT MINIMUM VOLTAGE IS MEASURED FROM N1 TO E1.
5. ON SINGLE PHASE (2 POLE) UNITS, CENTER POLE AND PHASE RELAYS (B2,B3) ARE NOT SUPPLIED.

CONTROLLED

ECN S-5004: 8-7-92

ZENITH CONTROLS, INC.

TITLE: LEGEND & OPERATION

DRAWING NO.: 40R-0103 | REV –

ACCESSORIES

The ZTS series switches are wired so that accessories can be easily added to the switch. The following is a description of the basic accessories. Those checked are supplied on this unit, see additional pages for complete legend & operation.

☐ A1 Auxiliary contact, S.P.D.T., operates on normal line failure.

☐ A1E Auxiliary contact, S.P.D.T., operates on emergency line failure.

☐ A3 Auxiliary contact closes when the transfer switch is in the Emergency position.

☐ A4 Auxiliary contact closes when the transfer switch is in Normal position.

☐ A6 Motor Disconnect. To de–energize external motor control circuit 5 seconds (adjustable) prior to transfer in either direction.

☐ C Plant Exercisor. Automatically starts generator for selected time intervals.

☐ C/D Plant Exercisor. Automatically starts generator to run unloaded or simulate a power failure and starts generator to run under load.

☐ E Engine Start Contact: 1 Normally Open
1 Normally Closed.

☐ F Auxiliary Fan Contact, S.P.N.O. Closes when generator is running.

☐ H Time delay to engine start, non–adjustable. Factory set 1 or 3 seconds. When the Normal line fails the relay de–energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ J1 Adjustable under frequency sensor.

☐ J2 Adjustable over/under frequency sensor.

☐ K Frequency meter to indicate load frequency.

☐ L1 Pilot Light. Switch in Emergency Position.

☐ L2 Pilot Light. Switch in Normal Position.

☐ L3 Pilot Light. Normal source available.

☐ L4 Pilot Light. Emergency source available.

☐ M1 Ammeter; Single phase.

☐ M2 Ammeter; Three phase

☐ M3 Voltmeter; Single phase.

☐ M4 Voltmeter; Three phase.

☐ P1 Time Delay to Engine Start (solid state). Adjustable over time range .5 to 6 seconds. When the Normal line fails the relay de–energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ P2 Time Delay to Engine Start (Pneumatic). Adjustable over time range 1/6 to 300 seconds. When the Normal line fails, the relay de–energizes. After the set time delay its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ Q2 Connections for remote peak shave or area protection relays. Includes bypass for automatic return to Normal if Emergency line fails and Normal is present.

☐ R1 Solid State Adjustable Overvoltage Relay(s). Set at 110% of pickup, 105% of dropout of nominal Line rate, unless otherwise specified.

☐ R4 In–Phase monitor. Prevents transfer until two sources are in–phase. For use of isochronous governors.

☐ R43 In–phase monitor. Prevents transfer until two sources are in–phase. For use with mechanical. governors.

☐ S1 Four–position Engine Control Selector Switch. "STOP", "HAND CRANK", "TEST", "AUTOMATIC".

☐ T Time delay, re–transfer to Normal. When the Normal line restores and the phase relays operate, the T timer is energized. After the set time delay, its contacts close the circuit to the CR relay which operates to restore the load to the Normal line. RT relay is supplied to bypass T contacts if Emergency is de–energized during timing. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ T3 W3 Presignal auxiliary Contact, S.P.D.T: Operates 0–30 seconds (adjustable) prior to transfer in either direction.

☐ U Time delay, engine cool–down. When the transfer switch is restored to the Normal position and the engine is signaled to shut down, the U timer operates to maintain the engine start circuit closed. At the end of the set time, the engine contacts open to shut down the engine. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ W Time delay, transfer to Emergency. When the Normal line fails and the engine has started, the VFSM relay energizes. The W timer energizes. After the set time delay, its contacts close to energize the RT relay. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ YE Pushbutton, Transfer to Emergency. Provides manual control of transfer to emergency source. If time delay accessory W is supplied pushbutton bypasses time delay for immediate transfer; otherwise, transfer to emergency will be automatic after time delay. If time delay accessory W is not supplied, transfer will be non–automatic (by pushbutton only).

☐ YN Pushbutton, Retransfer to Normal. Provides manual control of retransfer to normal source. If time delay accessory T is supplied, pushbutton bypasses time delay for immediate retransfer; otherwise, retransfer to normal will be automatic after time delay. If time delay accessory T is not supplied, retransfer will be non–automatic (by pushbutton only).

☐ Other:_____

_____

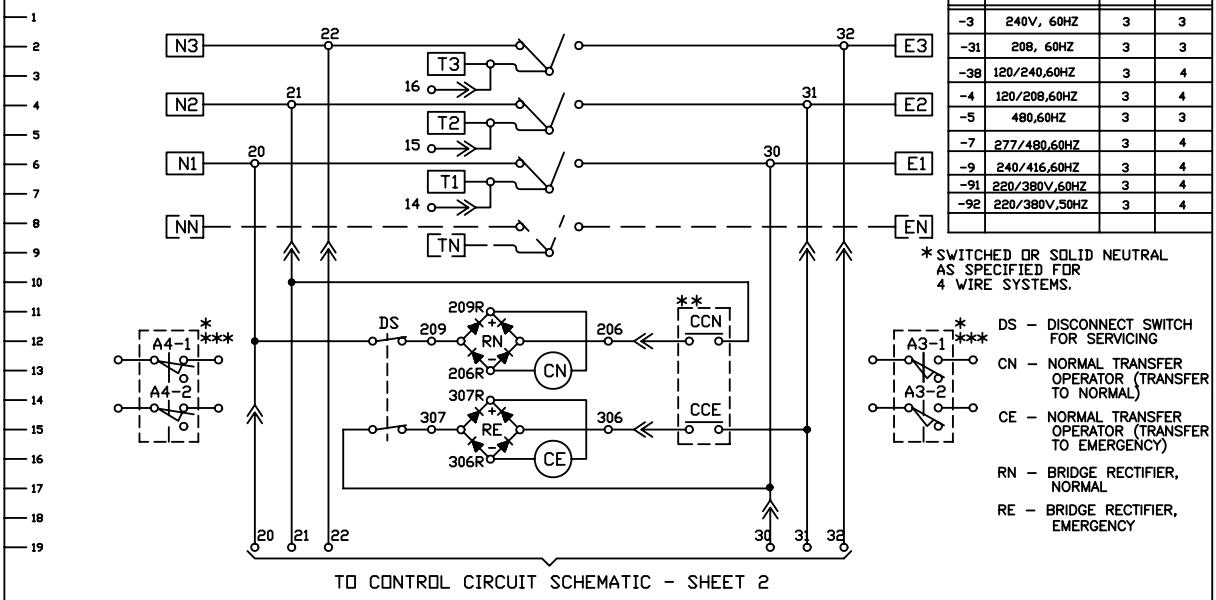
_____

ZENITH® CONTROLS, INC.

TITLE: ACCESSORIES

DRAWING NO.: 40R–0900 — REV

POWER CIRCUIT SCHEMATIC



VOLTAGE SYSTEMS

	VOLTS	NO. OF PHASES	NO. OF WIRES
-3	240V, 60HZ	3	3
-31	208, 60HZ	3	3
-38	120/240,60HZ	3	4
-4	120/208,60HZ	3	4
-5	480,60HZ	3	3
-7	277/480,60HZ	3	4
-9	240/416,60HZ	3	4
-91	220/380V,60HZ	3	4
-92	220/380V,50HZ	3	4

* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEMS.

DS - DISCONNECT SWITCH FOR SERVICING

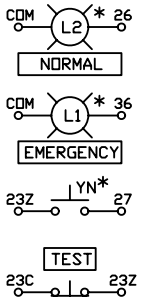
CN - NORMAL TRANSFER OPERATOR (TRANSFER TO NORMAL)

CE - NORMAL TRANSFER OPERATOR (TRANSFER TO EMERGENCY)

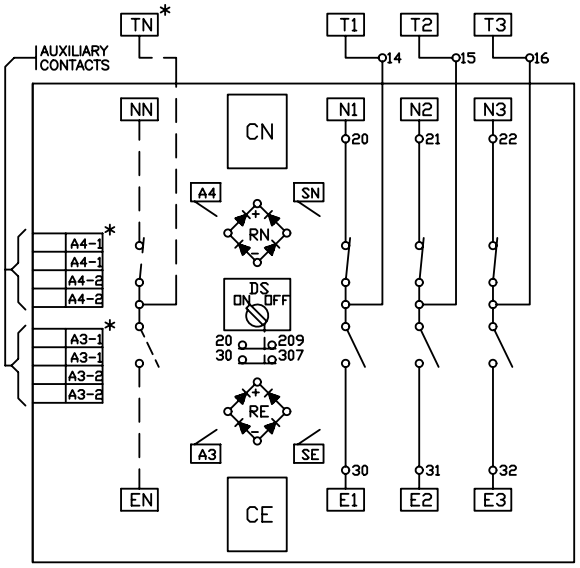
RN - BRIDGE RECTIFIER, NORMAL

RE - BRIDGE RECTIFIER, EMERGENCY

CABINET FRONT

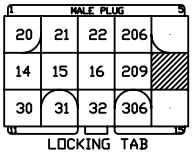


POWER PANEL LAYOUT



INTERCONNECT PLUGS

PA1



PA2



REVISIONS:
ECN S-5769

NOTES:
1. ZTSH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.
2. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3,A4,E,L1, L2,P,T,U,W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.

LEGEND
- WIRE CONNECTION
- WIRE ON MAIN TERMINAL BLOCK
- WIRE IN DISCONNECT PLUG
- * OPTIONAL
- ** LOCATED ON CONTROL PANEL
- *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL

REFER TO 40R-0103 FOR LEGEND & OPERATION

FOR MANUFACTURING:
SEE PAGE 3 FOR CONTROL PANEL
SEE 40R-0900 FOR ACCESSORIES

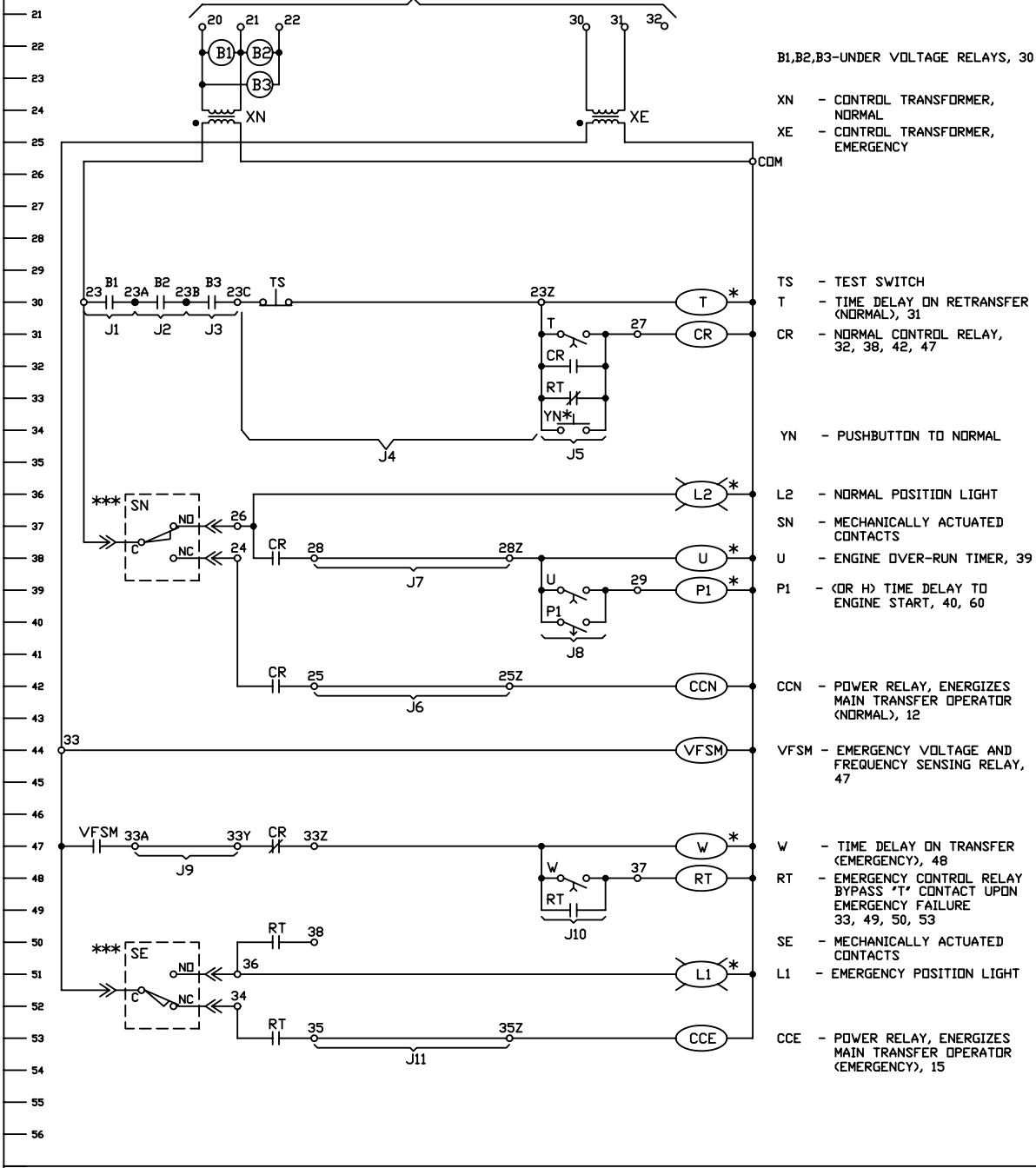
ZENITH CONTROLS, INC.

TITLE: POWER CIRCUIT & CABINET FRONT
MODEL: ZTSH160/300 (1600-3000 AMP)
DRFT: FHB | APP'D:
DATE: 07/22/94
DRAWING NO.: 43A-3000-3
SHEET 1 OF 3

ORIGINAL

CONTROL CIRCUIT SCHEMATIC

TO POWER CIRCUIT SCHEMATIC, SHEET 1



B1,B2,B3-UNDER VOLTAGE RELAYS, 30

XN - CONTROL TRANSFORMER, NORMAL

XE - CONTROL TRANSFORMER, EMERGENCY

TS - TEST SWITCH

T - TIME DELAY ON RETRANSFER (NORMAL), 31

CR - NORMAL CONTROL RELAY, 32, 38, 42, 47

YN - PUSHBUTTON TO NORMAL

L2 - NORMAL POSITION LIGHT

SN - MECHANICALLY ACTUATED CONTACTS

U - ENGINE OVER-RUN TIMER, 39

P1 - (OR H) TIME DELAY TO ENGINE START, 40, 60

CCN - POWER RELAY, ENERGIZES MAIN TRANSFER OPERATOR (NORMAL), 12

VFSM - EMERGENCY VOLTAGE AND FREQUENCY SENSING RELAY, 47

W - TIME DELAY ON TRANSFER (EMERGENCY), 48

RT - EMERGENCY CONTROL RELAY BYPASS "T" CONTACT UPON EMERGENCY FAILURE 33, 49, 50, 53

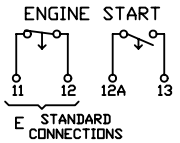
SE - MECHANICALLY ACTUATED CONTACTS

L1 - EMERGENCY POSITION LIGHT

CCE - POWER RELAY, ENERGIZES MAIN TRANSFER OPERATOR (EMERGENCY), 15

CUSTOMER CONNECTIONS

A3, A4 SEE POWER CIRCUIT SCHEMATIC AND LAYOUT



CONTACT RATING		
RELAY	CONTACT	RATING
H	E	10AMP @ 28VDC
P1	E	10AMP @ 32VDC
	A3, A4	20AMP, 125, 250 VAC

JUMPER	CONNECT POINTS	REMOVE JUMPER WHEN ACCESSORIES USED
J1	23, 23A	B1
J2	23A, 23B	B2
J3	23B, 23C	B3
J4	23C, 23Z	J1N, TS, C/D
J5	23Z, 27	T, YN
J6	25, 25Z	T3, R4
J7	28, 28Z	C, C/D
J8	28Z, 29	P1, U
J9	33A, 33Y	J1E, ER1, 2, 3
J10	33Z, 37	W
J11	35, 35Z	W3, R4

NOTES:
1. ZTSH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.
2. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3, A4, E, L1, L2, P, T, U, W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.

LEGEND
- WIRE CONNECTION
- WIRE ON MAIN TERMINAL BLOCK
- WIRE IN DISCONNECT PLUG
- * OPTIONAL
- *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL

REVISIONS:
ECN S-5769

ZENITH CONTROLS, INC.

TITLE: CONTROL CIRCUIT SCHEMATIC & CUSTOMER CONNECTIONS

MODEL: ZTSH160/300 (1600-3000 AMP)

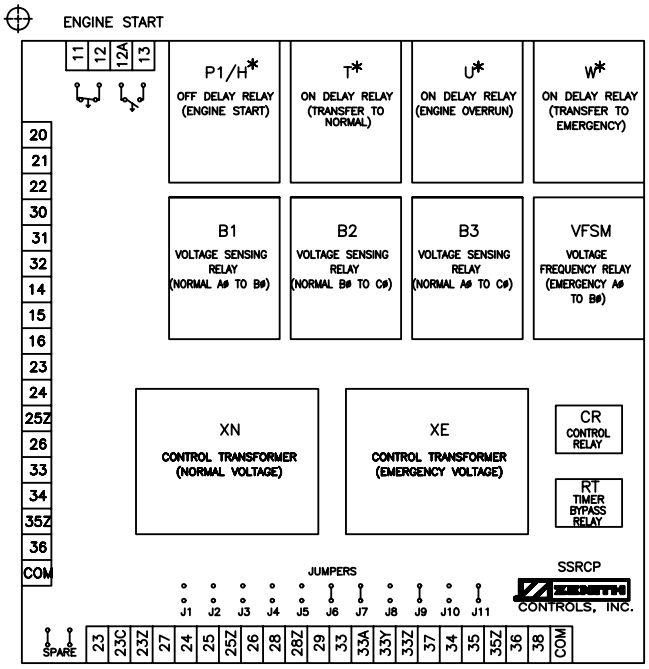
DRFT: FHB | APP'D:

DATE: 07/22/94

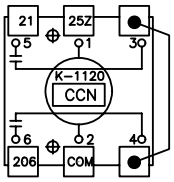
DRAWING NO.: 43A-3000-3 SHEET 2 OF 3

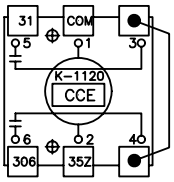
ORIGINAL

CONTROL PANEL LAYOUT









(18" X 29")
(457mm X 737mm)

REVISIONS:	NOTES:	MODEL:	ZENITH CONTROLS, INC.
ECN S-5769	1. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3, A4, E, L1, L2, P, T, U, W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES. 2. (*) OPTIONAL	ZTSH160/300 (1600-3000 AMP)	
		DRFT: FHB APP'D:	TITLE: CONTROL PANEL LAYOUT
		DATE: 07/22/94	DRAWING NO.: 43A-3000-3
		SCALE: 1/2 = 1	SHEET 3 OF 3

ORIGINAL

ZENITH®
CONTROLS, INC.

OPERATION AND MAINTENANCE MANUAL
40-260 AMPS
ZTSDH SERIES TRANSFER SWITCH (DELAY TRANSITION)
POWER PANEL

ISO 9001

47R-300
Rev. 12/9

TABLE OF CONTENTS

Section I **INSTALLATION**

1. Equipment Inspection & Storage 1
2. Mounting 1
3. Power Connections 1
4. Control Connections 2
5. Final Equipment Inspection 3
6. Functional Test 3

Section II **OPERATION AND FEATURES** 4

Section III **MAINTENANCE AND TESTING**

1. Inspection and Cleaning 6
2. Servicing 6
3. Testing 6
4. Troubleshooting 7
5. Replacement Parts 8

Section IV **ADJUSTMENTS AND SETTINGS**

1. Solid State Timers 10
2. Voltage/frequency Sensor (VFSM) 10
3. Solid State Phase Relay (ARSM) 11

Screw Type Terminals for External Power Connections				
Switch Size (Amps)	Normal, Emergency & Load Terminals		Fully Rated Neutral Bar (When Required)	
	Cable Per Pole	Range of Wire Sizes	Number of Cables	Range of Wire Sizes
40	1	#14 to 2 AWG	3	#14 to 1/0 AWG
80	1	#14 to 1/0 AWG	3	#14 to 1/0 AWG
100	1	#14 to 1/0 AWG	3	#14 to 1/0 AWG
150	1	#8 to 3/0 AWG	3	#6 AWG to 300 MCM
225	1	#6 AWG to 250 MCM	3	#6 AWG to 300 MCM
260	1	#6 AWG to 350 MCM	3	#6 AWG to 300 MCM

Table 1

4. CONTROL CONNECTIONS

A complete information package is furnished with each transfer switch including a complete connection diagram and schematic which details all necessary control circuit field connections.

The engine start control wires connect to the terminals specified in the upper left corner of the control panel. *Figure 2* below shows the location of these terminals on the standard SSRCP printed circuit board mounted on the steel backplate. These terminals are clearly identified by a pre-printed label attached to the steel control panel.

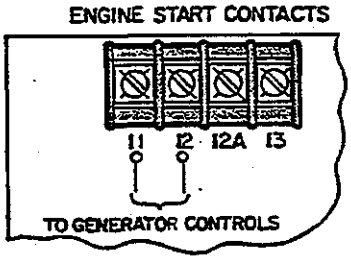


Figure 2

The terminals are clearly identified by a pre-printed label attached to the steel control panel. In the case of manual transfer switches, or in other applications not requiring the standard control panel, clearly marked terminal blocks are provided in the upper left corner of the control panel for the engine start control wires.

Tightening Torque for Lugs		
Socket Size Across Flat	Torque	
	Lb.-In.	Lb.-Ft.
1/8	45	4
5/32	100	8
3/16	120	10
7/32	150	12
1/4	200	17
5/16	275	23
3/8	375	31
½	500	42
9/16	600	50

Table 2

Terminals for field connections to the A3 Emergency auxiliary contacts and the A4 Normal auxiliary contacts are also provided. These terminals are clearly marked and appear on the left side of the power panel.

Make all other necessary external control connections to the appropriate terminal blocks located on the control panel. Insure that all connections are tightened to the torque specified in *Table 3* below.

Control Wire Connections	
Wire Size (AWG)	Torque Lb.-In.
18-16	19
14-8	19
6-4	36

Table 3

SECTION II – OPERATION AND FEATURES

Figure 4 is a typical schematic diagram of a Zenith transfer switch. The information supplied with the transfer switch includes a schematic diagram and description of operation of all timers and settings.

Transfer of the load to the Emergency source begins automatically when any phase of the Normal source falls below the preset dropout point and this undervoltage failure condition is detected by the solid state phase relays, B1, B2, B3.

The phase relays drop out, de-energizing the Normal control relay CR, and engine start timer P1 begins its timing cycle. The P1 time delay is provided to override momentary outages and to prevent nuisance starting of the engine generator. If the Normal source voltage returns above the pickup setting of the phase relays, the P1 timing cycle is reset to zero by re-energizing the CR relay.

If the normal source voltage does not return before the P1 time delay is completed, the P1 timer drops out and sends a starting signal to the engine generator. An emergency voltage and frequency sensing relay, VFSM, monitors the voltage and frequency of the Emergency source. When both the voltage and frequency of the Emergency source reach the preset pickup points, the VFSM relay initiates the transfer to the Emergency source and timer W begins its timing cycle. The W timer provides an adjustable transfer delay to the Emergency source as required.

When the W time is completed, the Emergency control relay RT energizes and picks up the Emergency control relay, CE1 opening the switch out of Normal position to a neutral position. The DW timer is then energized and keeps the switch in an open position for the length of its set timing cycle. The switch is held in the neutral position by a locking pin.

When the DW time delay has elapsed the SOL solenoid is energized, releasing the neutral position locking pin. SOL limit switch closes, re-activating CE1 relay and energizing the CE solenoid to close the transfer switch into the emergency source. The SE limit switch activates to de-energize the CE1 relay. The SN limit switch is deactivated at the same time, readying the Normal control circuit for retransfer when the Normal source is restored.

The sequence for retransfer to the Normal source begins automatically when the voltage on all phases of the Normal source reach the preset pickup point and this condition is detected by the solid state phase relays.

When the Normal source restores, the solid state phase relays B1, B2, B3 pick up and initiate retransfer of the switch to the Normal source by energizing timer T and beginning its timing cycle. The T timer provides an adjustable delay to insure that the Normal source has stabilized before re-connection to the load. If the Normal source fails before the T time delay is completed, the phase relays drop out and the T timing cycle is reset to zero.

When the T time delay is completed, the Normal control relay CR energizes and picks up the Normal control relay, CN1. The DT timer is energized and keeps the switch in a neutral position for his set time value. The switch is held in the neutral position by a locking pin.

When the DT time delay has elapsed the SOL solenoid is energized releasing the neutral position locking pin. SOL limit switch closes, re-activating the CN1 relay, energizing the CN solenoid to retransfer the switch into the normal source. The switch is mechanically locked in the Normal position. The power relay and the Normal operator are de-energized when the SN limit switch is activated by the operator. The SN limit switch also energizes the engine over-run timer U and begins its timing cycle. The timer provides a period of time for the engine generator to run without load and cool down before shutdown. After the U time delay is completed, the P1 timer is energized and the engine generator is shutdown.

SECTION III – MAINTENANCE AND TESTING

A preventive maintenance program will insure high reliability and long life for the transfer switch. The preventive maintenance program for the transfer switch should include the following items:

1. INSPECTION AND CLEANING

> **⚠ DANGER**
> **Hazardous voltage.**
> De-energize all sources of power before doing any work on the transfer switch.

The switch should be inspected for any accumulation of dust, dirt, or moisture, and should be cleaned by vacuuming or wiping with a dry cloth or soft brush. DO NOT use a blower since debris may become lodged in the electrical and mechanical components and cause damage.

Remove the transfer switch barriers and check the condition of the contacts. Any surface deposits must be removed with a clean cloth (DO NOT USE EMERY CLOTH OR A FILE). If the contacts are pitted or worn excessively, they should be replaced. A general inspection of mechanical integrity should be made to include loose, broken or badly worn parts.

2. SERVICING

All worn or inoperative parts must be replaced using Zenith recommended replacement parts. Please refer to Table 5 for specific part information.

The operating mechanism of the transfer switch is lubricated with Lubriplate 105. The lubricant applied at the factory provides adequate lubrication for the lifetime of the switch. Should debris contaminate the mechanism, clean and apply additional Lubriplate.

3. TESTING

A manual operator handle is provided with the transfer switch for maintenance purposes only. Manual operation of the switch must be checked before it is operated electrically. Both power sources MUST be disconnected before manual operation of the switch. Insert the handle and operate the transfer switch between the Normal and Emergency positions. The transfer switch should operate smoothly without binding. Return the switch to the Normal position, remove the handle, and return it to the holder provided.

After completing the inspection, cleaning and servicing of the transfer switch, reinstall the switch cover, and close and lock the cabinet door. Reclose the circuit breakers feeding the utility and generator sources to the switch.

Initiate the electrical transfer test by activating the TS test switch. The CR control relay will drop out and the P1 engine start timer will start its timing cycle.

After the P1 time delay, the engine start contact will close and signal the generator to start. The VFSM relay will energize. The switch will open out of Normal after the time delay of the W timer.

After opening out of Normal, the switch will remain in a neutral position for the duration of the DW time set. When the DW timer has timed out the switch will transfer to Emergency.

Deactivating the test switch will start retransfer to the Normal source. The switch will open out of Emergency after the time delay of the T timer. For the duration of the DT timer set the switch will remain in the neutral position. After the time delay of the DT timer, the switch will retransfer to Normal. The U engine over-run timer allows the engine generator to run unloaded for a preset cool-down period.

NOTICE: A periodic test of the transfer switch under load conditions is recommended to insure proper operation. (See National Electric Code articles 700 and 701.)

5. REPLACEMENT PARTS

POWER PANEL (MOLDED PANEL) 40 TO 260 AMPS							
TAG	DESCRIPTION		STOCK NUMBERS BY AMPERAGE				
		40	80	100	150	225	260
N1,2,3,N	Cable Connection Lug	PS-4419	PS-4423	PS-4423	27P-1128	27P-1126	27P-1127
E1,2,3,N T1,2,3,N	Wire Size	#14-2	#14-1/0	#14-1/0	#8-3/0	#6 to	#6 to 250 MCM 350 MCM
	Stationary Contact Assembly Kit	27P-1141	27P-1141	27P-1141	27P-1111	27P-1111	27P-1111
	Stationary Load Contact Assembly Kit	27P-1140	27P-1140	27P-1140	27P-1109	27P-1109	27P-1109
	Arc Grid Assembly Kit	27P-1014	27P-1014	27P-1014	27P-1014	27P-1014	27P-1014
	Moveable Contact Assembly Kit	27P-1036	27P-1036	27P-1036	27P-1037	27P-1037	27P-1037
CN/CE,CA	Linear Actuator & Capacitors			CN/CE	CA (See Note)		
	Note: 2S denotes two capacitors wired in series	Coil Volts	Poles		QTY	PART	mf
		120	2	K-2104PN	1	PS-4007	340-408
		240	2	K-2105PN	1	PS-4016	108-130
			3				
		208	3	K-2141PN	1	PS-4084	145-174
			4	K-2142PN	1	PS-4084	145-174
		575/600	3	K-2198PN	2S	PS-4083	36-43
			4	K-2197PN	2S	PS-4083	36-43
		480	3	K-2119PN	2S	PS-4008	72-86
			4	K-2111PN	2S	PS-4008	72-86
		416	3	K-2119PN	2S	PS-4008	72-86
SN	CN1 Cut-out Switch	L-5022					
SE	CE1 Cut-out Switch	L-5022					
A3	Emerg. Position Aux Contact	SPDT,L-5022;DPDT,L-5021					
A4	Norm. Position Aux Contact	SPDT,L-5022;DPDT,L-5021					
DS	Disconnect Switch	Operator L-4018;Contact Block L-1028					
	Limit Switch #1	L-3067F					
	Limit Switch #2	L-5025					
	Solenoid 4HDINT, 120VAC	K-2204, K-2204RPL					

Table 5

SECTION IV – ADJUSTMENTS AND SETTINGS

1. SOLID STATE TIMERS

Solid state timers are adjustable from 0.1 second to 100 hours. The red timing indicator in the upper left corner flashes as the timer progresses through the timing cycle. When the timing cycle is completed, the indicator remains illuminated. A flathead screwdriver is required to change the setting, as shown in *Figure 5* below.

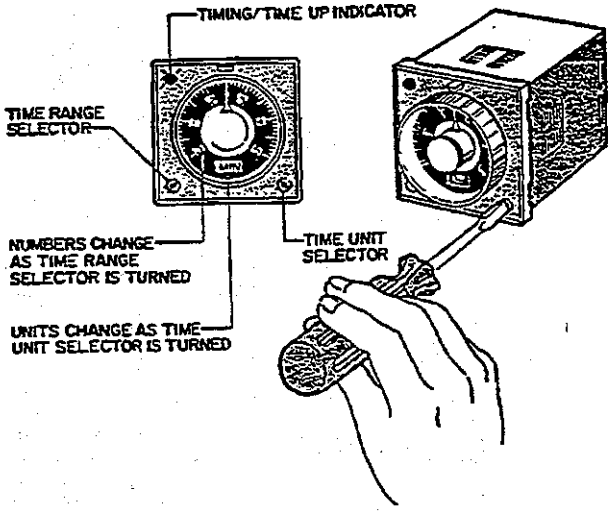


Figure 5

The time unit is selected by turning the rotary switch at the lower right of the timer. Four selections are available: "Seconds", "Minutes", "Hours", "10 Hours". The time unit selected is displayed in the window below the time setting know.

The time range is selected by turning the rotary switch at the lower left of the timer. Four ranges are available: "0-0.5", "0-1.0", "0-5.0", "0-10.0". The dial digits appear in the windows around the time setting knob.

CAUTION: Do NOT change the setting while the timer is energized. Timer malfunction or damage may occur.

The factory setting of the solid state timers used in the Zenith standard package are shown in *Table 6*.

TIMER	FACTORY SETTING
T	30 minutes
U	5 minutes
W	1 second
DT	5 seconds
DW	5 seconds

Table 6

2. VOLTAGE/FREQUENCY SENSOR (VFSM)

The pickup point may be adjusted by rotating the adjustment screw as shown in *Figure 6* below. Counter-clockwise rotation increases the pickup voltage.

Pickup Voltage (at 100% Frequency):
Adjustable: 80% to 95%
Factory Set: 90%
Pickup Frequency:
Adjustable: 80% to 100%
Factory Set: 95%

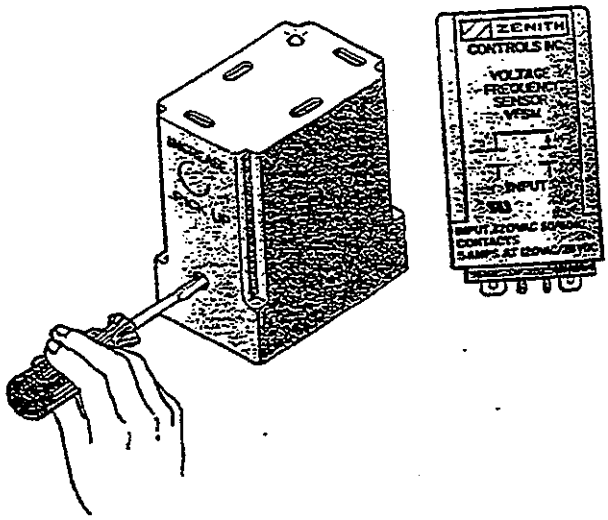


Figure 6

ZTSDH SERIES
AUTOMATIC TRANSFER SWITCHES
40 TO 260 AMP

FOR USE ON EMERGENCY OR STANDBY SYSTEMS
RATED FOR TOTAL SYSTEM & MOTOR LOAD

A. LEGEND

N1,2,3,(N).....Normal Line _____
E1,2,3,(N).....Emergency Line _____
T1,2,3,(N).....Load Connections
B1,2,3.....Solid State Phase Relay(s)
Dropout ____ %
Pickup ____ %
CA.....CN/CE Capacitor
CE1.....CE Control Relay, Emergency
CN1.....CN Control Relay, Normal
CN/CE.....Main Transfer Operator
CR.....Normal Control Relay
DS.....Disconnect Switch
DT.....Timer, Delay Open to Normal
DW.....Timer, Delay Open to Emergency
E.....Engine Start Contact
GND.....Ground
NB.....Neutral Bar (if required)
RT.....Emergency Control relay
SN.....Cutout Switch, Normal
SE.....Cutout Switch, Emergency
TS.....Test Switch,Momentary,Not Keyed
VFSM.....Emergency Volt–Freq. Relay
Pickup { 90% of rated Voltage, and / 95% of rated Frequency
XE.....Control Transformer, Emergency
XN.....Control Transformer, Normal

NOTES:

1. ⚠ CAUTION:In using a 3 phase, 4 wire delta or open delta power supply (usually 120/240 volts, sometimes listed as 120/208 volts) with one leg having a grounded center tap, one line will be 160 to 208 volts to ground. When such a system is used it is necessary to connect the high leg to N2.DO NOT CONNECT 120 VOLT LOAD CIRCUIT TO THE HIGH LEG.

2. GROUNDING TERMINAL: A grounding terminal (GND) is provided. When installing open type switches connect this to the metal enclosure or conduit.

3. ⚠ WARNING – TO ENSURE AGAINST SHOCK OR ACCIDENT HAZARD, DISCONNECT ALL SOURCES OF SUPPLY BEFORE SERVICING.

4. ON SINGLE PHASE UNITS WHERE THE EMERGENCY SOURCE IS A UTILITY LINE, CONNECT EMERGENCY LINE SO THAT MINIMUM VOLTAGE IS MEASURED FROM N1 TO E1.

5. ON SINGLE PHASE (2 POLE) UNITS, CENTER POLE AND PHASE RELAYS (B2,B3) ARE NOT SUPPLIED.

B. OPERATION

When the Normal Line falls below the preset dropout point, the phase relays will dropout disconnecting the CR relay.

When the Emergency Line voltage & frequency reach the preset pickup point, the VFSM relay picks up. RT relay picks up to operate the CE1 relay through the SE & SNO limit switches, causing the main transfer operator to operate. The load is now transferred to the Open position. The SNO limit switch operates to disconnect the relay and main transfer operator. The transfer switch is now mechanically locked open. Limit switch SNO is now activated, picking up the DW timer. After a set time delay, DW will pick up CE1 relay which will then pick up main transfer operator through the SOL limit switch and CE1 relay. The load is now transferred to the Emergency Line. The SE limit switch operates to disconnect The CE1 relay and main transfer operator. The transfer switch is now mechanically locked in Emergency.

When the Normal Line voltage exceeds the preset pickup point, the phase relays, B1, B2, & B3 pick up. CR relay picks up to operate the CN1 relay through the SN & SEO limit switches, causing the main transfer operator to operate. The load is now transferred to the Open position. The SEO limit switch operates to disconnect the relay and main transfer operator. The transfer switch is now mechanically locked Open. SEO is now activated, picking up the DT timer. After a set time delay, DT will pick up the CN1 relay which will then pick up the CN/O main transfer operator through the CN1 relay and SOL limit switch. The load is now transferred to the Normal LIne. The SN limit switch operates to disconnect the CN1 relay and main transfer operator. The transfer switch is now mechanically locked in Normal.

DS – Disconnect Switch
When the Disconnect Switch is placed in the INHIBIT position the control circuits are opened and transfer cannot take place.

TS – Test Switch
The Test Switch simulates a normal line failure when activated.
To test, activate the Test Switch allowing the transfer switch to transfer to the EMERGENCY position. De–activate the Test Switch. The transfer switch will reset to the NORMAL position. Testing at least once a month is recommended. For hospital emergency systems, test once a week.

NOTES

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S–6351	ESTABLISH DWG.		
B	S–7179	7/2/99	DF	SB

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION.
DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: LEGEND, OPERATION AND ACCESSORIES
JOB/MODEL: ZTSDH4/26 (40–260 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	40R–0100D

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SDW	SB	01/03/96	N/A	1 OF 1	B

ACCESSORIES

The ZTS series switches are wired so that accessories can be easily added to the switch. The following is a description of the basic accessories. Those checked are supplied on this unit, see additional pages for complete legend & operation.

☐ A1 Auxiliary contact, S.P.D.T., operates on normal line failure.

☐ A1E Auxiliary contact, S.P.D.T., operates on emergency line failure.

☐ A3 Auxiliary contact closes when the transfer switch is in the Emergency position.

☐ A4 Auxiliary contact closes when the transfer switch is in Normal position.

☐ A6 Motor Disconnect. To de–energize external motor control circuit 5 seconds (adjustable) prior to transfer in either direction.

☐ C Plant Exercisor. Automatically starts generator for selected time intervals.

☐ C/D Plant Exercisor. Automatically starts generator to run unloaded or simulate a power failure and starts generator to run under load.

☐ E Engine Start Contact: 1 Normally Open
1 Normally Closed.

☐ F Auxiliary Fan Contact, S.P.N.O. Closes when generator is running.

☐ H Time delay to engine start, non–adjustable. Factory set 1 or 3 seconds. When the Normal line fails the relay de–energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ J1 Adjustable under frequency sensor.

☐ J2 Adjustable over/under frequency sensor.

☐ K Frequency meter to indicate load frequency.

☐ L1 Pilot Light. Switch in Emergency Position.

☐ L2 Pilot Light. Switch in Normal Position.

☐ L3 Pilot Light. Normal source available.

☐ L4 Pilot Light. Emergency source available.

☐ M1 Ammeter; Single phase.

☐ M2 Ammeter; Three phase

☐ M3 Voltmeter; Single phase.

☐ M4 Voltmeter; Three phase.

☐ P1 Time Delay to Engine Start (solid state). Adjustable over time range .5 to 6 seconds. When the Normal line fails the relay de–energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ P2 Time Delay to Engine Start (Pneumatic). Adjustable over time range 1/6 to 300 seconds. When the Normal line fails, the relay de–energizes. After the set time delay its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ Q2 Connections for remote peak shave or area protection relays. Includes bypass for automatic return to Normal if Emergency line fails and Normal is present.

☐ R1 Solid State Adjustable Overvoltage Relay(s). Set at 110% of pickup, 105% of dropout of nominal Line rate, unless otherwise specified.

☐ R4 In–Phase monitor. Prevents transfer until two sources are in–phase. For use of isochronous governors.

☐ R43 In–phase monitor. Prevents transfer until two sources are in–phase. For use with mechanical. governors.

☐ S1 Four–position Engine Control Selector Switch. "STOP", "HAND CRANK", "TEST", "AUTOMATIC".

☐ T Time delay, re–transfer to Normal. When the Normal line restores and the phase relays operate, the T timer is energized. After the set time delay, its contacts close the circuit to the CR relay which operates to restore the load to the Normal line. RT relay is supplied to bypass T contacts if Emergency is de–energized during timing. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ T3 W3 Presignal auxiliary Contact, S.P.D.T: Operates 0–30 seconds (adjustable) prior to transfer in either direction.

☐ U Time delay, engine cool–down. When the transfer switch is restored to the Normal position and the engine is signaled to shut down, the U timer operates to maintain the engine start circuit closed. At the end of the set time, the engine contacts open to shut down the engine. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ W Time delay, transfer to Emergency. When the Normal line fails and the engine has started, the VFSM relay energizes. The W timer energizes. After the set time delay, its contacts close to energize the RT relay. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ YE Pushbutton, Transfer to Emergency. Provides manual control of transfer to emergency source. If time delay accessory W is supplied pushbutton bypasses time delay for immediate transfer; otherwise, transfer to emergency will be automatic after time delay. If time delay accessory W is not supplied, transfer will be non–automatic (by pushbutton only).

☐ YN Pushbutton, Retransfer to Normal. Provides manual control of retransfer to normal source. If time delay accessory T is supplied, pushbutton bypasses time delay for immediate retransfer; otherwise, retransfer to normal will be automatic after time delay. If time delay accessory T is not supplied, retransfer will be non–automatic (by pushbutton only).

☐ Other:_____

_____

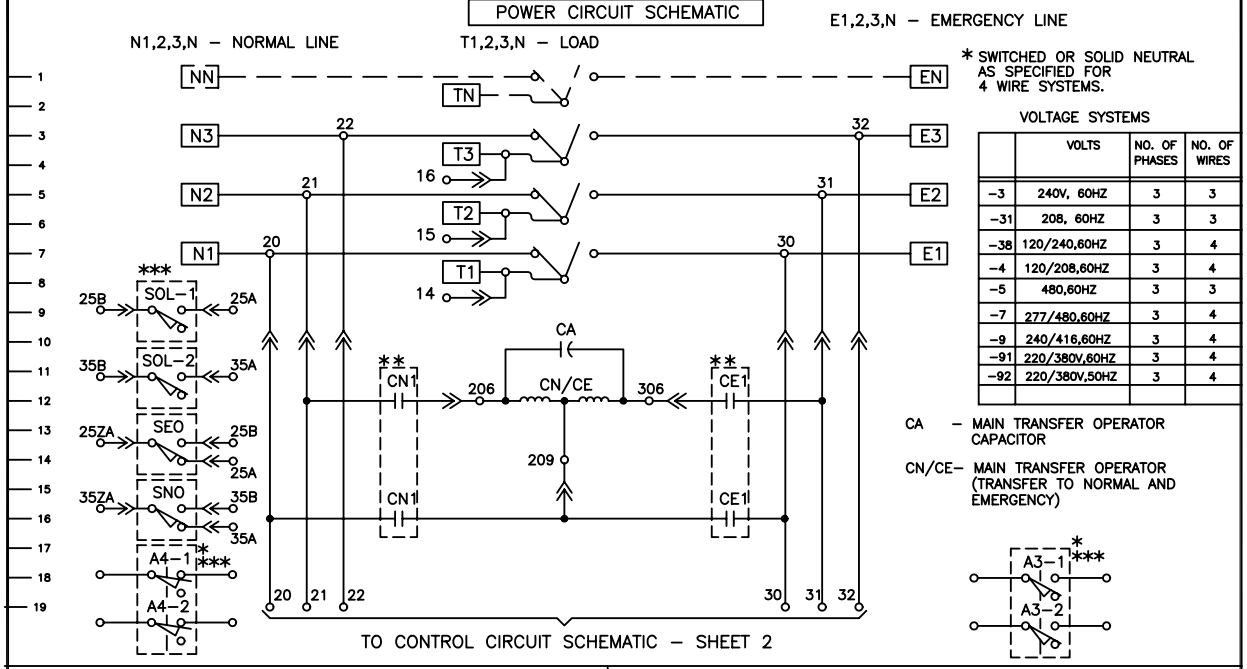
_____

ZENITH® CONTROLS, INC.

TITLE: ACCESSORIES

DRAWING NO.: 40R–0900 — REV

POWER CIRCUIT SCHEMATIC



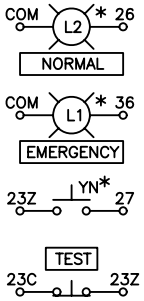
VOLTAGE SYSTEMS

	VOLTS	NO. OF PHASES	NO. OF WIRES
-3	240V, 60HZ	3	3
-31	208, 60HZ	3	3
-38	120/240,60HZ	3	4
-4	120/208,60HZ	3	4
-5	480,60HZ	3	3
-7	277/480,60HZ	3	4
-9	240/416,60HZ	3	4
-91	220/380V,60HZ	3	4
-92	220/380V,50HZ	3	4

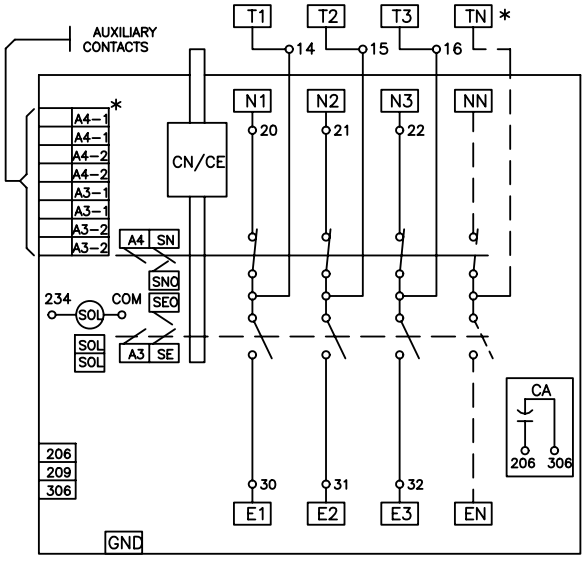
CA – MAIN TRANSFER OPERATOR CAPACITOR

CN/CE– MAIN TRANSFER OPERATOR (TRANSFER TO NORMAL AND EMERGENCY)

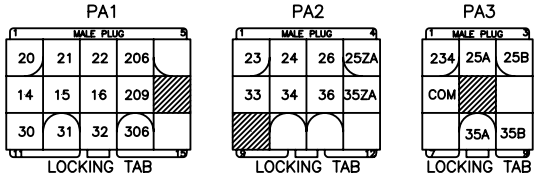
CABINET FRONT



POWER PANEL LAYOUT



INTERCONNECT PLUGS



LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —○— WIRE ON MAIN TERMINAL BLOCK —≫— WIRE IN DISCONNECT PLUG * OPTIONAL ** LOCATED ON CONTROL PANEL *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL	REFER TO 40R-0100D FOR LEGEND & OPERATION. FOR MANUFACTURING: SEE PAGE 3 FOR ENCLOSED UNIT CONTROL PANEL. SEE PAGE 4 FOR OPEN TYPE CONTROL PANEL. SEE 40R-0900 FOR ACCESSORIES.	1. ZTSDH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE. 2. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3,A4,E,L1, L2,P,T,U,W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S-6351	ESTABLISH DWG.		
B	S-6401	02/29/96	AG	PS
C	S-7179	6/30/99	DF	SB

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: POWER CIRCUIT & CABINET FRONT

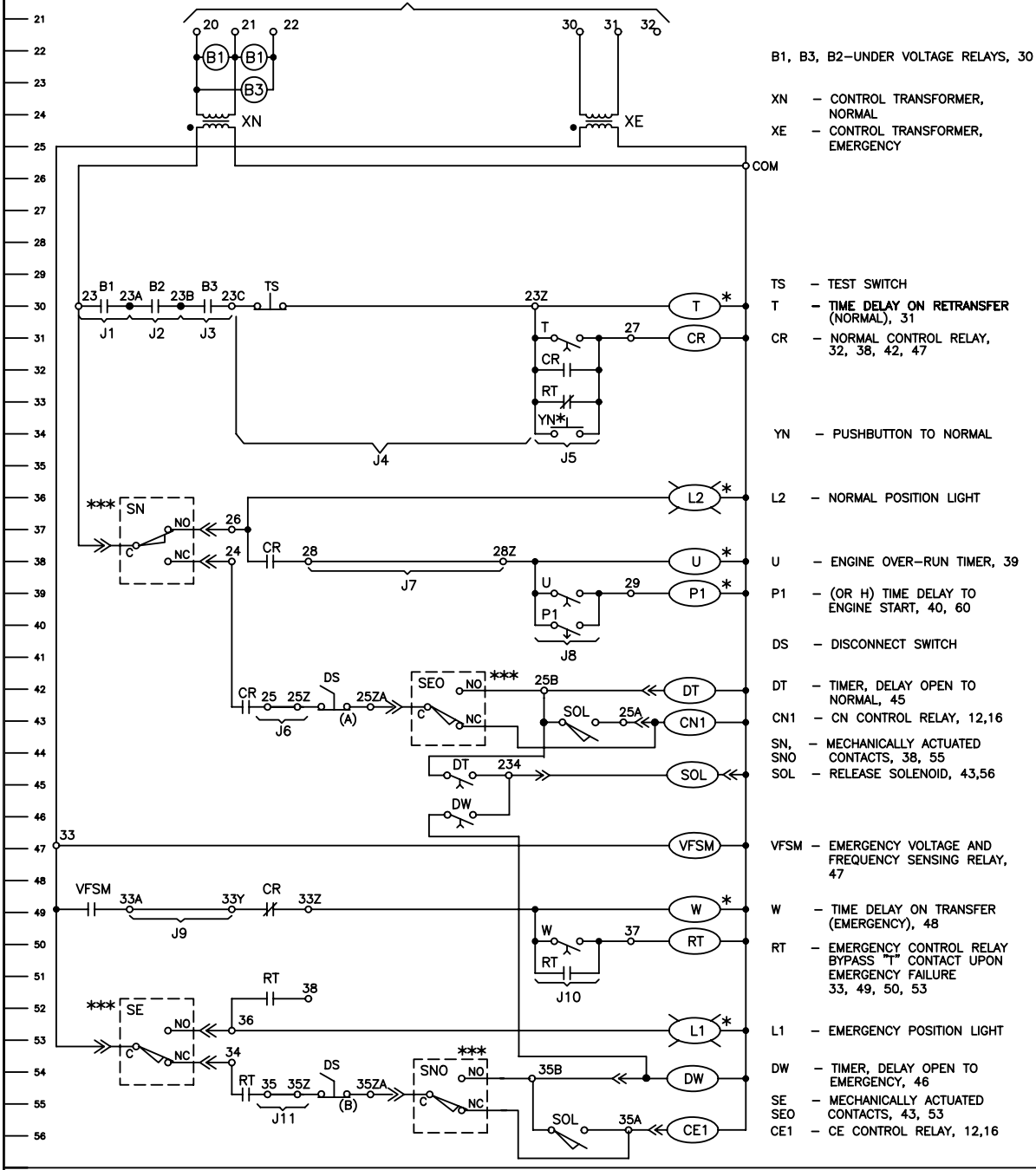
JOB/MODEL: ZTSDH4/26 (40-260 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	-	47A-1005D

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SDW	SB	12/29/95	N/A	1 OF 4	C

CONTROL CIRCUIT SCHEMATIC

TO POWER CIRCUIT SCHEMATIC, SHEET 1



B1, B3, B2–UNDER VOLTAGE RELAYS, 30

XN – CONTROL TRANSFORMER, NORMAL

XE – CONTROL TRANSFORMER, EMERGENCY

TS – TEST SWITCH

T – TIME DELAY ON RETRANSFER (NORMAL), 31

CR – NORMAL CONTROL RELAY, 32, 38, 42, 47

YN – PUSHBUTTON TO NORMAL

L2 – NORMAL POSITION LIGHT

U – ENGINE OVER–RUN TIMER, 39

P1 – (OR H) TIME DELAY TO ENGINE START, 40, 60

DS – DISCONNECT SWITCH

DT – TIMER, DELAY OPEN TO NORMAL, 45

CN1 – CN CONTROL RELAY, 12,16

SN, SNO – MECHANICALLY ACTUATED CONTACTS, 38, 55

SOL – RELEASE SOLENOID, 43,56

VFSM – EMERGENCY VOLTAGE AND FREQUENCY SENSING RELAY, 47

W – TIME DELAY ON TRANSFER (EMERGENCY), 48

RT – EMERGENCY CONTROL RELAY BYPASS "T" CONTACT UPON EMERGENCY FAILURE 33, 49, 50, 53

L1 – EMERGENCY POSITION LIGHT

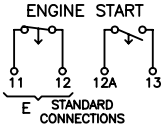
DW – TIMER, DELAY OPEN TO EMERGENCY, 46

SE SEO – MECHANICALLY ACTUATED CONTACTS, 43, 53

CE1 – CE CONTROL RELAY, 12,16

CUSTOMER CONNECTIONS

A3, A4 SEE POWER CIRCUIT SCHEMATIC AND LAYOUT



CONTACT RATING		
RELAY	CONTACT	RATING
H	E	10AMP @ 28VDC
P1	E	10AMP @ 32VDC
	A3, A4	20AMP, 125, 250 VAC

JUMPER	CONNECT POINTS	REMOVE JUMPER WHEN ACCESSORIES USED
J1	23,23A	B1
J2	23A,23B	B2
J3	23B,23C	B3
J4	23C,23Z	J1N,TS,C/D
J5	23Z,27	T,YN
J6	25,25Z	T3,R4
J7	28,28Z	C,C/D
J8	28Z,29	P1,U
J9	33A,33Y	J1E,ER1,2,3
J10	33Z,37	W
J11	35,35Z	W3,R4

LEGEND

- WIRE CONNECTION
- WIRE ON MAIN TERMINAL BLOCK
- WIRE IN DISCONNECT PLUG
- * OPTIONAL
- ** LOCATED ON CONTROL PANEL
- *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL

NOTES

1. ZTSDH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.
2. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3,A4,E,L1, L2,P,T,U,W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S–6351	ESTABLISH DWG.		
B	S–6401	02/29/96	AG	PS
C	S–7179	6/30/99	DF	SB

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

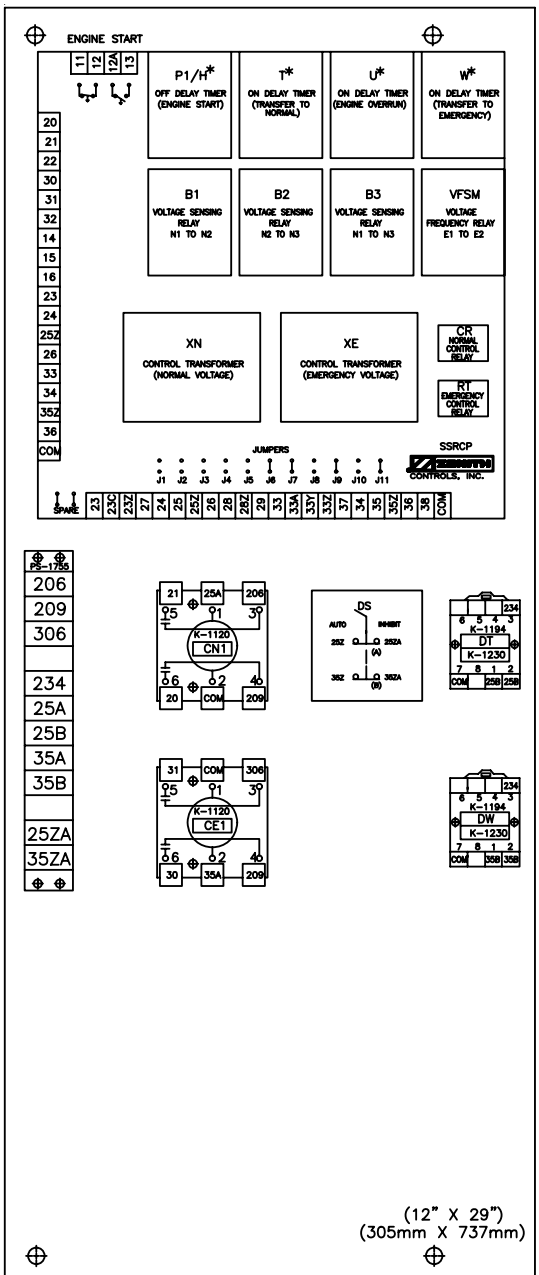
DWG TITLE: CNTRL CKT SCHEMATIC/CUSTOMER CONNS.

JOB/MODEL: ZTSDH4/26 (40–260 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	47A–1005D

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
SDW	SB	12/29/95	N/A	2 OF 4	C

CONTROL PANEL LAYOUT



(12" X 29")
(305mm X 737mm)

(12" X 41")
(305mm X 1041mm)

REVISIONS				
REV	ECN NO.	DATE	DFT	ENG
A	S-6351	ESTABLISH DWG.		
–	–	02/14/96	SDW	HL
B	S-6401	02/29/96	AG	PS
C	S-7179	06/30/99	DF	SB

NOTES

1. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3, A4, E, L1, L2, P, T, U, W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.
2. (*) OPTIONAL

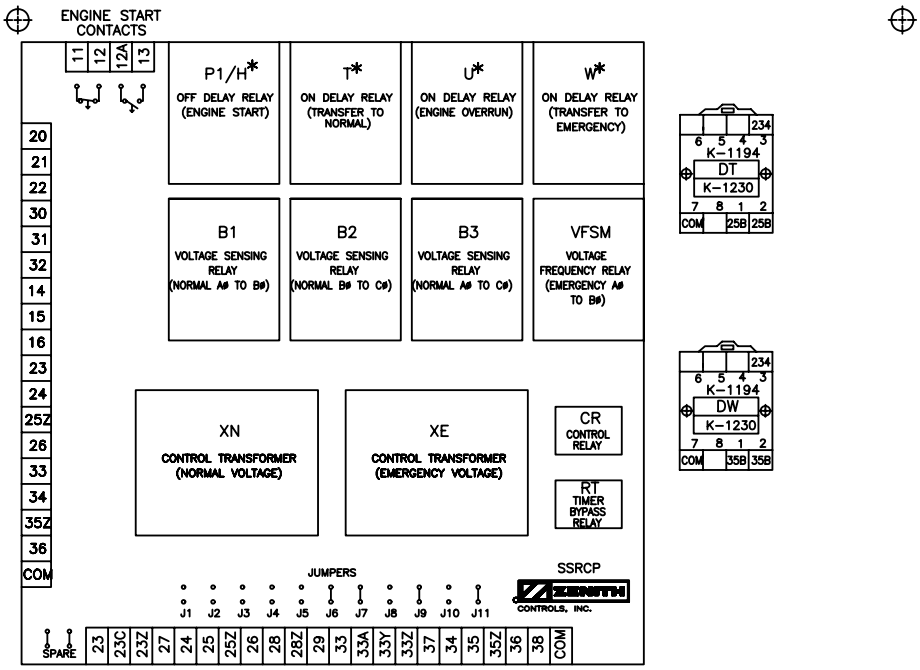
NOTE:
12" X 29"/12" X 41"
(305mm X 737mm)/
(305mm X 1041mm)
PANELS ARE STANDARD FOR ENCLOSED ZTSDH 40–260 AMP.

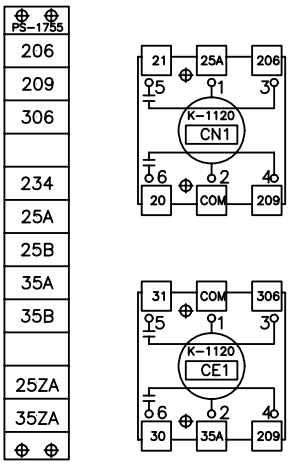
ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

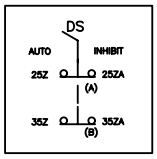
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION.
DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: CONTROL PANEL LAYOUT						
JOB/MODEL: ZTSDH4/26 (40–260 AMP)						
CHKD:	APPD:	CADD: ACAD	ORDER NUMBER: –		DRAWING NUMBER: 47A–1005D	
		DRWN: SDW	ENGR: SB	DATE: 01/03/96	SCALE: .375:1	SHEET: 3 OF 4	REV: C

CONTROL PANEL LAYOUT







NOTE:
18" X 29"
(457mm X 737mm)
PANEL IS STANDARD FOR OPEN TYPE ZTSDH 40-260 AMP.

(18" X 29")
(457mm X 737mm)

NOTES	REVISIONS					DWG TITLE: CONTROL PANEL LAYOUT							
1.DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3, A4, E, L1, L2, P, T, U, W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.	REV	ECN NO.	DATE	DFT	ENG	JOB/MODEL: ZTSDH4/26 (40-260 AMP)							
2.(*) OPTIONAL	A	S-6351	ESTABLISH DWG.			CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:			
	B	S-6401	02/29/96	AG	PS			ACAD	-	47A-1005D			
	C	S-7179	06/30/99	DF	SB			DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
								SDW	SB	01/05/96	1:2	4 OF 4	C

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

ORIGINAL

ZENITH
CONTROLS, INC.

47R-3000C
Revised March, 1996

OPERATION AND MAINTENANCE MANUAL

AUTOMATIC TRANSFER SWITCH - MECHANICALLY HELD

ZTSDH SERIES
400 AMPS

MODEL NUMBER

SERIAL NUMBER

ZENITH CONTROLS, INC., 830 W. 40th St., Chicago, IL 60609
(312)247-6400: FAX. (312)247-7805

PARTS LIST

IMPORTANT: Model number and serial number of switch must be included with all orders for replacement parts. If possible, also specify line voltages, drawing number and date of installation. When ordering mechanical parts not shown on the parts list, circle the part on the photograph and return with the parts list. When ordering electrical components not shown on the parts list, refer to this part by its legend description in the wiring diagram.

POWER PANEL PARTS

ITEM	TAG	DESCRIPTION	PART NUMBER BY AMPERAGE
			400A
1	NL1,2,3,N EL1,2,3,N T1,2,3,N	Normal Emergency Load — CABLE CONNECTION LUGS	S-1422
2		Contact Assembly	(Moveable & Stationary for 3 Pole Units)
	NL1,2,3	Normal	46P-1100E
	N	(Switch Neutral Normal)– Not Shown	46P-1101E
3	EL1,2,3	Emergency	46P-1102E
	N	(Switch Neutral Normal)– Not Shown	46P-1103E
4	Arc Grid Assy		46P-1099
5	CE/O CN/O	Main ATS Operating Coils Voltage Systems	
		No: –1 — Volts: 120 — Ph: 1 — Wire: 2 — Coil Volts: 120 — Poles: 2	K-2178
		No: –2 — Volts: 120/240 — Ph: 1 — Wire: 3 — Coil Volts: 240 — Poles: 2,3	K-2189
		No: –3 — Volts: 240 — Ph: 3 — Wire: 3 — Coil Volts: 240 — Poles: 3	K-2189
		No: –3B — Volts: 120/240 — Ph: 3 — Wire: 4 — Coil Volts: 240 — Poles: 3,4	K-2189
		No: –4 — Volts: 120/208 — Ph: 3 — Wire: 4 — Coil Volts: 208 — Poles: 3,4	K-2177
		No: –5 — Volts: 480 — Ph: 3 — Wire: 3 — Coil Volts: 480 — Poles: 3	K-2176
		No: –6 — Volts: 575/600 — Ph: 3 — Wire: 3 — Coil Volts: 575/600 — Poles: 3	SPO
		No: –7 — Volts: 277/480 — Ph: 3 — Wire: 4 — Coil Volts: 480 — Poles: 3,4	K-2176
		No: –9 — Volts: 240/416 — Ph: 3 — Wire: 4 — Coil Volts: 416 — Poles: 3,4	SPO
		No: –91 — Volts: 220/380 — Ph: 3 — Wire: 4 — Coil Volts: 380 — Poles: 3,4	K-2188
6	SN/SNO	CN1 Limit Switch/CNO Limit Switch	L-3080
7	SE/SEO	CE1 LIMIT SWITCH	
8	A3	ATS Emergency Position Switch	
9	A4	ATS Normal Position Switch	
10	SCN/O,SCE/O	CNE Limit Switches	L-3079
11	DS	ATS Solenoid Disconnect Switch Operator 2-Position Maintain Contact Block N.C.(1)	L-4018 L-1029
12	RTE/RTN	Rectifier (Not Shown)	PS-5076

CABINET DOOR

TAG	DESCRIPTION	PART NUMBER
L1 L2	ATS Emergency Position Indicator ATS Normal Position Indicator	
	Green Lens (Normal)	PS-5048
	Red Lens (Emergency)	PS-5047
	Bulb Socket	PS-5046
	Normal/ Emergency Nameplate	V-1502
	Emergency Bulb	PS-5105
	Normal Bulb	PS-5105
TS	Test Switch	
	Operator, Momentary	L-1025
	Contact Block N.C.	L-1029
	Name Plate	V-1503
	Contact Mounting Base	PS-3473

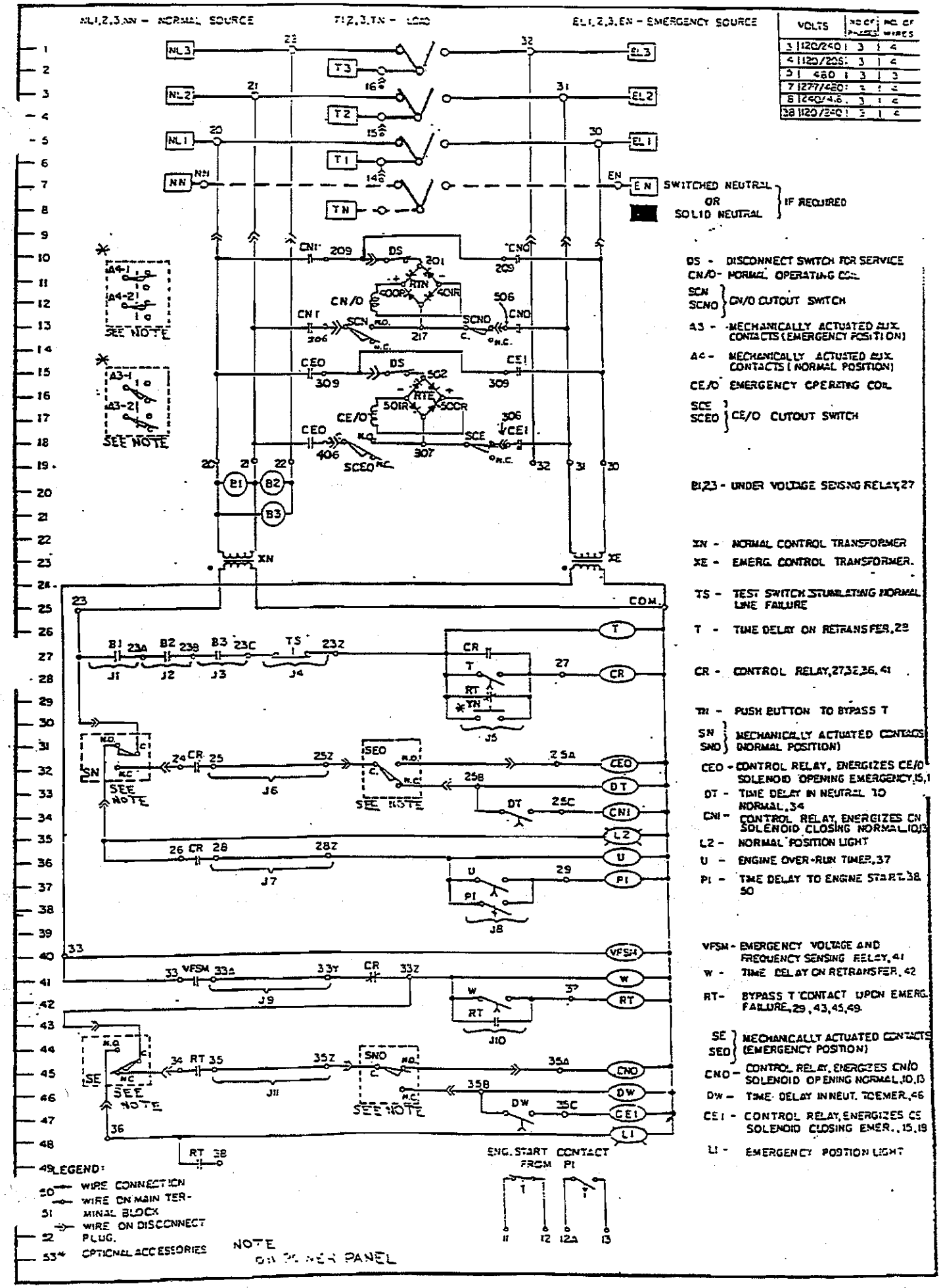
OPERATION OF AUTOMATIC TRANSFER SWITCH

OPERATION:

When the normal line (NL) falls to the preset dropout point, or if any normal phase fails, the phase relay(s) (adjustable) will drop out disconnecting the CR and signal the generator to start.

When emergency line (EL) voltage and frequency reach at least 90% of rated value, the VFSM relay is energized. The RT relay is now energized to operate the CNO relay thru the SE cutout switch causing the main transfer coil CN/O to operate. thru the SCNO limit switch. The load is now transferred to the open position. The SNO and SCNO limit switches operated to disconnect the CNO relay and CN/O transfer coil. The transfer switch is now locked mechanically open. SNO now is deactivated. This energizes the DW timer. After time setting has lapsed, DW will energize CE1, which will energize main transfer coil thru the SCE and CE1. The load is now transferred to the emergency line supply. The SE and SCE limit switches operate to disconnect the CE1 relay and CE/O main transfer coil. The transfer switch is now locked mechanically in emergency position.

When the normal line voltage restores to the preset value, the phase relay(s), (B1,2,3) operate to energize the normal restoration timer T. After the time setting has lapsed, the timer contact closes to energize CR relay. The CEO relay is now energized thru the SN and SEO limit switches, causing the main transfer coil CEO to operate thru the SCEO limit switch. The load is now transferred back to open position. The SEO and SCEO limit switches operate to disconnect the CEO relay and CE/O transfer coil. The transfer switch is now locked mechanically open. SEO is now activated, energizing DT timer. After time setting has lapsed, DT will energize CN1 which will energize main transfer coil thru the CN1 and SCN. The load is transferred to the normal line supply. The SN and SCN limit switches operate to disconnect the CN1 relay and CN/O main transfer coil. The transfer switch is now locked into Normal position.


NL1,2,3,NN - NORMAL SOURCE
T1,2,3,TN - LOAD
EL1,2,3,EN - EMERGENCY SOURCE
VOLTS | NO OF POLES | NO. OF WIRES
3 120/240 1 3 4
4 120/208 3 4
5 480 3 3
7 277/480 3 4
8 240/416 3 4
38 120/240 3 4
SWITCHED NEUTRAL OR SOLID NEUTRAL } IF REQUIRED
DS - DISCONNECT SWITCH FOR SERVICE
CN/O - NORMAL OPERATING COIL
SCN SCNO } CN/O CUTOUT SWITCH
A3 - MECHANICALLY ACTUATED AUX. CONTACTS (EMERGENCY POSITION)
A4 - MECHANICALLY ACTUATED AUX. CONTACTS (NORMAL POSITION)
CE/O EMERGENCY OPERATING COIL
SCE SCEO } CE/O CUTOUT SWITCH
B1,2,3 - UNDER VOLTAGE SENSING RELAY,27
XN - NORMAL CONTROL TRANSFORMER
XE - EMERG. CONTROL TRANSFORMER.
TS - TEST SWITCH STIMULATING NORMAL LINE FAILURE
T - TIME DELAY ON RETRANSFER,28
CR - CONTROL RELAY,27,32,36,41
RT - PUSH BUTTON TO BYPASS T
SN SNO } MECHANICALLY ACTUATED CONTACTS (NORMAL POSITION)
CEO - CONTROL RELAY, ENERGIZES CE/O SOLENOID OPENING EMERGENCY,15,1
DT - TIME DELAY IN NEUTRAL TO NORMAL,34
CNI - CONTROL RELAY, ENERGIZES CN SOLENOID CLOSING NORMAL,10,13
L2 - NORMAL POSITION LIGHT
U - ENGINE OVER-RUN TIMER,37
PI - TIME DELAY TO ENGINE START,38,50
VFSM - EMERGENCY VOLTAGE AND FREQUENCY SENSING RELAY,41
W - TIME DELAY ON RETRANSFER,42
RT - BYPASS T CONTACT UPON EMERG. FAILURE,29,43,45,49
SE SEO } MECHANICALLY ACTUATED CONTACTS (EMERGENCY POSITION)
CNO - CONTROL RELAY, ENERGIZES CN/O SOLENOID OPENING NORMAL,10,13
DW - TIME DELAY IN NEUT. TO EMER.,46
CEI - CONTROL RELAY, ENERGIZES CE SOLENOID CLOSING EMER.,15,19
LI - EMERGENCY POSITION LIGHT
SEE NOTE
ENG. START CONTACT FROM PI
LEGEND:
WIRE CONNECTION
WIRE ON MAIN TERMINAL BLOCK
WIRE ON DISCONNECT PLUG.
OPTIONAL ACCESSORIES
NOTE
ON POWER PANEL

FIELD NOTES

MODEL NO: _____

SERIAL NO: _____

DATE SHIPPED: _____

START-UP DATE: _____

DRAWINGS SUPPLIED: _____

_____

TEST AND MAINTENANCE NOTES:

DATE	TESTED	OBSERVATIONS	NOTES

PURPOSE

Zenith automatic transfer switches are used to provide a continuous source of voltage for lighting and power circuits by automatically transferring the lighting or power load from the normal source to an emergency source of voltage when the normal voltage fails or drops in voltage.

This manual is supplied to provide complete information on the operation, installation and maintenance of the ZENITH ZTSDH mechanically held transfer switch. In addition a complete wiring diagram is provided with each transfer switch. The instruction manual and the wiring diagram should be kept in a safe place to serve as complete reference information on this critically important piece of equipment.

For details of operation, accessories, and wiring see 47A series wiring diagram and operational sheet supplied with the switch.

WARNING

The power voltage present in this equipment is dangerous to life. When operating or adjusting this equipment with doors open, special care must be taken to avoid contact with terminals carrying this voltage.

CONTACT REPLACEMENT

Contact replacement is usually not necessary for many years in an average application. When replacement is necessary, all contacts are easily removed. Both the main contacts and all control contacts are easily visible from the front of the panel, for fast visual inspection.

INSTALLATION

A good installation is as necessary as a good transfer switch. This switch is designed for floor mounting. Floor mounted cabinets must be well braced and protected from damage. Be sure that the cabinet is not mounted directly under any water pipes which may sweat and drip water into the cabinet. Be sure cabinet is fully cleaned of dirt and concrete dust before operation.

Enough room should always be allowed to open the cabinet doors fully, so normal visual inspection of all parts is possible.

Before installing the switch and before energizing the circuits, check the switch for shipping or installation damage.

The following may be used as a test procedure after installation of the transfer switch:

Before connecting the load circuit, make sure normal line contacts are closed, then energize the NL circuit. The phase relays and control relay will be energized. Next, energize the EL circuit. The VFSM relay will be energized. Operate the test switch TS to the test position. The switch will ransfer to the EL side. Return the test switch to the auto position. The transfer switch will restore to the NL position. The load may now be connected and the same procedure followed. A periodic test of the switch, under load conditions, is recommended to insure proper operation of the main switch and all accessories.

CHECK LIST FOR START-UP

	Normal Operation	Points to Check if Normal Operation Does Not Occur
1	Normal line fails and the engine starts. (This can be simulated with the TEST switch.)	If engine generator does not start be sure the relay containing the engine start contacts (marked E) had dropped out and the contacts are closed. Be sure the battery is connected and the control switch on the engine is turned to automatic. If the engine fires does not start, contact the engine dealer.
2	Engine starts, generator reaches full voltage, switch transfers to emergency voltage.	Check at emergency line terminals of switch to be sure the generator voltage is up to the proper value. Be sure the VFSM relay pulls in. If not, check VFSM relay adjustment page 4. Check to see that the RT relay is energized. Check to see that the circuit to the CE1 coil is complete through the SE cutout switch.
3	Normal voltage restores and the switch transfers back to normal.	Check to see that the normal voltage has restored to full value. Check to see that the phase relays have pulled in. (See phase relay adjustment page 4. Check the CR relay to be sure that it is energized and its normal contact is closed. Check the circuit to the CN1 coil thru the SN cutout switch.
4	Engine shuts down.	Be sure voltage is present at relay containing E contact and the relay is energized. If timer U is used to be sure it times out and operates its end-of-cycle switch.

ZTSDH SERIES
AUTOMATIC TRANSFER SWITCHES
400 AMP
FOR USE ON EMERGENCY OR STANDBY SYSTEMS
RATED FOR TOTAL SYSTEM & MOTOR LOAD

A. LEGEND

N1,2,3,(N).....Normal Line_____
E1,2,3,(N).....Emergency Line_____
T1,2,3,(N).....Load Connections
B1,2,3.....Solid State Phase Relay(s)
Dropout _____%
Pickup _____%
CE/O.....Emergency Main Transfer Operator
CN/O.....Normal Main Transfer Operator
CE1.....CE/O Control Relay, Emergency Closing
CN1.....CN/O Control Relay, Normal Closing
CEO.....CE/O Control Relay, Emergency Opening
CNO.....CN/O Control Relay, Normal Opening
CR, RT.....Control Relays
DS.....Disconnect Switch
DT.....Timer, Delay Open To Normal
DW.....Timer, Delay Open To Emergency
E.....Engine Start Contact
GRD.....Ground
NB.....Neutral Bar (if required)
REO.....Bridge Rectifier, CEO
RNO.....Bridge Rectifier, CNO
RT.....Emergency Control Relay
RTE.....Bridge Rectifier, CE/O
RTN.....Bridge Rectifier, CN/O
SCN,SCNO.....Limit Switches, CN/O
SCE,SCEO.....Limit Switches, CE/O
SE,SEO.....Cutout Switch, Emergency
SN,SNO.....Cutout Switch, Normal
TS.....Test Switch,Momentary,Not Keyed
VFSM.....Emergency Volt–Freq. Relay
Pickup { 90% of rated Voltage, and 95% of rated Frequency
XE.....Control Transformer, Emergency
XN.....Control Transformer, Normal

NOTES:

1. ⚠ CAUTION: In using a 3 phase, 4 wire delta or open delta power supply (usually 120/240 volts, sometimes listed as 120/208 volts) with one leg having a grounded center tap, one line will be 160 to 208 volts to ground. When such a system is used it is necessary to connect the high leg to N2.DO NOT CONNECT 120 VOLT LOAD CIRCUIT TO THE HIGH LEG.
2. GROUNDING TERMINAL: A grounding terminal (GND) is provided. When installing open type switches connect this to the metal enclosure or conduit.
3. ⚠ WARNING – TO ENSURE AGAINST SHOCK OR ACCIDENT HAZARD, DISCONNECT ALL SOURCES OF SUPPLY BEFORE SERVICING.
4. ON SINGLE PHASE UNITS WHERE THE EMERGENCY SOURCE IS A UTILITY LINE, CONNECT EMERGENCY LINE SO THAT MINIMUM VOLTAGE IS MEASURED FROM N1 TO E1.
5. ON SINGLE PHASE (2 POLE) UNITS, CONNECTION LUGS (N3, E3, T3) AND PHASE RELAYS (B2, B3) ARE NOT SUPPLIED.

B. OPERATION

When the Normal Line falls to the preset dropout point, the phase relays will dropout disconnecting the CR relay.

When the Emergency Line voltage and frequency reach the preset pickup point, the VFSM relay picks up. RT relays picks up to operate the CNO relay thru the SE & SNO limit switches causing the main transfer operator CN/O to operate thru the SCNO limit switch. The load is now transferred to the Open position. The SNO and SCNO limit switches operate to disconnect the CNO relay and CN/O main transfer operator. The transfer switch is now mechanically locked open. Limit switch SNO is now deactivated, picking up the DW timer. After a set time delay, DW will pick up CE1 relay which will then pickup CE/O main transfer operator thru the SCE limit switch and CE1 relay. The load is now transferred to the Emergency line. The SE and SCE limit switches operate to disconnect the CE1 relay and CE/O main transfer operator. The transfer switch is now mechanically locked in Emergency.

When the normal Line voltage exceeds the preset pickup point, the phase relays B1, B2 & B3 pick up. CR relay picks up to operate the CEO relay thru the SN & SEO limit switches causing the main transfer operator CE/O to operate thru the SCEO limit switch. The load is now transferred to Open position. The SEO & SCEO limit switches operate to disconnect the CEO relay and CE/O main transfer operator. The transfer switch is now mechanically locked open. SEO is now activated picking up the DT timer. After a set time delay DT will pick up the CN1 relay which will then pick up CN/O main transfer operator thru the CN1 relay and SCN limit switch. The load is now transferred to the Normal line. The SN and SCN limit switches operate to disconnect the CN1 relay and CN/O main transfer operator. The transfer switch is now mechanically locked in Normal.

DS – Disconnect Switch
When the Disconnect Switch is placed in the INHIBIT position the control circuits are opened and transfer cannot take place.

TS – Test Switch
The Test Switch simulates a normal line failure when activated.
To test, activate the Test Switch allowing the transfer switch to transfer to the EMERGENCY position. De–activate the Test Switch. The transfer switch will reset to the NORMAL position. Testing at least once a month is recommended. For hospital emergency systems, test once a week.

REVISIONS				
REV	ECN NO.	DATE	DFT	ENG
A	S–5004	ESTABLISH DWG.		
B	S–7179	7/2/99	DF	SB

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION.
DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: LEGEND & OPERATION
JOB/MODEL: ZTSDH40 (400 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	40R–0104

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
–	–	8/7/92	N/A	1 OF 1	B

ACCESSORIES

The ZTS series switches are wired so that accessories can be easily added to the switch. The following is a description of the basic accessories. Those checked are supplied on this unit, see additional pages for complete legend & operation.

☐ A1 Auxiliary contact, S.P.D.T., operates on normal line failure.

☐ A1E Auxiliary contact, S.P.D.T., operates on emergency line failure.

☐ A3 Auxiliary contact closes when the transfer switch is in the Emergency position.

☐ A4 Auxiliary contact closes when the transfer switch is in Normal position.

☐ A6 Motor Disconnect. To de–energize external motor control circuit 5 seconds (adjustable) prior to transfer in either direction.

☐ C Plant Exercisor. Automatically starts generator for selected time intervals.

☐ C/D Plant Exercisor. Automatically starts generator to run unloaded or simulate a power failure and starts generator to run under load.

☐ E Engine Start Contact: 1 Normally Open
1 Normally Closed.

☐ F Auxiliary Fan Contact, S.P.N.O. Closes when generator is running.

☐ H Time delay to engine start, non–adjustable. Factory set 1 or 3 seconds. When the Normal line fails the relay de–energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ J1 Adjustable under frequency sensor.

☐ J2 Adjustable over/under frequency sensor.

☐ K Frequency meter to indicate load frequency.

☐ L1 Pilot Light. Switch in Emergency Position.

☐ L2 Pilot Light. Switch in Normal Position.

☐ L3 Pilot Light. Normal source available.

☐ L4 Pilot Light. Emergency source available.

☐ M1 Ammeter; Single phase.

☐ M2 Ammeter; Three phase

☐ M3 Voltmeter; Single phase.

☐ M4 Voltmeter; Three phase.

☐ P1 Time Delay to Engine Start (solid state). Adjustable over time range .5 to 6 seconds. When the Normal line fails the relay de–energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ P2 Time Delay to Engine Start (Pneumatic). Adjustable over time range 1/6 to 300 seconds. When the Normal line fails, the relay de–energizes. After the set time delay its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ Q2 Connections for remote peak shave or area protection relays. Includes bypass for automatic return to Normal if Emergency line fails and Normal is present.

☐ R1 Solid State Adjustable Overvoltage Relay(s). Set at 110% of pickup, 105% of dropout of nominal Line rate, unless otherwise specified.

☐ R4 In–Phase monitor. Prevents transfer until two sources are in–phase. For use of isochronous governors.

☐ R43 In–phase monitor. Prevents transfer until two sources are in–phase. For use with mechanical. governors.

☐ S1 Four–position Engine Control Selector Switch. "STOP", "HAND CRANK", "TEST", "AUTOMATIC".

☐ T Time delay, re–transfer to Normal. When the Normal line restores and the phase relays operate, the T timer is energized. After the set time delay, its contacts close the circuit to the CR relay which operates to restore the load to the Normal line. RT relay is supplied to bypass T contacts if Emergency is de–energized during timing. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ T3 W3 Presignal auxiliary Contact, S.P.D.T: Operates 0–30 seconds (adjustable) prior to transfer in either direction.

☐ U Time delay, engine cool–down. When the transfer switch is restored to the Normal position and the engine is signaled to shut down, the U timer operates to maintain the engine start circuit closed. At the end of the set time, the engine contacts open to shut down the engine. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ W Time delay, transfer to Emergency. When the Normal line fails and the engine has started, the VFSM relay energizes. The W timer energizes. After the set time delay, its contacts close to energize the RT relay. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ YE Pushbutton, Transfer to Emergency. Provides manual control of transfer to emergency source. If time delay accessory W is supplied pushbutton bypasses time delay for immediate transfer; otherwise, transfer to emergency will be automatic after time delay. If time delay accessory W is not supplied, transfer will be non–automatic (by pushbutton only).

☐ YN Pushbutton, Retransfer to Normal. Provides manual control of retransfer to normal source. If time delay accessory T is supplied, pushbutton bypasses time delay for immediate retransfer; otherwise, retransfer to normal will be automatic after time delay. If time delay accessory T is not supplied, retransfer will be non–automatic (by pushbutton only).

☐ Other:_____

_____

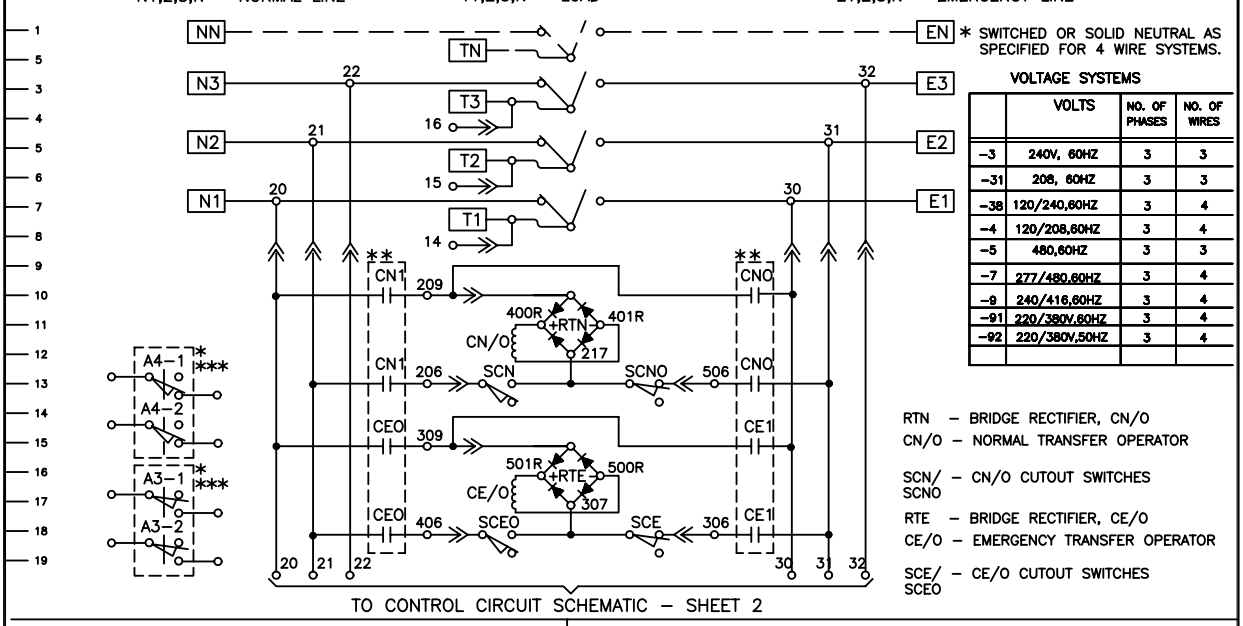
_____

ZENITH® CONTROLS, INC.

TITLE: ACCESSORIES

DRAWING NO.: 40R–0900 — REV

POWER CIRCUIT SCHEMATIC



* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEMS.

VOLTAGE SYSTEMS

	VOLTS	NO. OF PHASES	NO. OF WIRES
-3	240V, 60HZ	3	3
-31	208, 60HZ	3	3
-38	120/240,60HZ	3	4
-4	120/208,60HZ	3	4
-5	480,60HZ	3	3
-7	277/480,60HZ	3	4
-9	240/416,60HZ	3	4
-91	220/380V,60HZ	3	4
-92	220/380V,50HZ	3	4

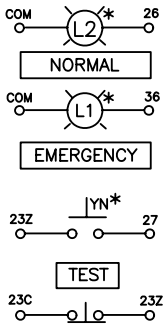
RTN – BRIDGE RECTIFIER, CN/O
CN/O – NORMAL TRANSFER OPERATOR

SCN/ SCNO – CN/O CUTOUT SWITCHES

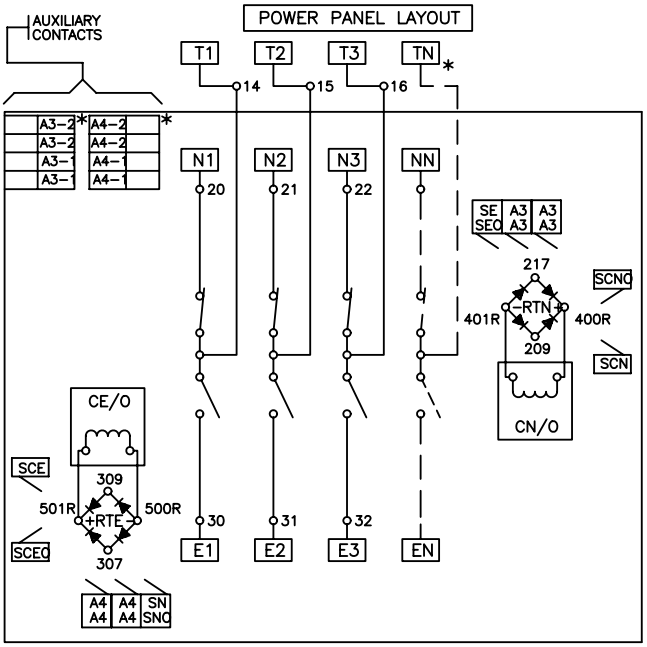
RTE – BRIDGE RECTIFIER, CE/O
CE/O – EMERGENCY TRANSFER OPERATOR

SCE/ SCEO – CE/O CUTOUT SWITCHES

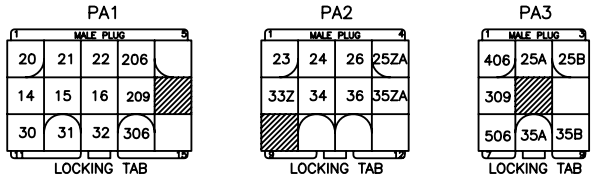
CABINET FRONT



POWER PANEL LAYOUT



INTERCONNECT PLUGS



LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —○— WIRE ON MAIN TERMINAL BLOCK —≫— WIRE IN DISCONNECT PLUG * OPTIONAL ** LOCATED ON CONTROL PANEL *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL	REFER TO 40R-0104 FOR LEGEND & OPERATION. FOR MANUFACTURING: SEE PAGE 3 FOR ENCLOSED UNIT CONTROL PANEL. SEE PAGE 4 FOR OPEN TYPE CONTROL PANEL. SEE 40R-0900 FOR ACCESSORIES.	1. ZTSDH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE. 2. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3,A4,E,L1, L2,P,T,U,W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	–	ESTABLISH DWG.		
F	S-6351	01/04/96	SDW	SB
G	S-7179	6/30/99	DF	SB

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

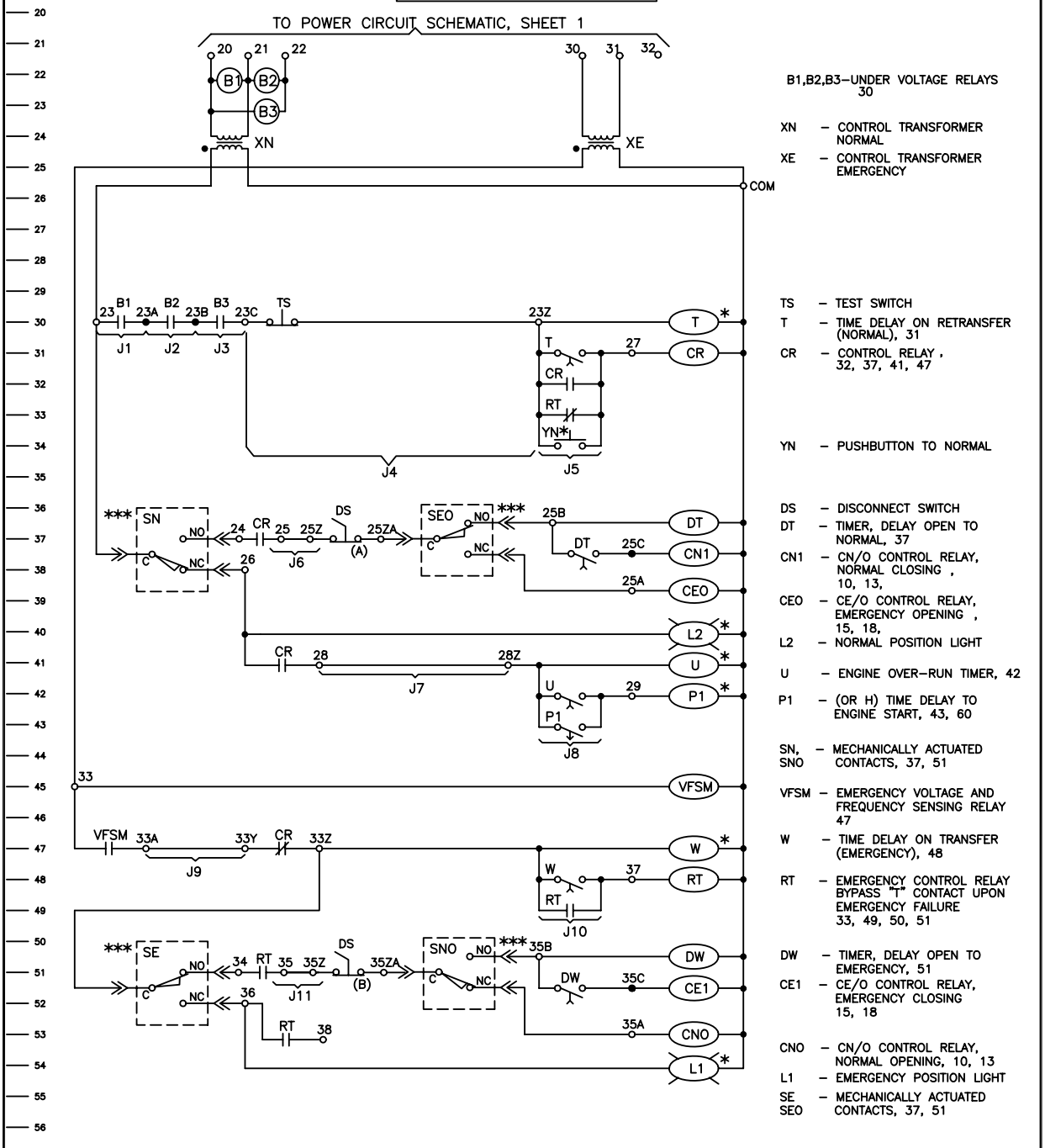
DWG TITLE: POWER CIRCUIT & CABINET FRONT

JOB/MODEL: ZTSDH40 (400 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	47A-3000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
FHB	SB	07/22/99	N/A	1 OF 4	G

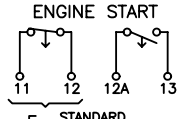
CONTROL CIRCUIT SCHEMATIC



CUSTOMER CONNECTIONS

A3, A4
SEE POWER CIRCUIT SCHEMATIC AND LAYOUT

ENGINE START



CONTACT RATING		
RELAY	CONTACT	RATING
H	E	10AMP @ 28VDC
P1	E	10AMP @ 32VDC
	A3, A4	20AMP, 125, 250 VAC

JUMPER	CONNECT POINTS	REMOVE JUMPER WHEN ACCESSORIES USED
J1	23,23A	B1
J2	23A,23B	B2
J3	23B,23C	B3
J4	23C,23Z	J1N,TS,C/D
J5	23Z,27	T,YN
J6	25,25Z	T3,R4
J7	28,28Z	C,C/D
J8	28Z,29	P1,U
J9	33A,33Y	J1E,ER1,2,3
J10	33Z,37	W
J11	35,35Z	W3,R4

LEGEND

- WIRE CONNECTION
- WIRE ON MAIN TERMINAL BLOCK
- WIRE IN DISCONNECT PLUG
- * OPTIONAL
- ** LOCATED ON CONTROL PANEL
- *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL

NOTES

1. ZTSDH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.
2. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3,A4,E,L1, L2,P,T,U,W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	–	ESTABLISH DWG.		
F	S-6351	01/04/96	SDW	SB
G	S-7179	6/30/99	DF	SB

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

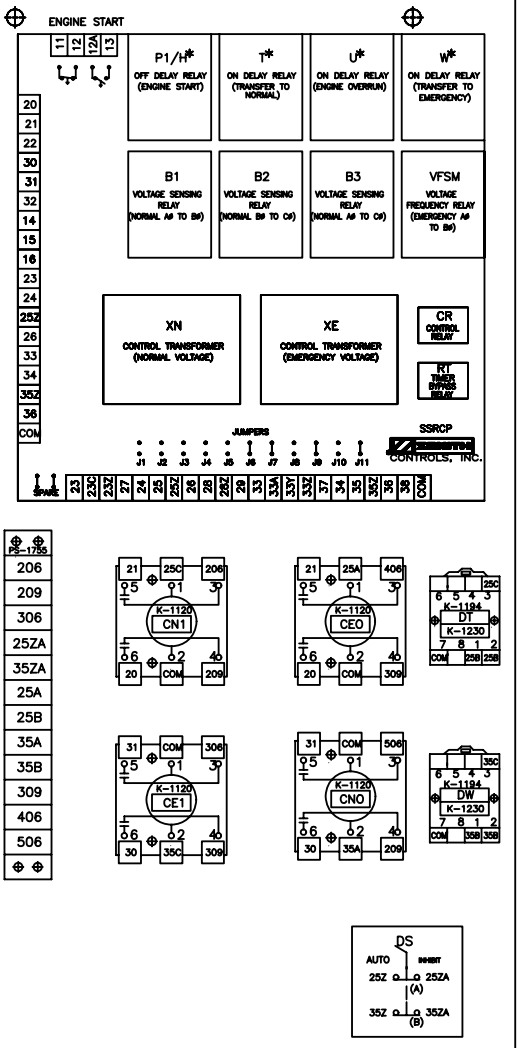
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: CNTRL CKT SCHEMATIC/CUSTOMER CONNS.
JOB/MODEL: ZTSDH40 (400 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	47A-3000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
FHB	SB	07/22/94	N/A	2 OF 4	G

CONTROL PANEL LAYOUT



(12" X 29")
(305mm X 737mm)

(12" X 41")
(305mm X 1041mm)

NOTE:
12" X 41"
(305mm X 1041mm)
PANEL IS STANDARD
FOR ENCLOSED ZTSDH
400 AMP.

REVISIONS				
REV	ECN NO.	DATE	DFT	ENG
A		ESTABLISH DWG.		
F	S-6351	01/05/96	SDW	SB
G	S-7179	06/30/99	DF	SB

NOTES

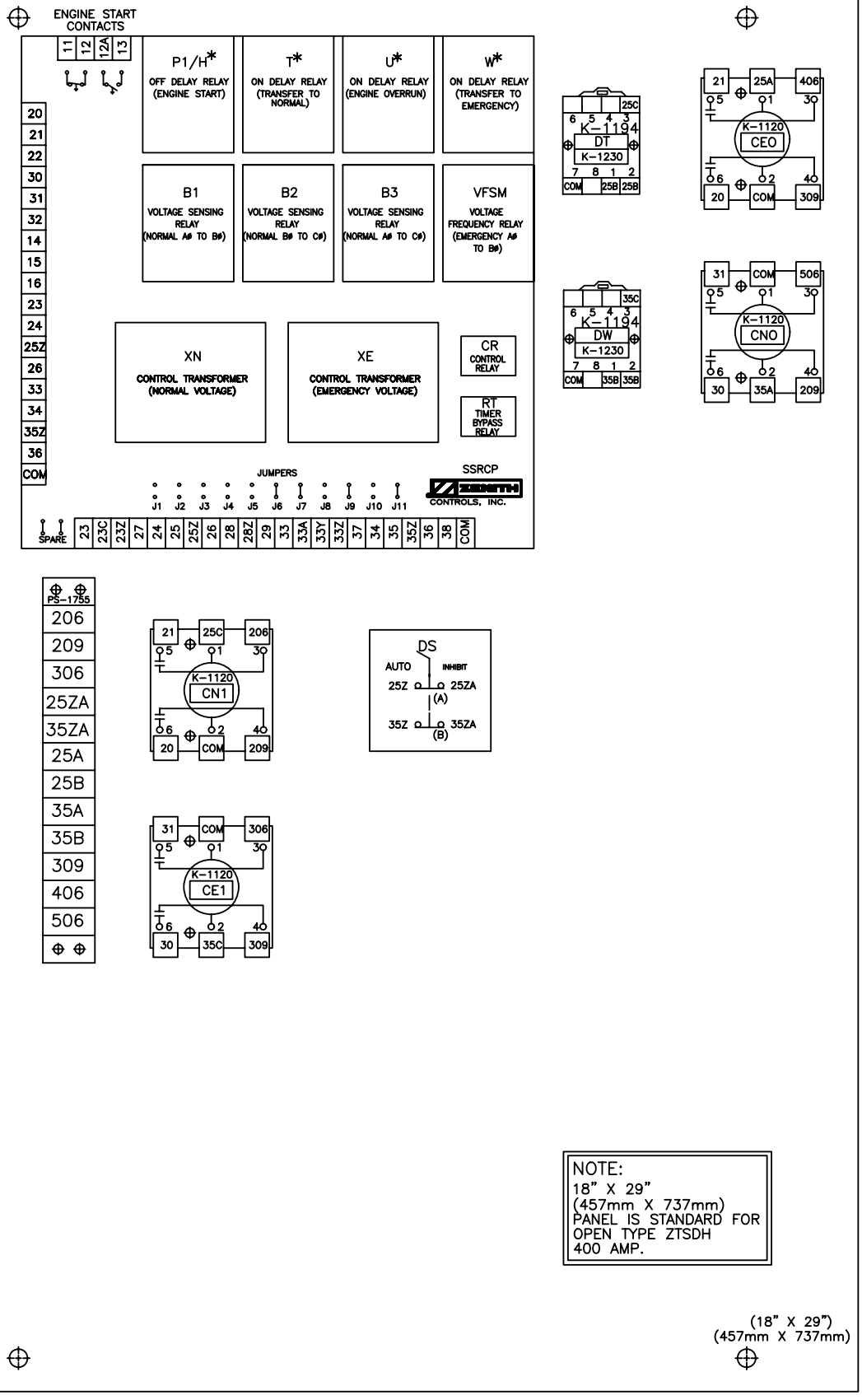
1. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3, A4, E, L1, L2, P, T, U, W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.
2. (*) OPTIONAL

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION.
DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: CONTROL PANEL LAYOUT						
JOB/MODEL: ZTSDH40 (400 AMP)						
CHKD:	APPD:	CADD: ACAD	ORDER NUMBER: –	DRAWING NUMBER: 47A-3000		
		DRWN: FHB	ENGR: SB	DATE: 07/22/94	SCALE: .375:1	SHEET: 3 OF 4	REV: G

CONTROL PANEL LAYOUT



NOTE:
18" X 29"
(457mm X 737mm)
PANEL IS STANDARD FOR OPEN TYPE ZTSDH 400 AMP.

(18" X 29")
(457mm X 737mm)

NOTES
1. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3, A4, E, L1, L2, P, T, U, W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.
2. (*) OPTIONAL

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	–	ESTABLISH DWG.		
F	S-6351	01/04/96	SDW	SB
G	S-7179	06/30/99	DF	SB

DWG TITLE: CONTROL PANEL LAYOUT
JOB/MODEL: ZTSDH40 (400 AMP)
CHKD: APPD: CADD: ACAD – ORDER NUMBER: DRAWING NUMBER: 47A-3000
DRWN: FHB ENGR: SB DATE: 07/22/94 SCALE: 1:2 SHEET: 4 OF 4 REV: G

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

ORIGINAL

ZENITH
CONTROLS, INC.

43R-5000B
Revised March, 1995
Supercedes January, 1995

OPERATION AND MAINTENANCE MANUAL

AUTOMATIC TRANSFER SWITCH - DELAYED TRANSITION
(Mechanically Held)

ZTSDH SERIES
600 THRU 1200 AMPS

UNROLLED

MODEL NUMBER

SERIAL NUMBER

ZENITH CONTROLS, INC., 830 W. 40th St., Chicago, IL 60609
(312)247-6400: FAX. (312)247-7805

IMPORTANT: Model number and serial number of switch must be included with all orders for replacement parts. If possible, also specify [illegible] drawing number and date of installation. When ordering mechanical parts not shown on the parts list, circle the part on the photograph and return with the parts list. When ordering electrical components not shown on the parts list, refer to this part by its legend description in the wiring diagram.

A. POWER PANEL

ITEM	TAG	DESCRIPTION	600	800	1000	1200
1	NL1,2,3,N EL1,2,3,N T1,2,3,N	Cable Connection LUG, CU WIRE	S1393F (2) 600 MCM-#2	S1392F (4) 600 MCM-#2	S1392F (4) 600 MCM-#2	S1392F (4) 600 MCM-#2
2	*	Stationary Contact Assembly Kit	23P-1471	26P-1336	26P-1336	26P-1336
3		Arc Grid Assembly Kit	23P-1366	23P-1366	23P-1366	23P-1366
4	*	Movable Contact Assembly Kit	23P-1469	26P-1334	26P-1334	26P-1334
		Movable Contact Se. Neut.	23P-1470	26P-1335	26P-1335	26P-1335
5	CN/CNO CE/CEO	Main Operating Coils DC				
	VOLTAGE SYSTEM					
	No. / Volts / Ph / Wire / Coil Volts / Pole					
	–1 / 120 / 1 / 2 / 120 / 2			CONSULT FACTORY		
	. / . / . / . / . / 2					
	–2 / 120/240 / 1 / 3 / 240 / 3		K-2146	K-2147	K-2147	K-2147
	–3 / 240 / 3 / 3 / 240 / 3		K-2146	K-2147	K-2147	K-2147
	–4 / 120/208 / 3 / 4 / 208 / 3,4		K-2146	K-2147	K-2147	K-2147
	–5 / 480 / 3 / 3 / 480 / 3		K-2158	K-2157	K-2157	K-2157
	–6 / 575 / 3 / 3 / 575/600 / 3			CONSULT FACTORY		
	–7 / 277/480 / 3 / 4 / 480 / 3,4		K-2158	K-2157	K-2157	K-2157
	–8 / 120/240 / 2 / 4 / 240 / 4		K-2146	K-2147	K-2147	K-2147
	–9 / 240/416 / 3 / 4 / 416 / 3			CONSULT FACTORY		
	OPERATING COIL HARDWARE KIT					
6	RN/RNO RE/REO	Coil Rectifier	23P-1473 (was PS-4870)			
7	SN/SNO SE/SEO	CN/CNO CE/CEO Cut-out Switch	23P-1397 23P-1397			
8	A3	Emerg. Position Aux. Contact	(Qty. 1) 23P-1389 (Qty. 2) 23P-1390			
9	A4	Norm. Position Aux. Contact	(Qty. 1) 23P-1393 (Qty. 2) 23P-1394			
10	DS	Disconnect Switch	Operator L4009; Contact Block L1020			
11		Nameplate	Contains switch information: voltage, amperage, frequency rating, number of phases, serial number, system voltage and model number			

CABINET DOOR

TAG	DESCRIPTION	PART NO.
L1	ATS Emergency Position Indicator	
L2	ATS Normal Position Indicator	
	Green Lens (Normal)	PS-5048
	Red Lens (Emergency)	PS-5047
	Bulb Socket	PS-5046
	Normal/Emergency Nameplate	V-1501
	Emergency Bulb	PS-5105
	Normal Bulb	PS-5105
TS	Test Switch	
	Operator, Momentary	L-1025
	Contact Block N.C.	L-1029
	Name Plate	V-1503
	Contact Mounting Base	PS-3473

CONTROLLED

D. ATS CONTROL PANEL (SSRCP)

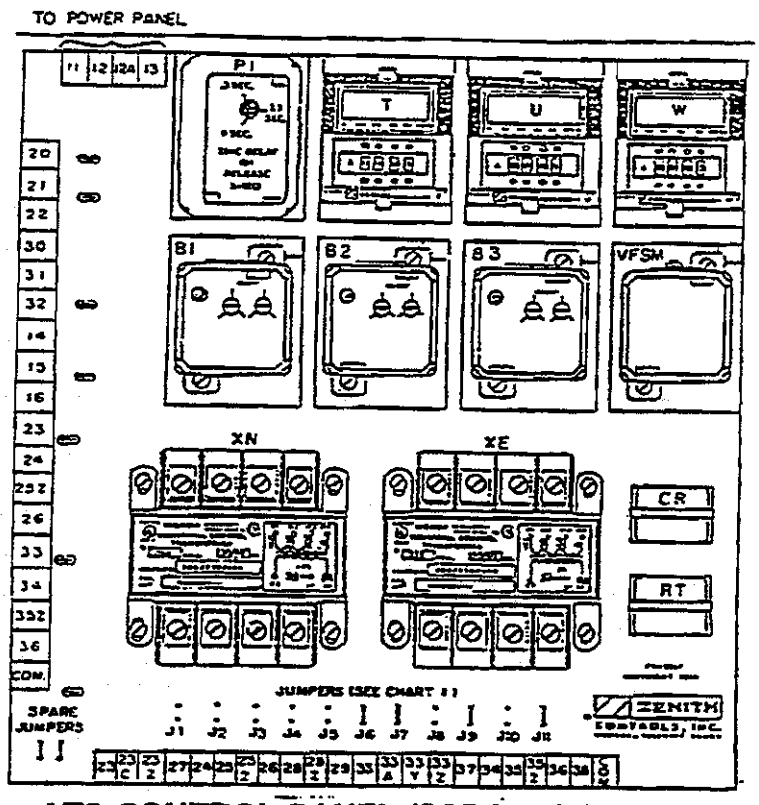


CHART 1

Jumper	Connects Points	Remove When Accessories Used
J1	23,23A	B1
J2	23A, 23B	B2
J3	23B, 23C	B3
J4	23C, 23Z	JIN, TS, C/D
J5	23Z, 27	T, YN
J6	25, 25Z	T3, R4
J7	28, 28Z	SI, C, C/D
J8	28Z, 29	PI & U
J9	33A, 33Y	ER1, 2, 3, J1E
J10	33Z,37	W
J11	35, 35Z	R4, W3

CONTROLLED

ATS CONTROL PANEL (SSRCP) STANDARD ITEMS

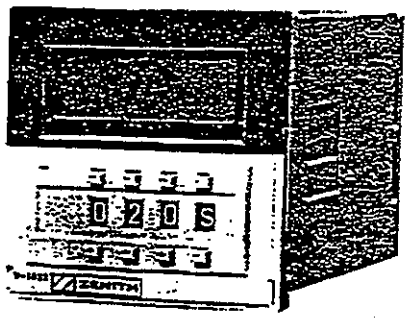
TAG	DESCRIPTION	VOLTAGE 50/60 HZ	PART NO.
XN, XE	Control Transformers (See Note 1)	120V	K-3068
		208V	K-3070
		240 or 480V	K-3071
		416V	K-3089
B-1, 2, 3	Phase Relays Solid State (See Note 1)	120V	K-1185
		208 or 240V	K-1186
		480V	K-1188
VFSM	Voltage Frequency Sensor	120V/60 Hz	K-1192R
CR	Control Relay	120V	K-1204
RT	Bypass T Relay	120V	K-1204
J1-J11	Jumpers		PS-5067
CCN, CCEO	Power Relays, energize CN & CEO Solenoids	120V	K-1120
CCE, CCNO	Power Relays, energize CE & CNO Solenoids	120V	K-1120

(OPTIONAL ITEMS)

TAG	DESCRIPTION	VOLTAGE	PART NUMBER
T	Time Delay to Normal, Timer Solid State	120V .1 Sec. to 9990 Hrs. (Adj.)	OSA-A-T
U	Engine Cool Down, Timer Solid State	120V .1 Sec. to 9990 Hrs. (Adj.)	OSA-A-U
W	Time Delay Emergency, Timer Solid State	120V .1 Sec. to 9990 Hrs. (Adj.)	OSA-A-W
PI	Time Delay Engine Start, Timer	120V (.5 to 6 sec. Adjustable)	K-1201
P2	Optional (Mounted below SSRCP)	120V (300 Sec. Adjustable)	K-1061

Notes:

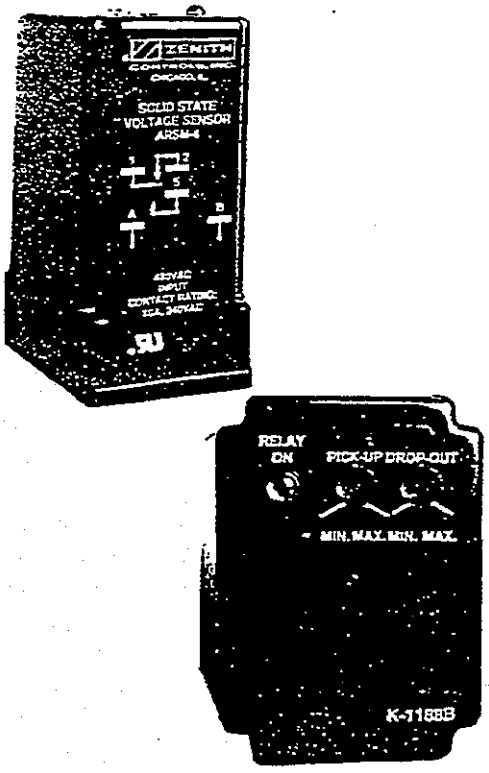
1. If -6 voltage system (575/600V) is supplied, then XN, XE is K-3087 and B1,2, 3 is K-1185 (120V) supplied with XB (575:600V/120V) 3 phase transformer assembly. B1, 2, 3 mounted below SSRCP.



Solid State Time Delay

Accessories T, U, W Solid State Timers Adjustable in Seconds, Minutes and Hours (Plug-In Style).

To select a time unit, operate the pushbuttons of the rightmost thumbwheel switch until the desired time unit is shown in window. The time unit can be selected by pushing the plus (+) bottom button or the minus (-) top button. The desired time is specified by operating the three thumbwheel switches in the middle of the front panel.



Close Differential (ARSM) Relay Adjustment

The voltage points at which the relay operates are adjustable. When the relay pulls in, an audible click is noticeable, and the LED will come on.

Setting the Relay:

If the relay should be set with a variable voltage supply (Variac):

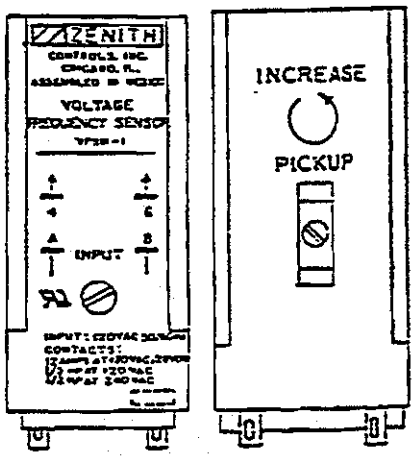
1. Turn pick-up control fully clockwise.
2. Turn drop-out control fully counterclockwise.
3. Set Variac pick-up voltage to desired level.
4. **Very slowly** rotate pick-up adjustment counterclockwise until relay picks up. (LED will energize).
5. Set Variac drop-out voltage to desired level.
6. **Very slowly** rotate drop-out adjustment clockwise until relay drops out (LED de-energizes).

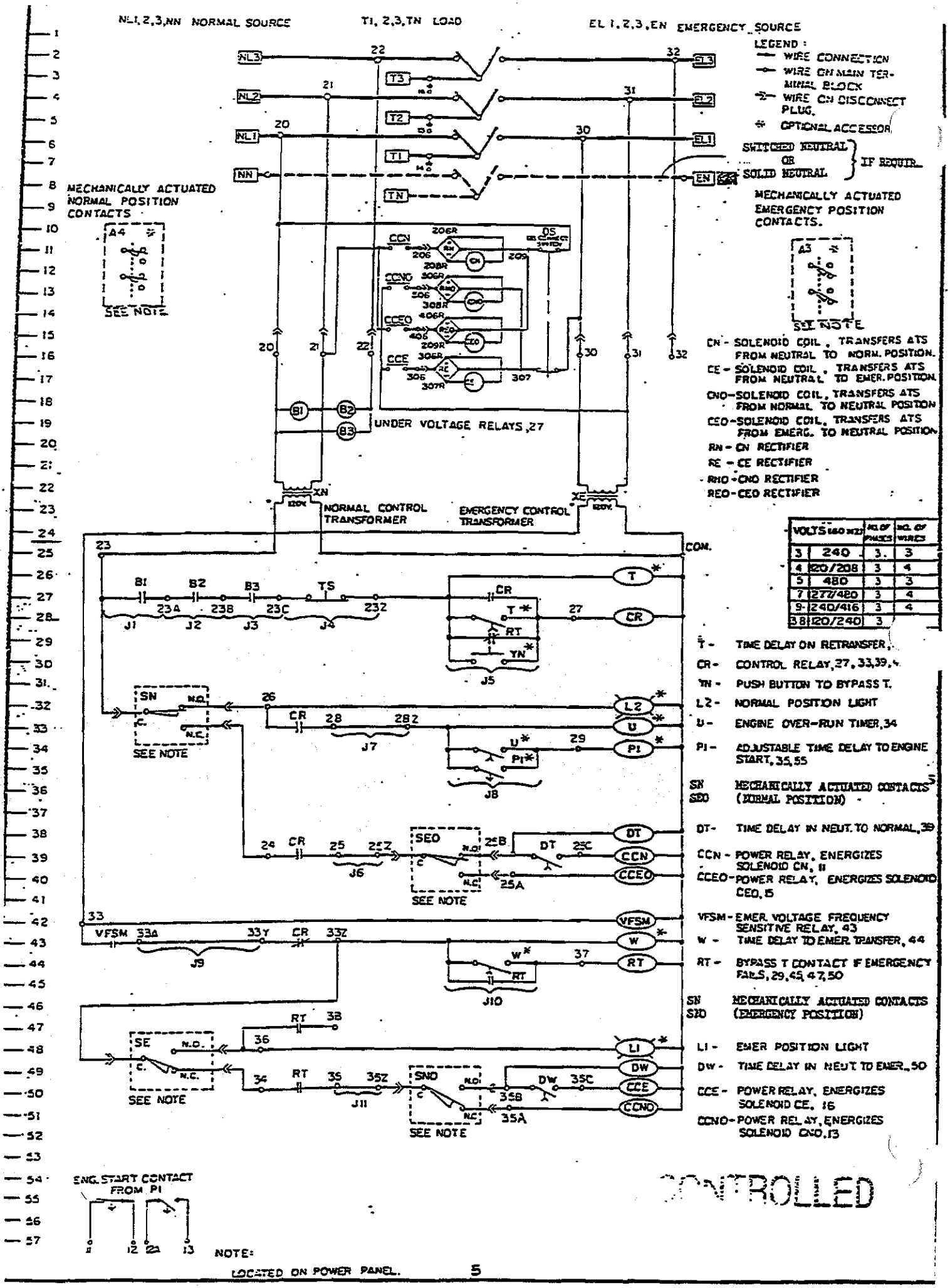
Verify settings by raising voltage until relay picks up, then lower voltage until relay drops out, making sure that relay operates at desired voltage levels.

VOLTAGE/FREQUENCY SENSOR (VFSM) ADJUSTMENT

The pickup point may be adjusted between 80-95% of rated voltage by rotating the offset screw located on the back of the relay.

Counter-clockwise rotation increases pickup voltage. Clockwise rotation decreases pickup voltage.





VOLTS (60 HZ)		NO. OF PHASES	NO. OF WIRES
3	240	3	3
4	120/208	3	4
5	480	3	3
7	277/480	3	4
9	240/416	3	4
38	120/240	3	

CONTROLLED

OPERATION OF AUTOMATIC TRANSFER SWITCH

OPERATION:

When the normal line (NL) falls to the preset dropout point, or if any normal phase fails, the phase relay(s) (adjustable) will drop out disconnecting the CR and signaling the generator to start.

When emergency line (EL) voltage and frequency reach at least 90% of rated value, the VFSM relay is energized. The RT relay is now energized to operate the CCNO relay through the CNO cutout switch causing the main transfer coil CNO to operate. The load is now transferred to the OPEN position. The SNO limit switch operates to disconnect the CCNO relay and CNO transfer coil. The transfer switch is now locked mechanically open. SNO is now activated. This energizes the DW timer. After time setting has lapsed, DW will energize CCE, which will energize main transfer coil CE. The load is now transferred to the emergency line supply. The SE limit switch operates to disconnect the CCE relay and CE main transfer coil. The transfer switch is now locked mechanically in Emergency position.

When the normal line voltage restores to the preset value, the phase relay(s) (B1,2,3) operate to energize the normal restoration timer T. After the time setting has lapsed, the timer contact closes to energize CR relay. The CCEO relay is now energized through the SN and SEO limit switches, causing the main transfer coil CEO to operate. The load is now transferred back to OPEN position. The SEO limit switch operates to disconnect the CCEO relay and CEO transfer coil. The transfer switch is now locked mechanically open. SEO is now activated, energizing DT timer. After time setting has lapsed, DT will energize CCN which will energize main transfer coil CN. The load is now transferred to the normal line supply. The SN limit switch operates to disconnect the CCN relay and CN main transfer coil. The transfer switch is now locked into normal position.

INSPECTION

CONTACTS - The movable and stationary contacts are a vital part of the ATS and must be kept clean. To inspect the ATS contacts, disconnect all power sources. Examine the contacts.

Any surface deposits must be removed with a clean cloth (DO NOT USE EMERY CLOTH OR A FILE).

After the movable and stationary contacts are wiped clean (no discoloration or deposits), reconnect power source.

CURRENT CARRYING PARTS - An easily detected but abnormal condition is the discoloration of current carrying parts (particularly copper). Discoloration appears as darkened material or finishes. Any discolored parts should be cleaned. WARNING: ANY MAINTENANCE SHOULD ONLY BE DONE WHILE THE POWER IS OFF. If the discoloration persists, contact the factory.

LUBRICATION

The cams of the ATS are lubricated with Super Lube PTFE grease, the gears with Dow Chemicals "Molykote" (321R or GN paste). These lubricants provide adequate lubrication for a clean and properly maintained swithces lifetime. Should debris contaminate the mechanism, clean and apply additional lubricants. Mobiltemp SHC-32 is used on isolating contacts.

CONTROLLED

FIELD NOTES

MODEL NO: _____

SERIAL NO: _____

DATE SHIPPED: _____

START-UP DATE: _____

DRAWINGS SUPPLIED: _____

_____

TEST AND MAINTENANCE NOTES:

DATE	TESTED	OBSERVATIONS	NOTES

CONTROLL

PURPOSE

Zenith automatic transfer switches are used to provide a continuous source of voltage for lighting and power circuits by automatically transferring the lighting or power load from the normal source to an emergency source of voltage when the normal voltage fails or drops in voltage.

This manual is supplied to provide complete information on the operation, installation and maintenance of the ZENITH ZTSDH series mechanically held transfer switch. In addition a complete wiring diagram is provided with each transfer switch. The instruction manual and the wiring diagram should be kept in a safe place to serve as complete reference information on this critically important piece of equipment.

Described in this manual, are the new ZTSDH series, 600 thru 1200 ampere sizes, featuring a new concept in transfer switch design.

For details of operation, accessories, and wiring see wiring diagram and operational sheet supplied with the switch.

WARNING

The power voltage present in this equipment is dangerous to life. When operating or adjusting this equipment with doors open, special care must be taken to avoid contact with terminals carrying this voltage.

CONTACT REPLACEMENT

Contact replacement is usually not necessary for many years on the average transfer switch. When replacement is necessary, all contacts are easily removed. Both the main contacts and all control contacts are easily visible from the front of the panel, for fast visual inspection.

INSTALLATION

A good installation is as necessary as a good transfer switch. This switch is designed for floor mounting. Floor mounted cabinets must be well braced and protected from damage. Be sure that the cabinet is not mounted directly under any water pipes which may sweat and drip water into the cabinet. Be sure cabinet is fully cleaned of dirt and concrete dust before operation.

Enough room should always be allowed to open the cabinet doors fully, so normal visual inspection of all parts is possible.

Before installing the switch and before energizing the circuits, check the switch for shipping or installation damage.

The following may be used as a test procedure after installation of the transfer switch:

Before connecting the load circuit, make sure normal line contacts are closed, then energize the NL circuit. The phase relays and control relay will be energized. Next, energize the EL circuit. The VFSM relay will be energized. Operate the test switch TS to the test position. The switch will transfer to the EL side. Return the test switch to the auto position. The transfer switch will restore to the NL position. The load may now be connected and the same procedure followed. A periodic test of the switch, under load conditions, is recommended to insure proper operation of the main switch and all accessories.

CHECK LIST FOR START-UP

	NORMAL OPERATION	POINTS TO CHECK IF NORMAL OPERATION DOES NOT OCCUR
1	Normal line fails and the engine starts. (This can be simulated with the TEST switch).	If engine generator does not start be sure the relay containing the engine start contacts (marked E) has dropped out and the contacts are closed. Be sure the battery is connected and the control switch on the engine is turned to automatic. If the engine fires but does not start, contact the engine dealer.
2	Engine starts, generator reaches full voltage, switch transfers to emergency voltage.	Check at emergency line terminals of switch to be sure the generator voltage is up to the proper value. Be sure the VFSM relay pulls in. If not, check VFSM relay adjustment page 4. Check to see that the RT relay is energized. Check to see that the circuit to the CCNO coil (to open Normal), then CCE coil (to close Emergency) is complete thru the SE cutout switch.
3	Normal voltage restores and the switch transfers back to normal.	Check to see that the normal voltage has restored to full value. Check to see that the phase relays have pulled in. (See phase relay adjustment page 4. Check the CR relay to be sure that it is energized and its normal contact is closed. Check to see that the circuit to the CCEO coil (to open Emergency), then CCN coil (to close Normal) is complete thru the SN cutout switch.
4	Engine shuts down.	Be sure voltage is present at relay containing E contact and the relay is energized. If timer U is used be sure it times out and operates its end-of-cycle switch.

ZTSDH SERIES
AUTOMATIC TRANSFER SWITCHES
600 - 3000 AMP

FOR USE ON EMERGNECY OR STANDBY SYSTEMS
RATED FOR TOTAL SYSTEM & MOTOR LOAD

A. LEGEND

N1,2,3,(N).....Normal Line
E1,2,3,(N).....Emergency Line
T1,2,3,(N).....Load Connections
B1,2,3.....Solid State Phase Relay(s)
Dropout _____%
Pickup _____%
CE.....Main Transfer Operator, Close into Emergency
CEO.....Main Transfer Operator, Open from Emergency
CN.....Main Transfer Operator, Close into Normal
CNO.....Main Transfer Operator, Open from Normal
CCE.....CE Control Relay, Emergency Closing
CCEO.....CEO Control Relay, Emergency Opening
CCN.....CN Control Relay, Normal Closing
CCNO.....CNO Control Relay, Normal Opening
CR.....Normal Control Relay
DS.....Disconnect Switch
DT.....Timer, Delay Open To Normal
DW.....Timer, Delay Open To Emergency
E.....Engine Start Contact
GND.....Ground
NB.....Neutral Bar (if required)
RN.....Bridge Rectifier, CN
RE.....Bridge Rectifier, CE
RNO.....Bridge Rectifier, CNO
REO.....Bridge Rectifier, CEO
RT.....Emergency Control Relay
SE,SEO.....Cutout Switch, Emergency
SN,SNO.....Cutout Switch, Normal
TS.....Test Switch,Momentary,Not Keyed
VFSM.....Emergency Volt-Freq. Relay
Pickup {90% of rated Voltage, and {95% of rated Frequency
XE.....Control Transformer, Emergency
XN.....Control Transformer, Normal

B. OPERATION

When the Normal Line falls to the preset dropout point, the phase relays will dropout disconnecting the CR relay.
When the Emergency Line voltage & frequency reach the preset pickup point, the VFSM relay picks up. RT relay picks up to operate the CCNO relay through the SE & SNO cutout switches causing the emergency main transfer operator CNO to operate. The load is now transferred to the Open position. The SNO limit switch operates to disconnect the CCNO relay and CNO main transfer operator. The transfer switch is now mechanically locked open. Limit switch SNO is now activated, picking up the DW timer. After a set time delay, DW will pick up the CCE relay which will then pick up CE main transfer operator. The load is now transferred to the Emergency line. The SE limit switch operates to disconnect the CCE relay and CE main transfer operator. The transfer switch is now mechanically locked in Emergency.

When the Normal Line voltage exceeds the preset pick up point, the phase relays B1, B2, & B3 pick up. CR relay picks up to operate the CCEO relay through the SN & SEO cutout switches, causing the main transfer operator CEO to operate. The load is now transferred to the Open position. The SEO limit switch operates to disconnect the CCEO relay and CNO main transfer operator. The transfer switch is now mechanically locked Open. Limit switch SEO is now activated, picking up the DT timer. After a set time delay, DT will pick up the CCN relay which will then pick up the CN main transfer operator. The load is now re-transferred back to the Normal line. The SN limit switch operates to disconnect the CCN relay and CN main transfer operator. The transfer switch is now mechanically locked in Normal.

DS - Disconnect Switch
When the Disconnect Switch is placed in the INHIBIT position the circuit to the main transfer operators CN and CE is opened and transfer cannot take place.

TS - Test Switch
The Test Switch simulates a normal line failure when activated.
To test, activate the Test Switch allowing the transfer switch to transfer to the EMERGENCY position. De-activate the Test Switch. The transfer switch will reset to the NORMAL position. Testing at least once a month is recommended. For hospital emergency systems, test once a week.

NOTES:

1. ⚠ CAUTION: In using a 3 phase, 4 wire delta or open delta power supply (usually 120/240 volts, sometimes listed as 120/208 volts) with one leg having a grounded center tap, one line will be 160 to 208 volts to ground. When such a system is used it is necessary to connect the high leg to N2. DO NOT CONNECT 120 VOLT LOAD CIRCUIT TO THE HIGH LEG.
2. GROUNDING TERMINAL: A grounding terminal (GND) is provided. When installing open type switches connect this to the metal enclosure or conduit.
3. ⚠ WARNING - TO ENSURE AGAINST SHOCK OR ACCIDENT HAZARD, DISCONNECT ALL SOURCES OF SUPPLY BEFORE SERVICING.
4. ON SINGLE PHASE UNITS WHERE THE EMERGENCY SOURCE IS A UTILITY LINE, CONNECT EMERGENCY LINE SO THAT MINIMUM VOLTAGE IS MEASURED FROM N1 TO E1.
5. ON SINGLE PHASE (2 POLE) UNITS, CENTER POLE AND PHASE RELAYS (B2,B3) ARE NOT SUPPLIED.

ECN S-5004: 8-7-92

CONTROLLED

ZENITH CONTROLS, INC.

TITLE: LEGEND & OPERATION

DRAWING NO.: 40R-0105 | REV -

ACCESSORIES

The ZTS series switches are wired so that accessories can be easily added to the switch. The following is a description of the basic accessories. Those checked are supplied on this unit, see additional pages for complete legend & operation.

☐ A1 Auxiliary contact, S.P.D.T., operates on normal line failure.

☐ A1E Auxiliary contact, S.P.D.T., operates on emergency line failure.

☐ A3 Auxiliary contact closes when the transfer switch is in the Emergency position.

☐ A4 Auxiliary contact closes when the transfer switch is in Normal position.

☐ A6 Motor Disconnect. To de–energize external motor control circuit 5 seconds (adjustable) prior to transfer in either direction.

☐ C Plant Exercisor. Automatically starts generator for selected time intervals.

☐ C/D Plant Exercisor. Automatically starts generator to run unloaded or simulate a power failure and starts generator to run under load.

☐ E Engine Start Contact: 1 Normally Open
1 Normally Closed.

☐ F Auxiliary Fan Contact, S.P.N.O. Closes when generator is running.

☐ H Time delay to engine start, non–adjustable. Factory set 1 or 3 seconds. When the Normal line fails the relay de–energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ J1 Adjustable under frequency sensor.

☐ J2 Adjustable over/under frequency sensor.

☐ K Frequency meter to indicate load frequency.

☐ L1 Pilot Light. Switch in Emergency Position.

☐ L2 Pilot Light. Switch in Normal Position.

☐ L3 Pilot Light. Normal source available.

☐ L4 Pilot Light. Emergency source available.

☐ M1 Ammeter; Single phase.

☐ M2 Ammeter; Three phase

☐ M3 Voltmeter; Single phase.

☐ M4 Voltmeter; Three phase.

☐ P1 Time Delay to Engine Start (solid state). Adjustable over time range .5 to 6 seconds. When the Normal line fails the relay de–energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ P2 Time Delay to Engine Start (Pneumatic). Adjustable over time range 1/6 to 300 seconds. When the Normal line fails, the relay de–energizes. After the set time delay its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ Q2 Connections for remote peak shave or area protection relays. Includes bypass for automatic return to Normal if Emergency line fails and Normal is present.

☐ R1 Solid State Adjustable Overvoltage Relay(s). Set at 110% of pickup, 105% of dropout of nominal Line rate, unless otherwise specified.

☐ R4 In–Phase monitor. Prevents transfer until two sources are in–phase. For use of isochronous governors.

☐ R43 In–phase monitor. Prevents transfer until two sources are in–phase. For use with mechanical. governors.

☐ S1 Four–position Engine Control Selector Switch. "STOP", "HAND CRANK", "TEST", "AUTOMATIC".

☐ T Time delay, re–transfer to Normal. When the Normal line restores and the phase relays operate, the T timer is energized. After the set time delay, its contacts close the circuit to the CR relay which operates to restore the load to the Normal line. RT relay is supplied to bypass T contacts if Emergency is de–energized during timing. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ T3 W3 Presignal auxiliary Contact, S.P.D.T: Operates 0–30 seconds (adjustable) prior to transfer in either direction.

☐ U Time delay, engine cool–down. When the transfer switch is restored to the Normal position and the engine is signaled to shut down, the U timer operates to maintain the engine start circuit closed. At the end of the set time, the engine contacts open to shut down the engine. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ W Time delay, transfer to Emergency. When the Normal line fails and the engine has started, the VFSM relay energizes. The W timer energizes. After the set time delay, its contacts close to energize the RT relay. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ YE Pushbutton, Transfer to Emergency. Provides manual control of transfer to emergency source. If time delay accessory W is supplied pushbutton bypasses time delay for immediate transfer; otherwise, transfer to emergency will be automatic after time delay. If time delay accessory W is not supplied, transfer will be non–automatic (by pushbutton only).

☐ YN Pushbutton, Retransfer to Normal. Provides manual control of retransfer to normal source. If time delay accessory T is supplied, pushbutton bypasses time delay for immediate retransfer; otherwise, retransfer to normal will be automatic after time delay. If time delay accessory T is not supplied, retransfer will be non–automatic (by pushbutton only).

☐ Other:_____

_____

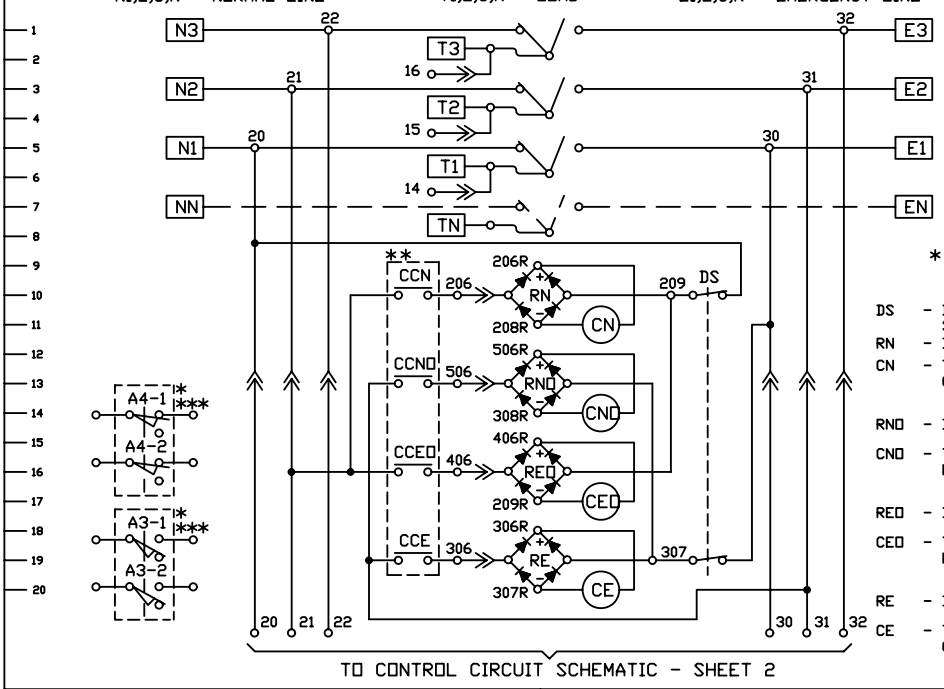
_____

ZENITH® CONTROLS, INC.

TITLE: ACCESSORIES

DRAWING NO.: 40R–0900 — REV

POWER CIRCUIT SCHEMATIC



VOLTAGE SYSTEMS

	VOLTS	NO. OF PHASES	NO. OF WIRES
-3	240V, 60HZ	3	3
-31	208, 60HZ	3	3
-38	120/240,60HZ	3	4
-4	120/208,60HZ	3	4
-5	480,60HZ	3	3
-7	277/480,60HZ	3	4
-9	240/416,60HZ	3	4
-91	220/380V,60HZ	3	4
-92	220/380V,50HZ	3	4

* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEM

DS - DISCONNECT SWITCH FOR SERVICING

RN - BRIDGE RECTIFIER, CN

CN - TRANSFER OPERATOR, CLOSE INTO NORMAL

RNO - BRIDGE RECTIFIER, CNO

CNO - TRANSFER OPERATOR, OPEN FROM NORMAL

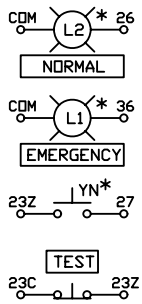
REO - BRIDGE RECTIFIER, CEO

CEO - TRANSFER OPERATOR, OPEN FROM EMERGENCY

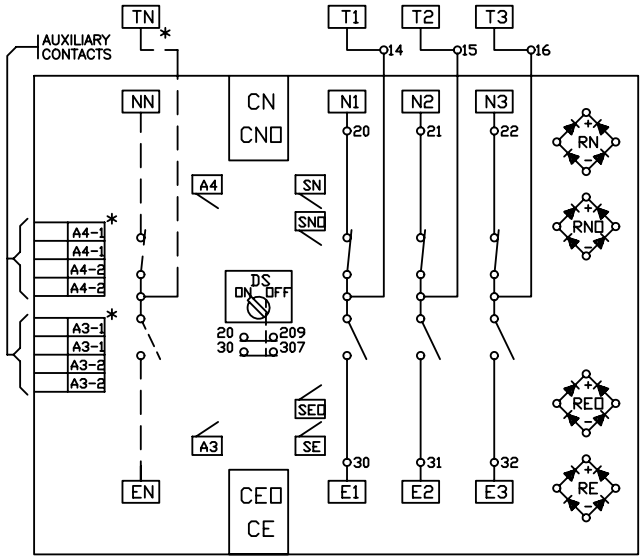
RE - BRIDGE RECTIFIER, CE

CE - TRANSFER OPERATOR, CLOSE INTO EMERGENCY

CABINET FRONT

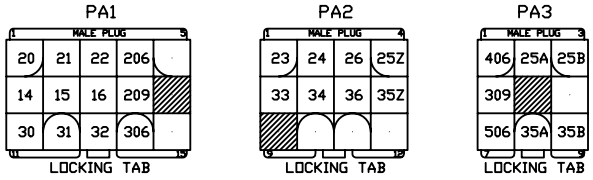


POWER PANEL LAYOUT



RECTIFIER LOCATIONS:
600 - 1200 AMP UNITS: RIGHT SIDE AS SHOWN
1600 - 3000 AMP UNITS: LEFT OF SOLENOIDS

INTERCONNECT PLUGS



REVISIONS:
ECN S-5769

NOTES:
1. ZTSDH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.
2. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3,A4,E,L1, L2,P,T,U,W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.

LEGEND
- WIRE CONNECTION
- WIRE ON MAIN TERMINAL BLOCK
- WIRE IN DISCONNECT PLUG
- * OPTIONAL
- ** LOCATED ON CONTROL PANEL
- *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL

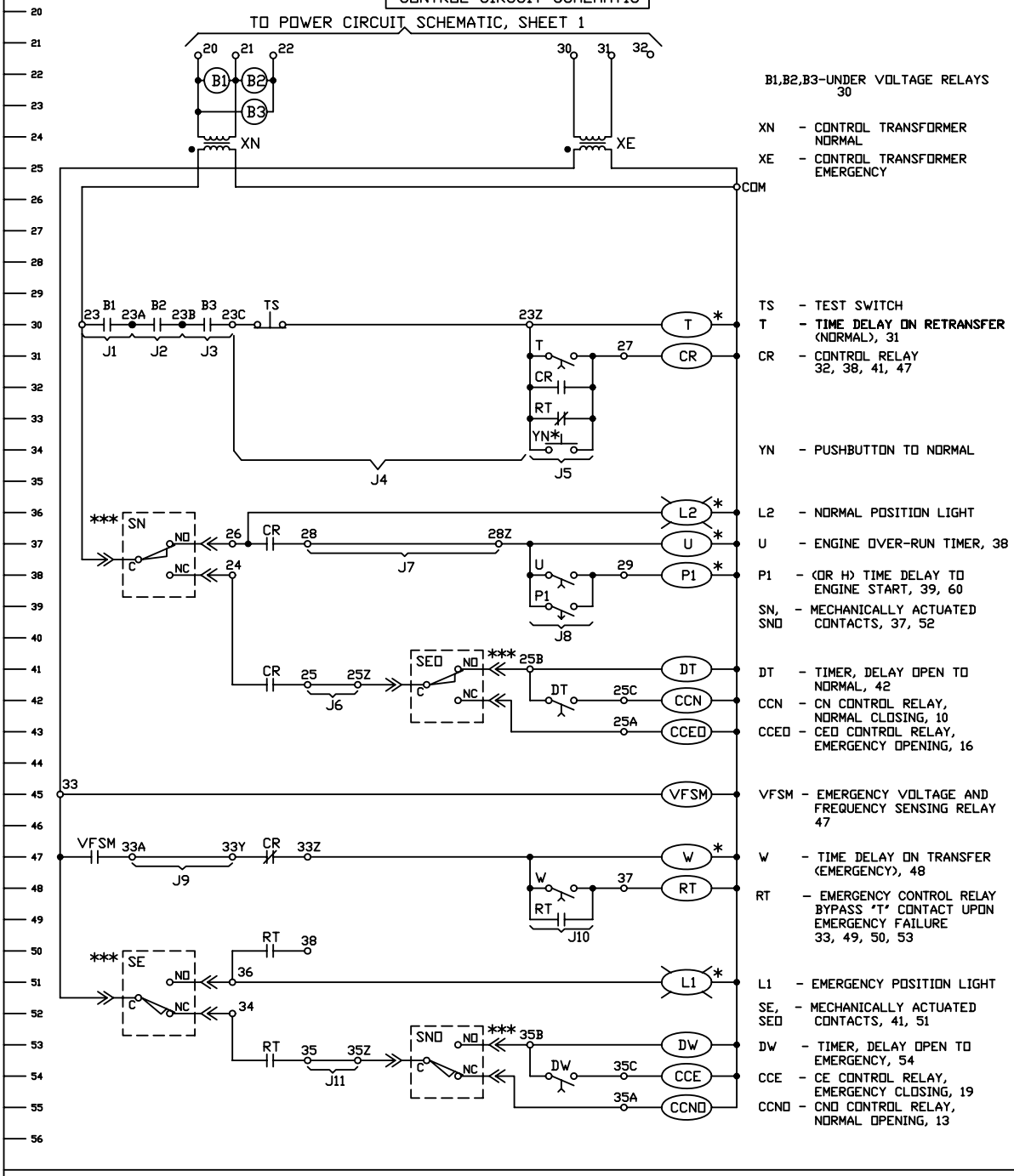
SEE 40R-0105 FOR LEGEND & OPERATION FOR MANUFACTURING: SEE PAGE 3 FOR ENCLOSED ZTSDH 600-1200 AMP CONTROL PANEL
SEE PAGE 4 FOR ENCLOSED ZTSDH 1600-3000 AMP & OPEN ZTSDH 600-3000 AMP
SEE 40R-0900 FOR ACCESSORIES

ZENITH CONTROLS, INC.

TITLE: POWER CIRCUIT & CABINET FRONT
MODEL: ZTSDH60/300 (600-3000 AMP)
DRFT: FHB | APP'D:
DATE: 07/22/94
DRAWING NO.: 43A-5000-3 SHEET 1 OF 4

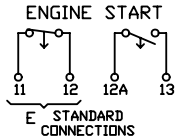
ORIGINAL

CONTROL CIRCUIT SCHEMATIC



CUSTOMER CONNECTIONS

A3, A4
SEE POWER CIRCUIT SCHEMATIC AND LAYOUT



CONTACT RATING		
RELAY	CONTACT	RATING
H	E	10AMP @ 28VDC
P1	E	10AMP @ 32VDC
	A3, A4	20AMP, 125, 250 VAC

JUMPER	CONNECT POINTS	REMOVE JUMPER WHEN ACCESSORIES USED
J1	23, 23A	B1
J2	23A, 23B	B2
J3	23B, 23C	B3
J4	23C, 23Z	J1N, TS, C/D
J5	23Z, 27	T, YN
J6	25, 25Z	T3, R4
J7	28, 28Z	C, C/D
J8	28Z, 29	P1, U
J9	33A, 33Y	J1E, ER1, 2, 3
J10	33Z, 37	W
J11	35, 35Z	W3, R4

NOTES:
1. ZTSDH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.
2. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3, A4, E, L1, L2, P, T, U, W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.

LEGEND
- WIRE CONNECTION
- WIRE ON MAIN TERMINAL BLOCK
- WIRE IN DISCONNECT PLUG
- * OPTIONAL
- *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL

REVISIONS:
ECN S-5769

ZENITH CONTROLS, INC.

TITLE: CONTROL CIRCUIT SCHEMATIC & CUSTOMER CONNECTIONS

MODEL: ZTSDH60/300 (600-3000 AMP)

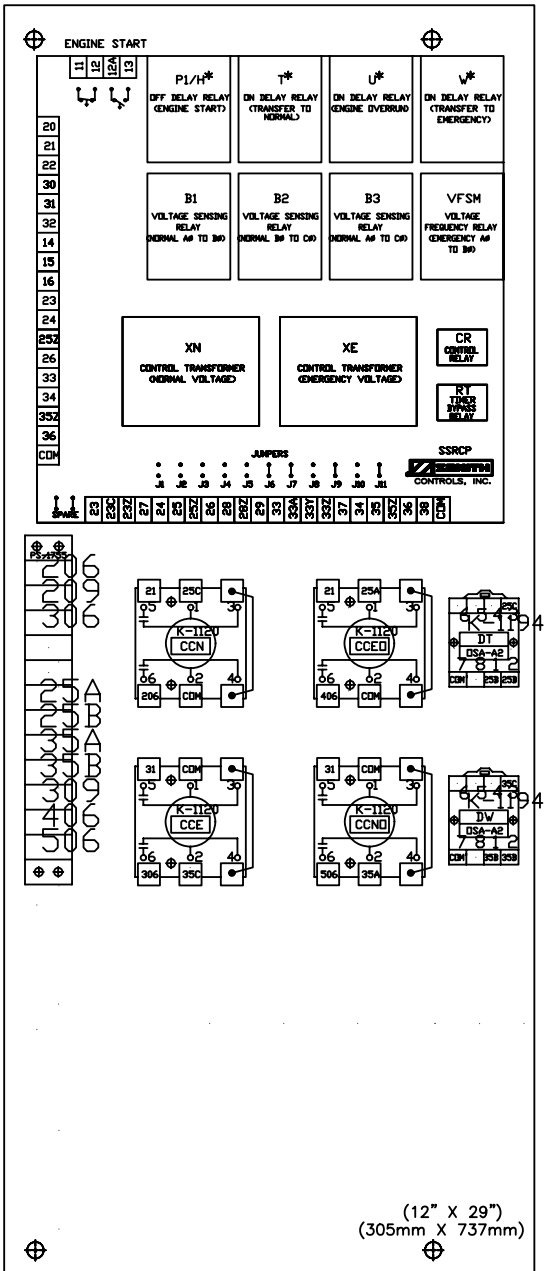
DRFT: FHB | APP'D:

DATE: 07/22/94

DRAWING NO.: 43A-5000-3 SHEET 2 OF 4

ORIGINAL

CONTROL PANEL LAYOUT



(12" X 29")
(305mm X 737mm)

(12" X 41")
(305mm X 1041mm)

NOTE:
12" X 41"
(305mm X 1041mm)
PANEL IS STANDARD FOR ENCLOSED ZTSDH 600–1200 AMP.

REVISIONS:
ECN S-5769

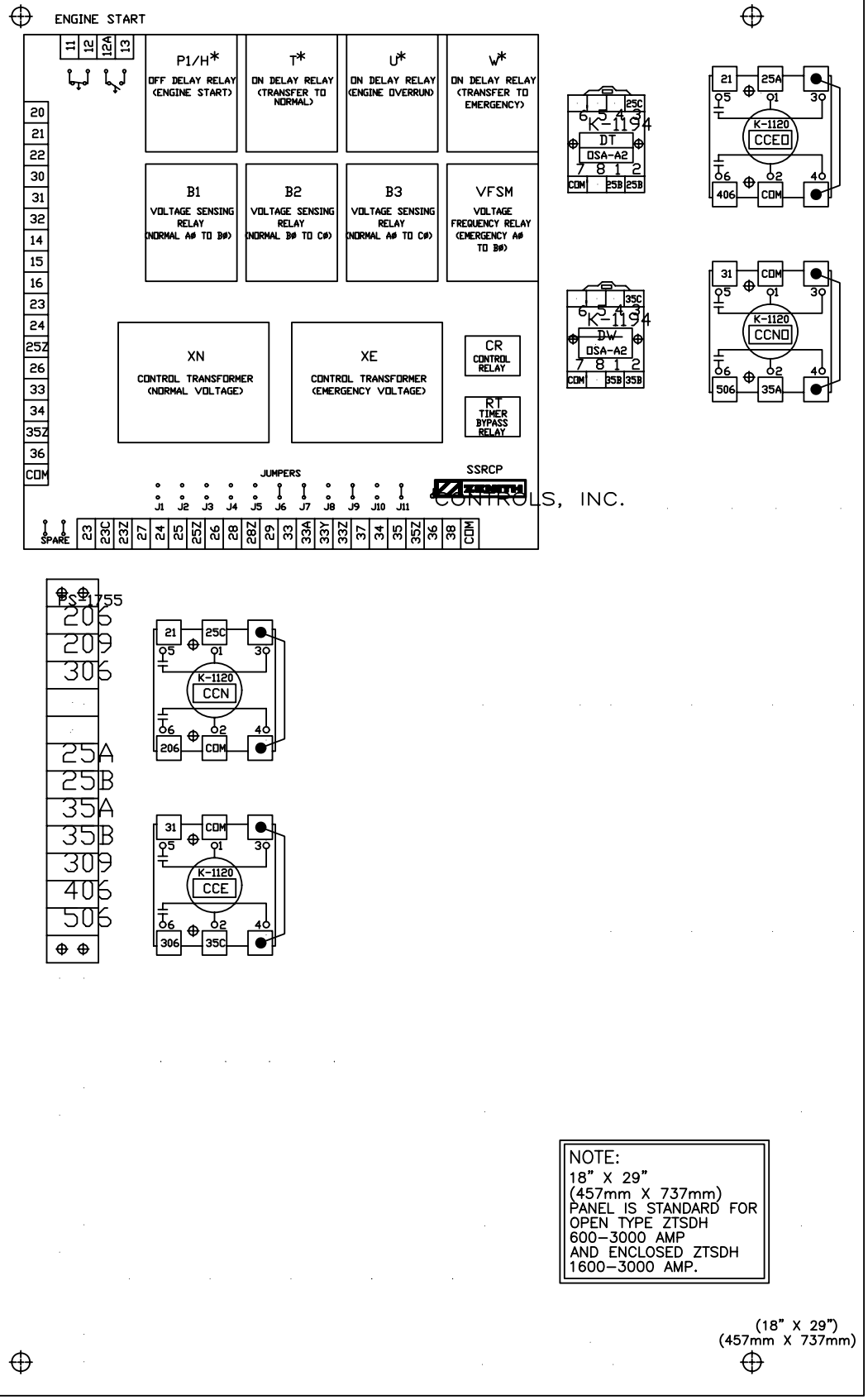
NOTES:
1. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3, A4, E, L1, L2, P, T, U, W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.
2. (*) OPTIONAL

ZENITH CONTROLS, INC.

TITLE: CONTROL PANEL LAYOUT
MODEL: ZTSDH60/300 (600-3000 AMP)
DRFT: FHB | APP'D:
DATE: 07/22/94
SCALE: 3/8 = 1
DRAWING NO.: 43A-5000-3
SHEET 3 OF 4

ORIGINAL

CONTROL PANEL LAYOUT



NOTE:
18" X 29"
(457mm X 737mm)
PANEL IS STANDARD FOR OPEN TYPE ZTSDH 600–3000 AMP AND ENCLOSED ZTSDH 1600–3000 AMP.

(18" X 29")
(457mm X 737mm)

REVISIONS:
ECN S–5769

NOTES:
1. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3, A4, E, L1, L2, P, T, U, W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.
2. ( ) OPTIONAL

MODEL:
ZTSDH60/300 (600–3000 AMP)

DRFT: FHB | APP'D:

DATE: 07/22/94

SCALE: 1/2 = 1

ZENITH CONTROLS, INC.

TITLE: CONTROL PANEL LAYOUT

DRAWING NO.: 43A–5000–3
SHEET 4 OF 4

ORIGINAL

ZENITH CONTROLS, INC.

43R-5001B
Revised March, 1996

OPERATION AND MAINTENANCE MANUAL

AUTOMATIC TRANSFER SWITCH - DELAYED TRANSITION
(Mechanically Held)

ZTSDH SERIES
1600 THRU 3000 AMPS

CONTROLLED

MODEL NUMBER _____

SERIAL NUMBER _____

ZENITH CONTROLS, INC., 830 W. 40th St., Chicago, IL 60609
(312)247-6400: FAX. (312)247-7805

PARTS LIST

IMPORTANT: Model number and serial number of switch must be included with all orders for replacement parts. If possible, also specify line voltages, drawing number and date of installation. When ordering mechanical parts not shown on the parts list, circle the part on the photograph and return with the parts list. When ordering electrical components not shown on the parts list, refer to this part by its legend description in the wiring diagram.

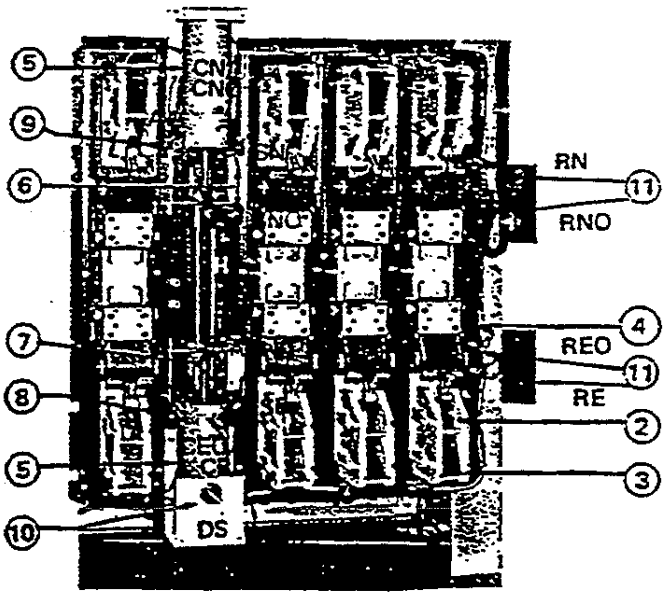
A. POWER PANEL PARTS

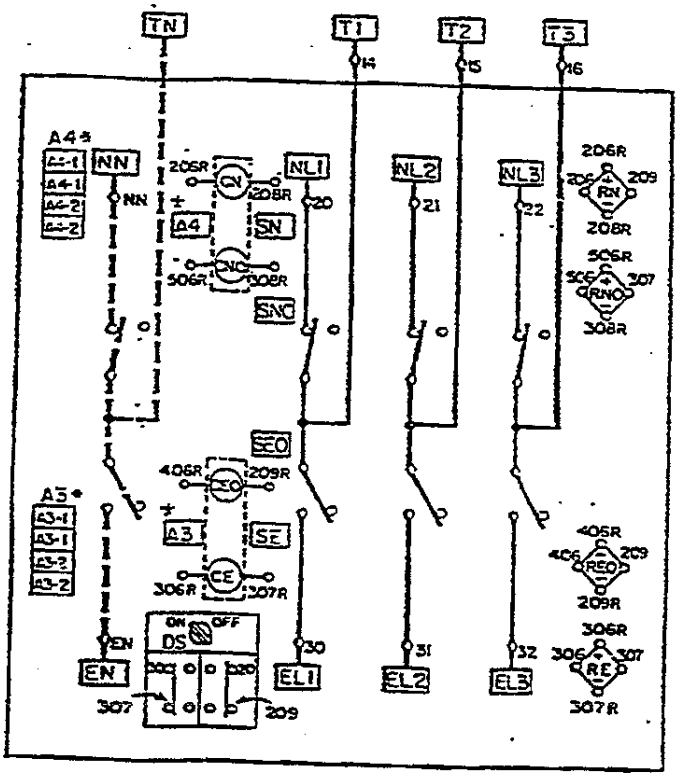
ITEM	TAG	DESCRIPTION	PART NUMBER BY AMPERAGE		
			1600	2000	3000
1	NL1,2,3 EL1,2,3 T1,2,3	Cable Connections at Rear	S-1126F (2) Optional (8) 600 MCM-2	S-1126F (2) Optional (8) 600 MCM-2	S-1126F (2) Optional (8) 600 MCM-2
2		Stationary Contact Assembly Kit	23P-1594	23P-1594	23P-1434Z
3		Arc Grid Assembly Kit	23P-1171	23P-1171	23P-1171
4		Moveable Contact Assembly Kit	23P-1400	23P-1400	23P-1344
5	CN/CNO,CEO/CE	Main ATS Operating Coils			
	Voltage Systems				
	No / Volts / Ph / Wire / Coil Volts / Poles				
	-1 / 120 / 1 / 2 / 120 / 2		SPO	SPO	SPO
	-2 / 120/240 / 1 / 3 / 240 / 2		K-2151	K-2151	K-2151
	-2 / 120/240 / 1 / 3 / 240 / 3		K-2151	K-2151	K-2151
	-3 / 240 / 3 / 3 / 240 / 3		K-2151	K-2151	K-2151
	-4 / 120/208 / 3 / 4 / 208 / 3,4		K-2151	K-2151	K-2151
	-5 / 480 / 3 / 3 / 480 / 3		K-2160	K-2160	K-2160
	-6 / 575 / 3 / 3 / 575/600 / 3		K-2195	K-2195	K-2195
	-7 / 277/480 / 3 / 4 / 480 / 3		K-2160	K-2160	K-2160
	-7 / 277/480 / 3 / 4 / 480 / 4		K-2160	K-2160	K-2160
	-8 / 120/240 / 2 / 4 / 240 / 4		K-2151	K-2151	K-2151
	-9 / 240/416 / 3 / 4 / 416 / 3		K-2193	K-2193	K-2193
	OPERATING COIL HARDWARE KIT				
6	SN/SNO	CN Cut-Out Switch	23P-1401		
7	SE/SEO	CE Cut-Out Switch	23P-1401		
8	A3	Emergency Position Aux. Contact	(QTY 1) 23P-1404 (QTY 2) 23P-1405		
9	A4	Normal Position Aux. Contact	(QTY 1) 23P-1402 (QTY 2) 23P-1403		
10	DS	Disconnect Switch	Operator L-4009, Contact Block L-1020		
11	RN,RE,RNO,REO	Rectifier	23P-1473 (240V), 23P-1582 (600V)		
		Nameplate (Not Shown)	Contains switch information: voltage, amperage, frequency rating, number of phases, serial number, system voltage and model number.		

CABINET DOOR

TAG	DESCRIPTION	PART NUMBER
L1 L2	ATS Emergency Position Indicator ATS Normal Position Indicator Green Lens (Normal) Red Lens (Emergency) Bulb Socket Normal/ Emergency Nameplate Emergency Bulb Normal Bulb	 PS-5048 PS-5047 PS-5046 V-1502 PS-5105 PS-5105
TS	Test Switch Operator, Momentary Contact Block N.C. Name Plate Contact Mounting Base	 L-1025 L-1029 V-1503 PS-3473

A. POWER PANEL





B. CONTROL PANEL

TORQUE REQUIREMENTS FOR ELECTRICAL CONNECTIONS

All current carrying parts use compression washers and should be torqued to the values presented below. Caution: DO NOT OVER-TORQUE WASHERS; follow the given torque values.

Torque Requirements (inch-lb. except denoted by + are ft.-lb.)

Bolt Size	Grade 5	Socket Head	Set Screw	Compression Washers	
				1	2
1/4 - 20	75	120	52	80	87
5/16 - 18	157	225	105	159	170
3/8 - 16	+23	412	165	+23	+26
1/2 - 13	+57	1030	386	+56	+59

Wire Connection Tightening Torque

Wire Cond. Size AWG or MM	Screw Driver Torque (inch-lb.)
18 - 16 AWG	19
14 - 8	19
6 - 4	36

Lug Bolting Torque

Bolt Dia. (in.)	Torque (ft.-lb)
1/4 or less	6
5/16	11
3/8	19
7/16	30
1/2	40
5/8 or more	55

TORQUE REQUIREMENTS FOR FIELD CONNECTIONS

NOTICE
TIGHTENING TORQUES FOR FIELD WIRING TERMINALS

Socket Size Across Flats, Inch	Tightening Torque Pound-Inches
1/8	45
5/32	100
3/16	120
7/32	150
1/4	200
5/16	275
3/8	375
1/2	500
9/16	600

D. ATS CONTROL PANEL (SSRCP)

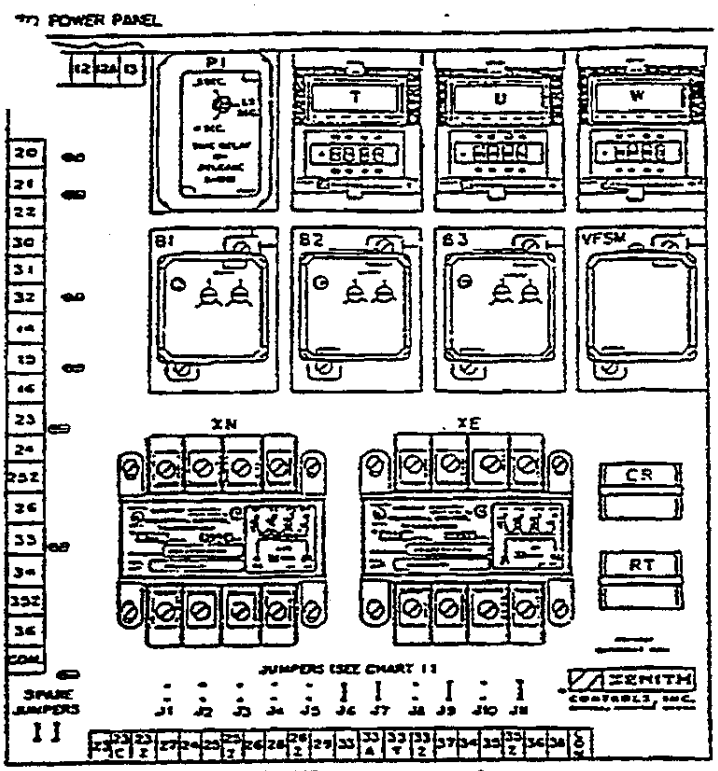


CHART 1

Jumper	Connects Points	Remove When Accessories Used
J1	23,23A	B1
J2	23A, 23B	B2
J3	23B, 23C	B3
J4	23C, 23Z	JIN, TS, C/D
J5	23Z, 27	T, YN
J6	25, 25Z	T3, R4
J7	28, 28Z	SI, C, C/D
J8	28Z, 29	PI & U
J9	33A, 33Y	ER1, 2, 3, J1E
J10	33Z,37	W
J11	35, 35Z	R4, W3

ATS CONTROL PANEL (SSRCP) STANDARD ITEMS

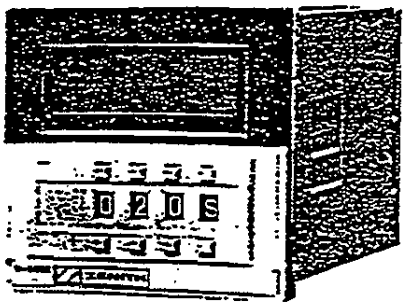
TAG	DESCRIPTION	VOLTAGE 50/60 HZ	PART NO.
XN, XE	Control Transformers (See Note 1)	120V	K-3068
		208V	K-3070
		240 or 480V	K-3071
		416V	K-3089
B-1, 2, 3	Phase Relays Solid State (See Note 1)	120V	K-1185
		208 or 240V	K-1186
		480V	K-1188
VFSM	Voltage Frequency Sensor	120V/60Hz	K-1192R
CR	Control Relay	120V	K-1204
RT	Bypass T Relay	120V	K-1204
J1-J11	Jumpers		PS-5057
CCN, CCEO	Power Relays, energize CN & CEO Solenoids	120V	K-1120
CCE, CCNO	Power Relays, energize CE & CNO Solenoids	120V	K-1120

(OPTIONAL ITEMS)

TAG	DESCRIPTION	VOLTAGE	PART NUMBER
T	Time Delay to Normal, Timer Solid State	120V .1 Sec. to 9990 Hrs. (Adj.)	OSA-A-T
U	Engine Cool Down, Timer Solid State	120V .1 Sec. to 9990 Hrs. (Adj.)	OSA-A-U
W	Time Delay Emergency, Timer Solid State	120V .1 Sec. to 9990 Hrs. (Adj.)	OSA-A-W
PI	Time Delay Engine Start, Timer	120V (.5 to 6 sec. Adjustable)	K-1201
P2	Optional (Mounted below SSRCP)	120V (300 Sec. Adjustable)	K-1061

Notes:

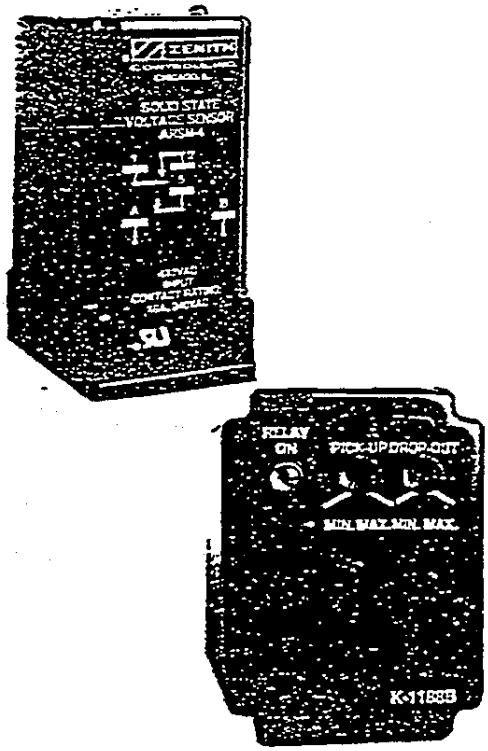
1. If -6 voltage system (575/600V) is supplied, then XN, XE is K-3087 and B1,2, 3 is K-1185 (120V) supplied with XB (575:600V/120V) 3 phase transformer assembly. B1, 2, 3 mounted below SSRCP.



Solid State Time Delay

Accessories T, U, W Solid State Timers Adjustable in Seconds, Minutes and Hours (Plug-In Style).

To select a time unit, operate the pushbuttons of the rightmost thumbwheel switch until the desired time unit is shown in window. The time unit can be selected by pushing the plus (+) bottom button or the minus (-) top button. The desired time is specified by operating the three thumbwheel switches in the middle of the front panel.



Close Differential (ARSM) Relay Adjustment

The voltage points at which the relay operates are adjustable. When the relay pulls in, an audible click is noticeable, and the LED will come on.

Setting the Relay:

If the relay should be set with a variable voltage supply (Variac):

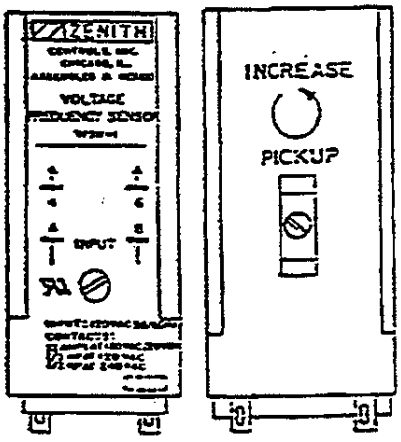
1. Turn pick-up control fully clockwise.
2. Turn drop-out control fully counterclockwise.
3. Set Variac pick-up voltage to desired level.
4. **Very slowly** rotate pick-up adjustment counterclockwise until relay picks up. (LED will energize).
5. Set Variac drop-out voltage to desired level.
6. **Very slowly** rotate drop-out adjustment clockwise until relay drops out (LED de-energizes).

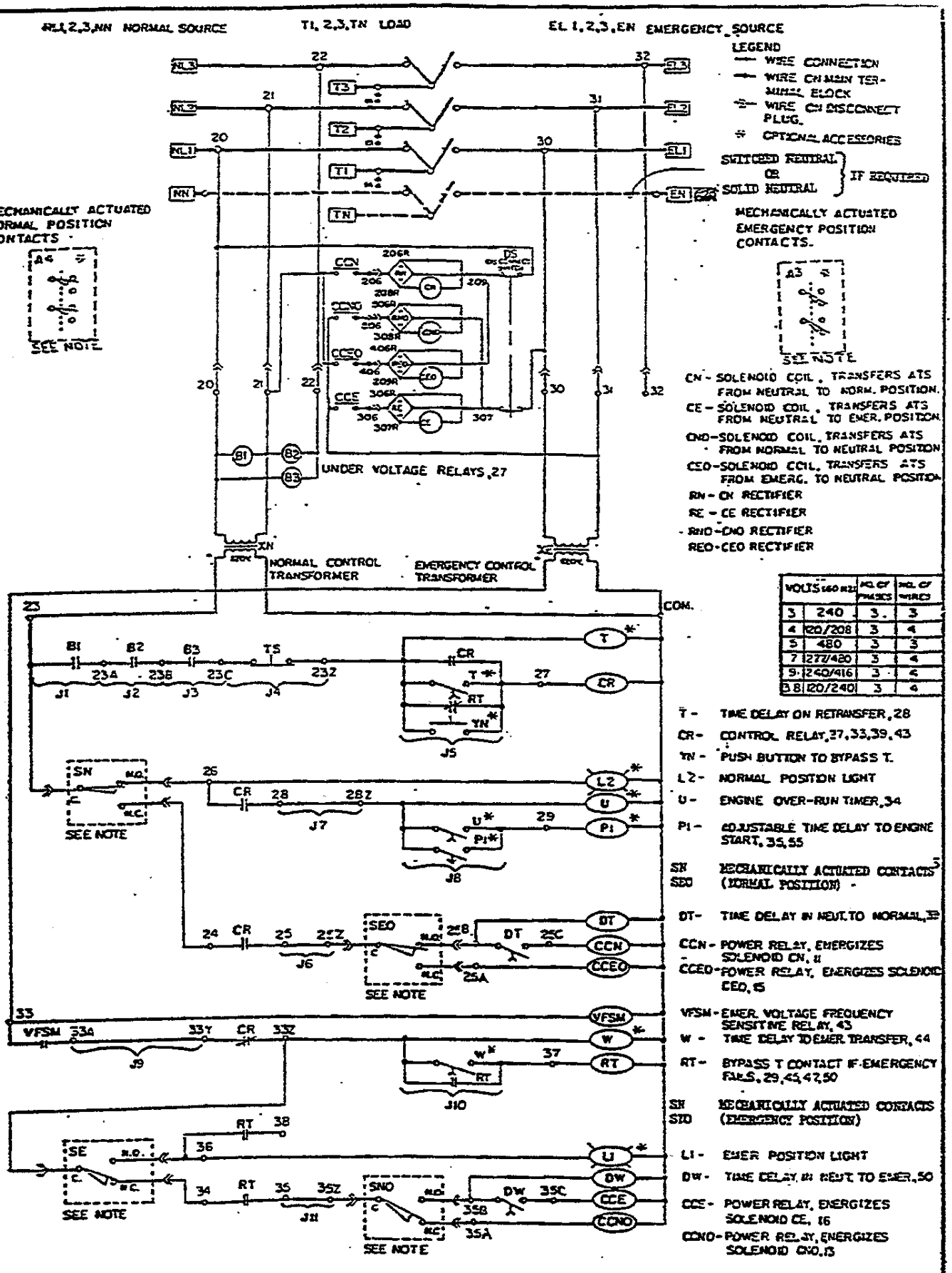
Verify settings by raising voltage until relay picks up, then lower voltage until relay drops out, making sure that relay operates at desired voltage levels.

VOLTAGE/FREQUENCY SENSOR (VFSM) ADJUSTMENT

The pickup point may be adjusted between 80-95% of rated voltage by rotating the offset screw located on the back of the relay.

Counter-clockwise rotation increases pickup voltage. Clockwise rotation decreases pickup voltage.





VOLTS (60 Hz)		NO. OF PHASES	NO. OF WIRES
3	240	3	3
4	120/208	3	4
5	480	3	3
7	277/480	3	4
9	240/416	3	4
38	120/240	3	4

OPERATION OF AUTOMATIC TRANSFER SWITCH

OPERATION:

When the normal line (NL) falls to the preset dropout point, or if any normal phase fails, the phase relay(s) (adjustable) will drop out disconnecting the CR and signaling the generator to start.

When emergency line (EL) voltage and frequency reach at least 90% of rated value, the VFSM relay is energized. The RT relay is now energized to operate the CCNO relay through the CNO cutout switch causing the main transfer coil CNO to operate. The load is now transferred to the OPEN position. The SNO limit switch operates to disconnect the CCNO relay and CNO transfer coil. The transfer switch is now locked mechanically open. SNO is now activated. This energizes the DW timer. After time setting has lapsed, DW will energize CCE, which will energize main transfer coil CE. The load is now transferred to the emergency line supply. The SE limit switch operates to disconnect the CCE relay and CE main transfer coil. The transfer switch is now locked mechanically in Emergency position.

When the normal line voltage restores to the preset value, the phase relay(s) (B1,2,3) operate to energize the normal restoration timer T. After the time setting has lapsed, the timer contact closes to energize CR relay. The CCEO relay is now energized through the SN and SEO limit switches, causing the main transfer coil CEO to operate. The load is now transferred back to OPEN position. The SEO limit switch operates to disconnect the CCEO relay and CEO transfer coil. The transfer switch is now locked mechanically open. SEO is now activated, energizing DT timer. After time setting has lapsed, DT will energize CCN which will energize main transfer coil CN. The load is now transferred to the normal line supply. The SN limit switch operates to disconnect the CCN relay and CN main transfer coil. The transfer switch is now locked into normal position.

INSPECTION

CONTACTS - The movable and stationary contacts are a vital part of the ATS and must be kept clean. To inspect the ATS contacts, disconnect all power sources. Examine the contacts.

Any surface deposits must be removed with a clean cloth (DO NOT USE EMERY CLOTH OR A FILE).

After the movable and stationary contacts are wiped clean (no discoloration or deposits), reconnect power source.

CURRENT CARRYING PARTS - An easily detected but abnormal condition is the discoloration of current carrying parts (particularly copper). Discoloration appears as darkened material or finishes. Any discolored parts should be cleaned. WARNING: ANY MAINTENANCE SHOULD ONLY BE DONE WHILE THE POWER IS OFF. If the discoloration persists, contact the factory.

LUBRICATION

The cams of the ATS are lubricated with Super Lube PTFE grease, the gears with Dow Chemicals "Molykote" (321R or GN paste). These lubricants provide adequate lubrication for a clean and properly maintained swithces lifetime. Should debris contaminate the mechanism, clean and apply additional lubricants. Mobiltemp SHC-32 is used on isolating contacts.

FIELD NOTES

MODEL NO: _____

SERIAL NO: _____

DATE SHIPPED: _____

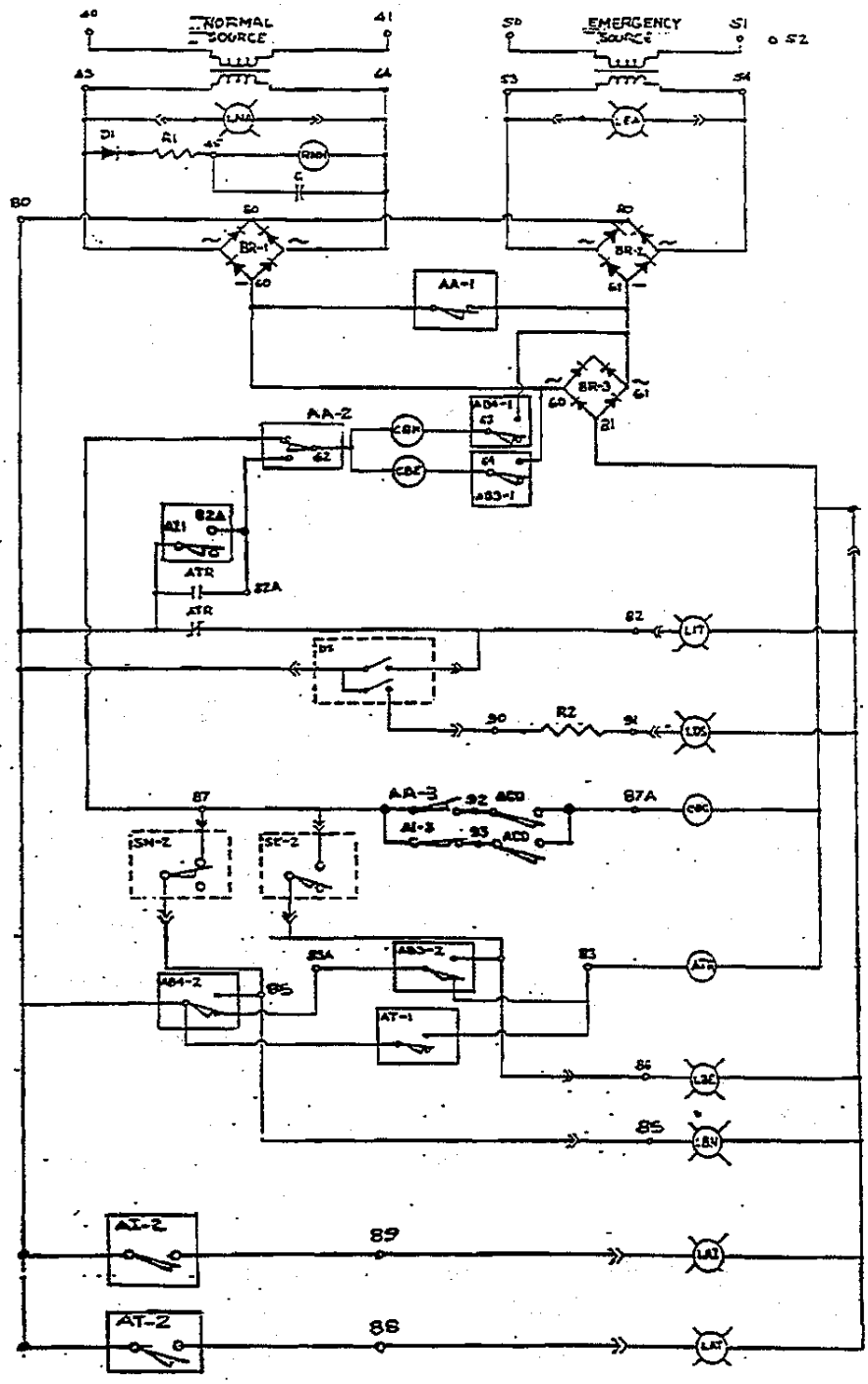
START-UP DATE: _____

DRAWINGS SUPPLIED: _____

_____

TEST AND MAINTENANCE NOTES:

DATE	TESTED	OBSERVATIONS	NOTES



LNA- Normal Lamp Available

LEA- Emergency Lamp Available

RNH- Relay Normal Hold
3,27,29

AA-1,2,3- Auto Limit Switch
6,8,14

BR-1,2,3- Bridge Rectifier

CBN- Normal Solenoid
8

CBE- Emergency Solenoid
9

AI-1,2-3 Isolate Limit Switch
10,22,14

ATR- Auto/Test Relay
11,17

LIT- Lamp Inhibit Transfer
11

LDS- Lamp Disconnect Switch
"INHIBIT" position . 13

CBC- Crank Solenoid . 14

AT-1,2- Test Limit Switch
18,23

LBE- Lamp Bypass Emergency 19

LBN- Lamp Bypass Normal 20

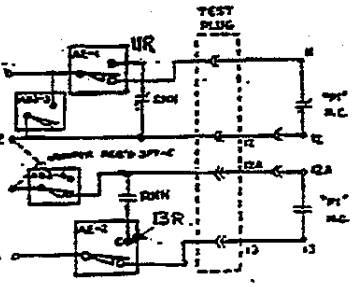
LAI- - - -Lamp ATS Isolate 22

LAT/TEST- Lamp Ats Test pos:23

AUTO- Lamp ATS Auto pos. 25

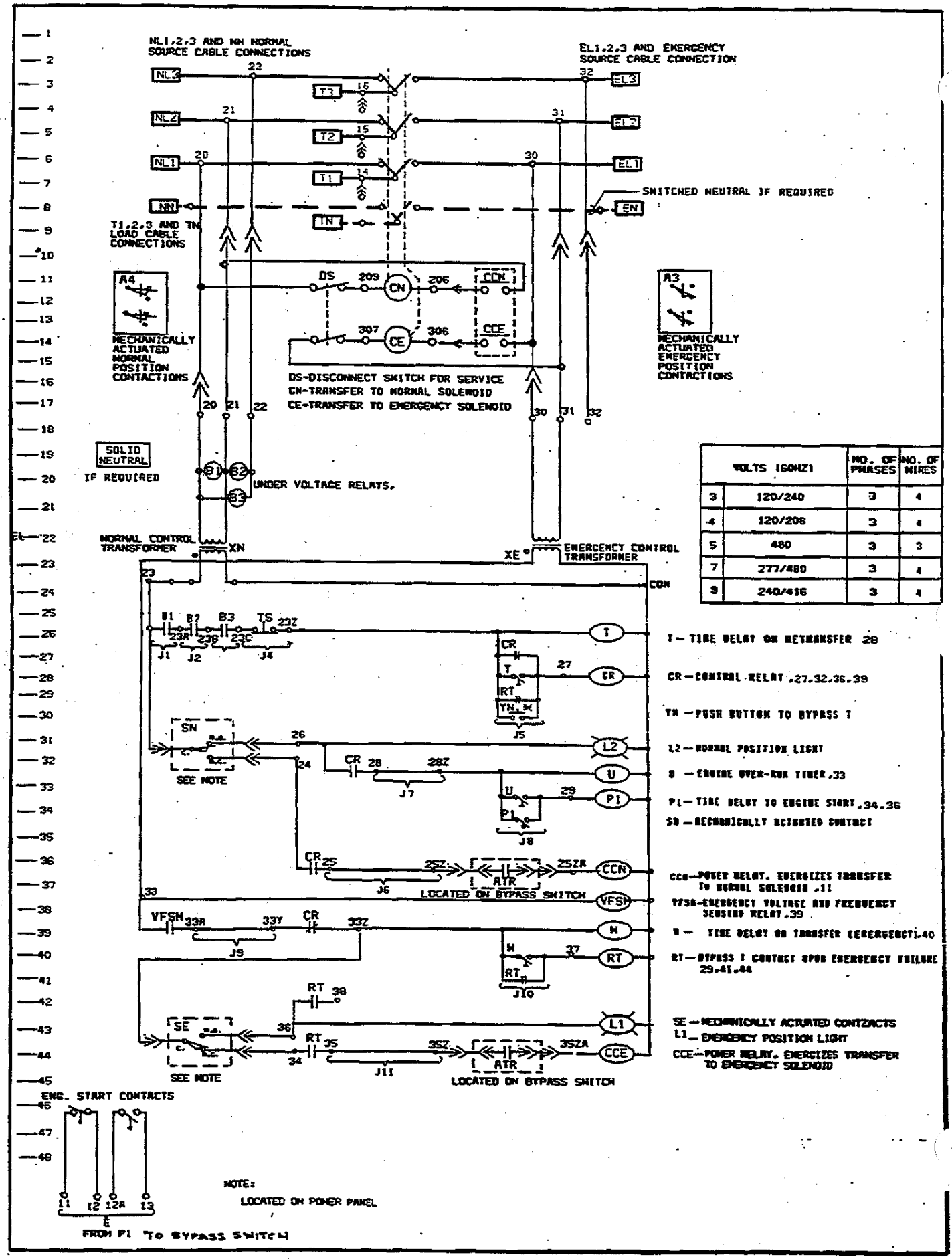
AB4-1,2- Bypass Normal
8,18

AB3-1,2,3,4- Bypass Emergency
9,17,27,29



NOTE:
WIRE NUMBER E12 BECOMES WIRE NUMBER 12 AFTER THE TEST PLUG (TP).

600 - 1200 AMP (ATS) BYPASS W/ SSRCP



	VOLTS (60HZ)	NO. OF PHASES	NO. OF WIRES
3	120/240	3	4
4	120/208	3	4
5	480	3	3
7	277/480	3	4
9	240/416	3	4

T - TIME DELAY ON RETRANSFER 28

CR - CONTROL RELAY 27,32,36,39

TN - PUSH BUTTON TO BYPASS T

L2 - NORMAL POSITION LIGHT

U - ENGINE OVER-RUN TIMER 33

P1 - TIME DELAY TO ENGINE START 34,36

SN - MECHANICALLY ACTUATED CONTACT

CCN - POWER RELAY, ENERGIZES TRANSFER TO NORMAL SOLENOID 11

VFSH - EMERGENCY VOLTAGE AND FREQUENCY SENSING RELAY 39

H - TIME DELAY ON TRANSFER (EMERGENCY) 40

RT - BYPASS T CONTACT UPON EMERGENCY FAILURE 29,41,44

SE - MECHANICALLY ACTUATED CONTACTS

L1 - EMERGENCY POSITION LIGHT

CCE - POWER RELAY, ENERGIZES TRANSFER TO EMERGENCY SOLENOID

PURPOSE

Zenith automatic transfer switches are used to provide a ...ious source of voltage for lighting and power circuits ...omatically transferring the lighting or power load from the normal source to an emergency source of voltage when the normal voltage fails or drops in voltage.

This manual is supplied to provide complete information on the operation, installation and maintenance of the ZENITH ZTSDH series mechanically held transfer switch. In addition a complete wiring diagram is provided with each transfer switch. The instruction manual and the wiring diagram should be kept in a safe place to serve as complete reference information on this critically important piece of equipment.

Described in this manual, are the new ZTSDH series, 1600 thru 3000 ampere sizes, featuring a new concept in transfer switch design.

For details of operation, accessories, and wiring see wiring diagram and operational sheet supplied with the switch.

WARNING

The power voltage present in this equipment is dangerous to life. When operating or adjusting this equipment with doors open, special care must be taken to avoid contact with terminals carrying this voltage.

CONTACT REPLACEMENT

...ontact replacement is usually not necessary for many years on the average transfer switch. When replacement is necessary, all contacts are easily removed. Both the main contacts and all control contacts are easily visible from the front of the panel, for fast visual inspection.

INSTALLATION

A good installation is as necessary as a good transfer switch. This switch is designed for floor mounting. Floor mounted cabinets must be well braced and protected from damage. Be sure that the cabinet is not mounted directly under any water pipes which may sweat and drip water into the cabinet. Be sure cabinet is fully cleaned of dirt and concrete dust before operation.

Enough room should always be allowed to open the cabinet doors fully, so normal visual inspection of all parts is possible.

Before installing the switch and before energizing the circuits, check the switch for shipping or installation damage.

The following may be used as a test procedure after installation of the transfer switch:

Before connecting the load circuit, make sure normal line contacts are closed, then energize the NL circuit. The phase relays and control relay will be energized. Next, energize the EL circuit. The VFSM relay will be energized. Operate the test switch TS to the test position. The switch will transfer to the EL side. Return the test switch to the auto position. The transfer switch will restore to the NL position. The load may now be connected and the same procedure followed. A periodic test of the switch, under load conditions, is recommended to insure proper operation of the main switch and all accessories.

CHECK LIST FOR START-UP

	NORMAL OPERATION	POINTS TO CHECK IF NORMAL OPERATION DOES NOT OCCUR
1	Normal line fails and the engine starts. (This can be simulated with the TEST switch).	If engine generator does not start be sure the relay containing the engine start contacts (marked E) has dropped out and the contacts are closed. Be sure the battery is connected and the control switch on the engine is turned to automatic. If the engine fires but does not start, contact the engine dealer.
2	Engine starts, generator reaches full voltage, switch transfers to emergency voltage.	Check at emergency line terminals of switch to be sure the generator voltage is up to the proper value. Be sure the VFSM relay pulls in. If not, check VFSM relay adjustment page 4. Check to see that the ET relay is energized. Check to see that the circuit to the CCNO coil (to open Normal), then CCE coil (to close Emergency) is complete thru the SE cutout switch.
3	Normal voltage restores and the switch transfers back to normal.	Check to see that the normal voltage has restored to full value. Check to see that the phase relays have pulled in. (See phase relay adjustment page 4. Check the CR relay to be sure that it is energized and its normal contact is closed. Check to see that the circuit to the CCEO coil (to open Emergency), then CCN coil (to close Normal) is complete thru the SN cutout switch.
4	Engine shuts down.	Be sure voltage is present at relay containing E contact and the relay is energized. If timer U is used be sure it times out and operates its end-of-cycle switch.

ZTSDH SERIES
AUTOMATIC TRANSFER SWITCHES
600 - 3000 AMP

FOR USE ON EMERGNECY OR STANDBY SYSTEMS
RATED FOR TOTAL SYSTEM & MOTOR LOAD

A. LEGEND

N1,2,3,(N).....Normal Line
E1,2,3,(N).....Emergency Line
T1,2,3,(N).....Load Connections
B1,2,3.....Solid State Phase Relay(s)
Dropout _____%
Pickup _____%
CE.....Main Transfer Operator, Close into Emergency
CEO.....Main Transfer Operator, Open from Emergency
CN.....Main Transfer Operator, Close into Normal
CNO.....Main Transfer Operator, Open from Normal
CCE.....CE Control Relay, Emergency Closing
CCEO.....CEO Control Relay, Emergency Opening
CCN.....CN Control Relay, Normal Closing
CCNO.....CNO Control Relay, Normal Opening
CR.....Normal Control Relay
DS.....Disconnect Switch
DT.....Timer, Delay Open To Normal
DW.....Timer, Delay Open To Emergency
E.....Engine Start Contact
GND.....Ground
NB.....Neutral Bar (if required)
RN.....Bridge Rectifier, CN
RE.....Bridge Rectifier, CE
RNO.....Bridge Rectifier, CNO
REO.....Bridge Rectifier, CEO
RT.....Emergency Control Relay
SE,SEO.....Cutout Switch, Emergency
SN,SNO.....Cutout Switch, Normal
TS.....Test Switch,Momentary,Not Keyed
VFSM.....Emergency Volt-Freq. Relay
Pickup {90% of rated Voltage, and {95% of rated Frequency
XE.....Control Transformer, Emergency
XN.....Control Transformer, Normal

B. OPERATION

When the Normal Line falls to the preset dropout point, the phase relays will dropout disconnecting the CR relay.
When the Emergency Line voltage & frequency reach the preset pickup point, the VFSM relay picks up. RT relay picks up to operate the CCNO relay through the SE & SNO cutout switches causing the emergency main transfer operator CNO to operate. The load is now transferred to the Open position. The SNO limit switch operates to disconnect the CCNO relay and CNO main transfer operator. The transfer switch is now mechanically locked open. Limit switch SNO is now activated, picking up the DW timer. After a set time delay, DW will pick up the CCE relay which will then pick up CE main transfer operator. The load is now transferred to the Emergency line. The SE limit switch operates to disconnect the CCE relay and CE main transfer operator. The transfer switch is now mechanically locked in Emergency.

When the Normal Line voltage exceeds the preset pick up point, the phase relays B1, B2, & B3 pick up. CR relay picks up to operate the CCEO relay through the SN & SEO cutout switches, causing the main transfer operator CEO to operate. The load is now transferred to the Open position. The SEO limit switch operates to disconnect the CCEO relay and CNO main transfer operator. The transfer switch is now mechanically locked Open. Limit switch SEO is now activated, picking up the DT timer. After a set time delay, DT will pick up the CCN relay which will then pick up the CN main transfer operator. The load is now re-transferred back to the Normal line. The SN limit switch operates to disconnect the CCN relay and CN main transfer operator. The transfer switch is now mechanically locked in Normal.

DS - Disconnect Switch
When the Disconnect Switch is placed in the INHIBIT position the circuit to the main transfer operators CN and CE is opened and transfer cannot take place.

TS - Test Switch
The Test Switch simulates a normal line failure when activated.
To test, activate the Test Switch allowing the transfer switch to transfer to the EMERGENCY position. De-activate the Test Switch. The transfer switch will reset to the NORMAL position. Testing at least once a month is recommended. For hospital emergency systems, test once a week.

NOTES:

1. ⚠ CAUTION: In using a 3 phase, 4 wire delta or open delta power supply (usually 120/240 volts, sometimes listed as 120/208 volts) with one leg having a grounded center tap, one line will be 160 to 208 volts to ground. When such a system is used it is necessary to connect the high leg to N2. DO NOT CONNECT 120 VOLT LOAD CIRCUIT TO THE HIGH LEG.
2. GROUNDING TERMINAL: A grounding terminal (GND) is provided. When installing open type switches connect this to the metal enclosure or conduit.
3. ⚠ WARNING - TO ENSURE AGAINST SHOCK OR ACCIDENT HAZARD, DISCONNECT ALL SOURCES OF SUPPLY BEFORE SERVICING.
4. ON SINGLE PHASE UNITS WHERE THE EMERGENCY SOURCE IS A UTILITY LINE, CONNECT EMERGENCY LINE SO THAT MINIMUM VOLTAGE IS MEASURED FROM N1 TO E1.
5. ON SINGLE PHASE (2 POLE) UNITS, CENTER POLE AND PHASE RELAYS (B2,B3) ARE NOT SUPPLIED.

ECN S-5004: 8-7-92

CONTROLLED

ZENITH CONTROLS, INC.

TITLE: LEGEND & OPERATION

DRAWING NO.: 40R-0105 | REV -

ACCESSORIES

The ZTS series switches are wired so that accessories can be easily added to the switch. The following is a description of the basic accessories. Those checked are supplied on this unit, see additional pages for complete legend & operation.

☐ A1 Auxiliary contact, S.P.D.T., operates on normal line failure.

☐ A1E Auxiliary contact, S.P.D.T., operates on emergency line failure.

☐ A3 Auxiliary contact closes when the transfer switch is in the Emergency position.

☐ A4 Auxiliary contact closes when the transfer switch is in Normal position.

☐ A6 Motor Disconnect. To de–energize external motor control circuit 5 seconds (adjustable) prior to transfer in either direction.

☐ C Plant Exercisor. Automatically starts generator for selected time intervals.

☐ C/D Plant Exercisor. Automatically starts generator to run unloaded or simulate a power failure and starts generator to run under load.

☐ E Engine Start Contact: 1 Normally Open
1 Normally Closed.

☐ F Auxiliary Fan Contact, S.P.N.O. Closes when generator is running.

☐ H Time delay to engine start, non–adjustable. Factory set 1 or 3 seconds. When the Normal line fails the relay de–energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ J1 Adjustable under frequency sensor.

☐ J2 Adjustable over/under frequency sensor.

☐ K Frequency meter to indicate load frequency.

☐ L1 Pilot Light. Switch in Emergency Position.

☐ L2 Pilot Light. Switch in Normal Position.

☐ L3 Pilot Light. Normal source available.

☐ L4 Pilot Light. Emergency source available.

☐ M1 Ammeter; Single phase.

☐ M2 Ammeter; Three phase

☐ M3 Voltmeter; Single phase.

☐ M4 Voltmeter; Three phase.

☐ P1 Time Delay to Engine Start (solid state). Adjustable over time range .5 to 6 seconds. When the Normal line fails the relay de–energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ P2 Time Delay to Engine Start (Pneumatic). Adjustable over time range 1/6 to 300 seconds. When the Normal line fails, the relay de–energizes. After the set time delay its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ Q2 Connections for remote peak shave or area protection relays. Includes bypass for automatic return to Normal if Emergency line fails and Normal is present.

☐ R1 Solid State Adjustable Overvoltage Relay(s). Set at 110% of pickup, 105% of dropout of nominal Line rate, unless otherwise specified.

☐ R4 In–Phase monitor. Prevents transfer until two sources are in–phase. For use of isochronous governors.

☐ R43 In–phase monitor. Prevents transfer until two sources are in–phase. For use with mechanical. governors.

☐ S1 Four–position Engine Control Selector Switch. "STOP", "HAND CRANK", "TEST", "AUTOMATIC".

☐ T Time delay, re–transfer to Normal. When the Normal line restores and the phase relays operate, the T timer is energized. After the set time delay, its contacts close the circuit to the CR relay which operates to restore the load to the Normal line. RT relay is supplied to bypass T contacts if Emergency is de–energized during timing. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ T3 W3 Presignal auxiliary Contact, S.P.D.T: Operates 0–30 seconds (adjustable) prior to transfer in either direction.

☐ U Time delay, engine cool–down. When the transfer switch is restored to the Normal position and the engine is signaled to shut down, the U timer operates to maintain the engine start circuit closed. At the end of the set time, the engine contacts open to shut down the engine. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ W Time delay, transfer to Emergency. When the Normal line fails and the engine has started, the VFSM relay energizes. The W timer energizes. After the set time delay, its contacts close to energize the RT relay. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ YE Pushbutton, Transfer to Emergency. Provides manual control of transfer to emergency source. If time delay accessory W is supplied pushbutton bypasses time delay for immediate transfer; otherwise, transfer to emergency will be automatic after time delay. If time delay accessory W is not supplied, transfer will be non–automatic (by pushbutton only).

☐ YN Pushbutton, Retransfer to Normal. Provides manual control of retransfer to normal source. If time delay accessory T is supplied, pushbutton bypasses time delay for immediate retransfer; otherwise, retransfer to normal will be automatic after time delay. If time delay accessory T is not supplied, retransfer will be non–automatic (by pushbutton only).

☐ Other:_____

_____

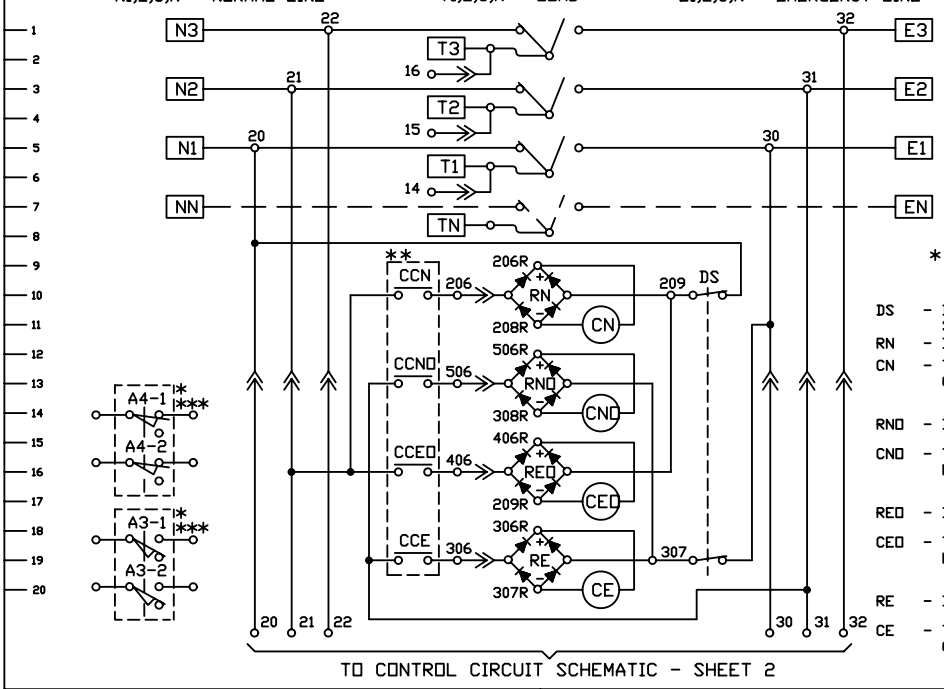
_____

ZENITH® CONTROLS, INC.

TITLE: ACCESSORIES

DRAWING NO.: 40R–0900 — REV

POWER CIRCUIT SCHEMATIC



VOLTAGE SYSTEMS

	VOLTS	NO. OF PHASES	NO. OF WIRES
-3	240V, 60HZ	3	3
-31	208, 60HZ	3	3
-38	120/240,60HZ	3	4
-4	120/208,60HZ	3	4
-5	480,60HZ	3	3
-7	277/480,60HZ	3	4
-9	240/416,60HZ	3	4
-91	220/380V,60HZ	3	4
-92	220/380V,50HZ	3	4

* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEM

DS - DISCONNECT SWITCH FOR SERVICING

RN - BRIDGE RECTIFIER, CN

CN - TRANSFER OPERATOR, CLOSE INTO NORMAL

RNO - BRIDGE RECTIFIER, CNO

CNO - TRANSFER OPERATOR, OPEN FROM NORMAL

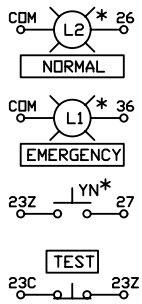
REO - BRIDGE RECTIFIER, CEO

CEO - TRANSFER OPERATOR, OPEN FROM EMERGENCY

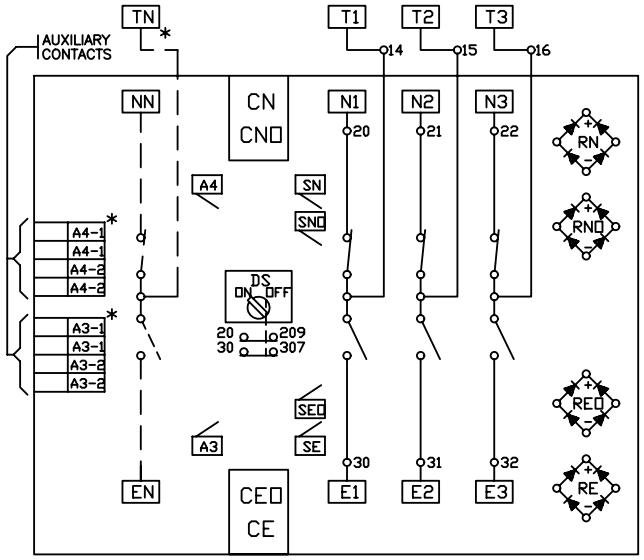
RE - BRIDGE RECTIFIER, CE

CE - TRANSFER OPERATOR, CLOSE INTO EMERGENCY

CABINET FRONT

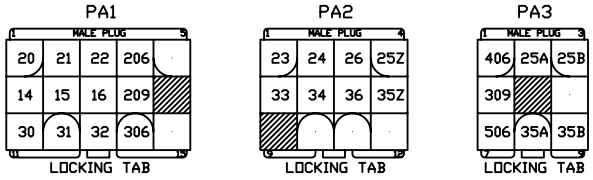


POWER PANEL LAYOUT



RECTIFIER LOCATIONS:
600 - 1200 AMP UNITS: RIGHT SIDE AS SHOWN
1600 - 3000 AMP UNITS: LEFT OF SOLENOIDS

INTERCONNECT PLUGS



REVISIONS:
ECN S-5769

NOTES:
1. ZTSDH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.
2. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3,A4,E,L1, L2,P,T,U,W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.

LEGEND
- WIRE CONNECTION
- WIRE ON MAIN TERMINAL BLOCK
- WIRE IN DISCONNECT PLUG
- * OPTIONAL
- ** LOCATED ON CONTROL PANEL
- *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL

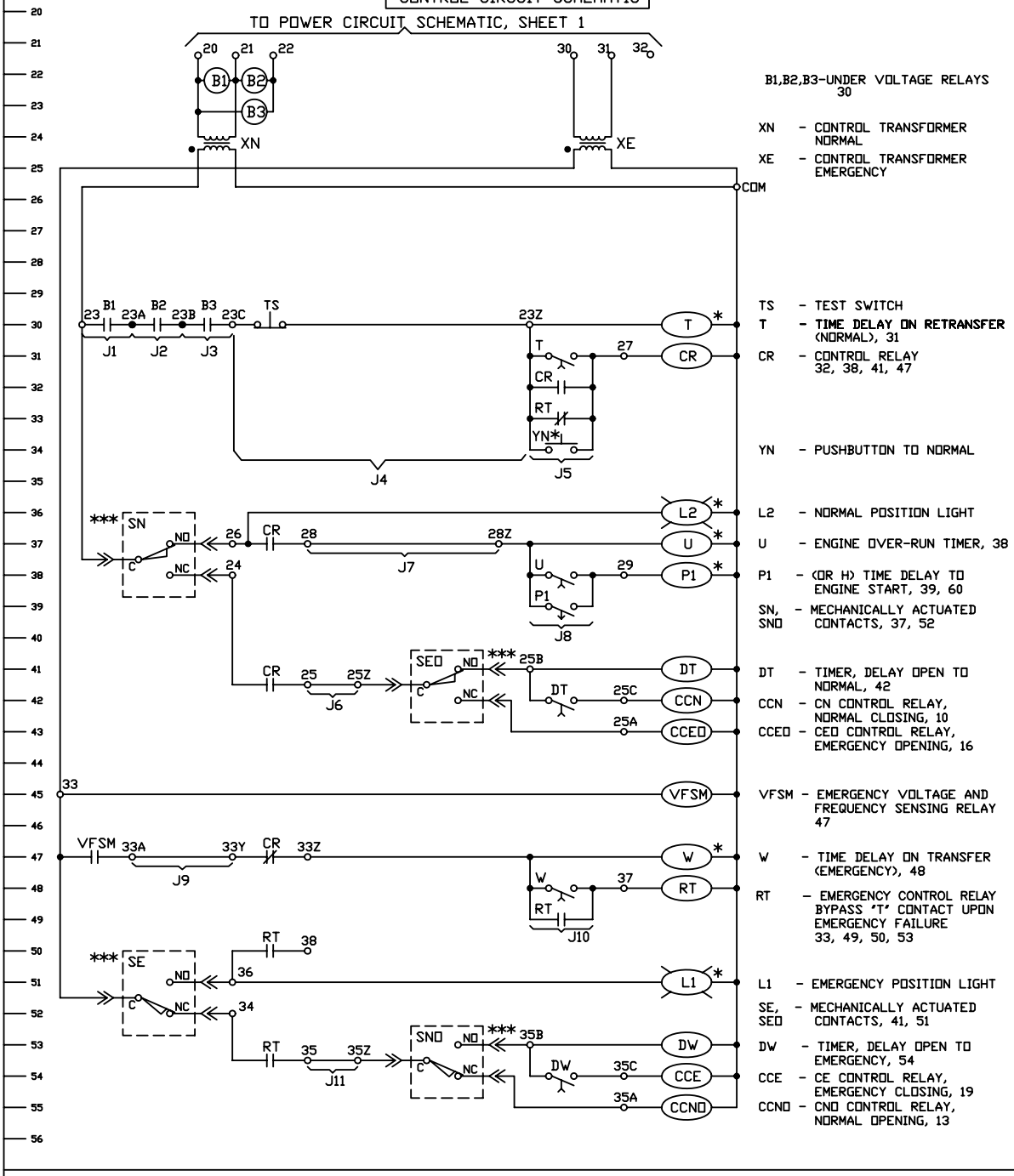
SEE 40R-0105 FOR LEGEND & OPERATION FOR MANUFACTURING: SEE PAGE 3 FOR ENCLOSED ZTSDH 600-1200 AMP CONTROL PANEL
SEE PAGE 4 FOR ENCLOSED ZTSDH 1600-3000 AMP & OPEN ZTSDH 600-3000 AMP
SEE 40R-0900 FOR ACCESSORIES

ZENITH CONTROLS, INC.

TITLE: POWER CIRCUIT & CABINET FRONT
MODEL: ZTSDH60/300 (600-3000 AMP)
DRFT: FHB | APP'D:
DATE: 07/22/94
DRAWING NO.: 43A-5000-3 SHEET 1 OF 4

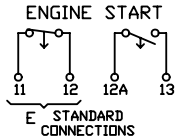
ORIGINAL

CONTROL CIRCUIT SCHEMATIC



CUSTOMER CONNECTIONS

A3, A4
SEE POWER CIRCUIT SCHEMATIC AND LAYOUT



CONTACT RATING		
RELAY	CONTACT	RATING
H	E	10AMP @ 28VDC
P1	E	10AMP @ 32VDC
	A3, A4	20AMP, 125, 250 VAC

JUMPER	CONNECT POINTS	REMOVE JUMPER WHEN ACCESSORIES USED
J1	23, 23A	B1
J2	23A, 23B	B2
J3	23B, 23C	B3
J4	23C, 23Z	J1N, TS, C/D
J5	23Z, 27	T, YN
J6	25, 25Z	T3, R4
J7	28, 28Z	C, C/D
J8	28Z, 29	P1, U
J9	33A, 33Y	J1E, ER1, 2, 3
J10	33Z, 37	W
J11	35, 35Z	W3, R4

NOTES:
1. ZTSDH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.
2. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3, A4, E, L1, L2, P, T, U, W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.

LEGEND
- WIRE CONNECTION
- WIRE ON MAIN TERMINAL BLOCK
- WIRE IN DISCONNECT PLUG
- * OPTIONAL
- *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL

REVISIONS:
ECN S-5769

ZENITH CONTROLS, INC.

TITLE: CONTROL CIRCUIT SCHEMATIC & CUSTOMER CONNECTIONS

MODEL: ZTSDH60/300 (600-3000 AMP)

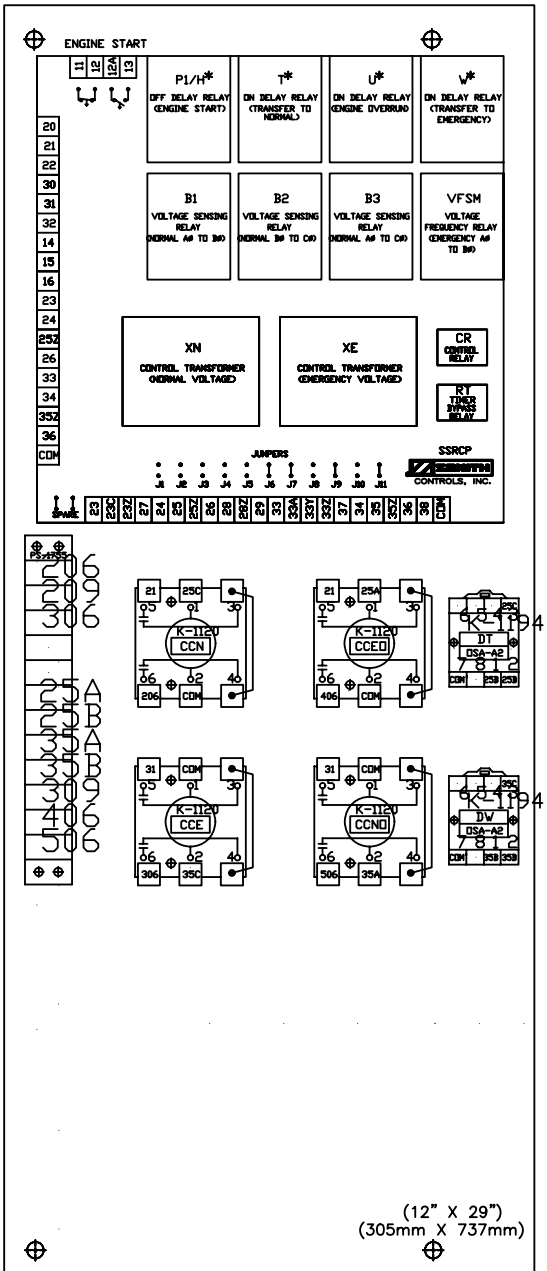
DRFT: FHB | APP'D:

DATE: 07/22/94

DRAWING NO.: 43A-5000-3 SHEET 2 OF 4

ORIGINAL

CONTROL PANEL LAYOUT



(12" X 29")
(305mm X 737mm)

(12" X 41")
(305mm X 1041mm)

NOTE:
12" X 41"
(305mm X 1041mm)
PANEL IS STANDARD FOR ENCLOSED ZTSDH 600–1200 AMP.

REVISIONS:
ECN S-5769

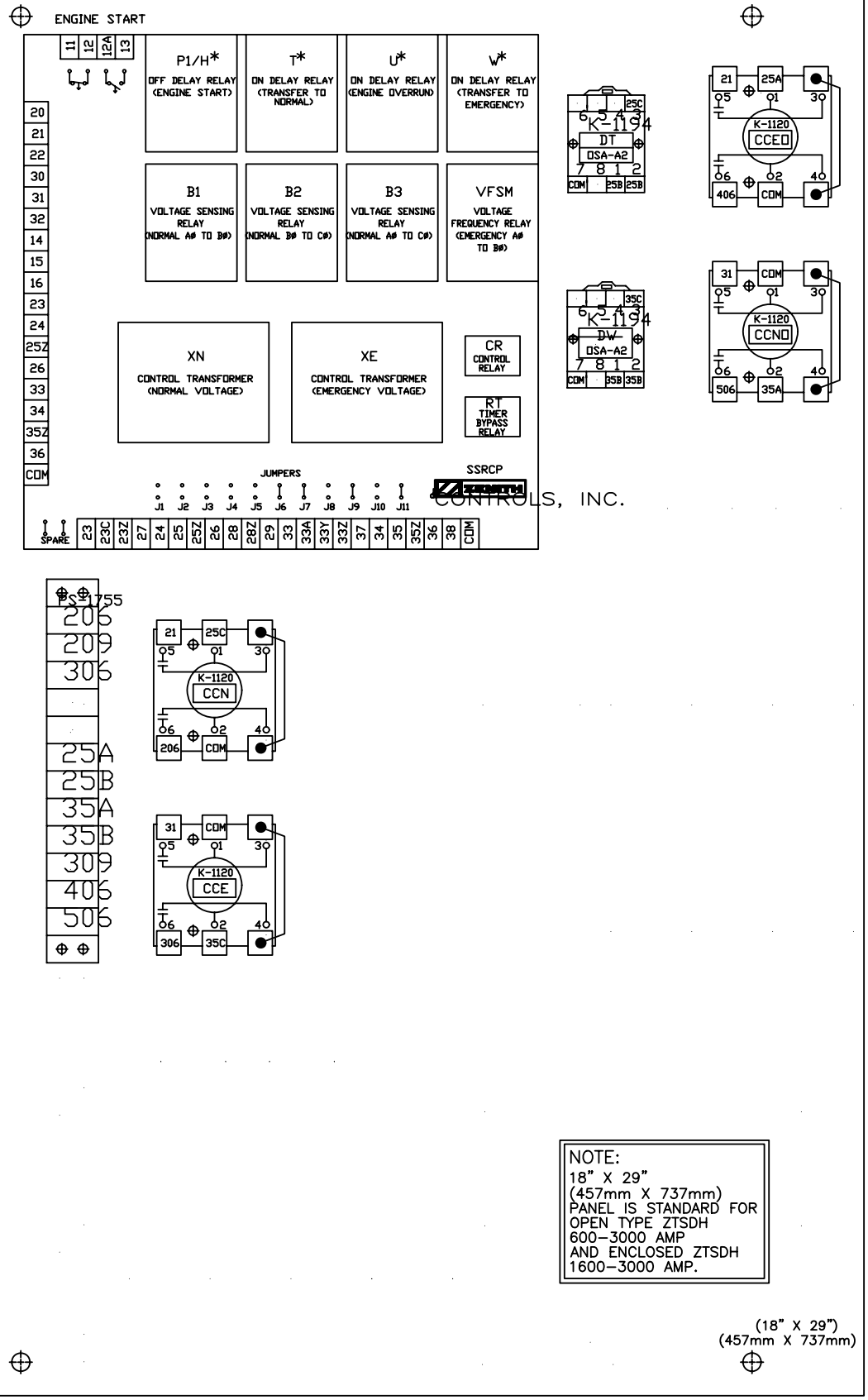
NOTES:
1. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3, A4, E, L1, L2, P, T, U, W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.
2. (*) OPTIONAL

ZENITH CONTROLS, INC.

TITLE: CONTROL PANEL LAYOUT
MODEL: ZTSDH60/300 (600-3000 AMP)
DRFT: FHB | APP'D:
DATE: 07/22/94
SCALE: 3/8 = 1
DRAWING NO.: 43A-5000-3
SHEET 3 OF 4

ORIGINAL

CONTROL PANEL LAYOUT



NOTE:
18" X 29"
(457mm X 737mm)
PANEL IS STANDARD FOR OPEN TYPE ZTSDH 600–3000 AMP AND ENCLOSED ZTSDH 1600–3000 AMP.

(18" X 29")
(457mm X 737mm)

REVISIONS:
ECN S–5769

NOTES:
1. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3, A4, E, L1, L2, P, T, U, W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.
2. ( ) OPTIONAL

MODEL:
ZTSDH60/300 (600–3000 AMP)

DRFT: FHB | APP'D:

DATE: 07/22/94

SCALE: 1/2 = 1

ZENITH CONTROLS, INC.

TITLE: CONTROL PANEL LAYOUT

DRAWING NO.: 43A–5000–3
SHEET 4 OF 4

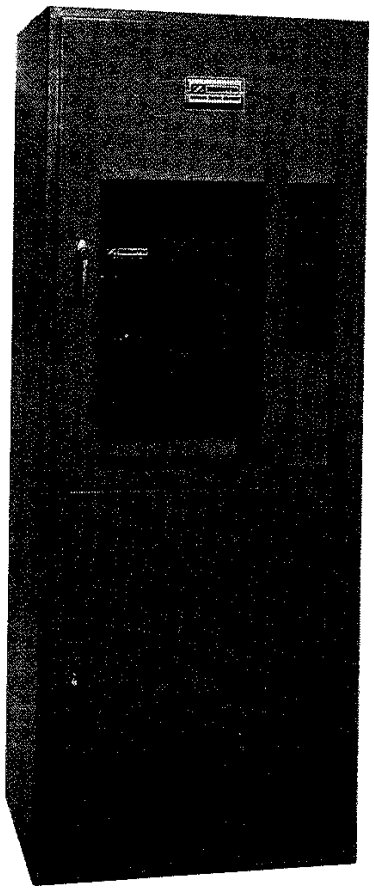
ORIGINAL

46R-1000E

Revised October, 1996

INSTRUCTION MANUAL

ZBTSH SERIES BYPASS/ISOLATION TRANSFER SWITCH
100 — 400 AMPS



MODEL NO. _____

SERIAL NO. _____

ZENITH CONTROLS, INC.

TABLE OF CONTENTS

Storage, Installation 1

Cabinet (exterior, front view) 2

Parts list (electrical) 3

Top and lower panels, front view.
Switch details 4

Bypass and ATS Power Panels — Parts list 5

Bypass and ATS Control Panel Layout 6

Bypass and ATS Control Panel — Parts list 7

Operation of Bypass/Isolation Switch 8

Definitions and Operation Notes 9

ZBTSH Operation, Maintenance 10, 11

Troubleshooting Decisions 12

ARSM and Timer Adj., Lubrication 13

Torque Requirements 14

Cabinet Dimensions 15

Control Disconnect Plugs 16

Field Notes 17

Bypass Control Panel Schematic Drawing 18

Typical Bypass and ATS Schematic Drawing 19

STORAGE:

The ZBTSH should be stored in a clean dry area. AVOID STORAGE BENEATH STEAM OR WATER PIPES. Excessive moisture may damage the unit. The switch should only be stored on a level (horizontal) surface.

INSTALLATION:

1. **Lifting:**

   To lift and manuever the Bypass Switch use lifting angles. See Fig. 1 (below). CAUTION: Depending upon the model, a ZBTSH weighs between 650 — 700 lbs. Use adequate machinery and cables to handle the load.

2. **Equipment Preparation:**

   a). Check nameplate to assure switch system voltage and amperage is correct. Any discrepancy should be immediately reported to a Zenith representative.

   b). Lock open breakers to normal and emergency lines.

3. **Cabinet Preparation:**

   a). A small amount of cabinet work is required before the cables are connected. **Cover the switch and the controls to avoid metal fragments from entering mechanical and electrical components.** Visually verify that metal filings are removed from top bus support. (Use vacuum if necessary).

   b). Standard cable entry is through the top or bottom of the cabinet. Fig. 2 below shows one suggested knockout order. For a guide to assist in the hole layout, refer to page 15.

4. **Cable and Wire Connections:**

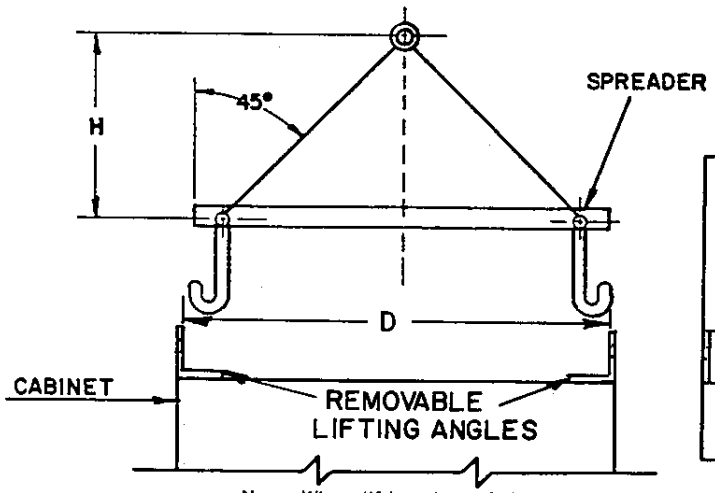
   a). To remove possible oxide, clean cable conductor with a wire brush and apply a contact oxide inhibitor. Insert cables into appropriate lugs.

   b). Connect all auxiliary wires for external electrical operation. Example: E-start, remote alarm lights or buzzers, motor control contacts, etc. Allow enough slack in wires to allow movement of the ATS to isolate position (approx. 1 ft.).

5. **Prior to the Unit's Energization:**

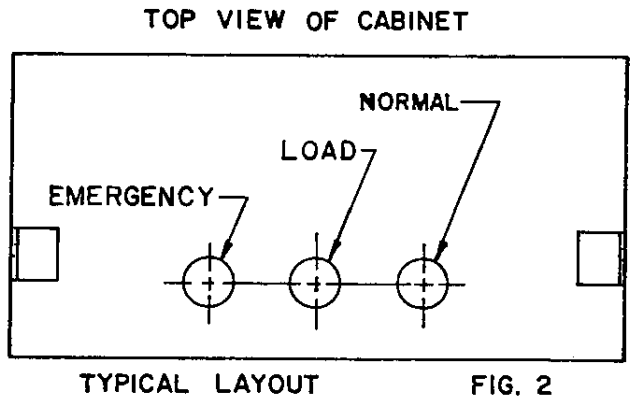
   a). Remove any debris incurred due to installation (cut cable strands, metal filings, etc.).

   b). Inspect the unit and verify torque of cable and wire connections.

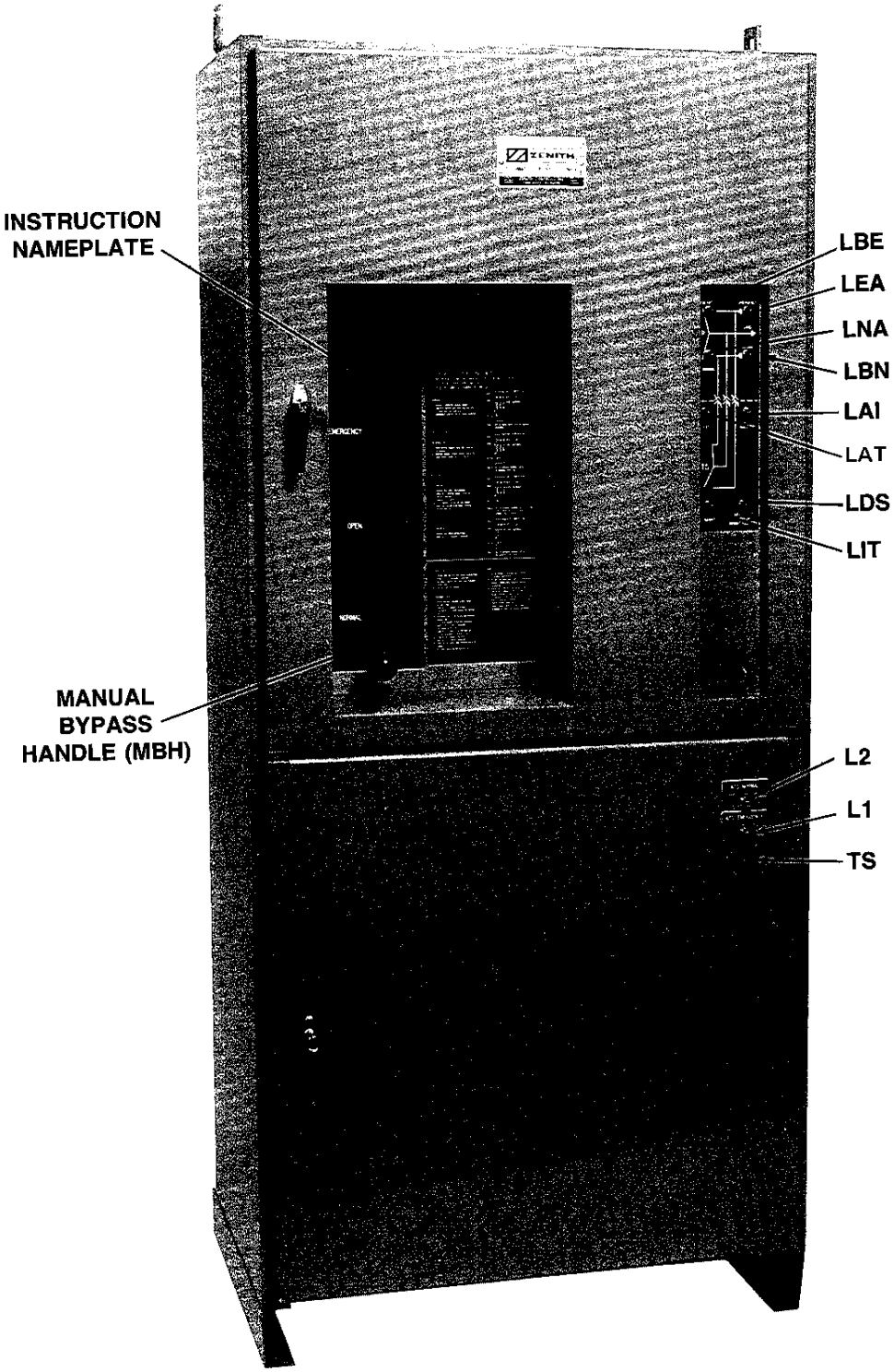


Note: When lifting the switch, a spreader must be used. The height H must be equal to D/2.

FIG. 1

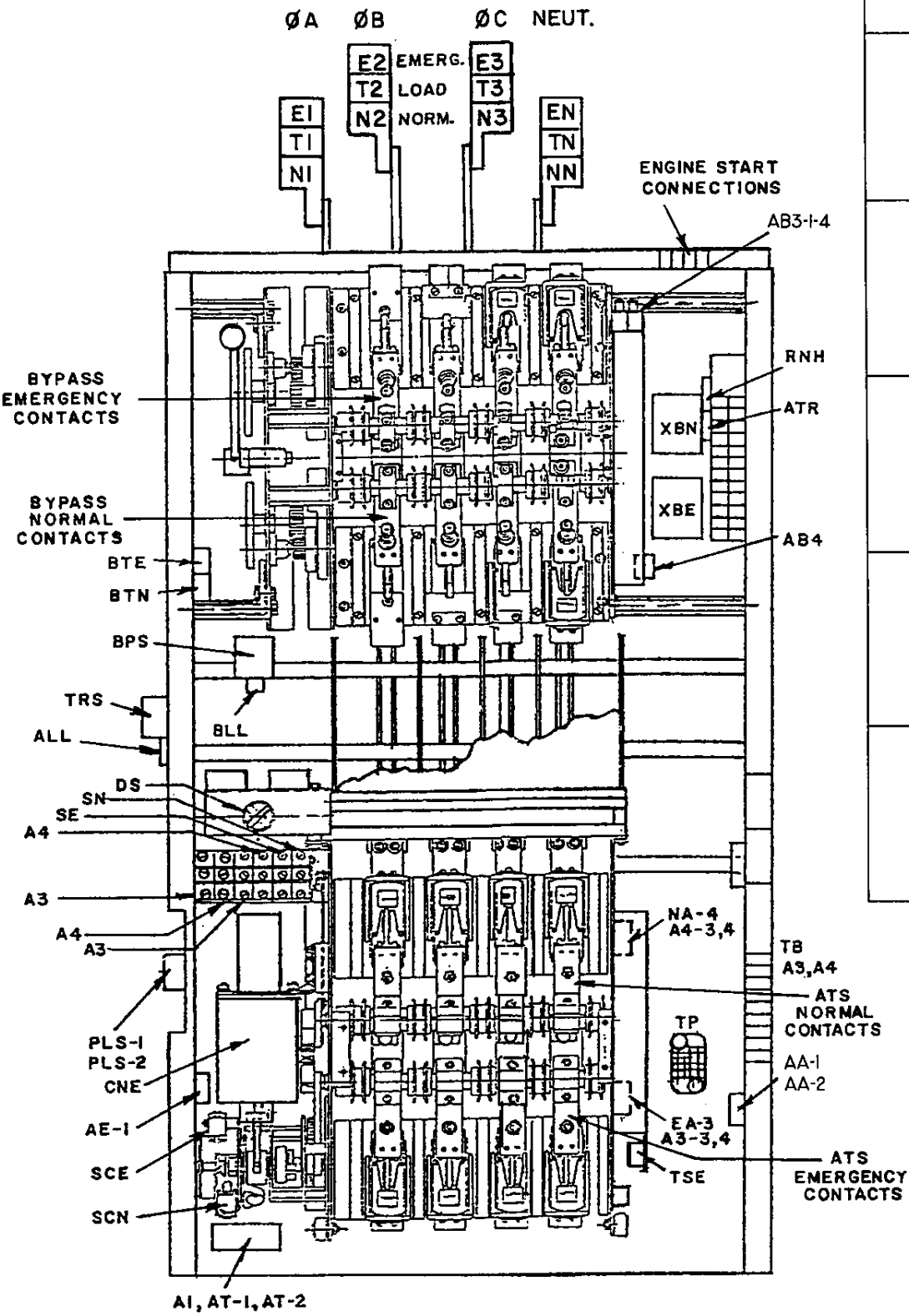


TYPICAL LAYOUT FIG. 2

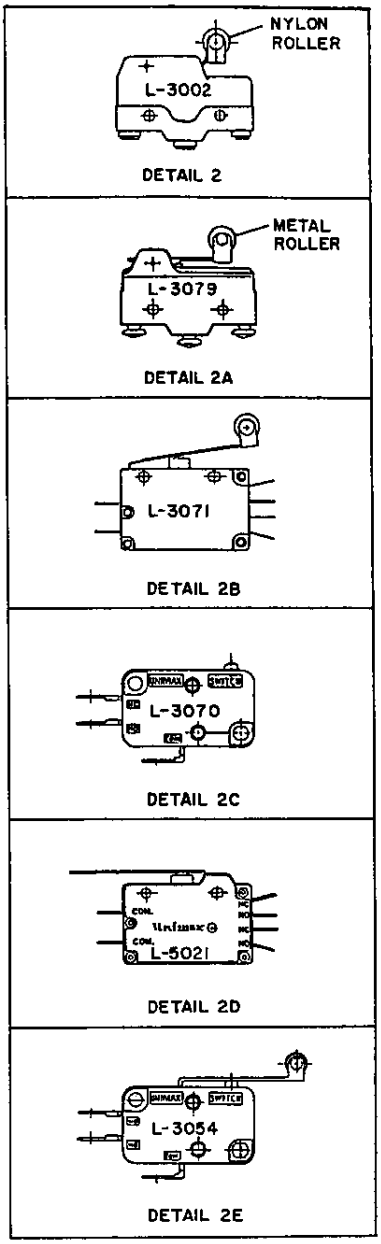

INSTRUCTION NAMEPLATE
MANUAL BYPASS HANDLE (MBH)
LBE
LEA
LNA
LBN
LAI
LAT
LDS
LIT
L2
L1
TS

A. CABINET ELECTRICAL PARTS

TAG	DESCRIPTION	PART NO.
LNA	Normal Available Indicator (G)	
LEA	Emergency Available Indicator (R)	
LBN	Bypass Normal Location Indicator (G)	
LBE	Bypass Emergency Location Indicator (R)	
LAT	ATS Test Position Indicator (A)	
LAI	ATS Isolate Position Indicator (A)	
LIT	ATS Inhibit Indicator (R)	
LDS	ATS Disconnect Switch "Off" Indicator (R) Flashing Bulb, PS-1272	
	COMMON PARTS BYPASS INDICATORS	
	Bulb	Y500005
	Socket	PS-5046
	Red Lens (R)	PS-5047
	Green Lens (G)	PS-5048
	Amber Lens (A)	PS-5049
L1	ATS Emergency Position Indicator	
L2	ATS Normal Position Indicator	
	Bulbs (Incandescent)	PS-5105
	Bulb Socket (Incandescent)	PS-5046
	Emergency Lens (Red)	PS-5047
	Normal Lens (Green)	PS-5048
TS	Test Switch	
	Operator, Momentary	L-1025
	Contact Block N.C.	L-1029
	Contact Mounting Base	PS-3473



ZBTSH 4 POLE



SWITCH DETAILS

B. BP-BYPASS AND ATS AUTOMATIC TRANSFER SWITCH POWER PANEL

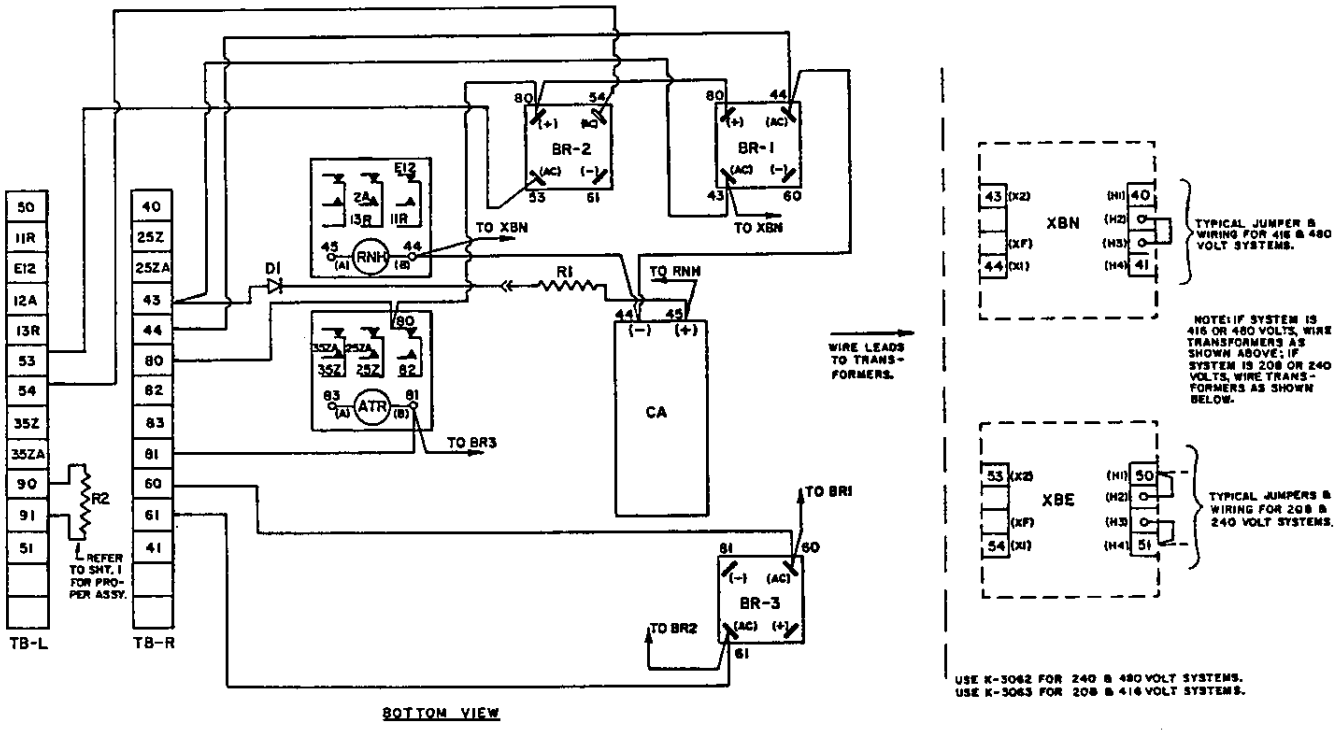
TAG	DESCRIPTION	PART NUMBER BY AMPERAGE				
Bypass		**100**	**150**	**225**	**260**	**400**
N1, 2, 3, N E1, 2, 3, N T1, 2, 3, N	Normal Emergency Load } LUGS	PS-4418	PS-4418	PS-4418	S-1422	S-1422
BYPASS	Contact Assembly	(Movable & Stationary for 3 Pole Units)				
N1, 2, 3	Normal	46P-1104A	46P-1104B	46P-1104C	46P-1104D	46P-1104E
N	(Sw. Neut. Norm.)	46P-1105A	46P-1105B	46P-1105C	46P-1105D	46P-1105E
E1, 2, 3	Emergency	46P-1106A	46P-1106B	46P-1106C	46P-1106D	46P-1106E
N	(Sw. Neut. Emerg.)	46P-1107A	46P-1107B	46P-1107C	46P-1107D	46P-1107E
ATS	Contact Assembly	(Movable & Stationary for 3 Pole Units)				
NL1, 2, 3	Normal	46P-1100A	46P-1100B	46P-1100C	46P-1100D	46P-1100E
N	(Sw. Neut. Norm)	46P-1101A	46P-1101B	46P-1101C	46P-1101D	46P-1101E
EL1, 2, 3	Emergency	46P-1102A	46P-1102B	46P-1102C	46P-1102D	46P-1102E
N	(Sw. Neut. Emerg.)	46P-1103A	46P-1103B	46P-1103C	46P-1103D	46P-1103E
Arc Grid Assy.		46P-1099				

XBN, XBE	Bypass Step-Down Transformer 25VA Secondary 24V	VOLTAGE	PART NO.
		120/240	K-3061
		208/416	K-3063
		220/440	K-3064
		240/480	K-3062
		380	K-3067
		575	K-3065
		600	K-3066

CNE	Main ATS Operating Coils Voltage Systems						
	No.	Volts	Ph	Wire	Coil Volts	Poles	PART NO.
	-1	120	1	2	120	2	K-2178
	-2	120/240	1	3	240	2,3	K-2189
	-3	240	3	3	240	3	K-2189
	-38	120/240	3	4	240	3,4	K-2189
	-4	120/208	3	4	208	3,4	K-2177
	-5	480	3	3	480	3	K-2176
	-6	575/600	3	3	575/600	3	K-2196
	-7	277/480	3	4	480	3,4	K-2176
	-9	240/416	3	4	416	3,4	K-2188
	-91	220/380	3	4	380	3,4	K-2188

SN	CN1 Limit Switch	L-3002 (Detail 2)
SE	CE1 Limit Switch	
A3	ATS Emergency Position Switch	
A4	ATS Normal Position Switch	
SCN/SCE	CNE Limit Switches	L-3079 (Detail 2a)
AA AE1, 2 PLS1, 2	ATS Auto Location Switch ATS Isolate/Remove Location Switch Position Lever Switch	L-3071 (Detail 2b)
AI AT1, 2	ATS Isolate Location Switch ATS Test Location Switch	L-3070 (Detail 2c)
AB3/ABE AB4/ABN NA4 EA3	Bypass Emergency Position Switch Bypass Normal Position Switch Normal TRS Limit Switch Emergency TRS Limit Switch	L-5021 (Detail 2d)
BTE BTN TSE BLL ALL	Bypass Emergency Position Switch Bypass Normal Positiion Switch ATS Engaged Switch Bypass Lock Location Switch ATS Lock Location Switch	L-3054 (Detail 2e)
DS	ATS Solenoid Disconnect Switch Operator 2-Position Maintain Contact Block N.C. (1) Contact Block N.O. (2) Contact Block Mounting Plate	L-4018 L-1029 L-1028 PS-3473
BPS TRS	Bypass Interlock Solenoid Transfer Release Solenoid	K-2180 K-2180

C. BYPASS CONTROL PANEL



D. ATS CONTROL PANEL (SSRCP)

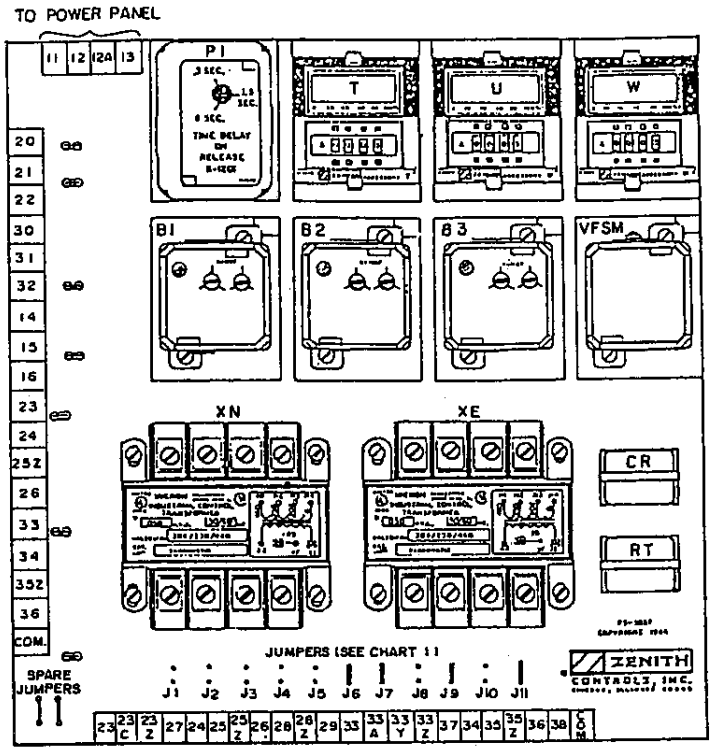


CHART 1

Jumper	Connects Points	Remove When Accessories Used
J1	23,23A	B1
J2	23A, 23B	B2
J3	23B, 23C	B3
J4	23C, 23Z	JIN, TS, C/D
J5	23Z, 27	T, YN
J6	25, 25Z	T3, R4
J7	28, 28Z	SI, C, C/D
J8	28Z, 29	PI & U
J9	33A, 33Y	ER1, 2, 3, J1E
J10	33Z,37	W
J11	35, 35Z	R4, W3

C. BYPASS CONTROL PANEL (46P-1079) INCLUDES PARTS BELOW

TAG	DESCRIPTION	PART NUMBER
BR1, 2, 3	Bridge Rectifier	PS-5076
RNH	Normal Voltage Relay	Y260000
R1	Resistor RNH, 30 ohm	PS-4056
R2	Resistor LDS, 120 ohm	PS-4057
D1	Diode	PS-4812
CA	Capacitor RNH	PS-4058
ATR	Auxilary Test Relay	Y260000

D. ATS CONTROL PANEL (SSRCP) STANDARD ITEMS

TAG	DESCRIPTION	VOLTAGE 50/60 HZ	PART NO.
XN, XE	Control Transformers	120V	K-3076
	(See Note 1)	208V	K-3070
		240 or 480V	K-3071
		416V	K-3089
B-1, 2, 3	Phase Relays	120V	K-1185
	Solid State	208 or 240V	K-1186
	(See Note 1)	480V	K-1188
VFSM	Voltage Frequency Sensor	120V	K-1192R
CR	Control Relay	120V	K-1204
RT	Bypass T Relay	120V	K-1204
CN1/CE1	CNE Transfer Relays (not shown)	120V	K-1120
J1-J11	Jumpers		PS-5067

(OPTIONAL ITEMS)

TAG	DESCRIPTION	VOLTAGE	PART NUMBER
T	Time Delay to Normal, Timer Solid State	120V .1 Sec. to 9990 Hrs. (Adj.)	K-1230
U	Engine Cool Down, Timer Solid State	120V .1 Sec. to 9990 Hrs. (Adj.)	K-1230
W	Time Delay Emergency, Timer Solid State	120V .1 Sec. to 9990 Hrs. (Adj.)	K-1230
PI	Time Delay Engine Start, Timer	120V (.5 to 6 sec. Adjustable)	K-1201
P2	Optional (Mounted below SSRCP)	120V (300 Sec. Adjustable)	K-1061

Notes:

1. If -6 voltage system (575/600V) is supplied, then XN, XE is K-3087 and B1,2, 3 is K-1185 (120V) supplied with XB (575;600V/120V) 3 phase transformer assembly. B1, 2, 3 mounted below SSRCP.

BYPASS/ISOLATION SWITCH OPERATION

BP — Bypass Switch, Indicated by Contacts BN/BE, is a 3 Position Switch
ATS — Automatic Transfer Switch

1. Automatic

1. Manually operated Bypass Switch contacts (BN/BE) are open and the ATS is supplying the load. (Fig. 1).
2. Disconnect Switch (DS) is in "Auto" position.

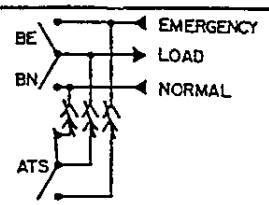


FIG. 1 BP IS OPEN WITH ATS IN NORMAL POSITION.

2. To Bypass ATS

1. Open bottom cabinet door and turn DS to "Inhibit".
2. Position Manual Bypass Handle (MBH) to same power source as ATS (Fig. 2).

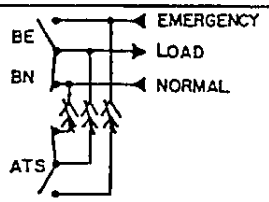


FIG.2 BP IS BYPASS NORMAL WITH ATS IN NORMAL POSITION.

3. To Test ATS

1. Bypass per above instructions.
2. Move ATS Location Handle (ALH) to "Test" location.
3. Turn DS to "Auto".
4. Test Switch (TS) on bottom cabinet door will allow electrical testing of ATS. (Fig. 3).

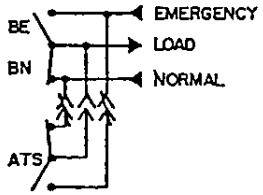


FIG.3 BP IS BYPASS NORMAL WITH ATS IN TEST LOCATION (ATS LOAD CONNECTION IS OPEN)

4. To Isolate ATS

1. Bypass per above instructions.
2. Move ALH to "Isolate" location.

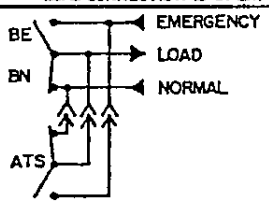


FIG.4 BP IS BYPASS NORMAL WITH ATS IN ISOLATE LOCATION

5. To Remove ATS

1. Bypass and Isolate per above instructions.
2. Move ALH to "Release" location.
3. Disconnect multi-pin plugs and external connections.
4. Lift ATS out of drawer.

6. To Reconnect ATS

1. Place ATS into drawer slots, (front rollers first).
2. Turn DS to "Inhibit" position.
3. Position ATS to same source as Bypass Switch.
4. Reconnect Multi-pin plugs and external connections.
5. Push ATS inward to engage carriage.
6. Move ALH to "Test" location (as indicated by light).
7. Turn DS to "Auto" position and use TS to electrically operate ATS.
8. Turn DS to "Inhibit" position.
9. Move ALH to "Auto" location.
10. Turn DS to "Auto" and position MBH to "Open".
11. ATS now fully automatic (Fig. 1).

7. Notes

1. DS in "Inhibit" position will prevent ATS electrical operation.
2. Do not use excessive force on mechanical handles (interlocks prevent incorrect sequencing).
3. When ATS is in Test or Isolate, Bypass Switch is a manual transfer switch to either **available** power source.
4. To operate Bypass Switch when ATS is in Test or Isolate, position MBH to available power source (indicated on light panel).
5. Above figures depict Bypass Normal; sequence is same for Bypass Emergency.

DEFINITIONS:

BP — Bypass/Isolation Switch

It is a manually operated device used in conjunction with an Automatic Transfer Switch (ATS) to provide a means of directly connecting load conductors to a power source, and of disconnecting the Automatic Transfer Switch.

The BP can also be used as a Manual Transfer Switch in the event of a power failure while the ATS is in the TEST, ISOLATE, or RELEASE positions.

ATS — Automatic Transfer Switch

Is a self-acting equipment for transferring one or more load conductor connections from one power source to another.

DS — Disconnect Switch

Inhibits operation of ATS Main Coil (CNE). In the "AUTO" position, the ATS operates normally. In the "INHIBIT" position the main coil (CNE) cannot be energized, and automatic transfer in either direction cannot take place.

MBH — Manual Bypass Handle

Actuates the Bypass Operator.
Center for Bypass Open.
Down for Normal Bypass.
Up for Emergency Bypass.

TS — Test Switch

Simulates Normal line failure when open.

OPERATION NOTES:

1. The ATS will not operate if:
   a). Harness plugs are not connected.
   b). DS is in the 'INHIBIT' position.
   c). ATS is not in 'AUTO' or 'TEST' location.
   d). ATS is in 'AUTO' location and BYPASS SWITCH is not open.

2. The MBH will not operate if:
   a). ALH is not engaged in one of the following: AUTO — TEST — ISOLATE.
   b). If source selected is opposite of the ATS position while in the AUTO location.
   c). ATS is in 'TEST' or 'ISOLATE' location and source selected is not available.

3. The ALH (ATS Location Handle) will not operate if:
   a). BP and ATS are not positioned to same source.
   b). Power is not available.
   c). Harness Plugs are not connected.
   d). ATS has reached limit of travel to 'AUTO' or 'ISOLATE'.

READ THE FOLLOWING PARAGRAPHS BEFORE PROCEEDING TO "TEST PROCEDURE". (THIS PROCEDURE IS ONLY TO BE PERFORMED BY AUTHORIZED PERSONNEL)

CAUTION:

Loads controlled by Bypass/Isolation Transfer Switch may cause PERSONAL INJURY by UNAUTHORIZED PERSONNEL operating or testing this equipment.

Check all wiring diagrams that have been supplied for added options that may affect external equipment: For example; Starting and Stopping of Elevators and Motors.

A 'Control Panel Test' or a test with the ATS in the TEST LOCATION runs the EMERGENCY SOURCE with no load. A no load operation may be detrimental to the engine, and the Engine/Generator Manufacturer should be consulted.

Allow sufficient time on the U timer for engine to safely cool down.

RECOMMENDED TIMER SETTINGS:

T — Restoration to Normal.....30 minutes (Factory set)
U — Engine Cooldown/Stop.....5 minutes (Factory set)
W — Engine Warmup.....1 second (Factory set)
P1 — Engine Start.....3 seconds (Factory set)

TEST PROCEDURE

The ATS can be tested in either of two locations:

1). AUTO LOCATION
2). TEST LOCTION

1). "AUTO LOCATION":

Full Transfer Test — This test checks the complete operation of the ATS by transferring and interrupting the load's power source from 'Normal' to 'Emergency'.

Depress TS (Test Switch) until Generator starts and the 'W' timer times out (timer will indicate ON). ATS will transfer to Emergency.

Release TS (this resets TS to AUTO). Normal restoration timer 'T' will time out (will indicate ON) which will energize the CR relay causing ATS to retransfer back to Normal.

Engine/Generator will shut down after timer U times out. Full Transfer Test is now complete.

2). "TEST LOCATION":

This procedure is recommended for Preventive Maintenance (PM) of ATS without interrupting the Load thru the BYPASS/ISOLATION SWITCH. Refer to Page 8 (Step 3).

NOTE: TEST LOCATION is recommended after maintenance of ATS.

OPERATION OF AUTOMATIC TRANSFER SWITCH

Operation:

When the normal line (NL) falls to the preset dropout point, or if any normal phase fails, the phase relay(s) will drop out disconnecting the CR relay.

When emergency line (EL) voltage and frequency reach at least 90% of rated value, the VFSM relay is energized. The RT relay is now energized to operate the CE1 relay thru the SE cutout switch causing the main transfer coil CNE to operate thru the SCE limit switch. The load is now transferred to the emergency line supply. The SE and SCE limit switches operate to disconnect the CE1 relay and CNE transfer coil. The transfer switch is now locked mechanically only. Limit switches SN and SCN operate to complete the circuit for the next closing operation to normal.

When the normal line voltage restores to the preset value, the phase relay(s), (B1, 2, 3) operate to energize the normal restoration timer T. After the set time delay, the timer contact closes to energize CR relay. The CN1 relay is now energized thru the SN cutout switch causing the main transfer coil CNE to operate thru the SCN limit switch. The load is now re-transferred back to the normal line supply. The SN and SCN limit switches operate to disconnect the CN1 relay and CNE transfer coil. The transfer is now locked mechanically only. Limit switches SE and SCE operate for the next emergency operation.

MAINTENANCE

Electrical Test:

The ATS may be electrically tested for preventive maintenance (refer to page 10 "Test Procedure"). After completion of an electrical test, the ATS should be returned to the Auto Operation Mode. If the ATS malfunctions, troubleshoot the switch, referring to page 12, and replace any faulty part(s) immediately.

Inspection:

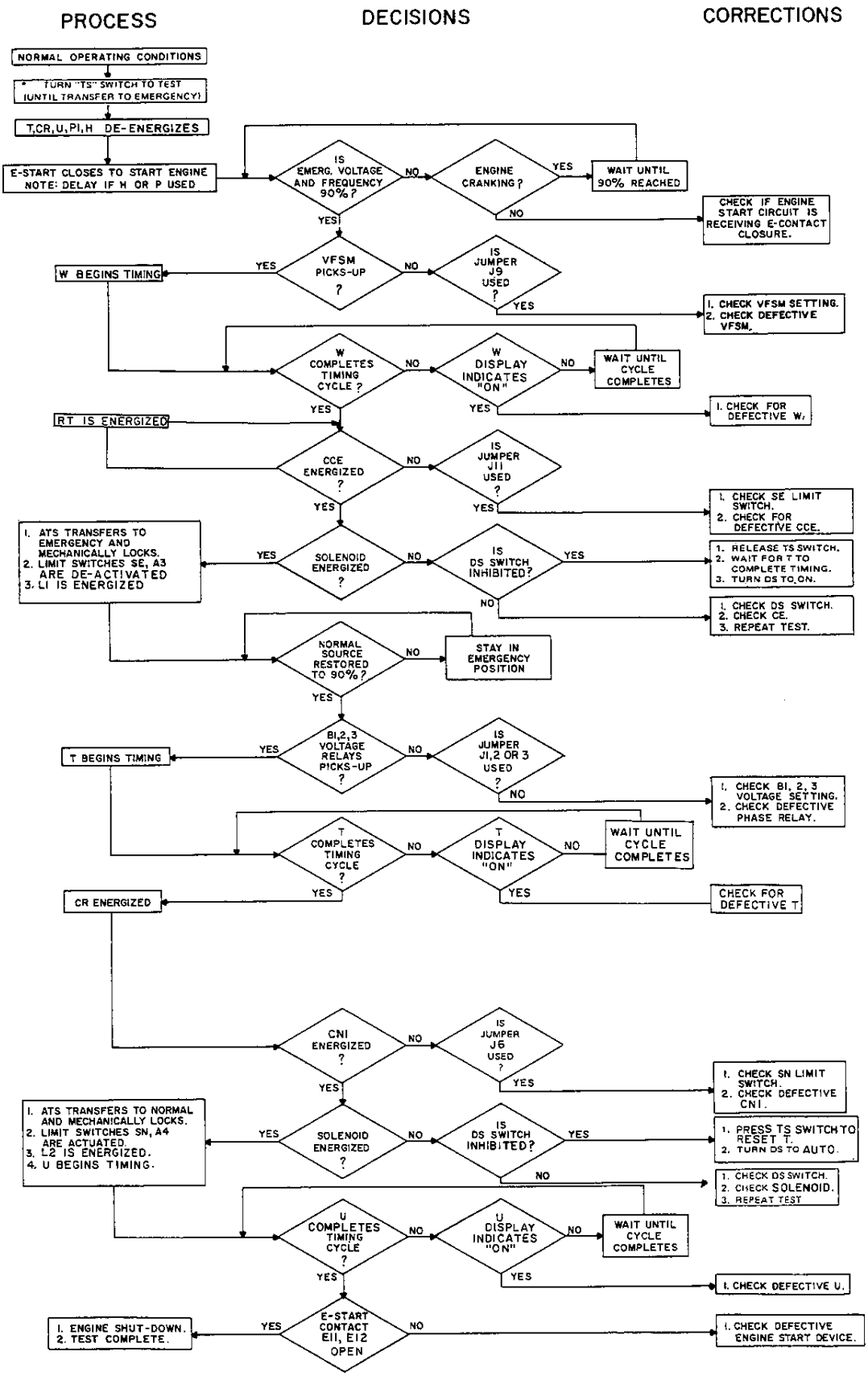
CONTACTS — The movable and stationary contacts are a vital part of the ZBTSH and must be kept clean. To inspect the ATS contacts, place ATS in Isolate location (see page 8). Examine the contacts.

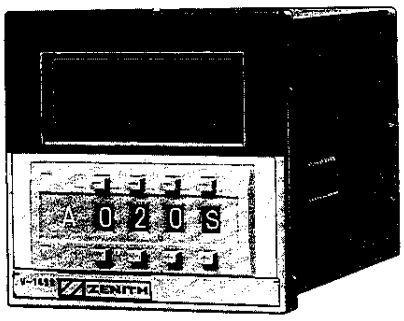
Any surface deposits must be removed with a clean cloth (DO NOT USE EMERY CLOTH OR A FILE).

After the movable and stationary contacts are wiped clean (no discoloration or deposits), return the ZBTSH to Auto Mode.

CURRENT CARRYING PARTS — An easily detected but abnormal condition is the discoloration of current carrying parts (particularly copper). Discoloration appears as darkened materials or finishes. Any discolored parts should be cleaned. **WARNING: ANY MAINTENANCE SHOULD ONLY BE DONE WHILE THE POWER IS OFF!** If the discoloration persists, contact the factory.

TABLE 3 "TROUBLE SHOOTING"





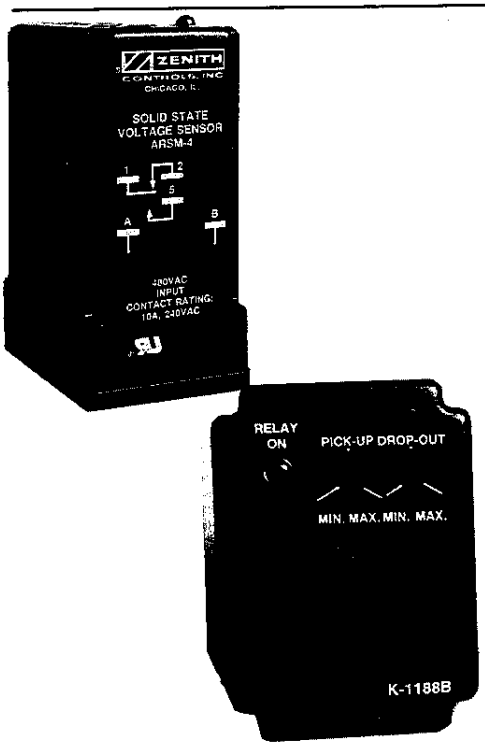
New Solid State Time Delay

Accessories T, U, W Solid State Timers Adjustable in Seconds, Minutes and Hours (Plug-In Style).

To select a time unit, operate the pushbuttons of the rightmost thumbwheel switch until the desired time unit is shown in window. The time unit can be selected by pushing the plus (+) bottom button or the minus (-) top button. The desired time is specified by operating the three thumbwheel switches in the middle of the front panel.

Setting of the timer at 000 will result in an infinite delay. The min. setting for OSA-A timers is 1/10 of 1 second as shown. See instructions.

0	0	1	0.1 Sec.



Close Differential (ARSM) Relay Adjustment

The voltage points at which the relay operates are adjustable. When the relay pulls in, an audible click is heard, and the LED will come on.

Setting the Relay:

If the relay should be set with a variable voltage supply (Variac):

1. Turn pick-up control fully clockwise.
2. Turn drop-out control fully counterclockwise.
3. Set Variac pick-up voltage to desired level.
4. **Very slowly** rotate pick-up adjustment counterclockwise until relay picks up. (LED will energize).
5. Set Variac drop-out voltage to desired level.
6. **Very slowly** rotate drop-out adjustment clockwise until relay drops out (LED de-energizes).

Verify settings by raising voltage until relay picks up, then lower voltage until relay drops out, making sure that relay operates at desired voltage levels.

LUBRICATION

The cams of the ZBTSH are lubricated with Super Lube PTFE grease, and gears with Dow Chemicals "Molykote" (321R or GN paste). These lubricants provide adequate lubrication for a clean and properly maintained switch's lifetime. Should debris contaminate the mechanism, clean and apply additional lubricants. Mobiltemp SHC-32 is used on isolating contacts.

LUBRICATION MAINTENANCE CHART

Date Inspected	Date Lubricated	Lubricant Used (Cams) (Gears)	Notes

NOTICE
TIGHTENING TORQUES FOR FIELD WIRING TERMINALS

Socket Size Across Flats, Inch	Tightening Torque Pound-Inches
1/8	45
5/32	100
3/16	120
7/32	150
1/4	200
5/16	275
3/8	375
1/2	500
9/16	600

TORQUE REQUIREMENTS FOR ELECTRICAL CONNECTIONS

All current carrying parts use compression washers and should be torqued to the values presented below. Caution: DO NOT OVERTORQUE WASHERS; follow the given torque values.

TORQUE REQUIREMENTS (inch - lb. except denoted by + are ft. - lb.)

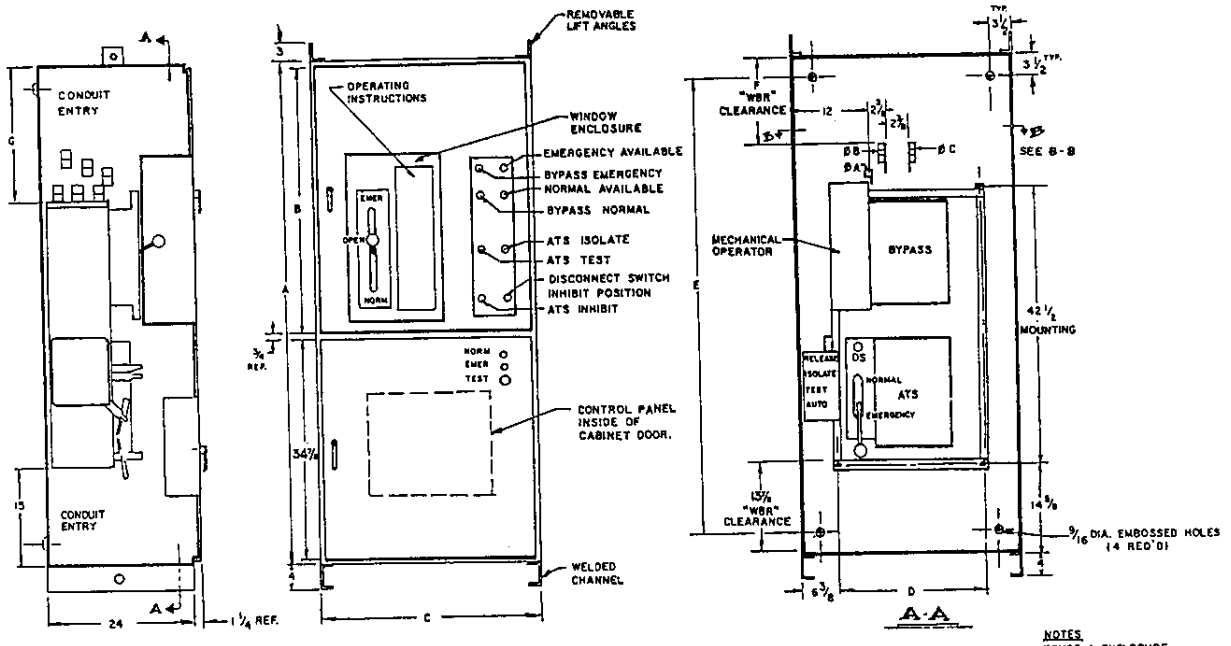
BOLT SIZE	GRADE 5	SOCKET HEAD	SET SCREW	COMPRESSION WASHERS	
				1	2
1/4 - 20	75	120	52	80	87
5/16 - 18	157	225	105	159	170
3/8 - 16	+23	412	165	+23	+26
1/2 - 13	+57	1030	386	+56	+59

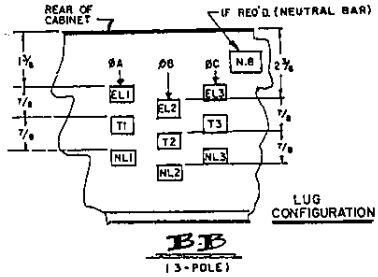
WIRE CONNECTION TIGHTENING TORQUE

WIRE COND. SIZE AWG or MM	SCREW DRIVER TORQUE (inch - lb.)
18 - 16 AWG	19
14 - 8	19
6 - 4	36

LUG BOLTING TORQUE

BOLT DIA. (inch)	TORQUE (ft. - lb.)
1/4 OR LESS	6
5/16	11
3/8	19
7/16	30
1/2	40
5/8 OR MORE	55

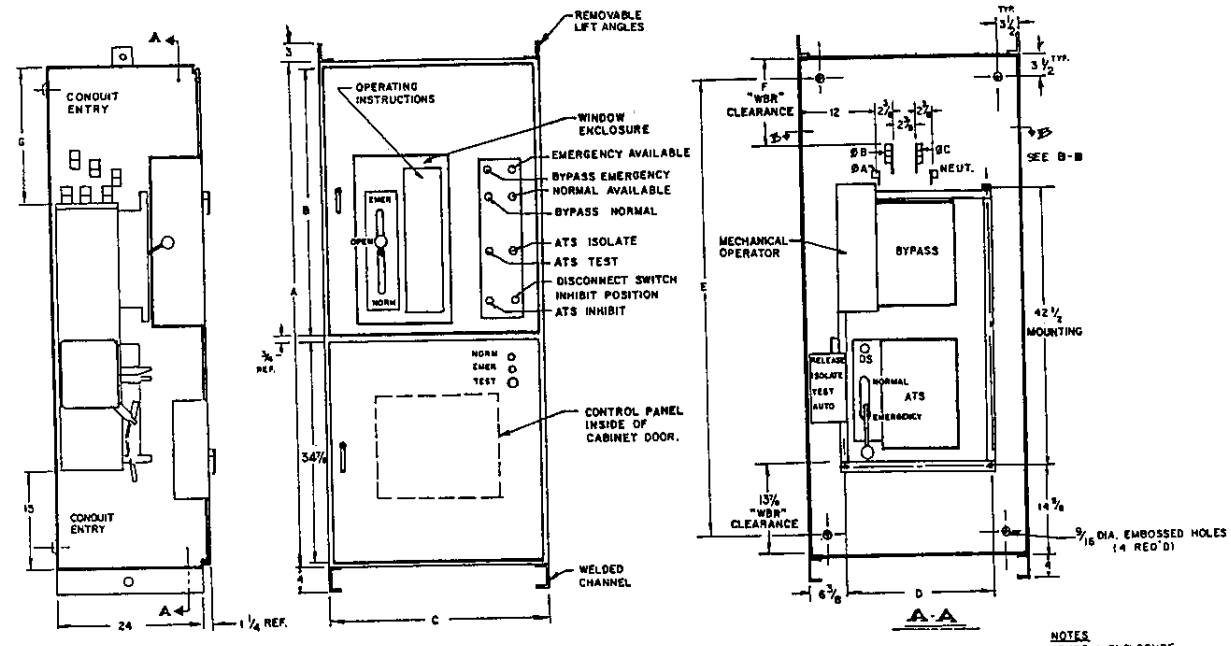


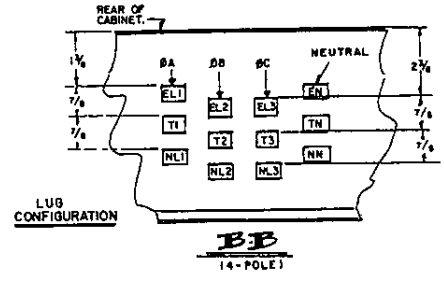


NOTES
1)TYPE 1 ENCLOSURE
2)ALL DIM ± 1/8
3)"WBR" WIRE BENDING RADIUS.

3 POLE

ZBTSH	CABINET NO.	A	B	C	D	E	F	G
10-22 (3P)	F-1310	79	42⅞	30	21½	72	15¼	21⅛
26-40 (3P)	F-1310	79	42⅞	30	21½	72	15¼	21⅛



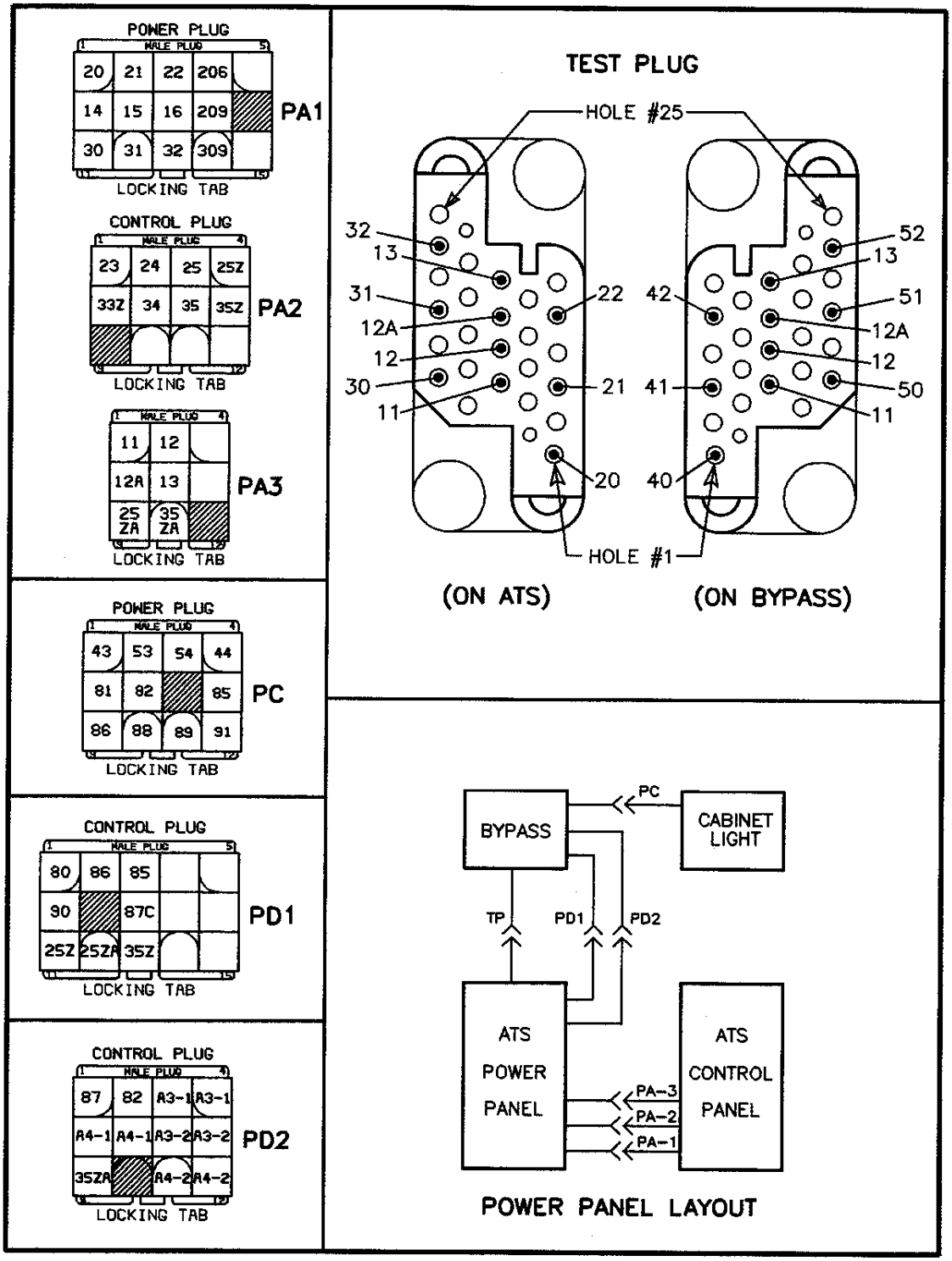


NOTES
1)TYPE 1 ENCLOSURE
2)ALL DIM ± 1/8
3)"WBR" WIRE BENDING RADIUS.

4 POLE

ZBTSH	CABINET NO.	A	B	C	D	E	F	G
10-22 (4P)	F-1311	79	42⅞	36	23⅞	72	15¼	21⅛
26-40 (4P)	F-1311	79	42⅞	36	23⅞	72	15¼	21⅛

DISCONNECT PLUGS
ZBTSH 100-400 AMPS



10/96

FIELD NOTES

MODEL NO: _____

SERIAL NO: _____

DATE SHIPPED: _____

START-UP DATE: _____

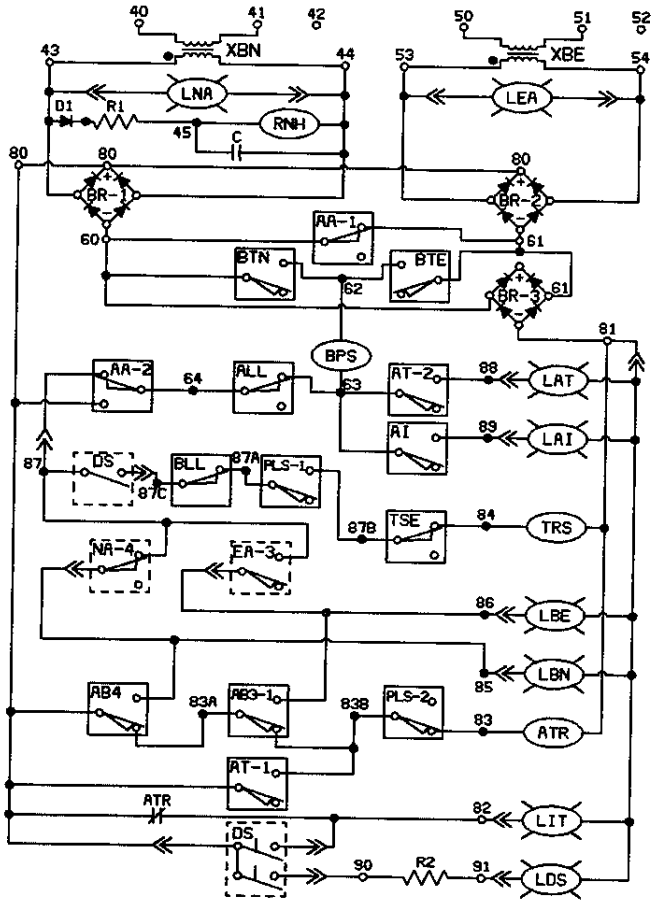
DRAWING SUPPLIED: _____

_____

TEST AND MAINTENANCE NOTES:

DATE	TESTED	PROBLEMS	NOTES

BYPASS CONTROL SCHEMATIC



LNA - NORMAL AVAILABLE LIGHT
LEA - EMERGENCY AVAILABLE LIGHT
RNH - NORMALLY HELD RELAY
D1 - DIODE
R1 - RESISTOR, RNH
C - CAPACITOR, RNH
BR-1,2,3 - BRIDGE RECTIFIER

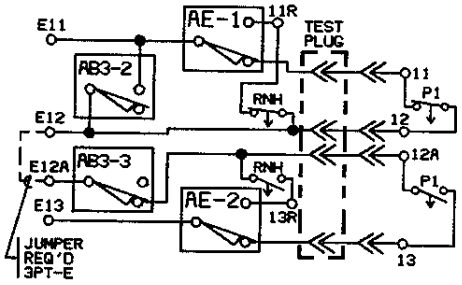
AA-1 - LIMIT SWITCH, ATS AUTO LOCATION
BTN - LIMIT SWITCH, BYPASS TRANSFER NORMAL (MBH MOVEMENT TO NORMAL)
BTE - LIMIT SWITCH, BYPASS TRANSFER EMERG. (MBH MOVEMENT TO EMERGENCY)
BPS - BYPASS SOLENOID
AA-2 - LIMIT SWITCH, ATS AUTO LOCATION
ALL - LIMIT SWITCH, ATS LOCK LOCATION
AT-2 - LIMIT SWITCH, ATS TEST LOCATION
LAT - LIGHT, ATS TEST LOCATION
AI - LIMIT SWITCH, ATS ISOLATE LOCATION
LAI - LIGHT, ATS ISOLATE LOCATION
BLL - LIMIT SWITCH, BYPASS LOCK LOCATION
PLS-1- PERMISSIVE LIMIT SWITCH
TSE - LIMIT SWITCH, TRANSFER SWITCH ENGAGED
TRS - SOLENOID, TRANSFER RELEASE
NA-4 - LIMIT SWITCH, ATS IN NORMAL
EA-3 - LIMIT SWITCH, ATS IN EMERGENCY
LBE - LIGHT, BYPASS EMERGENCY

LBN - LIGHT, BYPASS NORMAL
AB4 - LIMIT SWITCH, BYPASS NORMAL
AB3-1- LIMIT SWITCH, BYPASS EMERGENCY
PLS-2- PERMISSIVE LIMIT SWITCH
ATR - AUTO/TEST RELAY
AT-1 - LIMIT SWITCH, ATS TEST LOCATION

LIT - LIGHT, ATS INHIBIT
DS - ATS DISCONNECT SWITCH
R2 - RESISTOR, LDS
LDS - LIGHT, DISCONNECT SWITCH INHIBIT POSITION
ALH - ATS LOCATION HANDLE

ENGINE START CIRCUIT

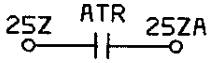
AE-1,2 - LIMIT SWITCH, ENGINE START TRANSFER
AB3-2,3- LIMIT SWITCH, BYPASS EMERGENCY



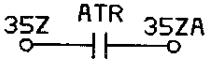
LIMIT SWITCH CHART

X = ACTUATED	ATS LOCATION				ATS MODE		BYPASS MODE		
	AUTO	TEST	ISO	REMOVE	NORM	EMERG.	NORM	EMERG.	OPEN
AA-1,2	X								
AT-1,2		X							
AI			X	X					
ALL	X	X	X	X					
TSE	X	X	X						
AE-1,2			X	X					
NA-4					X				
EA-3						X			
AB4							X		
AB3-1,2,3								X	
BLL							X	X	X
PLS-1,2	ACTIVATED WHEN ALH IS OPERATED								

PERMIT CIRCUITS

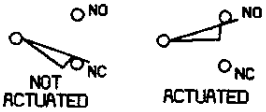


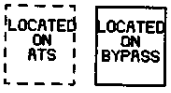
NORMAL TRANSFER PERMIT CIRCUIT IN AUTO AND TEST POSITIONS

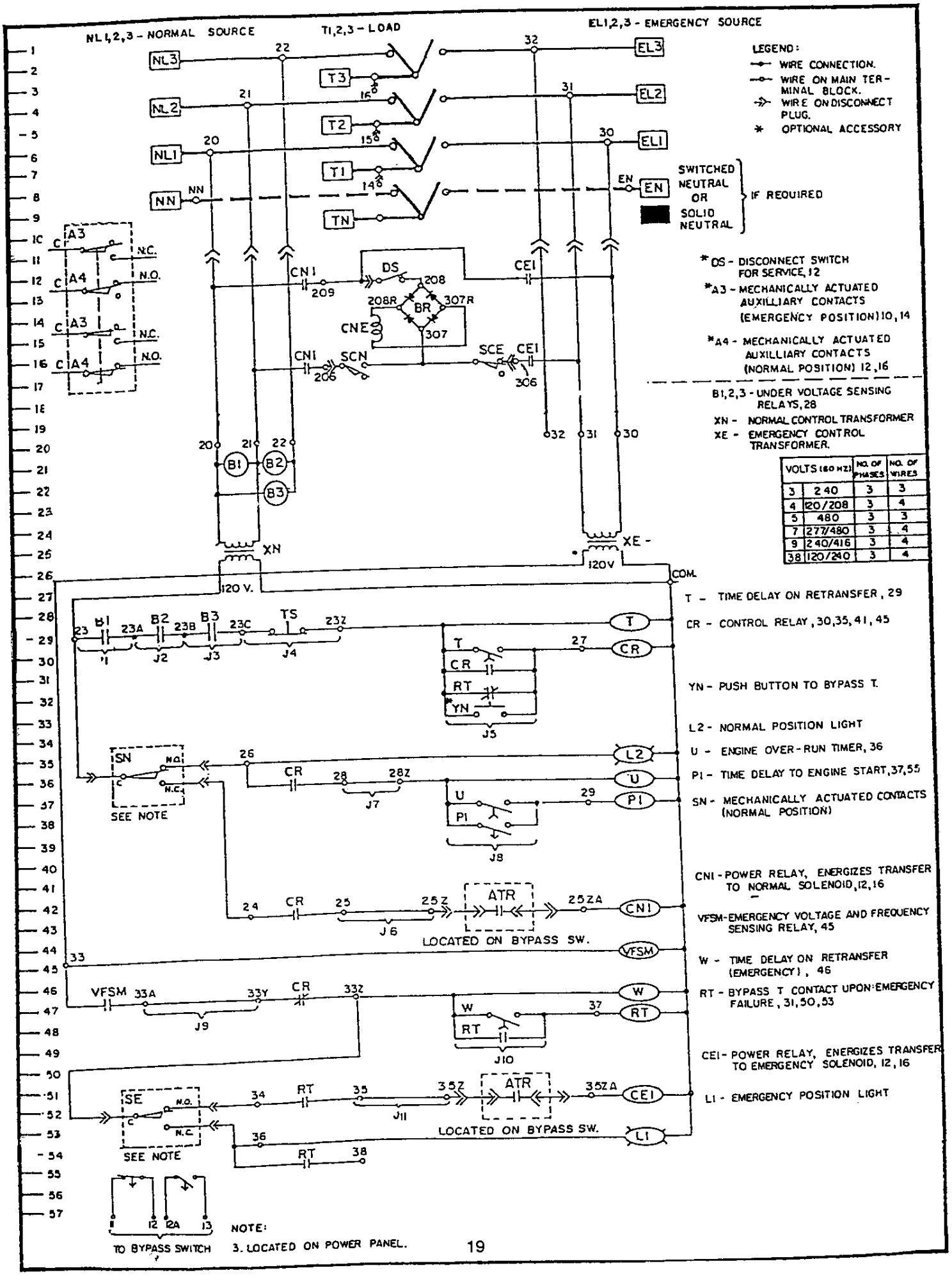


EMERGENCY TRANSFER PERMIT CIRCUIT IN AUTO AND TEST POSITIONS

LIMIT SWITCHES







VOLTS (60 HZ)		NO. OF PHASES	NO. OF WIRES
3	240	3	3
4	120/208	3	4
5	480	3	3
7	277/480	3	4
9	240/416	3	4
38	120/240	3	4



830 W. 40th St., Chicago, Illinois 60609
1 (773) 247 6400

ZBTSH SERIES
BYPASS/ISOLATION/TRANSFER SWITCH OPERATION
100-400 AMP

OPERATION: BYPASS/ISOLATION SWITCH

AUTOMATIC

1. Manually operated Bypass Switch contact (BN/BE) are open and ATS is supplying load
2. Disconnect Switch (DS) is in "AUTO".

TO BYPASS ATS

1. Open bottom cabinet door & turn DS to "INHIBIT".
2. Position manual bypass handle (MBH) to same power source as ATS.

TO TEST ATS

1. Bypass per above instructions.
2. Move ATS location handle (ALH) to "TEST" location.
3. Turn DS to "AUTO".

Test Switch (TS) on bottom cabinet door will allow electrical operation of ATS.

TO ISOLATE ATS

1. Bypass per above instructions.
2. Move ALH to "ISOLATE" location.

TO REMOVE ATS

1. Bypass and Isolate per above instructions.
2. Move ALH to "RELEASE" location.
3. Disconnect multipin plugs.
4. Lift ATS out of drawer.

TO RECONNECT ATS

1. Place ATS into drawer slots (front rollers first).
2. Turn DS to "INHIBIT".
3. Manually position ATS into same source as Bypass Switch.
4. Reconnect multipin plugs and external connections to ATS.
5. Push ATS inward to engage carriage.
6. Move ALH to "TEST" location (as indicated by light)
7. Turn DS to "AUTO" and use TS to electrically operate ATS.
8. Turn DS to "INHIBIT".
9. Move ALH to "AUTO" location.
10. Turn DS to "AUTO" & open Bypass with MBH.
11. ATS is now fully automatic (Fig.1).

NOTES:

1. DS in "INHIBIT" will prevent ATS electrical operation.
2. Do not use excessive force on mechanical handles.
3. Above Figures depict Bypass NORMAL. Sequence is same for Bypass EMERGENCY.
4. When ATS is in TEST or ISOLATE, Bypass Switch is manual transfer switch to either available source (indicated on light panel).
5. To operate Bypass Switch when ATS is in TEST or ISOLATE, position MBH to available power source.

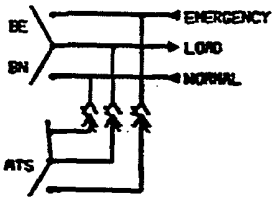


FIG. 1 BP IS OPEN WITH ATS IN NORMAL

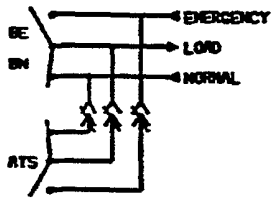


FIG. 2 BP IN NORMAL WITH ATS IN NORMAL

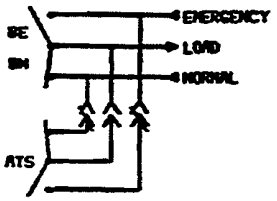


FIG. 3 BP IN NORMAL WITH ATS IN TEST (LOAD CONNECTIONS ARE OPEN)

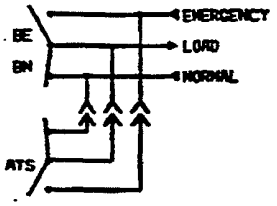


FIG. 4 BP IN NORMAL WITH ATS ISOLATED

NOTES:
1. BP-Bypass switch (indicated by contac BN/BE) is a 3 position switch.
2. ATS-Automatic Transfer Switch

CONTROLLED

REVISIONS:	MODEL: ZBTSH10/40 (100-400 AMP)		ZENITH CONTROLS, INC.
	DRFT: BRB	APP'D:	TITLE: BYPASS/ISOLATION TRANSFER SWITCH OPERATION
	DATE: 4/8/92	DWG DIR: ZE3	DRAWING NO.: 40R-0500 SHEET 1 OF 3
	SCALE:		R

LEGEND: BYPASS/ISOLATION SWITCH (BP)

I. (BP) BYPASS/ISOLATION SWITCH: MECHANICAL COMPONENTS

N1,2,3,(N)..... Normal Line connections
E1,2,3,(N)..... Emergency Line connections
T1,2,3,(N)..... Load Line connections
BE..... Bypass Emergency contacts
BN..... Bypass Normal contacts
MBH..... Manual Bypass Handle
ALH..... ATS Location Handle

II. (BP) BYPASS/ISOLATION: ELECTRICAL COMPONENTS

AA-1,2..... Limit switch held actuated in Auto location of ATS, Non-actuated Test and Isolated locations.
AB3-1,2,3..... Limit switch, actuated in Bypass Emergency position
AB4..... Limit switch, actuated in Bypass Normal position
ABE..... Auxiliary Bypass contact (Emergency)
ABN..... Auxiliary Bypass contact (Normal)
AE-1,2..... Limit switch, switches Engine Start from ATS control to bypass control during ATS Isolate
AI..... Limit switch, actuated in Isolate location
ALL..... Limit switch, ATS lock location
AT-1,2..... Limit switch, actuated in Test location
ATR..... Auto/Test Relay. Energized in AUTO and TEST locations
BLL..... Limit switch, Bypass lock location
BPS..... Bypass Solenoid
BR-1,2,3..... Bridge Rectifier
BTE..... Limit switch, Bypass Transfer Emergency (actuates during MBH movement to Emergency)
BTN..... Limit switch, Bypass Transfer Normal (actuates during MBH movement to Normal)
C..... Capacitor: RNH
D1..... Diode
EA-3..... Limit switch, ATS in Emergency
NA-4..... Limit switch, ATS in Normal
PLS-1,2..... Permissive limit switches
R1..... Resistor: RNH
R2..... Resistor: LDS
RNH..... Relay normally held, 24 VDC coil, 3PDT
TRS..... Transfer Release Solenoid
TSE..... Limit switch. Transfer switch engaged non-activated in remove position
XBE..... Emergency line control transformer
XBN..... Normal line control transformer

III. (BP) BYPASS/ISOLATION SWITCH: INDICATOR LIGHTS

LNA..... Normal available
LEA..... Emergency available
LBN(NOTE 1)..... Bypass Normal (BN closed)
LBE(NOTE 1)..... Bypass Emergency (BE closed)
LAT(NOTE 1)..... ATS in Test location
LAI(NOTE 1)..... ATS in Isolate location
LIT(NOTE 1)..... ATS Inhibit
LDS(NOTE 1)..... ATS DS switch in INHIBIT position

CONTROLLED

NOTES:
1. Indicator off during automatic operation of ATS.
2. Four pole includes neutral lugs.

REVISIONS:	MODEL: ZBTSH10/40 (100-400 AMP)		ZENITH CONTROLS, INC.	
	DRFT: BRB	APP'D: [illegible]	TITLE: BYPASS/ISOLATION SW. LEGEND	
	DATE: 4/8/92	DWG DIR: ZE3	DRAWING NO.: 40R-0500 SHEET 2 OF 3	REV —
	SCALE:			

LEGEND & OPERATION: AUTOMATIC TRANSFER SWITCH (ATS)

A. LEGEND

B1,2,3.....Solid State Phase Relay(s)
Dropout _____%
Pickup _____%
BR.....Bridge Rectifier
CE1.....CE Control Relay, Emergency
CN1.....CN Control Relay, Normal
CNE.....Main Transfer Operator
CR.....Normal Control Relay
DS.....Disconnect Switch
E.....Engine Start Contact
EA-3.....Limit Switch, ATS in Emergency
GND.....Ground
NA-4.....Limit Switch, ATS in Normal
NB.....Neutral Bar (if required)
RT.....Emergency Control Relay
SCN,SCE.....CNE Limit Switches
SE.....Cutout Switch, Emergency
SN.....Cutout Switch, Normal
TS.....Test Switch,Momentary,Not Keyed
VFSM.....Emergency Volt-Freq. Relay
Pickup { 90% of rated Voltage, and 95% of rated Frequency
XE.....Control Transformer, Emergency
XN.....Control Transformer, Normal

B. OPERATION

When the Normal Line falls below the preset dropout point, the phase relays will dropout disconnecting the CR relay.

When the Emergency Line voltage & frequency reach the preset pickup point, the VFSM relay picks up. RT relay picks up to operate the CE1 relay through the SE cutout switch, causing the main transfer operator CNE to operate. The load is now transferred to the Emergency Line. The SE limit switch operates to disconnect the CE1 relay and CNE main transfer operator. The transfer switch is now mechanically locked. Limit switch SN operates to complete the circuit for the next closing operation to Normal.

When the Normal Line voltage exceeds the preset pickup point, the phase relays, B1, B2 & B3 pick up. CR relay picks up to operate the CN1 relay through the SN cutout switch causing the main transfer operator CNE to operate. The load is now re-transferred back to the Normal Line. The SN limit switch operates to disconnect the CN1 relay and CNE main transfer operator. The transfer switch is now mechanically locked. Limit switch SE operates to complete the circuit for the next closing operation to Emergency.

DS – Disconnect Switch
When the Disconnect Switch is placed in the INHIBIT position the circuit to the main transfer operator CNE is opened and transfer cannot take place.

TS – Test Switch
The Test Switch simulates a normal line failure when activated.
To test, activate the Test Switch allowing the transfer switch to transfer to the EMERGENCY position. De-activate the Test Switch. The transfer switch will reset to the NORMAL position. Testing at least once a month is recommended. For hospital emergency systems, test once a week.

NOTES:

1. ⚠ CAUTION: In using a 3 phase, 4 wire delta or open delta power supply (usually 120/240 volts, sometimes listed as 120/208 volts) with one leg having a grounded center tap, one line will be 160 to 208 volts to ground. When such a system is used it is necessary to connect the high leg to N2. DO NOT CONNECT 120 VOLT LOAD CIRCUIT TO THE HIGH LEG.
2. GROUNDING TERMINAL: A grounding terminal (GND) is provided. When installing open type switches connect this to the metal enclosure or conduit.
3. ⚠ WARNING – TO ENSURE AGAINST SHOCK OR ACCIDENT HAZARD, DISCONNECT ALL SOURCES OF SUPPLY BEFORE SERVICING.
4. ON SINGLE PHASE UNITS WHERE THE EMERGENCY SOURCE IS A UTILITY LINE, CONNECT EMERGENCY LINE SO THAT MINIMUM VOLTAGE IS MEASURED FROM N1 TO E1.
5. ON SINGLE PHASE UNITS, CONNECTION LUGS(N3,E3,T3) AND PHASE RELAYS (B2,B3) ARE NOT SUPPLIED.

CONTROLLED

ECN S-5004: 8-7-9

ZENITH CONTROLS, INC.

TITLE: ATS LEGEND & OPERATION

DRAWING NO.: 40R-0500 SHEET 3 OF 3 | - R

ACCESSORIES

The ZTS series switches are wired so that accessories can be easily added to the switch. The following is a description of the basic accessories. Those checked are supplied on this unit, see additional pages for complete legend & operation.

☐ A1 Auxiliary contact, S.P.D.T., operates on normal line failure.

☐ A1E Auxiliary contact, S.P.D.T., operates on emergency line failure.

☐ A3 Auxiliary contact closes when the transfer switch is in the Emergency position.

☐ A4 Auxiliary contact closes when the transfer switch is in Normal position.

☐ A6 Motor Disconnect. To de–energize external motor control circuit 5 seconds (adjustable) prior to transfer in either direction.

☐ C Plant Exercisor. Automatically starts generator for selected time intervals.

☐ C/D Plant Exercisor. Automatically starts generator to run unloaded or simulate a power failure and starts generator to run under load.

☐ E Engine Start Contact: 1 Normally Open
1 Normally Closed.

☐ F Auxiliary Fan Contact, S.P.N.O. Closes when generator is running.

☐ H Time delay to engine start, non–adjustable. Factory set 1 or 3 seconds. When the Normal line fails the relay de–energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ J1 Adjustable under frequency sensor.

☐ J2 Adjustable over/under frequency sensor.

☐ K Frequency meter to indicate load frequency.

☐ L1 Pilot Light. Switch in Emergency Position.

☐ L2 Pilot Light. Switch in Normal Position.

☐ L3 Pilot Light. Normal source available.

☐ L4 Pilot Light. Emergency source available.

☐ M1 Ammeter; Single phase.

☐ M2 Ammeter; Three phase

☐ M3 Voltmeter; Single phase.

☐ M4 Voltmeter; Three phase.

☐ P1 Time Delay to Engine Start (solid state). Adjustable over time range .5 to 6 seconds. When the Normal line fails the relay de–energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ P2 Time Delay to Engine Start (Pneumatic). Adjustable over time range 1/6 to 300 seconds. When the Normal line fails, the relay de–energizes. After the set time delay its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ Q2 Connections for remote peak shave or area protection relays. Includes bypass for automatic return to Normal if Emergency line fails and Normal is present.

☐ R1 Solid State Adjustable Overvoltage Relay(s). Set at 110% of pickup, 105% of dropout of nominal Line rate, unless otherwise specified.

☐ R4 In–Phase monitor. Prevents transfer until two sources are in–phase. For use of isochronous governors.

☐ R43 In–phase monitor. Prevents transfer until two sources are in–phase. For use with mechanical. governors.

☐ S1 Four–position Engine Control Selector Switch. "STOP", "HAND CRANK", "TEST", "AUTOMATIC".

☐ T Time delay, re–transfer to Normal. When the Normal line restores and the phase relays operate, the T timer is energized. After the set time delay, its contacts close the circuit to the CR relay which operates to restore the load to the Normal line. RT relay is supplied to bypass T contacts if Emergency is de–energized during timing. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ T3 W3 Presignal auxiliary Contact, S.P.D.T: Operates 0–30 seconds (adjustable) prior to transfer in either direction.

☐ U Time delay, engine cool–down. When the transfer switch is restored to the Normal position and the engine is signaled to shut down, the U timer operates to maintain the engine start circuit closed. At the end of the set time, the engine contacts open to shut down the engine. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ W Time delay, transfer to Emergency. When the Normal line fails and the engine has started, the VFSM relay energizes. The W timer energizes. After the set time delay, its contacts close to energize the RT relay. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ YE Pushbutton, Transfer to Emergency. Provides manual control of transfer to emergency source. If time delay accessory W is supplied pushbutton bypasses time delay for immediate transfer; otherwise, transfer to emergency will be automatic after time delay. If time delay accessory W is not supplied, transfer will be non–automatic (by pushbutton only).

☐ YN Pushbutton, Retransfer to Normal. Provides manual control of retransfer to normal source. If time delay accessory T is supplied, pushbutton bypasses time delay for immediate retransfer; otherwise, retransfer to normal will be automatic after time delay. If time delay accessory T is not supplied, retransfer will be non–automatic (by pushbutton only).

☐ Other:_____

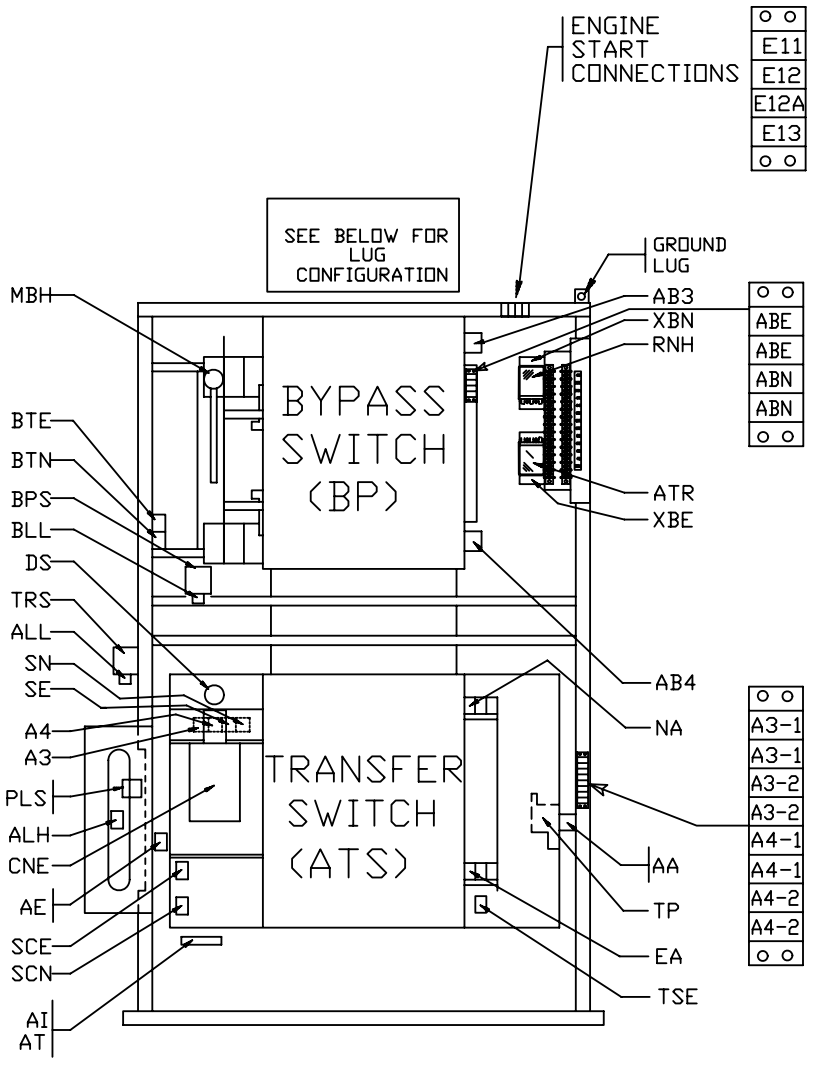
_____

_____

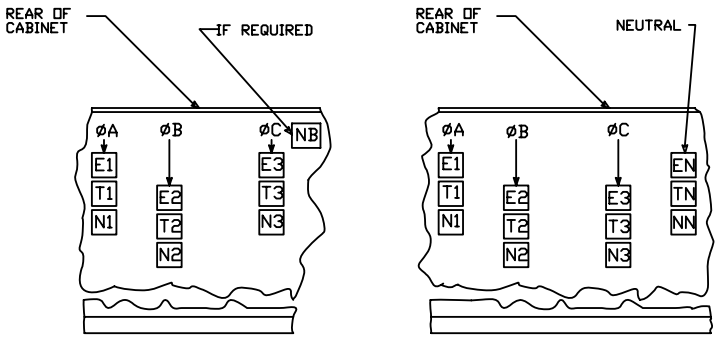
ZENITH® CONTROLS, INC.

TITLE: ACCESSORIES

DRAWING NO.: 40R–0900 — REV



DEVICE TAG	TERMINAL MARKINGS WIRE NUMBER					
TRANSFORMERS	X1	X2	H1	H2	H3	H4
XBE	53	54	50			51
XBN	43	44	40			41
SOLENOIDS	NO MARKINGS					
BPS	62	63				
CNE	208R	307R				
TRS	84	81				
SWITCHES	NO		NC		NO	
DS	80	82	208	209	87	87C
	80	90				
LIMIT SWITCHES	C	NC	NO	C	NC	NO
AA-1,2	60		61	64	80	87
AB3-1	83A	83B	86			
AB3-2,3	E12		E11	E12A	12A	
AB4	80	83A	85			
AE-1,2	E11	11	11R	E13	13	13R
AI	63		89			
ALL	64		63			
AT-1,2	80		83B	63		88
BLL	87C		87A			
BTE	61		62			
BTN	60		62			
EA-3	86		87			
NA-4	85		87			
PLS-1,2	87A		87B	83B	83	
SCE	307		306			
SCN	206		307			
SE	33Z	34	36			
SN	23	26	24			
TSE	87B		84			
RECTIFIERS	AC	AC	+	−		
BR-1	43	44	80	60		
BR-2	53	54	80	61		
BR-3	60	61		81		



LUG CONFIGURATION

LEGEND	REFERENCE	NOTES
	REFER TO 40R-0500 FOR LEGEND & OPERATION FOR MANUFACTURING: SEE PAGE 5 FOR CONTROL PANEL SEE 40R-0900 FOR ACCESSORIES.	

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
A	S-5769	ESTABLISH DWG.		
H	S-6240	02/29/96	BRB	SB

ZENITH CONTROLS, INC.

TITLE: BP & ATS COMPONENT LOCATIONS

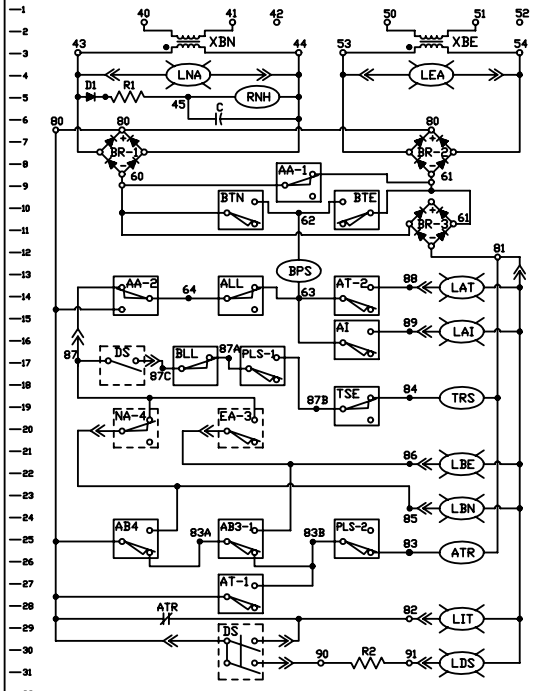
MODEL: ZBTSH10/40 (100-400 AMPS)

DRFT: FHB	DATE:	SCALE:	CHK:	APPD:
ENGR: SB	07/22/94	N/A		

DWG NO.: 46A-1001 REV H

CADD: S5K SHT. 1 OF 5

ORIGINAL



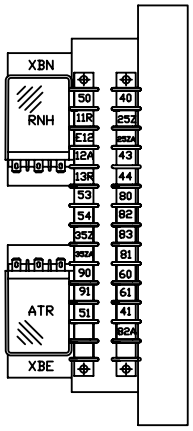
LNA - NORMAL AVAILABLE LIGHT
LEA - EMERGENCY AVAILABLE LIGHT
RNH - NORMALLY HELD RELAY
D1 - DIODE
R1 - RESISTOR, RNH
C - CAPACITOR, RNH
BR-1,2,3 - BRIDGE RECTIFIER

AA-1 - LIMIT SWITCH, ATS AUTO LOCATION
BTN - LIMIT SWITCH, BYPASS TRANSFER NORMAL (MBH MOVEMENT TO NORMAL)
BTE - LIMIT SWITCH, BYPASS TRANSFER EMERG. (MBH MOVEMENT TO EMERGENCY)
BPS - BYPASS SOLENOID
AA-2 - LIMIT SWITCH, ATS AUTO LOCATION
ALL - LIMIT SWITCH, ATS LOCK LOCATION
AT-2 - LIMIT SWITCH, ATS TEST LOCATION
LAT - LIGHT, ATS TEST LOCATION
AI - LIMIT SWITCH, ATS ISOLATE LOCATION
LAI - LIGHT, ATS ISOLATE LOCATION
BLL - LIMIT SWITCH, BYPASS LOCK LOCATION
PLS-1- PERMISSIVE LIMIT SWITCH
TSE - LIMIT SWITCH, TRANSFER SWITCH ENGAGED
TRS - SOLENOID, TRANSFER RELEASE
NA-4 - LIMIT SWITCH, ATS IN NORMAL
EA-3 - LIMIT SWITCH, ATS IN EMERGENCY
LBE - LIGHT, BYPASS EMERGENCY

LBN - LIGHT, BYPASS NORMAL
AB4 - LIMIT SWITCH, BYPASS NORMAL
AB3-1- LIMIT SWITCH, BYPASS EMERGENCY
PLS-2- PERMISSIVE LIMIT SWITCH
ATR - AUTO/TEST RELAY
AT-1 - LIMIT SWITCH, ATS TEST LOCATION

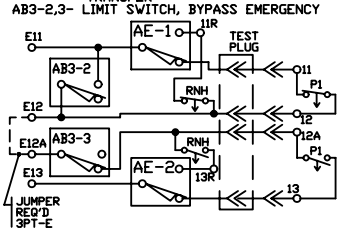
LIT - LIGHT, ATS INHIBIT
DS - ATS DISCONNECT SWITCH
R2 - RESISTOR, LDS
LDS - LIGHT, DISCONNECT SWITCH INHIBIT POSITION
ALH - ATS LOCATION HANDLE

BYPASS SUBPANEL



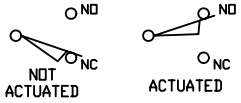
ENGINE START CIRCUIT

AE-1,2 - LIMIT SWITCH, ENGINE START TRANSFER
AB3-2,3- LIMIT SWITCH, BYPASS EMERGENCY

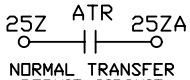


LOCATED ON ATS
LOCATED ON BYPASS

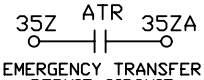
LIMIT SWITCHES



PERMIT CIRCUITS



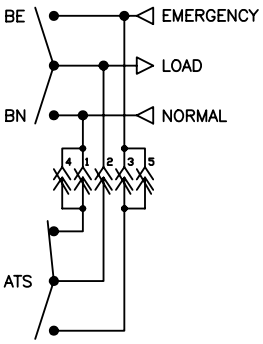
NORMAL TRANSFER PERMIT CIRCUIT IN AUTO AND TEST POSITIONS

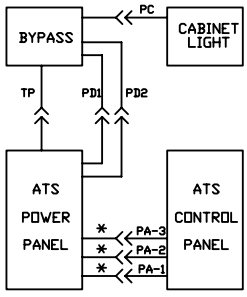


EMERGENCY TRANSFER PERMIT CIRCUIT IN AUTO AND TEST POSITIONS

LIMIT SWITCH CHART

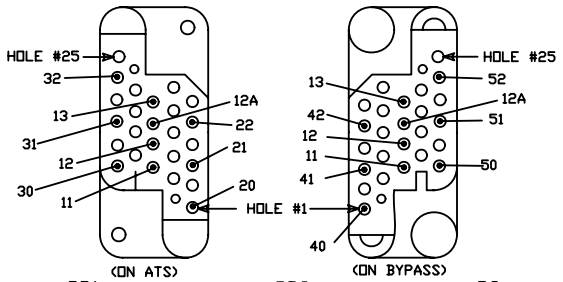
X = ACTUATED	ATS LOCATION				ATS MODE		BYPASS MODE		
	AUTO	TEST	ISO	REMOVE	NORM	EMERG.	NORM	EMERG.	OPEN
AA	X								
AT		X							
AI			X	X					
ALL	X	X	X	X					
TSE	X	X	X						
AE			X	X					
NA					X				
EA						X			
AB4							X		
AB3								X	
BLL							X	X	X
PLS	ACTIVATED WHEN ALH IS OPERATED								

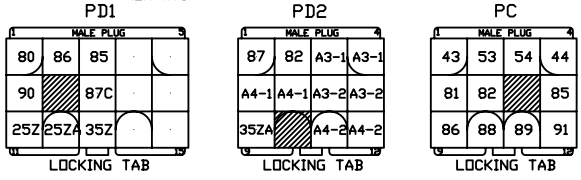




* SEE ATS POWER CIRCUIT SCHEMATIC, LIGHTS AND PLUGS

ATS TEST PLUG (TP)





ATS LOCATION	LOAD CARRYING CONTACTS			ATS TEST PLUG (TP)	
	1	2	3	4	5
AUTO	X	X	X	X	X
TEST	O	O	O	X	X
ISOLATE	O	O	O	O	O

X = CLOSED
O = OPEN

NOTES

ATS SHOWN IN NORMAL POSITION, BYPASS OPEN WITH NO POWER AVAILABLE.

REVISIONS

RV	ECN NO.	DATE	DRF	ENG
A	S-5769	ESTABLISH DWG.		
H	S-6240	02/29/96	BRB	SB

ZENITH CONTROLS, INC.

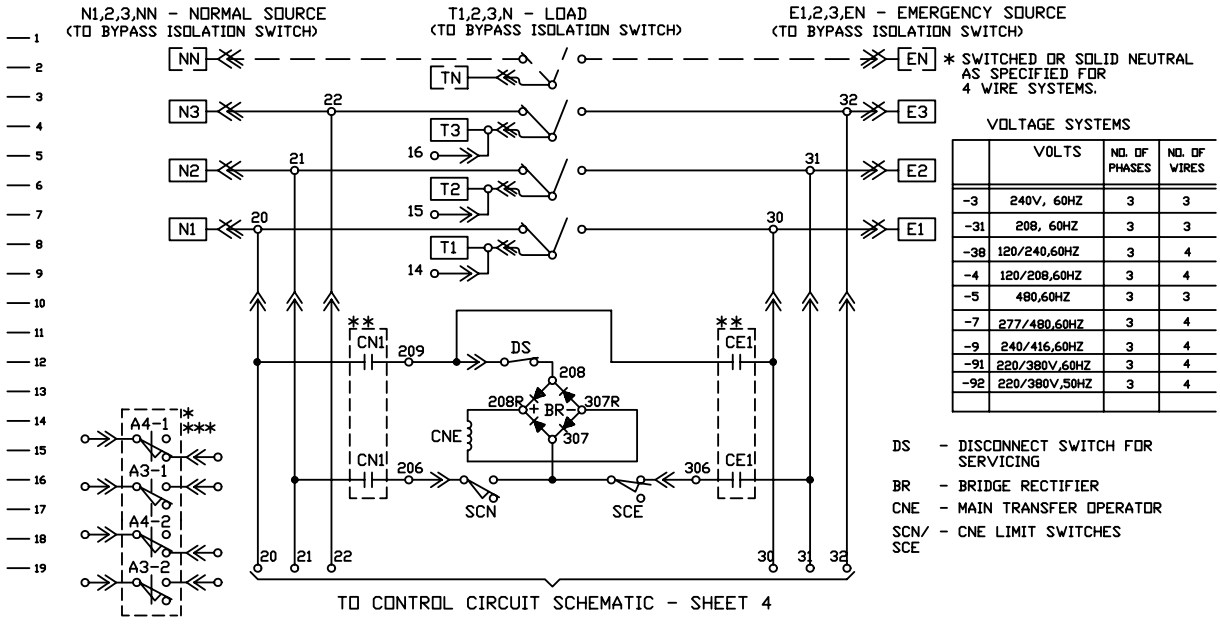
TITLE: BYPASS CONTROL CIRCUIT SCHEMATIC
MODEL: ZBTSH10/40 (100-400 AMPS)

DRFT: FHB	DATE:	SCALE:	CHK:	APPD:
ENGR: SB	07/22/94	N/A		

DWG NO.: 46A-1001 SHT. 2 OF 5 REV H
CADD: S5K

ORIGINAL

POWER CIRCUIT SCHEMATIC

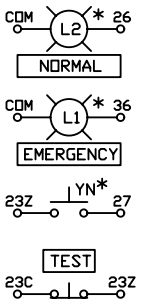


VOLTAGE SYSTEMS

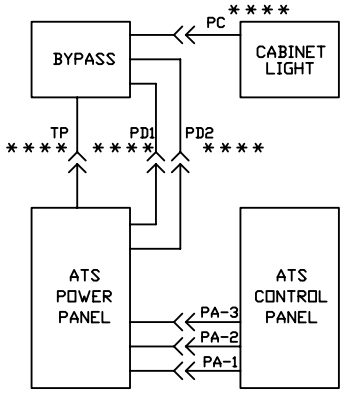
	VOLTS	NO. OF PHASES	NO. OF WIRES
-3	240V, 60HZ	3	3
-31	208, 60HZ	3	3
-38	120/240,60HZ	3	4
-4	120/208,60HZ	3	4
-5	480,60HZ	3	3
-7	277/480,60HZ	3	4
-9	240/416,60HZ	3	4
-91	220/380V,60HZ	3	4
-92	220/380V,50HZ	3	4

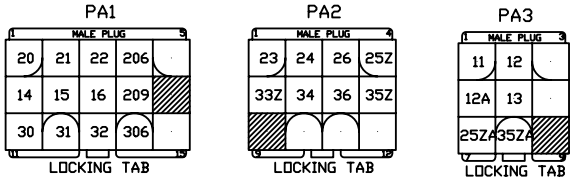
DS - DISCONNECT SWITCH FOR SERVICING
BR - BRIDGE RECTIFIER
CNE - MAIN TRANSFER OPERATOR
SCN/ SCE - CNE LIMIT SWITCHES

CABINET FRONT



INTERCONNECT PLUGS





LEGEND	NOTES
WIRE CONNECTION WIRE ON MAIN TERMINAL BLOCK WIRE IN DISCONNECT PLUG * OPTIONAL ** LOCATED ON CONTROL PANEL *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL **** SEE BYPASS CONTROL SUBPANEL AND PLUGS	1. ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE. 2. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3,A4,E,L1, L2,P,T,U,W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.

REVISIONS

RV	ECN NO.	DATE	DRF	ENG
A	S-5769	ESTABLISH DWG.		
H	S-6240	02/29/96	BRB	SB

ZENITH CONTROLS, INC.

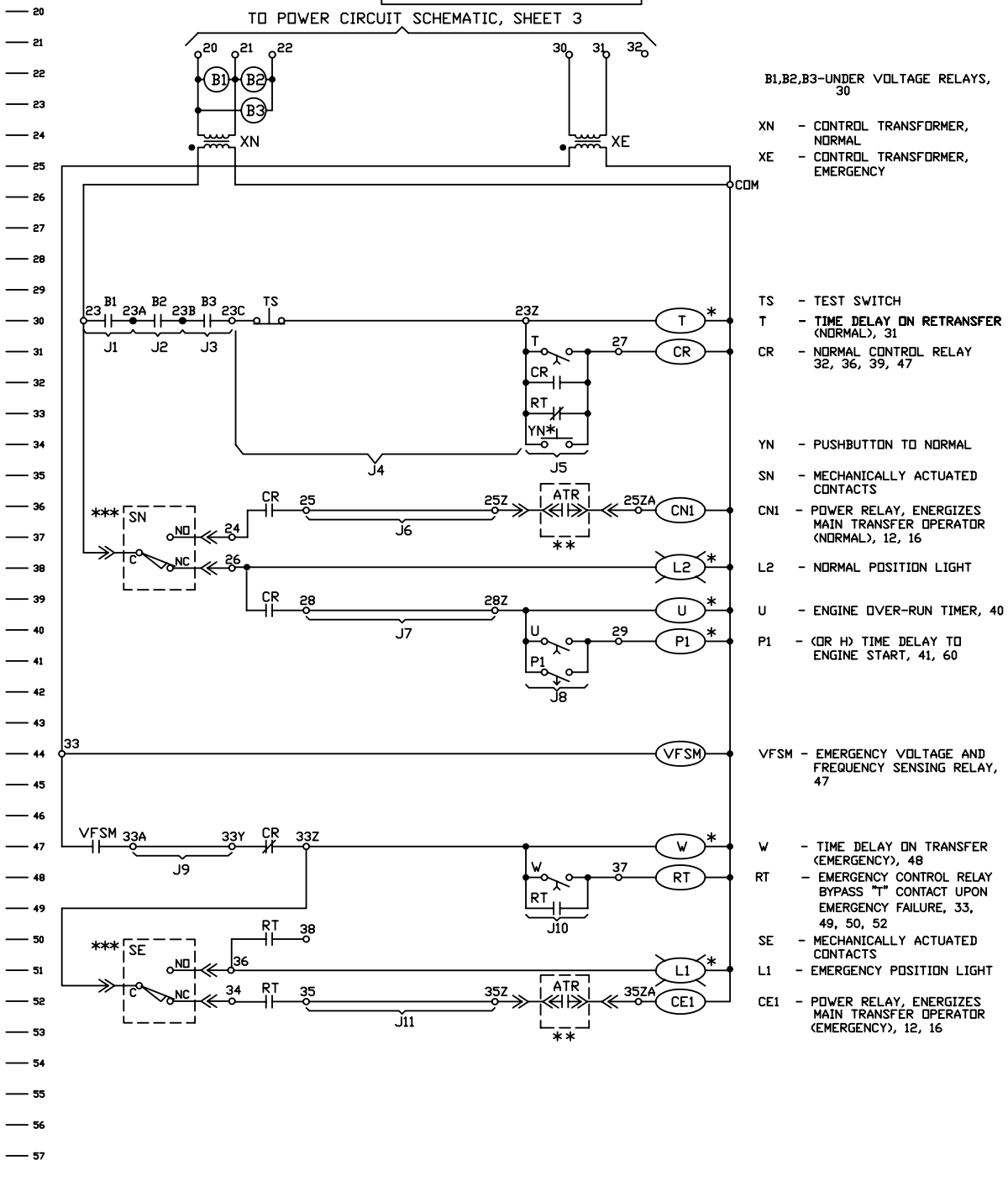
TITLE: ATS POWER CIRCUIT SCHEMATIC
MODEL: ZBTSH10/40 (100-400 AMPS)

DRFT: FHB	DATE:	SCALE:	CHK:	APPD:
ENGR: SB	07/22/94	N/A		

DWG NO.: 46A-1001 H
CADD: S5K SHT. 3 OF 5 REV

ORIGINAL

CONTROL CIRCUIT SCHEMATIC



CUSTOMER CONNECTIONS

A3,A4
SEE ATS POWER CIRCUIT SCHEMATIC & BP & ATS COMPONENT LOCATIONS

ENGINE START
SEE BP CONTROL CIRCUIT SCHEMATIC & BP & ATS COMPONENT LOCATIONS

CONTACT RATING		
RELAY	CONTACT	RATING
H	E	10AMP @ 28VDC
P1	E	10AMP @ 32VDC
	A3, A4	20AMP, 125, 250 VAC

JUMPER	CONNECT POINTS	REMOVE JUMPER WHEN ACCESSORIES USED
J1	23, 23A	B1
J2	23A, 23B	B2
J3	23B, 23C	B3
J4	23C, 23Z	J1N, TS, C/D
J5	23Z, 27	T, YN
J6	25, 25Z	T3, R4
J7	28, 28Z	C, C/D
J8	28Z, 29	P1, U
J9	33A, 33Y	J1E, ER1, 2, 3
J10	33Z, 37	W
J11	35, 35Z	W3, R4

NOTES:
1. ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.
2. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3, A4, E, L1, L2, P, T, U, W), AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.

LEGEND
- WIRE CONNECTION
- WIRE ON MAIN TERMINAL BLOCK
- WIRE IN DISCONNECT PLUG
- * OPTIONAL
- ** LOCATED ON BYPASS SUBPANEL
- *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL

REVISIONS					
RV	ECN NO.	DATE	DRF	ENG	
A	S-5769	ESTABLISH DWG.			
H	S-6240	02/29/96	BRB	SB	

ZENITH CONTROLS, INC.

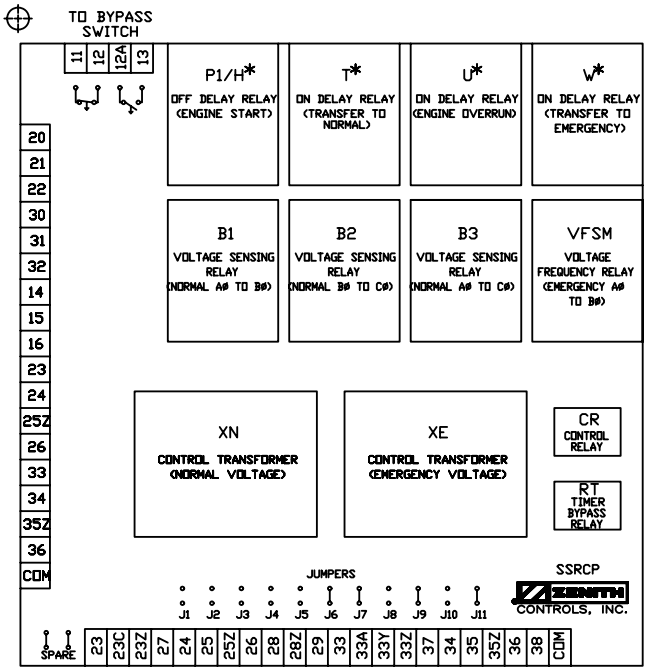
TITLE: CONTROL CIRCUIT SCHEMATIC, CUST. CONN.
MODEL: ZBTSH10/40 (100-400 AMPS)

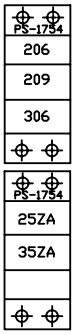
DRFT: FHB	DATE:	SCALE:	CHK:	APPD:
ENGR: SB	07/22/94	N/A		

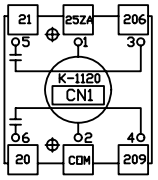
DWG NO.: 46A-1001 H
CADD: S5K SHT. 4 OF 5 REV

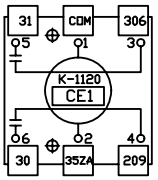
ORIGINAL

CONTROL PANEL LAYOUT









(18" X 29")
(457mm X 737mm)

NOTES
1. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3, A4, E, L1, L2, P, T, U, W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.
2. (*) OPTIONAL

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
A	S-5769	ESTABLISH DWG.		
H	S-6240	02/29/96	BRB	SB

MODEL: ZBTSH10/40 (100-400 AMPS)

DRFT: FHB | SCALE: 1/2 = 1
ENGR: SB | CHK:
DATE: 07/22/94 | APP'D:

ZENITH CONTROLS, INC.

TITLE: CONTROL PANEL LAYOUT

DWG NO.: 46A-1001 | H REV
CADD: S5K SHT. 5 OF 5

ORIGINAL

ZENITH CONTROLS, INC.

46R-2000A
Revised March, 1996

OPERATION AND MAINTENANCE MANUAL

BYPASS/ ISOLATION TRANSFER SWITCH

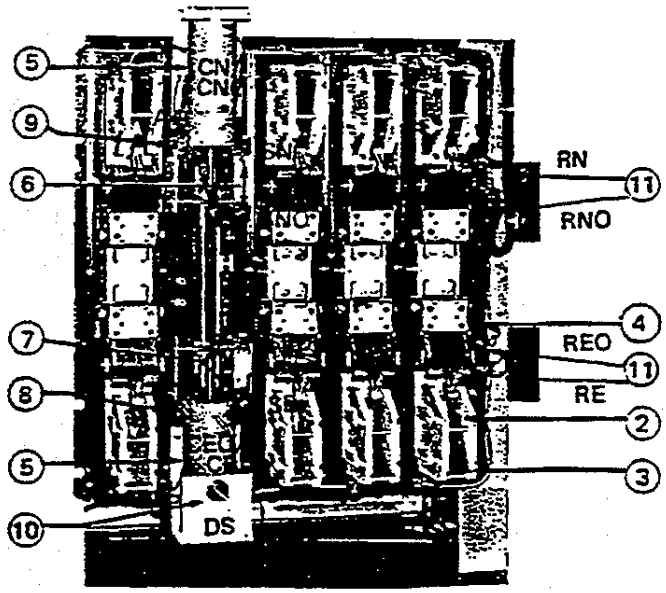
ZBTSH SERIES 600 THRU 1200 AMPS

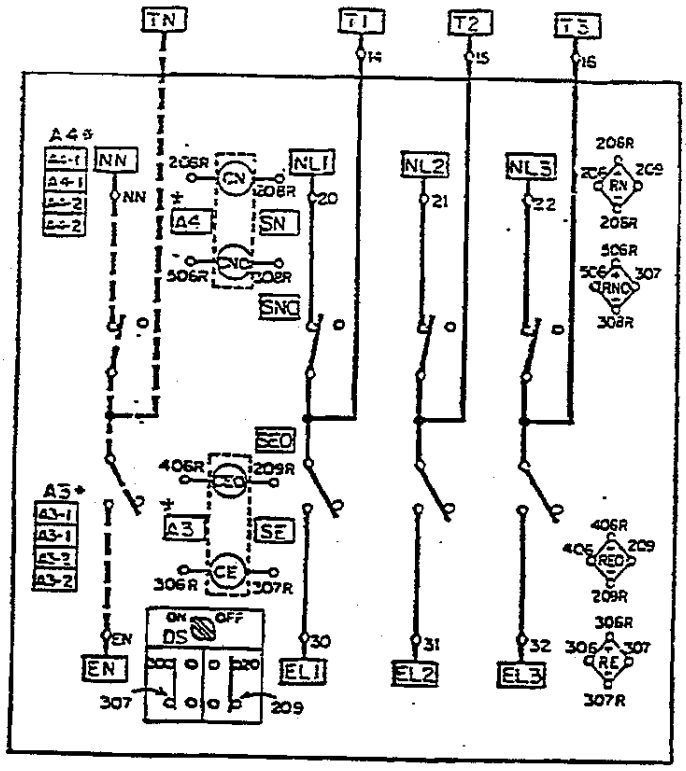
MODEL NUMBER _____

SERIAL NUMBER _____

ZENITH CONTROLS, INC., 830 W. 40th St., Chicago, IL 60609
(312)247-6400: FAX. (312)247-7805

A. POWER PANEL





B. CONTROL PANEL

TORQUE REQUIREMENTS FOR ELECTRICAL CONNECTIONS

All current carrying parts use compression washers and should be torqued to the values presented below. Caution: DO NOT OVER-TORQUE WASHERS; follow the given torque values.

Torque Requirements (inch-lb. except denoted by + are ft.-lb.)

Bolt Size	Grade 5	Socket Head	Set Screw	Compression Washers	
				1	2
1/4 - 20	75	120	52	80	87
5/16 - 18	157	225	105	159	170
3/8 - 16	+23	412	165	+23	+26
1/2 - 13	+57	1030	386	+56	+59

Wire Connection Tightening Torque

Wire Cond. Size AWG or MM	Screw Driver Torque (inch-lb.)
18 - 16 AWG	19
14 - 8	19
6 - 4	36

Lug Bolting Torque

Bolt Dia. (in.)	Torque (ft.-lb)
1/4 or less	6
5/16	11
3/8	19
7/16	30
1/2	40
5/8 or more	55

TORQUE REQUIREMENTS FOR FIELD CONNECTIONS

NOTICE
TIGHTENING TORQUES FOR FIELD WIRING TERMINALS

Socket Size Across Flats, Inch	Tightening Torque Pound-Inches
1/8	45
5/32	100
3/16	120
7/32	150
1/4	200
5/16	275
3/8	375
1/2	500
9/16	600

PARTS LIST

IMPORTANT: Model number and serial number of switch must be included with all orders for replacement parts. If possible, also specify line voltages, drawing number and date of installation. When ordering mechanical parts not shown on the parts list, circle the part on the photograph and return with the parts list. When ordering electrical components not shown on the parts list, refer to this part by its legend description in the wiring diagram.

A. POWER PANEL PARTS

ITEM	TAG	DESCRIPTION					PART NUMBER BY AMPERAGE		
							1600	2000	3000
1	NL1,2,3 EL1,2,3 T1,2,3	Cable Connections at Rear					S-1126F (2) Optional (8) 600 MCM-2	S-1126F (2) Optional (8) 600 MCM-2	S-1126F (2) Optional (8) 600 MCM-2
2		Stationary Contact Assembly Kit					23P-1594	23P-1594	23P-1434Z
3		Arc Grid Assembly Kit					23P-1171	23P-1171	23P-1171
4		Moveable Contact Assembly Kit					23P-1400	23P-1400	23P-1344
5	CN/CNO,CEO/CE	Main ATS Operating Coils							
		Voltage Systems							
		No	Volts	Ph	Wire	Coil Volts	Poles			
		-1	120	1	2	120	2	SPO	SPO	SPO
		-2	120/240	1	3	240	2	K-2151	K-2151	K-2151
							3	K-2151	K-2151	K-2151
		-3	240	3	3	240	3	K-2151	K-2151	K-2151
		-4	120/208	3	4	208	3,4	K-2151	K-2151	K-2151
		-5	480	3	3	480	3	K-2160	K-2160	K-2160
		-6	575	3	3	575/600	3	K-2195	K-2195	K-2195
		-7	277/480	3	4	480	3	K-2160	K-2160	K-2160
							4	K-2160	K-2160	K-2160
		-8	120/240	2	4	240	4	K-2151	K-2151	K-2151
		-9	240/416	3	4	416	3	K-2193	K-2193	K-2193
	OPERATING COIL HARDWARE KIT									
6	SN/SNO	CN Cut-Out Switch					23P-1401		
7	SE/SEO	CE Cut-Out Switch					23P-1401		
8	A3	Emergency Position Aux. Contact					(QTY 1) 23P-1404 (QTY 2) 23P-1405		
9	A4	Normal Position Aux. Contact					(QTY 1) 23P-1402 (QTY 2) 23P-1403		
10	DS	Disconnect Switch					Operator L-4009, Contact Block L-1020		
11	RN,RE,RNO,REO	Rectifier					23P-1473 (240V), 23P-1582 (600V)		
		Nameplate (Not Shown)					Contains switch information: voltage, amperage, frequency rating, number of phases, serial number, system voltage and model number.		

CABINET DOOR

TAG	DESCRIPTION	PART NUMBER
L1 L2	ATS Emergency Position Indicator ATS Normal Position Indicator Green Lens (Normal) Red Lens (Emergency) Bulb Socket Normal/ Emergency Nameplate Emergency Bulb Normal Bulb	 PS-5048 PS-5047 PS-5046 V-1502 PS-5105 PS-5105
TS	Test Switch Operator, Momentary Contact Block N.C. Name Plate Contact Mounting Base	 L-1025 L-1029 V-1503 PS-3473

D. ATS CONTROL PANEL (SSRCP)

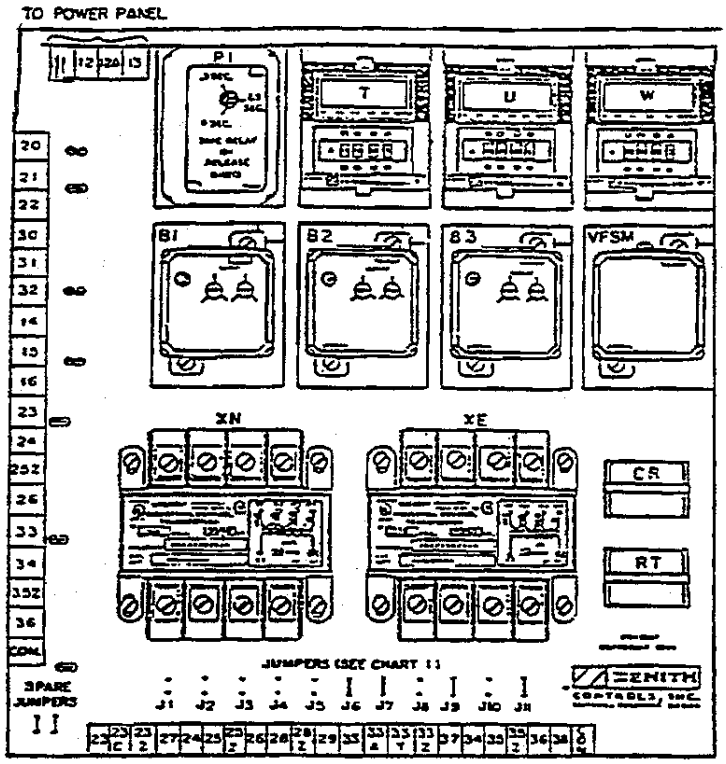


CHART 1

Jumper	Connects Points	Remove When Accessories Used
J1	23,23A	B1
J2	23A, 23B	B2
J3	23B, 23C	B3
J4	23C. 23Z	JIN, TS, C/D
J5	23Z, 27	T, YN
J6	25, 25Z	T3, R4
J7	28, 28Z	SI, C, C/D
J8	28Z, 29	PI & U
J9	33A, 33Y	ER1, 2, 3, J1E
J10	33Z,37	W
J11	35, 35Z	R4, W3

ATS CONTROL PANEL (SSRCP) STANDARD ITEMS

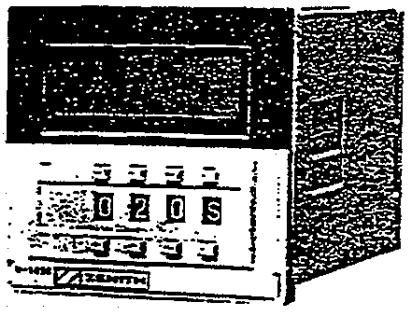
TAG	DESCRIPTION	VOLTAGE 50/60 HZ	PART NO.
XN, XE	Control Transformers (See Note 1)	120V	K-3068
		208V	K-3070
		240 or 480V	K-3071
		416V	K-3089
B-1, 2, 3	Phase Relays Solid State (See Note 1)	120V	K-1185
		208 or 240V	K-1186
		480V	K-1188
VFSM	Voltage Frequency Sensor	120V/60Hz	K-1192R
CR	Control Relay	120V	K-1204
RT	Bypass T Relay	120V	K-1204
J1-J11	Jumpers		PS-5067
CCN, CCEO	Power Relays, energize CN & CEO Solenoids	120V	K-1120
CCE, CCNO	Power Relays, energize CE & CNO Solenoids	120V	K-1120

(OPTIONAL ITEMS)

TAG	DESCRIPTION	VOLTAGE	PART NUMBER
T	Time Delay to Normal, Timer Solid State	120V .1 Sec. to 9990 Hrs. (Adj.)	OSA-A-T
U	Engine Cool Down, Timer Solid State	120V .1 Sec. to 9990 Hrs. (Adj.)	OSA-A-U
W	Time Delay Emergency, Timer Solid State	120V .1 Sec. to 9990 Hrs. (Adj.)	OSA-A-W
PI	Time Delay Engine Start, Timer	120V (.5 to 6 sec. Adjustable)	K-1201
P2	Optional (Mounted below SSRCP)	120V (300 Sec. Adjustable)	K-1061

Notes:

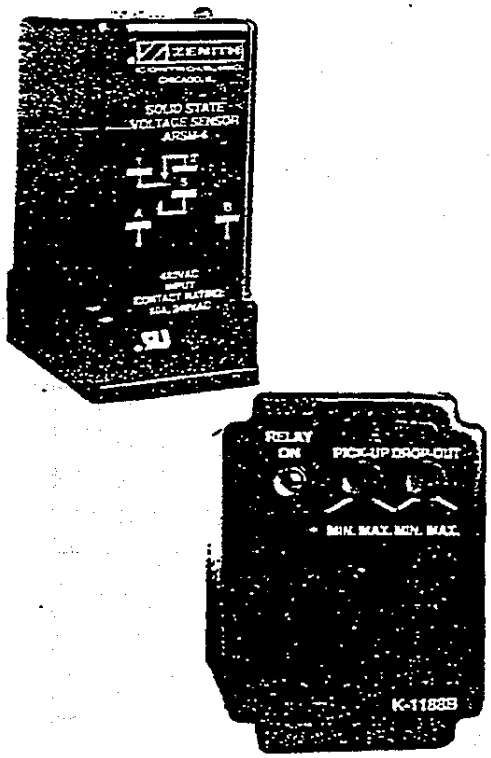
1. If -6 voltage system (575/600V) is supplied, then XN, XE is K-3087 and B1,2, 3 is K-1185 (120V) supplied with XB (575:600V/120V) 3 phase transformer assembly. B1, 2, 3 mounted below SSRCP.



Solid State Time Delay

Accessories T, U, W Solid State Timers Adjustable in Seconds, Minutes and Hours (Plug-In Style).

To select a time unit, operate the pushbuttons of the rightmost thumbwheel switch until the desired time unit is shown in window. The time unit can be selected by pushing the plus (+) bottom button or the minus (-) top button. The desired time is specified by operating the three thumbwheel switches in the middle of the front panel.



Close Differential (ARSM) Relay Adjustment

The voltage points at which the relay operates are adjustable. When the relay pulls in, an audible click is noticeable, and the LED will come on.

Setting the Relay:

If the relay should be set with a variable voltage supply (Variac):

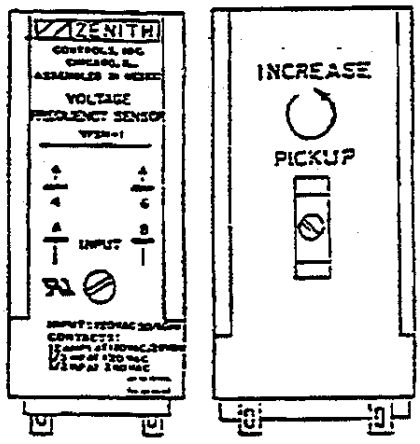
1. Turn pick-up control fully clockwise.
2. Turn drop-out control fully counterclockwise.
3. Set Variac pick-up voltage to desired level.
4. **Very slowly** rotate pick-up adjustment counterclockwise until relay picks up. (LED will energize).
5. Set Variac drop-out voltage to desired level.
6. **Very slowly** rotate drop-out adjustment clockwise until relay drops out (LED de-energizes).

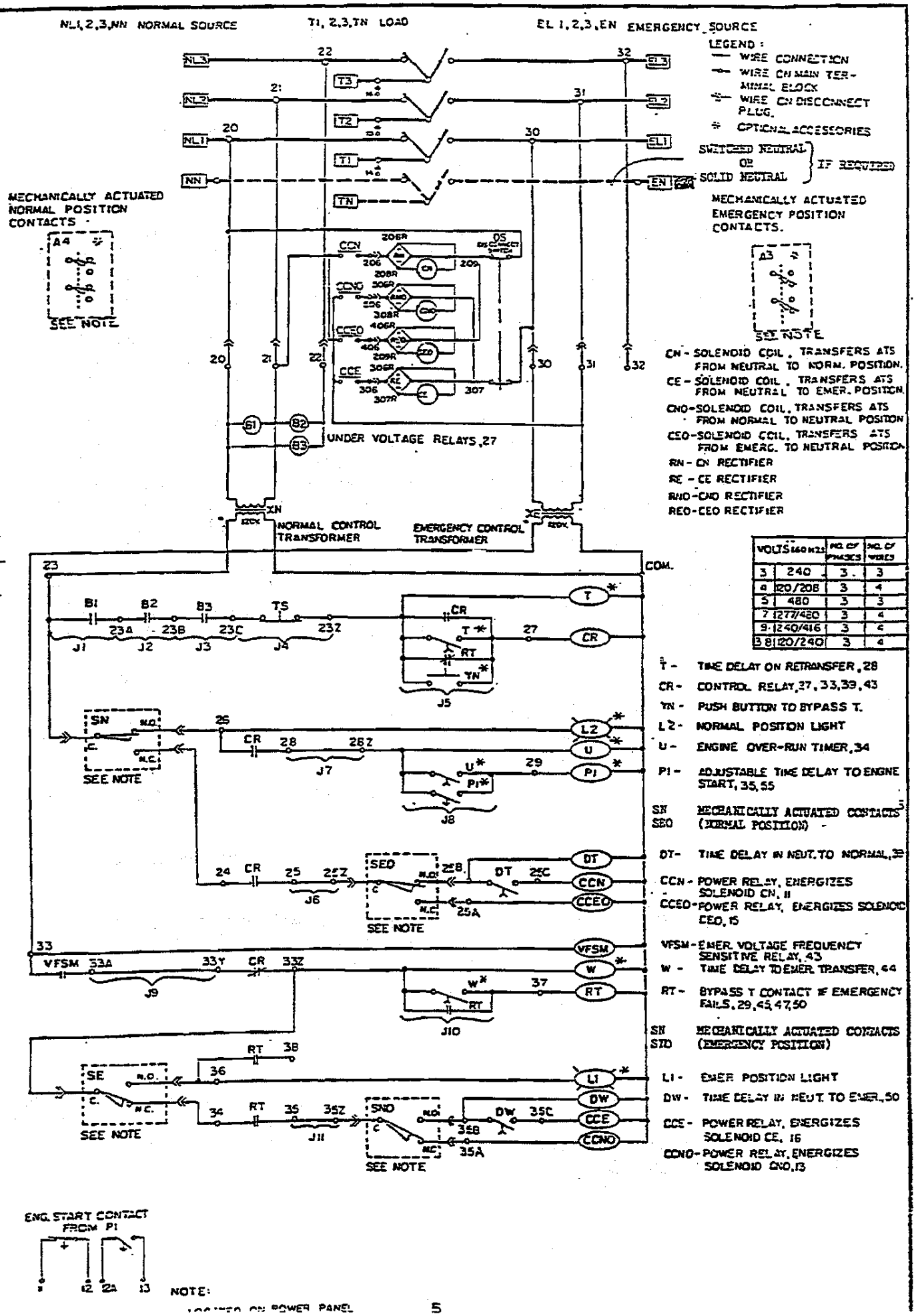
Verify settings by raising voltage until relay picks up, then lower voltage until relay drops out, making sure that relay operates at desired voltage levels.

VOLTAGE/FREQUENCY SENSOR (VFSM) ADJUSTMENT

The pickup point may be adjusted between 80-95% of rated voltage by rotating the offset screw located on the back of the relay.

Counter-clockwise rotation increases pickup voltage. Clockwise rotation decreases pickup voltage.





VOLTS (60 HZ)		NO. OF PHASES	NO. OF WIRES
3	240	3	3
4	120/208	3	4
5	480	3	3
7	277/480	3	4
9	240/416	3	4
8	120/240	3	4

OPERATION OF AUTOMATIC TRANSFER SWITCH

OPERATION:

When the normal line (NL) falls to the preset dropout point, or if any normal phase fails, the phase relay(s) (adjustable) will drop out disconnecting the CR and signaling the generator to start.

When emergency line (EL) voltage and frequency reach at least 90% of rated value, the VFSM relay is energized. The RT relay is now energized to operate the CCNO relay through the CNO cutout switch causing the main transfer coil CNO to operate. The load is now transferred to the OPEN position. The SNO limit switch operates to disconnect the CCNO relay and CNO transfer coil. The transfer switch is now locked mechanically open. SNO is now activated. This energizes the DW timer. After time setting has lapsed, DW will energize CCE, which will energize main transfer coil CE. The load is now transferred to the emergency line supply. The SE limit switch operates to disconnect the CCE relay and CE main transfer coil. The transfer switch is now locked mechanically in Emergency position.

When the normal line voltage restores to the preset value, the phase relay(s) (B1,2,3) operate to energize the normal restoration timer T. After the time setting has lapsed, the timer contact closes to energize CR relay. The CCEO relay is now energized through the SN and SEO limit switches, causing the main transfer coil CEO to operate. The load is now transferred back to OPEN position. The SEO limit switch operates to disconnect the CCEO relay and CEO transfer coil. The transfer switch is now locked mechanically open. SEO is now activated, energizing DT timer. After time setting has lapsed, DT will energize CCN which will energize main transfer coil CN. The load is now transferred to the normal line supply. The SN limit switch operates to disconnect the CCN relay and CN main transfer coil. The transfer switch is now locked into normal position.

INSPECTION

CONTACTS - The movable and stationary contacts are a vital part of the ATS and must be kept clean. To inspect the ATS contacts, disconnect all power sources. Examine the contacts.

Any surface deposits must be removed with a clean cloth (DO NOT USE EMERY CLOTH OR A FILE).

After the movable and stationary contacts are wiped clean (no discoloration or deposits), reconnect power source.

CURRENT CARRYING PARTS - An easily detected but abnormal condition is the discoloration of current carrying parts (particularly copper). Discoloration appears as darkened material or finishes. Any discolored parts should be cleaned. WARNING: ANY MAINTENANCE SHOULD ONLY BE DONE WHILE THE POWER IS OFF. If the discoloration persists, contact the factory.

LUBRICATION

The cams of the ATS are lubricated with Super Lube PTFE grease, the gears with Dow Chemicals "Molykote" (321R or GN paste). These lubricants provide adequate lubrication for a clean and properly maintained swithces lifetime. Should debris contaminate the mechanism, clean and apply additional lubricants. Mobiltemp SHC-32 is used on isolating contacts.

FIELD NOTES

MODEL NO: _____

SERIAL NO: _____

DATE SHIPPED: _____

START-UP DATE: _____

DRAWINGS SUPPLIED: _____

_____

TEST AND MAINTENANCE NOTES:

DATE	TESTED	OBSERVATIONS	NOTES

PURPOSE

Zenith automatic transfer switches are used to provide a continuous source of voltage for lighting and power circuits by automatically transferring the lighting or power load from the normal source to an emergency source of voltage when the normal voltage fails or drops in voltage.

This manual is supplied to provide complete information on the operation, installation and maintenance of the ZENITH ZTSDH series mechanically held transfer switch. In addition a complete wiring diagram is provided with each transfer switch. The instruction manual and the wiring diagram should be kept in a safe place to serve as complete reference information on this critically important piece of equipment.

Described in this manual, are the new ZTSDH series, 1600 thru 3000 ampere sizes, featuring a new concept in transfer switch design.

For details of operation, accessories, and wiring see wiring diagram and operational sheet supplied with the switch.

WARNING

The power voltage present in this equipment is dangerous to life. When operating or adjusting this equipment with doors open, special care must be taken to avoid contact with terminals carrying this voltage.

CONTACT REPLACEMENT

Contact replacement is usually not necessary for many years on the average transfer switch. When replacement is necessary, all contacts are easily removed. Both the main contacts and all control contacts are easily visible from the front of the panel, for fast visual inspection.

INSTALLATION

A good installation is as necessary as a good transfer switch. This switch is designed for floor mounting. Floor mounted cabinets must be well braced and protected from damage. Be sure that the cabinet is not mounted directly under any water pipes which may sweat and drip water into the cabinet. Be sure cabinet is fully cleaned of dirt and concrete dust before operation.

Enough room should always be allowed to open the cabinet doors fully, so normal visual inspection of all parts is possible.

Before installing the switch and before energizing the circuits, check the switch for shipping or installation damage.

The following may be used as a test procedure after installation of the transfer switch:

Before connecting the load circuit, make sure normal line contacts are closed, then energize the NL circuit. The phase relays and control relay will be energized. Next, energize the EL circuit. The VFSM relay will be energized. Operate the test switch TS to the test position. The switch will transfer to the EL side. Return the test switch to the auto position. The transfer switch will restore to the NL position. The load may now be connected and the same procedure followed. A periodic test of the switch, under load conditions, is recommended to insure proper operation of the main switch and all accessories.

CHECK LIST FOR START-UP

	NORMAL OPERATION	POINTS TO CHECK IF NORMAL OPERATION DOES NOT OCCUR
1	Normal line fails and the engine starts. (This can be simulated with the TEST switch).	If engine generator does not start be sure the relay containing the engine start contacts (marked E) has dropped out and the contacts are closed. Be sure the battery is connected and the control switch on the engine is turned to automatic. If the engine fires but does not start, contact the engine dealer.
2	Engine starts, generator reaches full voltage, switch transfers to emergency voltage.	Check at emergency line terminals of switch to be sure the generator voltage is up to the proper value. Be sure the VFSM relay pulls in. If not, check VFSM relay adjustment page 4. Check to see that the RT relay is energized. Check to see that the circuit to the CCNO coil (to open Normal), then CCE coil (to close Emergency) is complete thru the SE cutout switch.
3	Normal voltage restores and the switch transfers back to normal.	Check to see that the normal voltage has restored to full value. Check to see that the phase relays have pulled in. (See phase relay adjustment page 4. Check the CR relay to be sure that it is energized and its normal contact is closed. Check to see that the circuit to the CCEO coil (to open Emergency), then CCN coil (to close Normal) is complete thru the SN cutout switch.
4	Engine shuts down.	Be sure voltage is present at relay containing E contact and the relay is energized. If timer U is used be sure it times out and operates its end-of-cycle switch.

ZBTSH SERIES
BYPASS/ISOLATION/TRANSFER SWITCH OPERATION
600-1200 AMP

OPERATION: BYPASS/ISOLATION SWITCH

AUTOMATIC

1. Manually operated Bypass Switch contacts (BN/BE) are open and ATS is supplying load.
2. Disconnect Switch (DS) is in "AUTO".

TO BYPASS ATS

1. Open bottom cabinet door and turn DS to "INHIBIT".
2. Turn Bypass Selector Switch (BSS) to same power source as ATS.
3. Move the Manual Bypass Handle (MBH) upward.

TO TEST ATS

1. Bypass per above instructions.
2. Rotate crank mechanism counterclockwise until ATS TEST light is illuminated.
3. Turn DS to "AUTO".
4. Test Switch (TS) on bottom cabinet door will allow electrical operation of ATS.

TO ISOLATE ATS

1. Bypass per above instructions.
2. Rotate crank mechanism counterclockwise until ATS ISOLATED light is illuminated.

TO REMOVE ATS

1. Bypass and isolate per above instructions.
2. Disconnect multipin plugs and external connections to ATS.
3. Rotate four power panel latches to vertical position, slide ATS forward & lock mechanism in place.
4. ATS can now be removed from cabinet.

TO RECONNECT ATS

1. Place ATS in slide mechanism.
2. Unlock slide mechanism. Slide ATS over power panel latches and rotate latches to horizontal position.
3. Turn DS Switch to "INHIBIT".
4. Manually position ATS into same source as Bypass Switch.
5. Reconnect multipin plugs and external connections to ATS.
6. Rotate crank mechanism clockwise until ATS TEST light is illuminated.
7. Turn DS Switch to "AUTO" and use TS to electrically operate ATS.
8. Turn DS to "INHIBIT".
9. Rotate crank mechanism clockwise until ATS location pointer is aligned with "AUTO" mark on location indicator. (ATS must be in same source as Bypass).
10. Turn DS to "AUTO" and open Bypass with MBH.
11. ATS is now fully automatic (Figure 1).

NOTES:

1. DS in "INHIBIT" will prevent ATS electrical operation.
2. DO NOT use excessive force on mechanical handles.
3. Above Figures depict Bypass NORMAL. Sequence is same for Bypass EMERGENCY.
4. When ATS is in TEST or ISOLATE, Bypass Switch is a manual transfer switch to either available source. (Indicated on light panel).
5. To operate Bypass Switch when ATS is in TEST or ISOLATE:
   a) Move MBH downward (to open Bypass Contacts BN/BE).
   b) Turn BSS to opposite power source.
   c) Move MBH upward to close into selected power source.

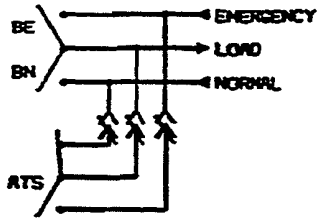


FIG. 1 BP IS OPEN WITH ATS IN NORMAL

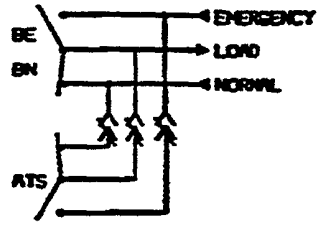


FIG. 2 BP IN NORMAL WITH ATS IN NORMAL

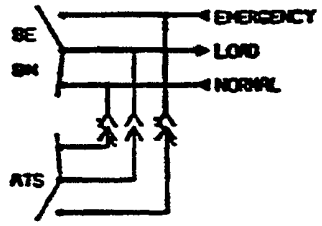


FIG. 3 BP IN NORMAL WITH ATS IN TEST (LOAD CONNECTIONS ARE OPEN)

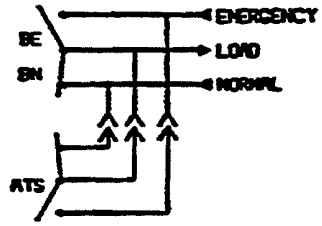


FIG. 4 BP IN NORMAL WITH ATS ISOLATED

NOTES:
1. BP—Bypass switch (indicated by contacts BN/BE) is a 3 position switch.
2. ATS—Automatic Transfer Switch

CONTROLLED

REVISIONS:	MODEL: ZBTSH60/120 (600-1200 AMPS)		ZENITH CONTROLS, INC.
	DRFT: BRB	APP'D:	TITLE: BYPASS/ISOLATION TRANSFER SWITCH OPERATION
	DATE: 4/8/92	DWG DIR: ZE3	DRAWING NO.: 40R-0501 SHEET 1 OF 3 — REV
	SCALE:		

LEGEND: BYPASS/ISOLATION SWITCH (BP)

I. (BP) BYPASS/ISOLATION SWITCH: MECHANICAL COMPONENTS

N1,2,3,(N).....Normal Line connections
E1,2,3,(N).....Emergency Line connections
T1,2,3,(N).....Load Line connections
BE.....Bypass Emergency contacts
BN.....Bypass Normal contacts
BSS.....Bypass Selector Switch
MBH.....Manual Bypass Handle

II. (BP) BYPASS/ISOLATION: ELECTRICAL COMPONENTS

AA-1,2,3.....Limit switch held actuated in Auto location of ATS, Non-actuated Test and Isolated locations.
AB3-1,2,3,4.....Limit switch, actuated in Bypass Emergency position
AB4-1,2.....Limit switch, actuated in Bypass Normal position
ACU/ACD.....Limit Switch, actuated when crankhandle is engaged
AE-1,2.....Limit switch, switches Engine Start from ATS control to bypass control during ATS Isolate
AI-1,2,3.....Limit switch, actuated in Isolate location
AT-1,2.....Limit switch, actuated in Test location
ATR.....Auto/Test Relay. Energized in AUTO and TEST locations
BR-1,2,3.....Bridge Rectifier
C.....Capacitor: RNH
CBC.....Crank Solenoid
CBE.....Emergency Bypass Permissive Solenoid
CBN.....Normal Bypass Permissive Solenoid
D1.....Diode
RNH.....Relay normally held, 24 VDC coil, 3PDT
R1.....Resistor: RNH
R2.....Resistor: LDS
XBE.....Emergency line control transformer
XBN.....Normal line control transformer

III. (BP) BYPASS/ISOLATION SWITCH: INDICATOR LIGHTS

LNA.....Normal available
LEA.....Emergency available
LBN(NOTE 1).....Bypass Normal (BN closed)
LBE(NOTE 1).....Bypass Emergency (BE closed)
LAT(NOTE 1).....ATS in Test location
LAI(NOTE 1).....ATS in Isolate location
LIT(NOTE 1).....ATS Inhibit
LDS(NOTE 1).....ATS DS switch in INHIBIT position

NOTES:
1. Indicator off during automatic operation of ATS.
2. Four pole includes neutral lugs.

CONTROLLED

REVISIONS:	MODEL: ZBTSH60/120 (600-1200 AMPS)		ZENITH CONTROLS, INC.
	DRFT: BRB	APP'D:	TITLE: BYPASS/ISOLATION SW. LEGEND
	DATE: 4/10/92	DWG DIR: ZE3	DRAWING NO.: 40R-0501 SHEET 2 OF 3 — REV
	SCALE:		

LEGEND & OPERATION: AUTOMATIC TRANSFER SWITCH (ATS)

A. LEGEND

B1,2,3.....Solid State Phase Relay(s)
Dropout _____%
Pickup _____%
CCE.....CE Control Relay, Emergency
CCN.....CN Control Relay, Normal
CE.....Emergency Main Transfer Operator
CN.....Normal Main Transfer Operator
CR.....Normal Control Relay
DS.....Disconnect Switch
E.....Engine Start Contact
GND.....Ground
NB.....Neutral Bar (if required)
RT.....Emergency Control Relay
SE.....Cutout Switch, Emergency
SE-2.....Aux. Cutout Switch, Emergency
SN.....Cutout Switch, Normal
SN-2.....Aux. Cutout Switch, Normal
TS.....Test Switch,Momentary,Not Keyed
VFSM.....Emergency Volt-Freq. Relay
Pickup {90% of rated Voltage, and 95% of rated Frequency
XE.....Control Transformer, Emergency
XN.....Control Transformer, Normal

B. OPERATION

When the Normal Line falls to the preset dropout point, the phase relays will dropout disconnecting the CR relay.

When the Emergency Line voltage & frequency reach the preset pick up point, the VFSM relay picks up. RT relay picks up to operate the CCE relay through the SE cutout switch causing the emergency main transfer operator CE to operate. The load is now transferred to the emergency line supply. The SE limit switch operates to disconnect the CCE relay and CE emergency main transfer operator. The transfer switch is now mechanically locked. Limit switch SN operates to complete the circuit for the next closing operation to Normal.

When the Normal Line voltage exceeds the preset pick up point, the phase relays B1, B2 & B3 pick up. CR relay picks up to operate the CCN relay through the SN cutout switch, causing the main transfer operator CN to operate. The load is now re-transferred back to the Normal line. The SN limit switch operates to disconnect the CCN relay and CN normal main transfer operator. The transfer switch is now mechanically locked. Limit switch SE operates to complete the circuit for the next closing operation to Emergency.

DS - Disconnect Switch
When the Disconnect Switch is placed in the INHIBIT position the circuit to the main transfer operators CN and CE is opened and transfer cannot take place.

TS - Test Switch
The Test Switch simulates a normal line failure when activated.
To test, activate the Test Switch allowing the transfer switch to transfer to the EMERGENCY position. De-activate the Test Switch. The transfer switch will reset to the NORMAL position. Testing at least once a month is recommended. For hospital emergency systems, test once a week.

NOTES:

1. ⚠ CAUTION: In using a 3 phase, 4 wire delta or open delta power supply (usually 120/240 volts, sometimes listed as 120/208 volts) with one leg having a grounded center tap, one line will be 160 to 208 volts to ground. When such a system is used it is necessary to connect the high leg to N2. DO NOT CONNECT 120 VOLT LOAD CIRCUIT TO THE HIGH LEG.
2. GROUNDING TERMINAL: A grounding terminal (GND) is provided. When installing open type switches connect this to the metal enclosure or conduit.
3. ⚠ WARNING - TO ENSURE AGAINST SHOCK OR ACCIDENT HAZARD, DISCONNECT ALL SOURCES OF SUPPLY BEFORE SERVICING.
4. ON SINGLE PHASE UNITS WHERE THE EMERGENCY SOURCE IS A UTILITY LINE, CONNECT EMERGENCY LINE SO THAT MINIMUM VOLTAGE IS MEASURED FROM N1 TO E1.
5. ON SINGLE PHASE (2 POLE) UNITS, CENTER POLE AND PHASE RELAYS (B2,B3) ARE NOT SUPPLIED.

CONTROLLED

ECN S-5004: 8-7-92

ZENITH CONTROLS, INC.

TITLE: ATS LEGEND & OPERATION

DRAWING NO.: 40R-0501 SHEET 3 OF 3 | REV —

ACCESSORIES

The ZTS series switches are wired so that accessories can be easily added to the switch. The following is a description of the basic accessories. Those checked are supplied on this unit, see additional pages for complete legend & operation.

☐ A1 Auxiliary contact, S.P.D.T., operates on normal line failure.

☐ A1E Auxiliary contact, S.P.D.T., operates on emergency line failure.

☐ A3 Auxiliary contact closes when the transfer switch is in the Emergency position.

☐ A4 Auxiliary contact closes when the transfer switch is in Normal position.

☐ A6 Motor Disconnect. To de–energize external motor control circuit 5 seconds (adjustable) prior to transfer in either direction.

☐ C Plant Exercisor. Automatically starts generator for selected time intervals.

☐ C/D Plant Exercisor. Automatically starts generator to run unloaded or simulate a power failure and starts generator to run under load.

☐ E Engine Start Contact: 1 Normally Open
1 Normally Closed.

☐ F Auxiliary Fan Contact, S.P.N.O. Closes when generator is running.

☐ H Time delay to engine start, non–adjustable. Factory set 1 or 3 seconds. When the Normal line fails the relay de–energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ J1 Adjustable under frequency sensor.

☐ J2 Adjustable over/under frequency sensor.

☐ K Frequency meter to indicate load frequency.

☐ L1 Pilot Light. Switch in Emergency Position.

☐ L2 Pilot Light. Switch in Normal Position.

☐ L3 Pilot Light. Normal source available.

☐ L4 Pilot Light. Emergency source available.

☐ M1 Ammeter; Single phase.

☐ M2 Ammeter; Three phase

☐ M3 Voltmeter; Single phase.

☐ M4 Voltmeter; Three phase.

☐ P1 Time Delay to Engine Start (solid state). Adjustable over time range .5 to 6 seconds. When the Normal line fails the relay de–energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ P2 Time Delay to Engine Start (Pneumatic). Adjustable over time range 1/6 to 300 seconds. When the Normal line fails, the relay de–energizes. After the set time delay its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ Q2 Connections for remote peak shave or area protection relays. Includes bypass for automatic return to Normal if Emergency line fails and Normal is present.

☐ R1 Solid State Adjustable Overvoltage Relay(s). Set at 110% of pickup, 105% of dropout of nominal Line rate, unless otherwise specified.

☐ R4 In–Phase monitor. Prevents transfer until two sources are in–phase. For use of isochronous governors.

☐ R43 In–phase monitor. Prevents transfer until two sources are in–phase. For use with mechanical. governors.

☐ S1 Four–position Engine Control Selector Switch. "STOP", "HAND CRANK", "TEST", "AUTOMATIC".

☐ T Time delay, re–transfer to Normal. When the Normal line restores and the phase relays operate, the T timer is energized. After the set time delay, its contacts close the circuit to the CR relay which operates to restore the load to the Normal line. RT relay is supplied to bypass T contacts if Emergency is de–energized during timing. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ T3 W3 Presignal auxiliary Contact, S.P.D.T: Operates 0–30 seconds (adjustable) prior to transfer in either direction.

☐ U Time delay, engine cool–down. When the transfer switch is restored to the Normal position and the engine is signaled to shut down, the U timer operates to maintain the engine start circuit closed. At the end of the set time, the engine contacts open to shut down the engine. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ W Time delay, transfer to Emergency. When the Normal line fails and the engine has started, the VFSM relay energizes. The W timer energizes. After the set time delay, its contacts close to energize the RT relay. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ YE Pushbutton, Transfer to Emergency. Provides manual control of transfer to emergency source. If time delay accessory W is supplied pushbutton bypasses time delay for immediate transfer; otherwise, transfer to emergency will be automatic after time delay. If time delay accessory W is not supplied, transfer will be non–automatic (by pushbutton only).

☐ YN Pushbutton, Retransfer to Normal. Provides manual control of retransfer to normal source. If time delay accessory T is supplied, pushbutton bypasses time delay for immediate retransfer; otherwise, retransfer to normal will be automatic after time delay. If time delay accessory T is not supplied, retransfer will be non–automatic (by pushbutton only).

☐ Other:_____

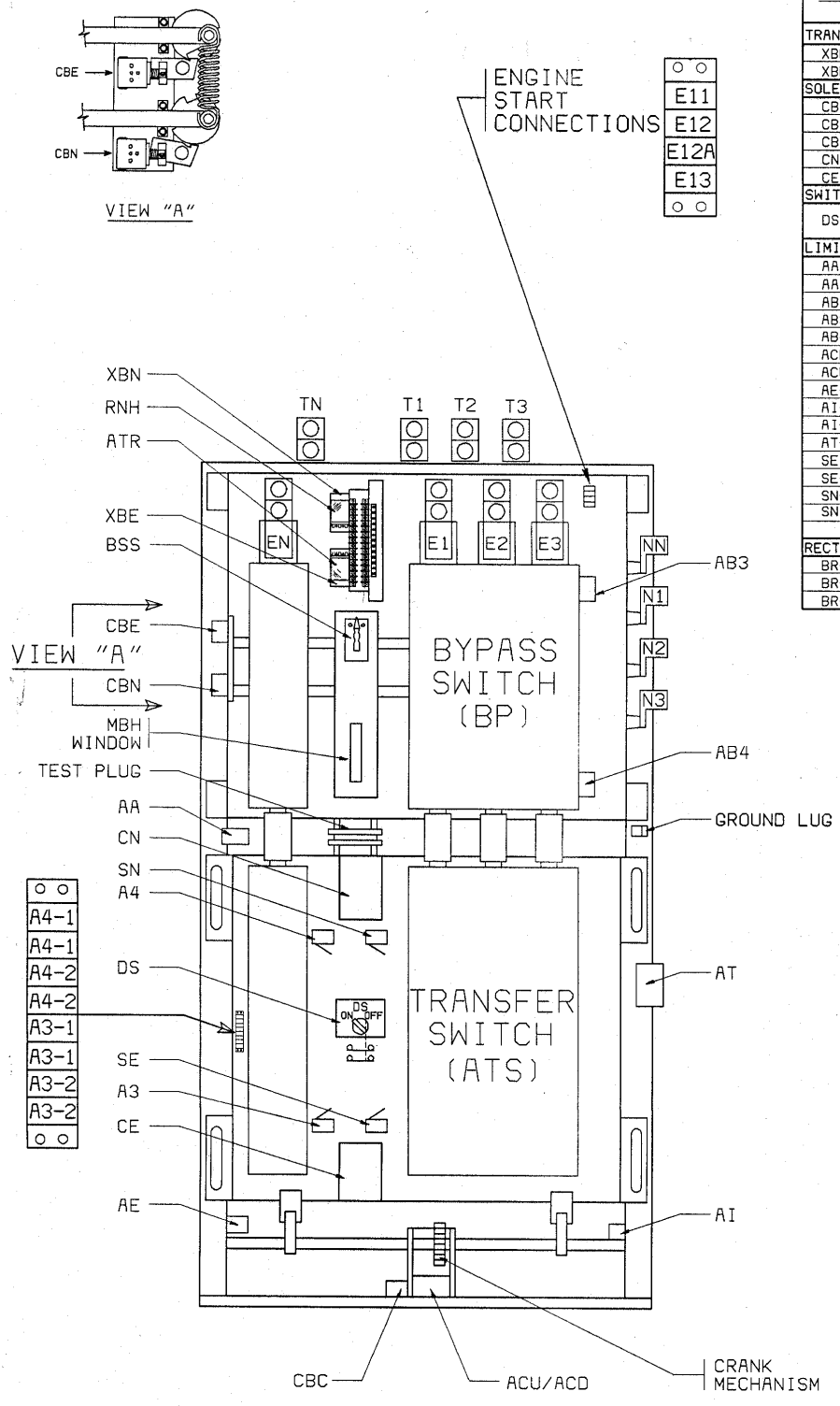
_____

_____

ZENITH® CONTROLS, INC.

TITLE: ACCESSORIES

DRAWING NO.: 40R–0900 — REV



DEVICE TAG	TERMINAL MARKINGS WIRE NUMBER					
TRANSFORMERS	X1	X2	H1	H2	H3	H4
XBE	53	54	50			51
XBN	43	44	40			41
SOLENOIDS	NO MARKINGS					
CBE	64		62			
CBN	63		62			
CBC	87A		81			
CN	206		209			
CE	306		307			
SWITCHES	NO		NC			
DS	80	82	20	209		
	80	90	30	307		
LIMIT SWITCHES	C	NC	NO	C	NC	NO
AA-1,2	60		61	62	82A	87
AA-3	87	92				
AB3-1,2	64		60	83A	83	86
AB3-3,4	E12		E11	E12A	12A	
AB4-1,2	63		61	80	83A	85
ACD	93		87A			
ACU	92		87A			
AE-1,2	E11	11	11R	E13	13	13R
AI-1,2	80		82A	80		89
AI-3	87	93				
AT-1,2	80		83	80		88
SE	33	34	36			
SE-2	86		87			
SN-2	85		87			
SN	23	24	26			
RECTIFIERS	AC	AC	+	-		
BR-1	43	44	80	60		
BR-2	53	54	80	61		
BR-3	60	61		81		

NOTES

REFER TO 40R-0501 FOR LEGEND & OPERATION. FOR MANUFACTURING: SEE PAGE 5 FOR CONTROL PANEL. SEE 40R-0900 FOR ACCESSORIES.

REVISIONS

REV	ECN NO.	DATE	DWN	ENG
D	S-7032	11/05/98	EC	SB

DWG TITLE: BP & ATS COMPONENT LOCATIONS

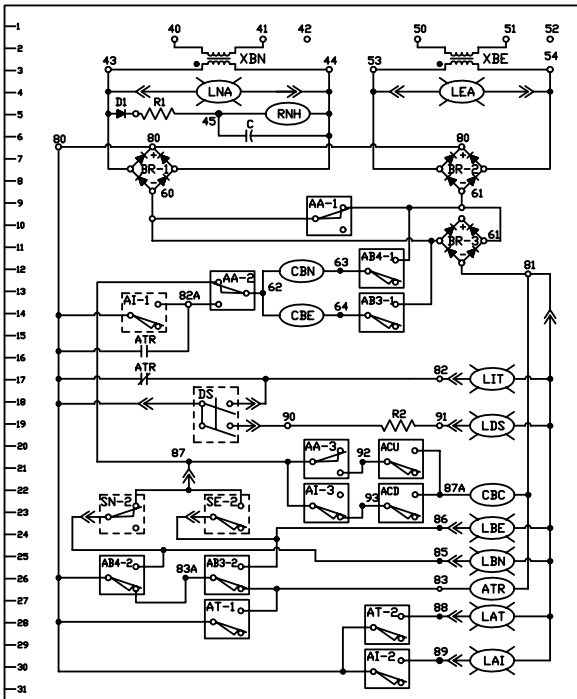
JOB/MODEL: ZBTSH60-120

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
SC	SB	S5K	N/A	46A-2000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
FHB	SB	07/22/94	N/A	1 OF 5	D

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.



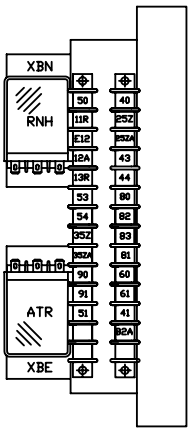
LNA - NORMAL AVAILABLE LIGHT
LEA - EMERGENCY AVAILABLE LIGHT
RNH - NORMAL VOLTAGE RELAY
D1 - DIODE
R1 - RESISTOR, RNH
C - CAPACITOR, RNH
BR-1,- BRIDGE RECTIFIER 2,3

AA-1 - LIMIT SWITCH, ATS AUTO LOCATION

AB4-1- LIMIT SWITCH, BYPASS NORMAL
CBN - NORMAL TRANSFER OPERATOR
AA-2 - LIMIT SWITCH, ATS IN AUTO
AB3-1- LIMIT SWITCH, BYPASS EMERGENCY
CBE - EMERGENCY TRANSFER OPERATOR

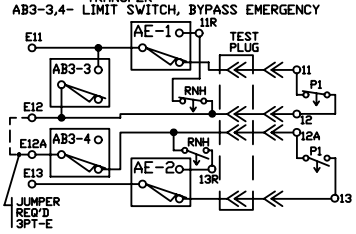
LIT - ATS INHIBIT LIGHT
AI-1 - LIMIT SWITCH, ATS IN ISOLATE
LDS - DISCONNECT SWITCH
DS - ATS DISCONNECT SWITCH
R2 - RESISTOR, LDS
AA-3 - LIMIT SWITCH, ATS IN AUTO
ACD - LIMIT SWITCH, CRANK HANDLE
ACU ENGAGED
AI-3 - LIMIT SWITCH, ATS IN ISOLATE
CBC - CRANK SOLENOID
LBE - BYPASS EMERGENCY
LBN - BYPASS NORMAL LIGHT
AB4-2- LIMIT SWITCH, BYPASS NORMAL
AB3-2- LIMIT SWITCH, BYPASS EMERGENCY
ATR - AUTO/TEST RELAY
AT-1 - LIMIT SWITCH, ATS TEST LOCATION
LAT - ATS TEST LOCATION
AT-2 - LIMIT SWITCH, ATS IN TEST
LAI - ATS ISOLATE LIGHT
AI-2 - LIMIT SWITCH, ATS IN ISOLATE

BYPASS SUBPANEL

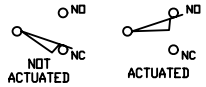


ENGINE START CIRCUIT

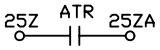
AE-1,2 - LIMIT SWITCH, ENGINE START TRANSFER
AB3-3,4- LIMIT SWITCH, BYPASS EMERGENCY



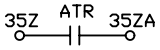
LIMIT SWITCHES



PERMIT CIRCUITS



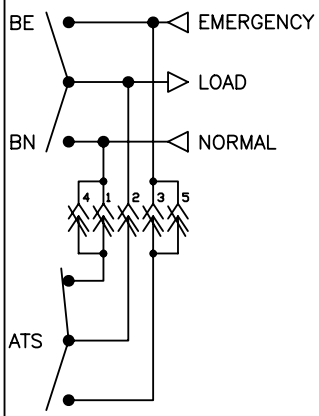
NORMAL TRANSFER PERMIT CIRCUIT IN AUTO AND TEST POSITIONS



EMERGENCY TRANSFER PERMIT CIRCUIT IN AUTO AND TEST POSITIONS

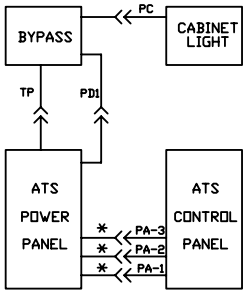
LIMIT SWITCH CHART

X = ACTUATED	ATS LOCATION				ATS MODE		BYPASS MODE		
	AUTO	TEST	ISO	REMOVE	NORM	EMERG.	NORM	EMERG.	OPEN
AA	X								
AT		X							
AI			X	X					
AE			X	X					
SN					X				
SE						X			
AB4							X		
AB3								X	



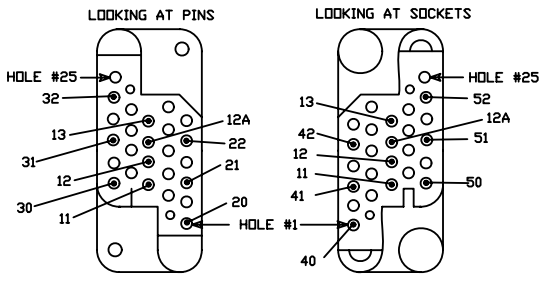
ATS LOCATION	LOAD CARRYING CONTACTS			ATS TEST PLUG (TP)	
	1	2	3	4	5
AUTO	X	X	X	X	X
TEST	O	O	O	X	X
ISOLATE	O	O	O	O	O

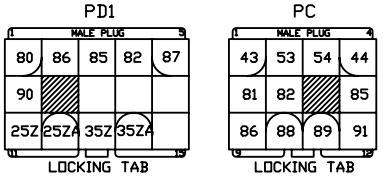
X = CLOSED
O = OPEN



* SEE ATS POWER CIRCUIT SCHEMATIC, LIGHTS AND PLUGS.

ATS TEST PLUG (TP)





NOTES

ATS SHOWN IN NORMAL POSITION, BYPASS OPEN WITH NO POWER AVAILABLE.

REVISIONS				
REV	ECN NO.	DATE	DWN	ENG
D	S-7032	11/05/98	EC	SB

DWG TITLE: BYPASS CNTL CIRCUIT SCHEMATIC, SUBPANEL & PLUGS
JOB/MODEL: ZBTSH60/120

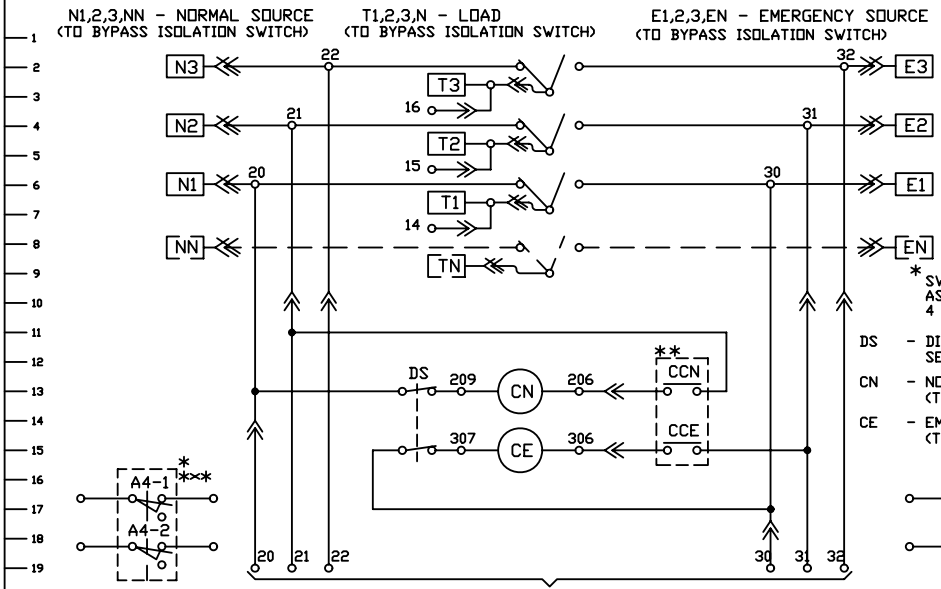
CHKD	APPD	CADD	ORDER NUMBER	DRAWING NUMBER
		S5K	N/A	46A-2000

DRWN	ENGR	DATE	SCALE	SHEET	REV
FHB	SB	07/22/94	N/A	2 OF 5	D

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

POWER CIRCUIT SCHEMATIC



TO CONTROL CIRCUIT SCHEMATIC - SHEET 4

VOLTAGE SYSTEMS

	VOLTS	NO. OF PHASES	NO. OF WIRES
-3	240V, 60HZ	3	3
-31	208, 60HZ	3	3
-38	120/240,60HZ	3	4
-4	120/208,60HZ	3	4
-5	480,60HZ	3	3
-7	277/480,60HZ	3	4
-9	240/416,60HZ	3	4
-91	220/380V,60HZ	3	4
-92	220/380V,50HZ	3	4

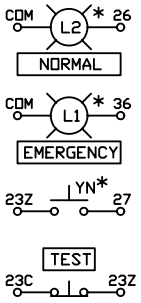
* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEMS.

DS - DISCONNECT SWITCH FOR SERVICING

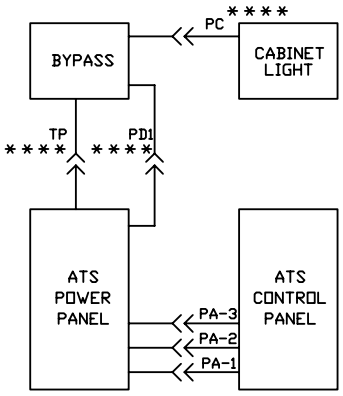
CN - NORMAL TRANSFER OPERATOR (TRANSFER TO NORMAL)

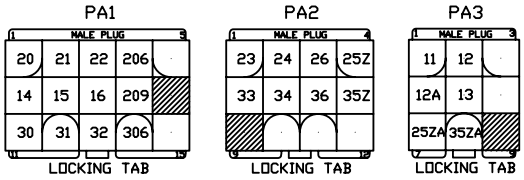
CE - EMERGENCY TRANSFER OPERATOR (TRANSFER TO EMERGENCY)

CABINET FRONT



INTERCONNECT PLUGS





LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —○— WIRE ON MAIN TERMINAL BLOCK ≫ WIRE IN DISCONNECT PLUG * OPTIONAL ** LOCATED ON CONTROL PANEL *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL **** SEE BYPASS CONTROL SUBPANEL AND PLUGS		1. ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE. 2. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3,A4,E,L1,L2,P,T,U,W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.

REVISIONS

REV	ECN NO.	DATE	DWN	ENG
D	S-7032	11/05/98	EC	SB

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: ATS POWER CIRCUIT SCHEMATIC, LIGHTS & PLUGS

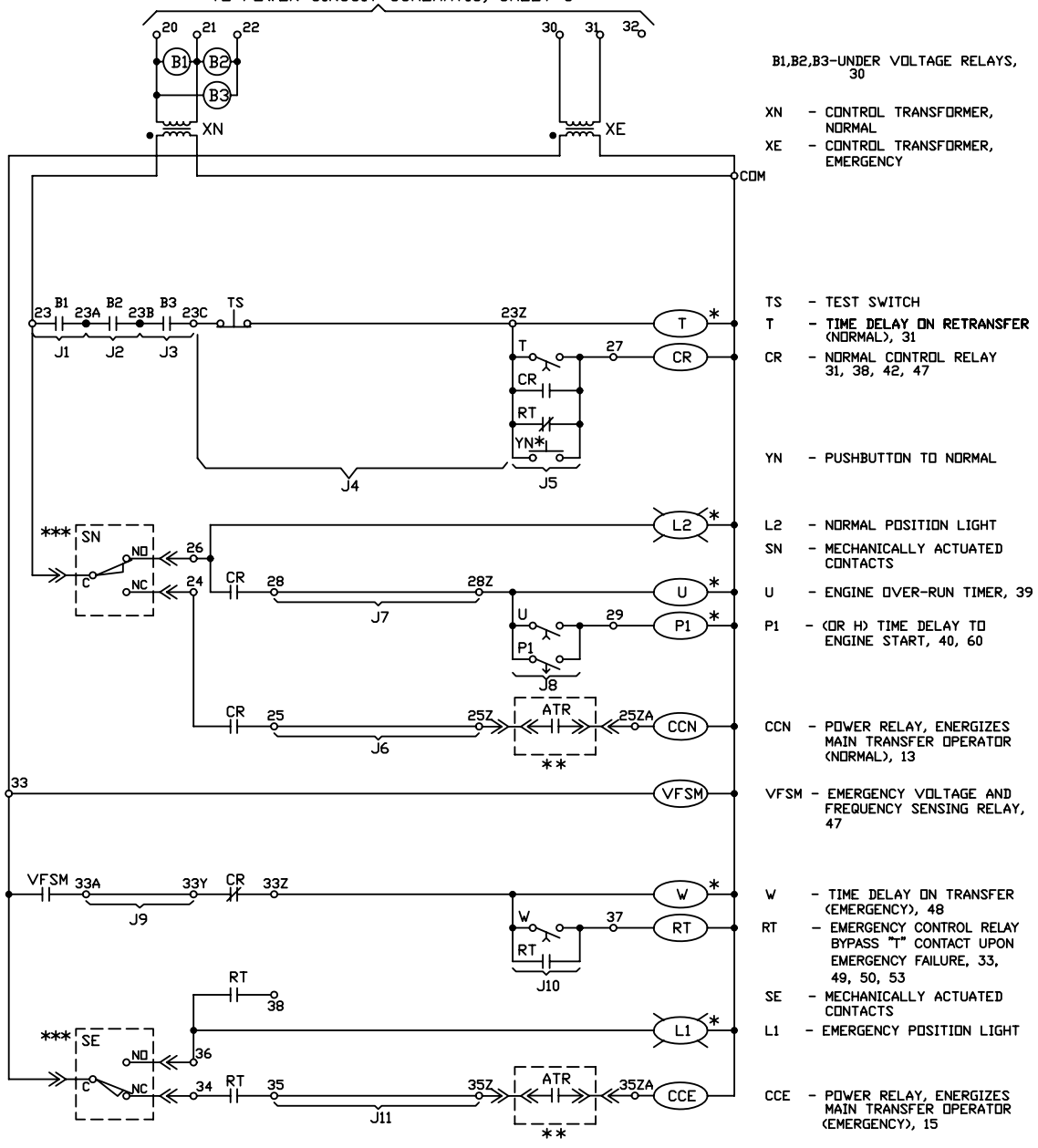
JOB/MODEL: ZBTSH60-120

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		S5K	N/A	46A-2000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
FHB	SB	07/22/94	N/A	3 OF 5	D

CONTROL CIRCUIT SCHEMATIC

TO POWER CIRCUIT SCHEMATIC, SHEET 3



B1,B2,B3-UNDER VOLTAGE RELAYS, 30

XN - CONTROL TRANSFORMER, NORMAL

XE - CONTROL TRANSFORMER, EMERGENCY

TS - TEST SWITCH

T - TIME DELAY ON RETRANSFER (NORMAL), 31

CR - NORMAL CONTROL RELAY 31, 38, 42, 47

YN - PUSHBUTTON TO NORMAL

L2 - NORMAL POSITION LIGHT

SN - MECHANICALLY ACTUATED CONTACTS

U - ENGINE OVER-RUN TIMER, 39

P1 - (OR H) TIME DELAY TO ENGINE START, 40, 60

CCN - POWER RELAY, ENERGIZES MAIN TRANSFER OPERATOR (NORMAL), 13

VFSM - EMERGENCY VOLTAGE AND FREQUENCY SENSING RELAY, 47

W - TIME DELAY ON TRANSFER (EMERGENCY), 48

RT - EMERGENCY CONTROL RELAY BYPASS "T" CONTACT UPON EMERGENCY FAILURE, 33, 49, 50, 53

SE - MECHANICALLY ACTUATED CONTACTS

L1 - EMERGENCY POSITION LIGHT

CCE - POWER RELAY, ENERGIZES MAIN TRANSFER OPERATOR (EMERGENCY), 15

CUSTOMER CONNECTIONS

A3,A4

SEE ATS POWER CIRCUIT SCHEMATIC & BP & ATS COMPONENT LOCATIONS

ENGINE START

SEE BP CONTROL CIRCUIT SCHEMATIC & BP & ATS COMPONENT LOCATIONS

CONTACT RATING		
RELAY	CONTACT	RATING
H	E	10AMP 28VDC
P1	E	10AMP 32VDC
	A3, A4	20AMP, 125, 250 VAC

JUMPER	CONNECT POINTS	REMOVE JUMPER WHEN ACCESSORIES USED
J1	23, 23A	B1
J2	23A, 23B	B2
J3	23B, 23C	B3
J4	23C, 23Z	J1N, TS, C/D
J5	23Z, 27	T, YN
J6	25, 25Z	T3, R4
J7	28, 28Z	C, C/D
J8	28Z, 29	P1, U
J9	33A, 33Y	J1E, ER1, 2, 3
J10	33Z, 37	W
J11	35, 35Z	W3, R4

LEGEND

- WIRE CONNECTION
- WIRE ON MAIN TERMINAL BLOCK
- WIRE IN DISCONNECT PLUG
- * OPTIONAL
- ** LOCATED ON BYPASS SUBPANEL
- *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL

NOTES

1. ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.
2. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3,A4,E,L1,L2,P, T,U,W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.

REVISIONS					
REV	ECN NO.	DATE	DWN	ENG
D	S-7032	11/05/98	EC	SB

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

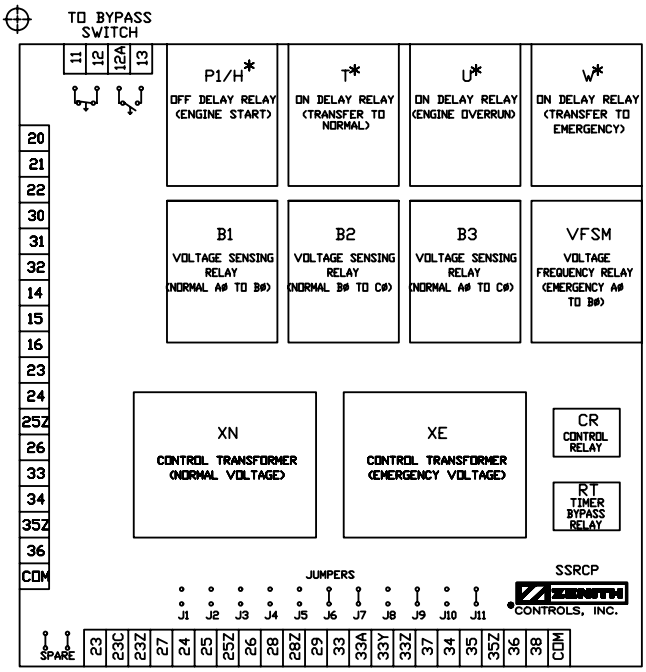
DWG TITLE: ATS CONTROL CIRCUIT SCHEMATIC

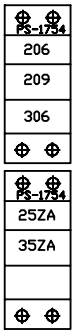
JOB/MODEL: ZBTSH60/120

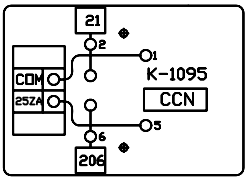
CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		S5K	N/A	46A-2000

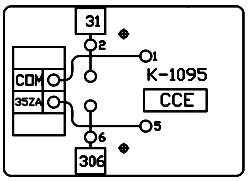
DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
FHB	SB	07/22/94	N/A	4 OF 5	D

CONTROL PANEL LAYOUT









(18" X 29")
(457mm X 737mm)

NOTES	REVISIONS					DWG TITLE: CONTROL PANEL LAYOUT							
1.DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3, A4, E, L1, L2, P, T, U, W AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES. 2. ◈ OPTIONAL	REV	ECN NO.	DATE	DWN	ENG	JOB/MODEL: ZBTSH60-120							
	D	S-7032	11/05/93	EC	SB	CHKD:	APPD:	CADD: S5K	ORDER NUMBER: N/A	DRAWING NUMBER: 46A-2000			
								DRWN: FHB	ENGR: SB	DATE: 07/22/94	SCALE: 1/2 : 1	SHEET: 5 OF 5	REV: D

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

ZENITH CONTROLS, INC.

46R-3000A
Revised March, 1996

OPERATION AND MAINTENANCE MANUAL

BYPASS/ ISOLATION TRANSFER SWITCH

ZBTSH SERIES 1600 THRU 3000 AMPS

MODEL NUMBER _____

SERIAL NUMBER _____

ZENITH CONTROLS, INC., 830 W. 40th St., Chicago, IL 60609
(312)247-6400: FAX. (312)247-7805

TABLE OF CONTENTS

Storage, Installation 1

Cabinet (exterior, front view) 2

Parts list (electrical) 3

Top and lower panels, front view.
Switch details 4

Bypass and ATS Power Panels — Parts list 5

Bypass and ATS Control Panel Layout 6

Bypass and ATS Control Panel — Parts list 7

Operation of Bypass/Isolation Switch 8

Definitions and Operation Notes 9

ZBTSH Operation, Maintenance 10, 11

Troubleshooting Decisions 12

ARSM and Timer Adj., Lubrication 13

Torque Requirements 14

Cabinet Dimensions 15

Control Disconnect Plugs 16

Field Notes 17

Bypass Control Panel Schematic Drawing 18

Typical Bypass and ATS Schematic Drawing 19

STORAGE

The ZBTSH should be stored in a clean dry area. AVOID STORAGE BENEATH STEAM OR WATER PIPES. Excessive moisture may damage the unit. The switch should only be stored on a level (horizontal) surface.

INSTALLATION

1. HANDLING

   CAUTION: Depending upon the model, a ZBTSH weighs between 3000-5000 pounds. Use adequate machinery and cables to handle the load.

2. EQUIPMENT PREPARATION

   a) Check nameplate to assure switch system voltage and amperage is correct. Any discrepancy should be immediately reported to a Zenith representative.

   b) Lock open breakers to Normal and Emergency lines.

3. CABINET PREPARATION

   a) A small amount of cabinet work is required before the cables are connected. Cover the switch and the controls to avoid metal fragments from entering mechanical and electrical componets. Visually verify that metal filings are removed from bus support. (Use vacuum if necessary).

   b) Standard cable entry is through the top or bottom of cabinet. Fig. 1 shows one suggested knockout. For a guide to assist in the hole layout, refer to Appendix A for determining appropriate knockout arrangement.

4. CABLE AND WIRE CONNECTIONS

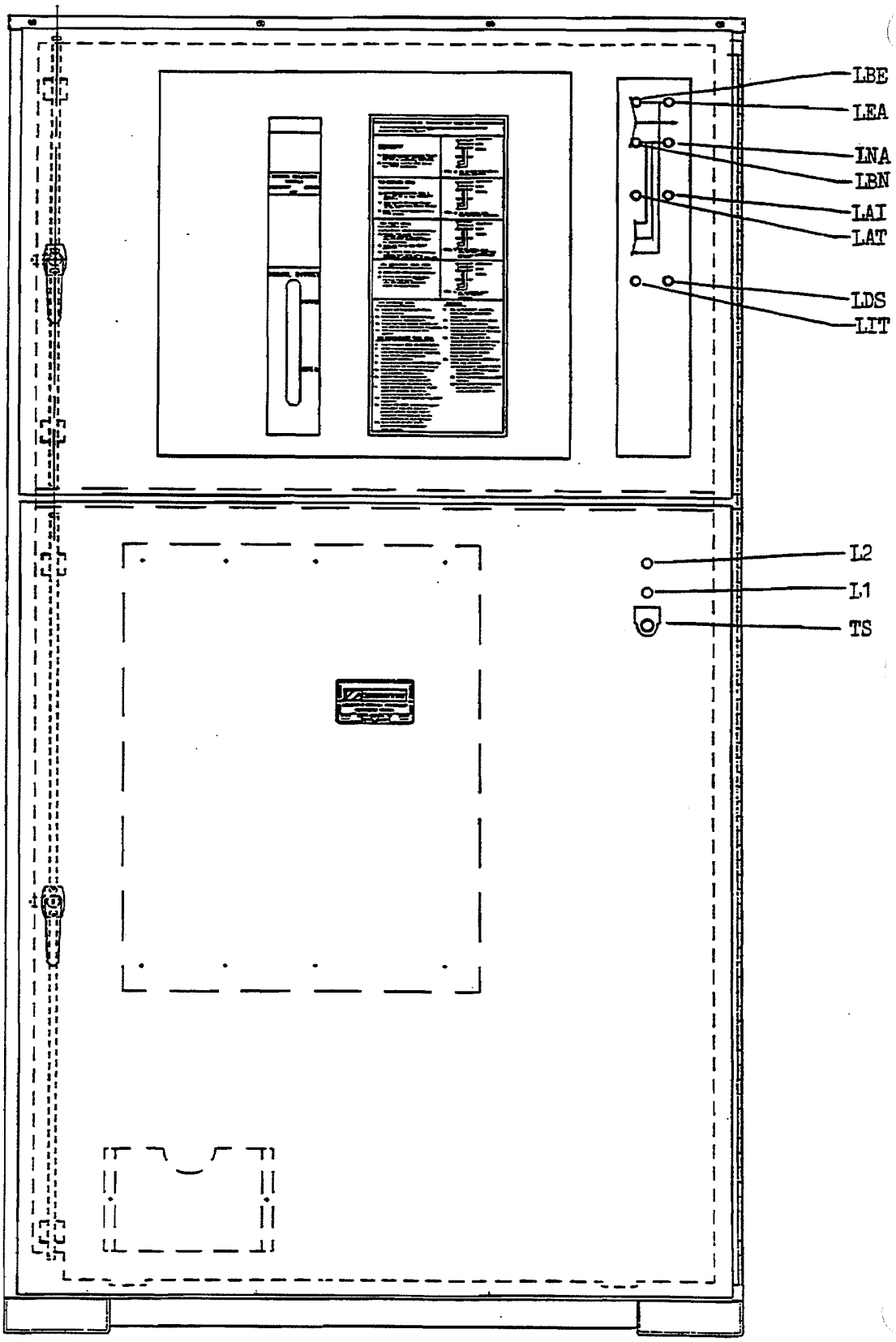
   a) To remove possible oxide, clean cable conductor with a wire brush and apply a contact oxide inhibitor. Insert cables into appropriate lugs.

   b) Connect all auxilliary wires for external electrical operation. Example: E-Start, remote alarm lights or buzzers, motor control contacts, etc. Allow enough slack in wires to allow movement of the ATS to Isolate Position.

5. PRIOR TO THE UNIT'S ENERGIZATION

   a) Remove any debris incurred due to installation (cut cable strands, metal filings, etc.)

   b) Inspect the unit and verify torque of cable and wire connections.


LBE
LEA
LNA
LBN
LAI
LAT
LDS
LIT
L2
L1
TS

EXAMPLE OF CABLE ENTRIES. TOP VIEW OF CABINET

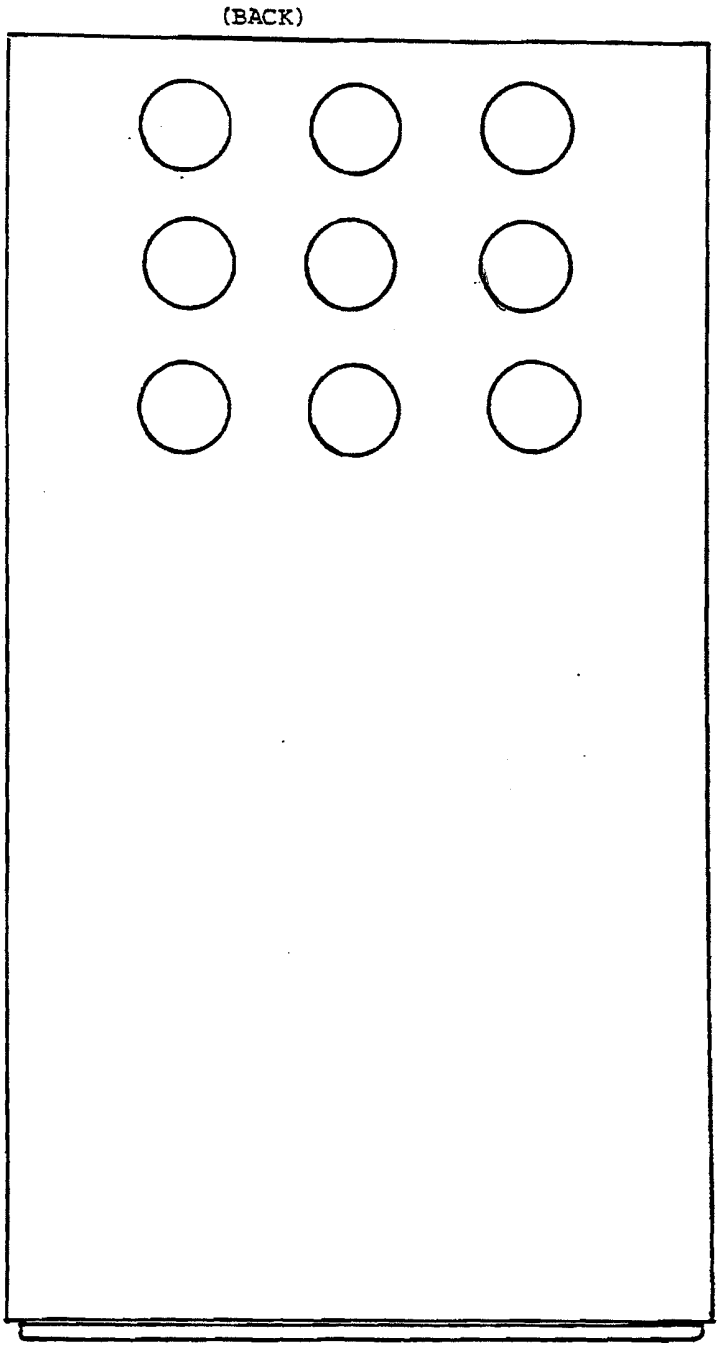
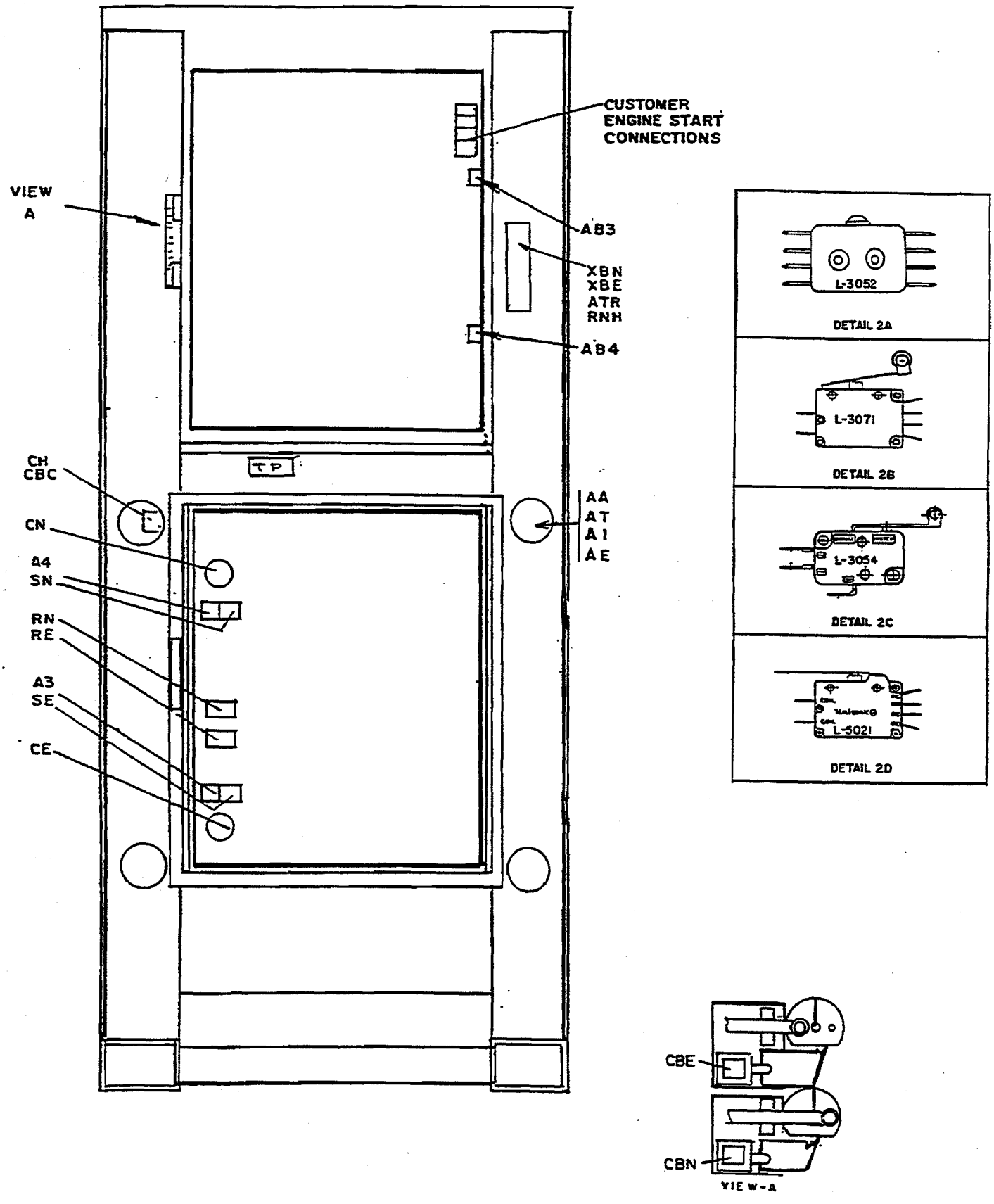


FIG. 1

A. CABINET ELECTRICAL PARTS

TAG	DESCRIPTION	PART NUMBER
LNA	Normal Available Indicator (G)	
LEA	Emergency Available Indicator (R)	
LBN	Bypass Normal Location Indicator (G)	
LBE	Bypass Emergency Location Indicator (R)	
LAT	ATS Test Position Indicator (A)	
LAI	ATS Isolate Position Indicator (A)	
LIT	ATS Inhibit Indicator (R)	
LDS	ATS Disconnect Switch "Off" Indicator (R)	
	Flashing Bulb	PS-1272
	COMMON PARTS BYPASS INDICATORS	
	Bulb	Y500005
	Socket	PS-5046
	Red Lens (R)	PS-5047
	Green Lens (G)	PS-5048
	Amber Lens (A)	PS-5049
L1	ATS Emergency Position Indicator	
L2	ATS Normal Position Indicator	
	Green Lens (Normal)	PS-5048
	Red Lens (Emergency)	PS-5047
	Bulb Socket	PS-5046
	Normal/ Emergency Nameplate	V-1502
	Emergency Bulb	PS-5105
	Normal Bulb	PS-5105
TS	Test Switch	
	Operator, Momentary	L-1025
	Contact Block N.C.	L-1029
	Name Plate	V-1503
	Contact Mounting Base	PS-3473


CUSTOMER
ENGINE START
CONNECTIONS
VIEW
A
AB3
XBN
XBE
ATR
RNH
AB4
TP
CH
CBC
CN
A4
SN
RN
RE
A3
SE
CE
AA
AT
A1
AE
L-3052
DETAIL 2A
L-3071
DETAIL 2B
L-3054
DETAIL 2C
L-5021
DETAIL 2D
CBE
CBN
VIEW-A

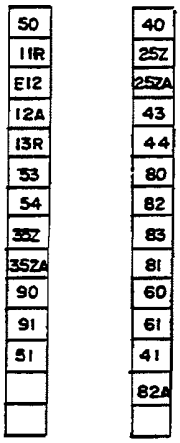
TAG	DESCRIPTION	PART NUMBER		
		STOCK NUMBER BY AMPERAGE		
		1600 A	2000 A	3000 A
NL1,2,3 EL1,2,3 T1,2,3	Cable Connection at Rear	S-1392F(2) OPTIONAL (8)600MCM-2	S-1392F(2) OPTIONAL (8)600MCM-2	S-1392F(2) OPTIONAL (8)600MCM-2
STAT(BP)	Stationary Contact Assembly(Bypass)	S-2308	S-2308	S-2343
STAT(ATS)	Stationary Contact Assembly (ATS)	S-2308	S-2308	S-2343
ARC	Arc Grid Assembly	23P-1171	23P-1171	23P-1171
MOV	Movable Contact Assembly	23P-1400	23P-1400	23P-1344

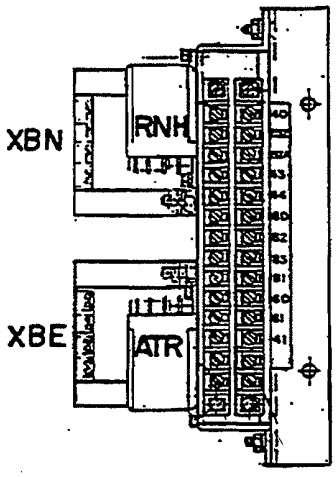
XBE,XBN	Bypass Step-Down Transformer 25VA Secondary 24V	VOLTAGE	PART NUMBER
		120/240 volts	K-3061
		208/416 volts	K-3063
		220/440 volts	K-3064
		240/480 volts	K-3062
		380 volts	K-3067
		575 volts	K-3065
		600 volts	K-3066

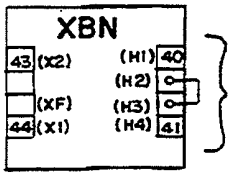
CN, CE	Main Operating Coils VOLTAGE SYSTEM							
No.	Volts	Ph	Wire	Coil Volts	Pole	1600A	2000A	3000A
-2	120%240	1	3	240	3	K-2123	K-2123	K-2123
-3	240	3	3	240	3	K-2123	K-2123	K-2123
			4		4	K-2127	K-2127	K-2127
-4	120/208	3	4	208	3	K-2125	K-2125	K-2125
					4	K-2128	K-2128	K-2128
-5	480	3	3	480	3	K-2120	K-2120	K-2120
-7	277/480	3	4	480	3	K-2120	K-2120	K-2120
					4	K-2130	K-2130	K-2130
-9	240/416	3	4	416	3	K-2126	K-2126	K-2126

SN	ATS Normal Position Coil Cutout Sw.	26P-1311
SE	ATS Emerg. Position Coil Cutout Sw.	26P-1312
A3	ATS Emergency Position Switch	23P-1352,1353,1354,1355
A4	ATS Normal Position Switch	23P-1356,1357,1358,1359
CH	Crank Handle Limit Switch	L-3052 (Detail 2A)
AA1,2,3,4	ATS Auto Location Switch	L-3071 (Detail 2b)
AE1,2	ATS Isolate/Remove Location Switch	L-3052 (Detail 2A)
AI1,2	ATS Isolate Location Switch	
AT1,2	ATS Test Location Switch	L-3071 (Detail 2b)
AB3/A	Bypass Emergency Position Switch	
AB4/A	Bypass Normal Position Switch	L-5021 (Detail 2d)
AL-1,2,3,4	ATS Latched Limit Switch	L-3054 (Detail 2c)
DS	ATS Solenoid Disconnect Switch Operator 2-Position Maintain Contact Block N.C. (1) Contact Block N.O. (2) Contact Block Mounting Plate	 L-4018 L-1029 L-1028 PS-3473
CBN, CBE	Bypass Interlock Solenoid	K-2192
CBC	Crank Enable Solenoid	K-2159R

C. BYPASS CONTROL PANEL

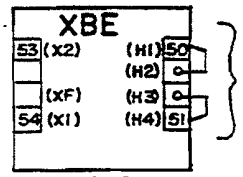






TYPICAL JUMPER WIRING FOR 416 480 VOLT SYSTE

NOTE: IF SYSTEM IS 416 OR 480 VOL WIRE TRANSFORMERS AS SHOWN ABOVE; SYSTEM IS 208 OR 240 VOLTS, WIRE TRANSFORMERS AS SHOWN BELOW.



TYPICAL JUMPER WIRING FOR 208 240 VOLT SYSTE

USE K-3062 FOR 240 & 480V SYSTEMS. USE K-3063 FOR 208 & 240V SYSTEMS

D. ATS CONTROL PANEL

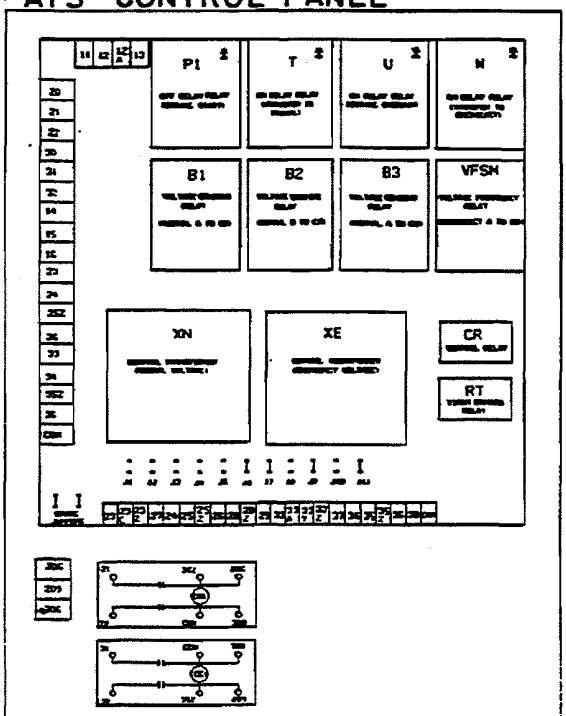


CHART 1

JUMPER	CONNECTS POINTS	REMOVE WHEN ACCESSORIES USI
J1	23,23A	B1
J2	23A,23B	B2
J3	23B,23C	B3
J4	23C,23Z	J1N,TS,C/D
J5	23Z,27	T,YN
J6	25,25Z	T3,R4
J7	28,28Z	S1,C,C/D
J8	28Z,29	P1 & U
J9	33A,33Y	ER1,2,3,J1E
J10	33Z,37	W
J11	35,35Z	R4,W3

C. BYPASS CONTROL PANEL (46P-1079) INCLUDES PARTS BELOW

TAG	DESCRIPTION	PART NUMBER
BR,1,2,3	Bridge Rectifier	PS-5076
RNH	Normal Voltage Relay	K-1218
R1	Resistor RNH, 30 ohm	PS-4056
R2	Resistor LDS, 120 ohm	PS-4057
D1	Diode	PS-4812
CA	Capacitor RNH	PS-4058
ATR	Auxiliary Test Relay	K-1218

D. ATS CONTROL PANEL (SSRCP) STANDARD ITEMS

TAG	DESCRIPTION	VOLTAGE 50/60 HZ	PART NUMBER
XN,XE	Control Transformers (see Note 1)	120 Volts	K-3076
		208 Volts	K-3070
		240 or 480 Volts	K-3071
		416 Volts	K-3089
B1,2,3	Phase Relays, Solid State (See Note 1)	120 Volts	K-1185
		208 or 240 Volts	K-1186
		480 Volts	K-1188
VFSM	Voltage Frequency Sensor	120VVolts	K-1192
CR	Control Relay	120 Volts	K-1204
RT	Bypass T Relay	120 Volts	K-1204
J1-J11	Jumpers		PS-5067
CCN/CCE	CN/CE Transfer Control Relays	120 Volts	K-1120

(OPTIONAL ITEMS)

TAG	DESCRIPTION	VOLTAGE	PART NUMBER	REPLACED BY
T	Time Delay to Normal, Timer Solid State .	120V .1 Sec. to 9990 Hrs. (Adj.)	OSA-A-T	OSA-A2-T
U	Engine Cool Down, Timer Solid State	120V .1 Sec. to 9990 Hrs. (Adj.)	OSA-A-U	OSA-A2-U
W	Time Delay Emergency, Timer Solid State	120V .1 Sec to 9990 Hrs. (Adj.)	OSA-A-W	OSA-A2-W
P1	Time Delay Engine Start, Timer	120V (.5 to 6 sec. Adjustable)	K-1201	
P2	Optional (Mounted below SSRCP)	120V (300 Sec. Adjustable)	K-1061	

Notes:

1. If -6 voltage system (575/600V) is supplied, then XN, XE is K-3087 and B1,2, 3 is K-1185 (120V) supplied with XB (575:600V/120V) 3 phase transformer assembly. B1, 2, 3 mounted below SSRCP.

BYPASS/AUTOMATIC TRANSFER SWITCH OPERATION

BP-BYPASS SWITCH INDICATED BY CONTACTS BN/BE IS A 3 POSITION SWITCH
ATS-AUTOMATIC TRANSFER SWITCH

AUTOMATIC

1. Manually operated Bypass Switch contacts (BN/BE) are open and the ATS is supplying the Load.
2. Disconnect switch (DS) is in the "AUTO" position.

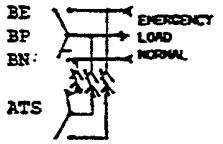


FIG. 1 BP IN OPEN WITH ATS IN NORMAL POSITION.

TO BYPASS ATS

1. Open bottom cabinet door & turn ATS DS to the "INHIBIT" position.
2. Turn Bypass Selector Switch (BSS) to the same Power Source as the ATS.
3. Move the Manual Bypass Handle (MBH) upward.

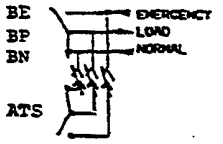


FIG. 2 BP IN NORMAL WITH ATS IN NORMAL POSITION.

TO TEST ATS

1. Bypass per above instructions.
2. Rotate the crank mechanism counter clockwise until the ATS TEST POSITION light is illuminated.
3. Turn the DS to the "AUTO" position.
4. Test Switch (TS) on the bottom cabinet door will allow electrical operation of the ATS.

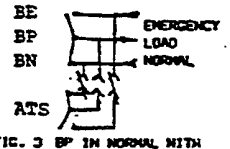


FIG. 3 BP IN NORMAL WITH ATS IN TEST LOCATION (ATS LOAD CONNECTIONS IS OPEN)

TO ISOLATE THE ATS

1. Bypass per above instructions.
2. Rotate the crank mechanism counter clockwise until the ATS ISOLATE POSITION light is illuminated.

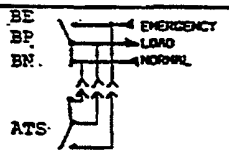


FIG. 4 BP IN NORMAL WITH ATS IN ISOLATE LOCATION

TO REMOVE ATS

1. Bypass and Isolate per above instructions.
2. Disconnect the multi-pin plugs and external connections.
3. Slide the four corner latches of the ATS to the innermost position.
4. ATS can now be removed from cabinet.

TO RECONNECT THE ATS

1. Roll the cart back in the cabinet
2. Slide the four corner latches of the ATS to the outermost position.
3. Turn the DS switch to the "INHIBIT" position.
4. Manually position the ATS into the same source as the Bypass Switch.
5. Re-connect the multi-pin plugs and external connections.
6. Rotate the crank mechanism clockwise until the ATS TEST POSITION light is illuminated.
7. Turn the DS switch to the "AUTO" position and use the TS to electrically operate the ATS.
8. Turn the DS switch to the "INHIBIT" position.
9. Rotate the crank mechanism clockwise until the ATS location pointer points to the "AUTO" location. (ATS must be in the same position as the Bypass.)
10. Turn the DS to the "AUTO" position & open the Bypass with the MBH.

NOTES:

1. DS in "INHIBIT" position will prevent electrical operation.
2. Do not use excessive force on mechanical handles.
3. Above figures depict Bypass NORMAL, Sequence is the same for Bypass EMERGENCY.
4. When ATS is in TEST or ISOLATE, Bypass Switch is a manual transfer switch to either available source. (opposite power source must be available).
5. To operate Bypass Switch in TEST and ISOLATE.
   a) Move manual Bypass Handle downward (to open Bypass contacts BN/BE).
   b) Turn BSS to opposite power source.
   c) Move Manual Bypass Handle upward to close into selected power source.

V-1587

DEFINITIONS:

BP - Bypass/Isolation Switch

It is a manually operated device used in conjunction with an Automatic Transfer Switch (ATS) to provide a means of directly connecting load conductors to a power source, and of disconnecting the Automatic Transfer Switch.

The BP can also be used as a Manual Transfer SWitch in the event of power failure while the ATS is in the TEST or ISOLATE positions.

ATS - Automatic Transfer Switch

Is a self-acting equipment for transferring one or more load conductor connections from one power source to another.

DS - Disconnect Switch

Inhibits operation of ATS Main Coils(CN-CE). In the "AUTO" position, the ATS operates normally. In the "INHIBIT" position the main coils (CN-CE) cannot be energized, and automatic transfer in either direction cannot take place.

BSS - Bypass Selector Switch

Selects position to bypass.

MBH - Manual Bypass Handle

Actuates the Bypass Operator
Down for Bypass Open
UP for bypass Normal and Bypass Emergency

TS - Test Switch

Simulates Normal Line failure when open.

OPERATION NOTES:

1. The ATS will not operate if:
   a) Harness plugs are not connected.
   b) DS is in the "INHIBIT" position.
   c) ATS is not in "AUTO" location with bypass switch open or ATS is not in "TEST".
   d) ATS is in "AUTO" location and BYPASS SWITCH is not open.
2. The MBH will not close the Bypass if:
   a) The BSS is turned to the opposite source that the ATS is in.
3. The MBH will not open the Bypass if:
   a) ATS is not engaged in one of the following; AUTO - TEST- ISOLATE.
   b) ATS is in "TEST" or "ISOLATE" location and the opposite source is not available.
4. The CH (CRANK HANDLE) will not operate if:
   a) BP and ATS are not positioned to same source.
   b) Power is not available.
   c) Harness Plugs are not connected.
   d) ATS has reached limit of travel to "AUTO" or "ISOLATE" (Clutch device on the crank mechanism slips.)

READ THE FOLLOWING PARAGRAPHS BEFORE PROCEEDING TO "TEST PROCEDURE". (THIS PROCEDURE IS ONLY TO BE PERFORMED BY AUTHORIZED PERSONNEL)

CAUTION:

Loads controlled by Bypass/Isolation Transfer Switch may cause PERSONAL INJURY by UNAUTHORIZED PERSONNEL operating or testing this equipment.

Check all wiring diagrams that have been supplied for added options that may affect external equipment: For example; Starting and Stopping of Elevators and Motors.

A 'Control Panel Test' or a test with the ATS in the TEST LOCATION runs the EMERGENCY SOURCE with no load. A no load operation may be detrimental to the engine, and the Engine/Generator Manufacturer should be consulted.

Allow sufficient time on the U timer for engine to safely cool down.

RECOMMENDED TIMER SETTINGS:

T — Restoration to Normal.....30 minutes (Factory set)
U — Engine Cooldown/Stop.....5 minutes (Factory set)
W— Engine Warmup .....5 seconds (Factory set)
P1—Engine Start .....3 seconds (Factory set)

TEST PROCEDURE

The ATS can be tested in either of two locations:

1). AUTO LOCATION
2). TEST LOCTION

1). "AUTO LOCATION":

Full Transfer Test — This test checks the complete operation of the ATS by transferring and and interrupting the load's power source from 'Normal' to 'Emergency'.

Depress TS (Test Switch) until Generator starts and the 'W' timer times out (timer will indicate ON). ATS will transfer to Emergency.

Release TS (this resets TS to AUTO). Normal restoration timer 'T' will time out (will indicate ON) which will energize the CR relay causing ATS to retransfer back to Normal.

Engine/Generator will shut down after timer U times out. Full Transfer Test is now complete.

2). "TEST LOCATION":

This procedure is recommended for Preventive Maintenance (PM) of ATS without interrupting the Load thru the BYPASS/ISOLATION SWITCH.

NOTE: TEST LOCATION is recommended after maintenance of ATS.

OPERATION OF AUTOMATIC TRANSFER SWITCH (ATS)

OPERATION OF ZENITH ACCESSORY MODULE 9

When the Normal Line (NL) voltage falls to the preset dropout point, or if any phase fails, the phase relays (B1,B2,B3) will dropout disconnecting the CR relay. This will de-energize the P1 timer. The P1 timer signals the generator to start.

When the Emergency Line (EL) voltage and frequency reach at least 90% of rated value, the VFSM relay will energize. The W timer then energizes. After the W timer times out the RT relay will now energize to operate the CCE relay thru the SE limit switch. The CCE then energizes the CE solenoids. The load is now transferred to the EL supply. The SE limit switch operates to disconnect the CCE relay and the CE solenoid. The ATS is now locked mechanically only. Limit switch SN operates to enable the next transfer back to Normal when NL returns. When NL returns B1, B2 and B3 pick-up to energize the T timer. After the set time delay the T timer contact closes to energize the CR relay. The CR relay will now operate the CCN relay thru the SN limit switch. The CCN energizes the CN solenoid. The load is now transferred to NL supply. The SN limit switch operates to disconnect the CCN relay and the CN solenoid. The ATS is now locked mechanically only. Limit Switch SE operates to enable the next transfer back to Emergency when NL fails.

MAINTENANCE

ELECTRICAL TEST:

The ATS may be electrically tested for preventative maintenance (refer to page 10, "Test Procedure"). After completion of an electrical test, the ATS should be returned to the Auto Operation Mode. If the ATS malfunctions, troubleshoot the switch, referring to page 12, and replace any faulty part(s) immediately.

INSPECTION

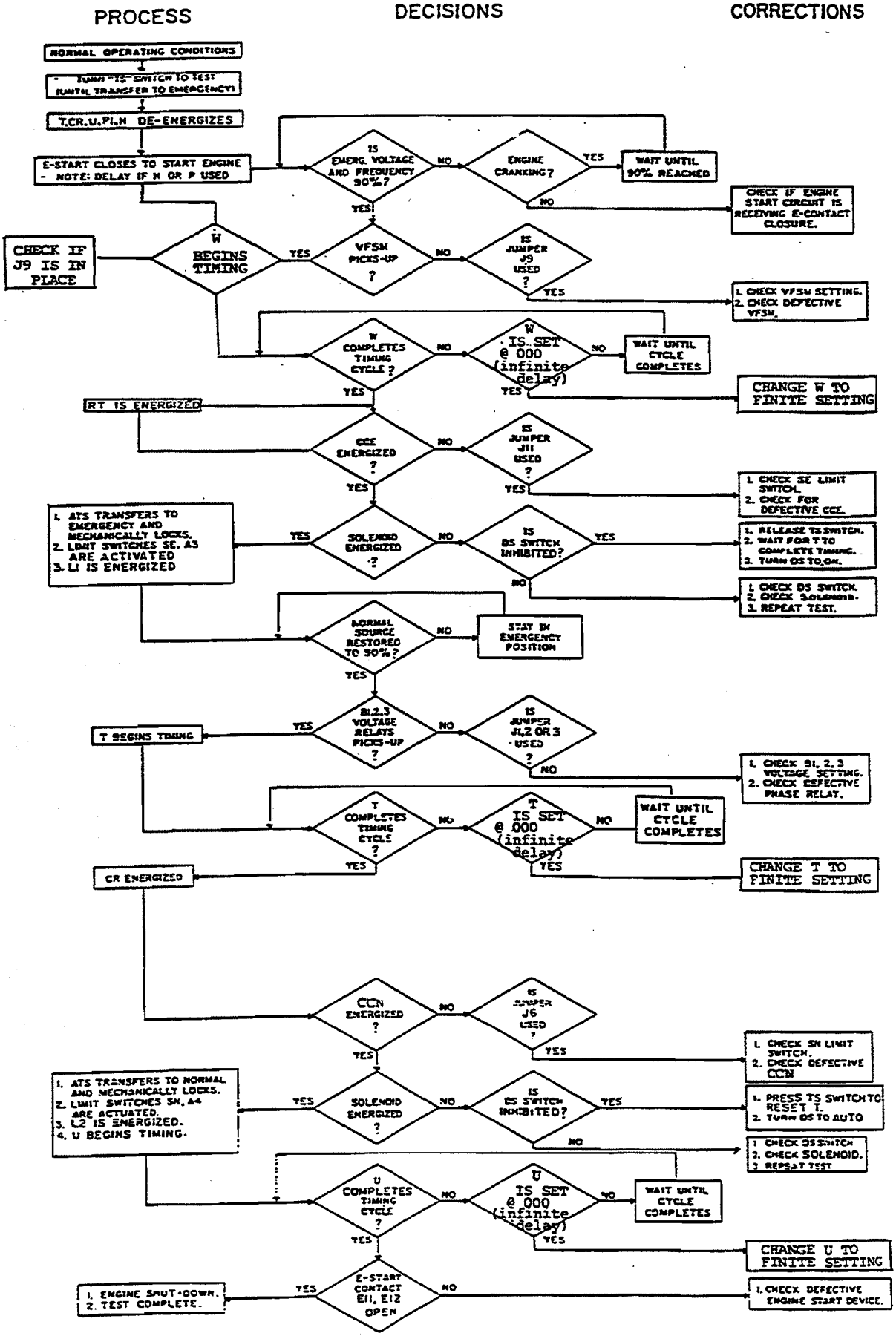
CONTACTS - The movable and stationary contacts are a vital part of the ZBTSH and must be kept clean. To inspect the ATS contacts, place ATS in Isolate location (see page 8). Examine the contacts.

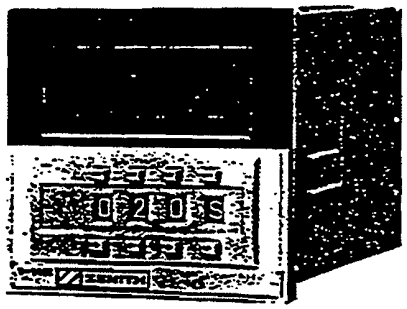
Any surface deposits must be removed with a clean cloth (DO NOT USE EMERY CLOTH OR A FILE).

After the movable and stationary contacts are wiped clean (no discoloration or deposits) return the ZBTSH to Auto Mode.

CURRENT CARRYING PARTS - An easily detected but abnormal condition is the discoloration of current carrying parts (particularly copper). Discoloration appears as darkened materials or finishes. Any discolored parts should be cleaned. WARNING: ANY MAINTENANCE SHOULD ONLY BE DONE WHILE THE POWER IS OFF! If the discoloration persists, consult the factory.

TABLE 3 "TROUBLE SHOOTING"





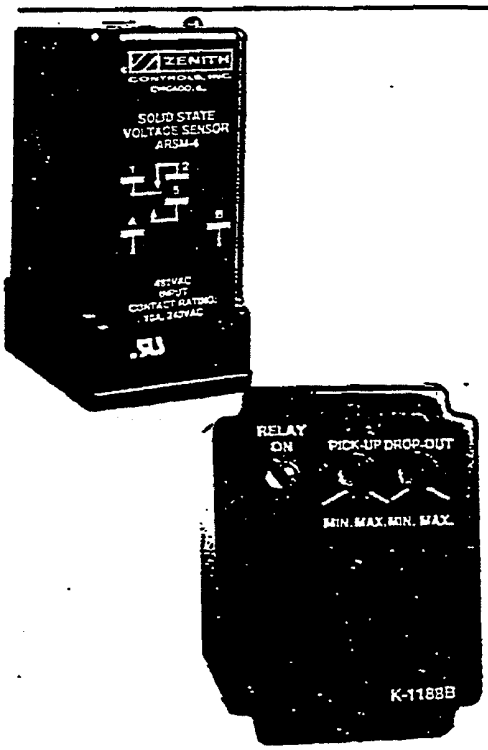
New Solid State Time Delay

Accessories T, U, W Solid State Timers Adjustable in Seconds, Minutes and Hours (Plug-In Style).

To select a time unit, operate the pushbuttons of the rightmost thumbwheel switch until the desired time unit is shown in window. The time unit can be selected by pushing the plus (+) bottom button or the minus (-) top button. The desired time is specified by operating the three thumbwheel switches in the middle of the front panel.

Setting of the timer at 000 will result in an infinite delay. The min. setting for OSA-A timers is $\frac{1}{10}$ of 1 second as shown. See instructions.

0	0	1	0.1 Sec.



Close Differential (ARSM) Relay Adjustment

The voltage points at which the relay operates are adjustable. When the relay pulls in, an audible click is heard, and the LED will come on.

Setting the Relay:

If the relay should be set with a variable voltage supply (Variac):

1. Turn pick-up control fully clockwise.
2. Turn drop-out control fully counterclockwise.
3. Set Variac pick-up voltage to desired level.
4. **Very** slowly rotate pick-up adjustment counterclockwise until relay picks up. (LED will energize).
5. Set Variac drop-out voltage to desired level.
6. **Very slowly** rotate drop-out adjustment clockwise until relay drops out (LED de-energizes).

Verify settings by raising voltage until relay picks up, then lower voltage until relay drops out, making sure that relay operates at desired voltage levels.

LUBRICATION

The cams and gears of the ZBTSH are lubricated with Dow Chemicals "Molykote" (321R or GN paste). These lubricants provide adequate lubrication for a clean and properly maintained switch's lifetime. Should debris contaminate the mechanism, clean and apply additional lubricants. Mobiltemp SHC-32 is used on isolating contacts.

LUBRICATION MAINTENANCE CHART

Date Inspected	Date Lubricated	Lubricant Used (Cams) (Gears)	Notes

TORQUE REQUIREMENTS FOR FIELD CONNECTIONS

NOTICE
TIGHTENING TORQUES FOR FIELD WIRING TERMINALS

Socket Size Across Flats, Inch	Tightening Torque Pound-Inches
1/8	45
5/32	100
3/16	120
7/32	150
1/4	200
5/16	275
3/8	375
1/2	500
9/16	600

TORQUE REQUIREMENTS FOR ELECTRICAL CONNECTIONS

All current carrying parts use compression washers and should be torqued to the values presented below. Caution: DO NOT OVERTORQUE WASHERS; follow the given torque values.

TORQUE REQUIREMENTS (inch - lb. except denoted by + are ft. - lb.)

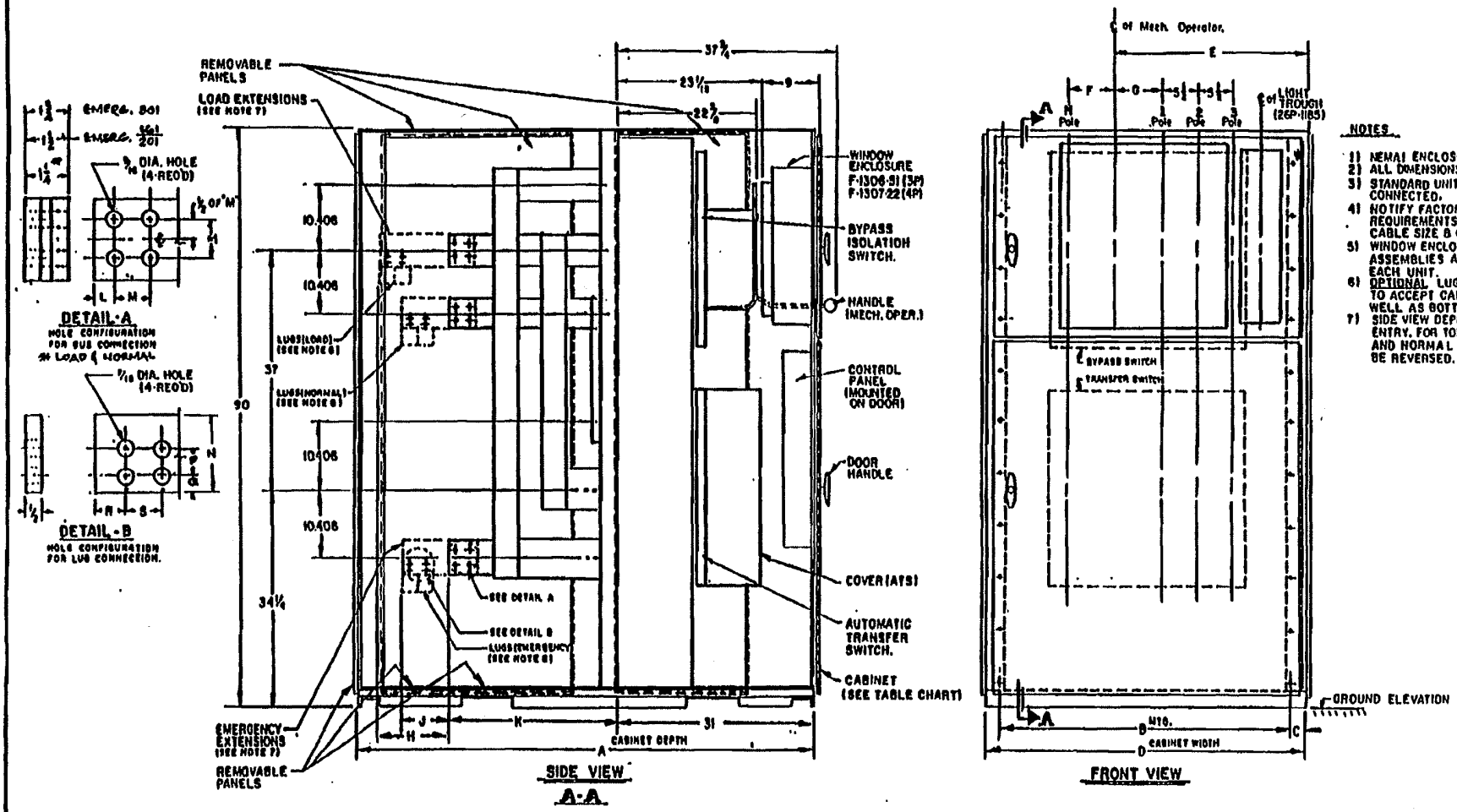
BOLT SIZE	GRADE 5	SOCKET HEAD	SET SCREW	COMPRESSION WASHERS	
				1	2
1/4 - 20	75	120	52	80	87
5/16 - 18	157	225	105	159	170
3/8 - 16	+23	412	165	+23	+26
1/2 - 13	+57	1030	386	+56	+59

WIRE CONNECTION TIGHTENING TORQUE

WIRE COND. SIZE AWG or MM	SCREW DRIVER TORQUE (inch - lb.)
18 - 16 AWG	19
14 - 8	19
6 - 4	36

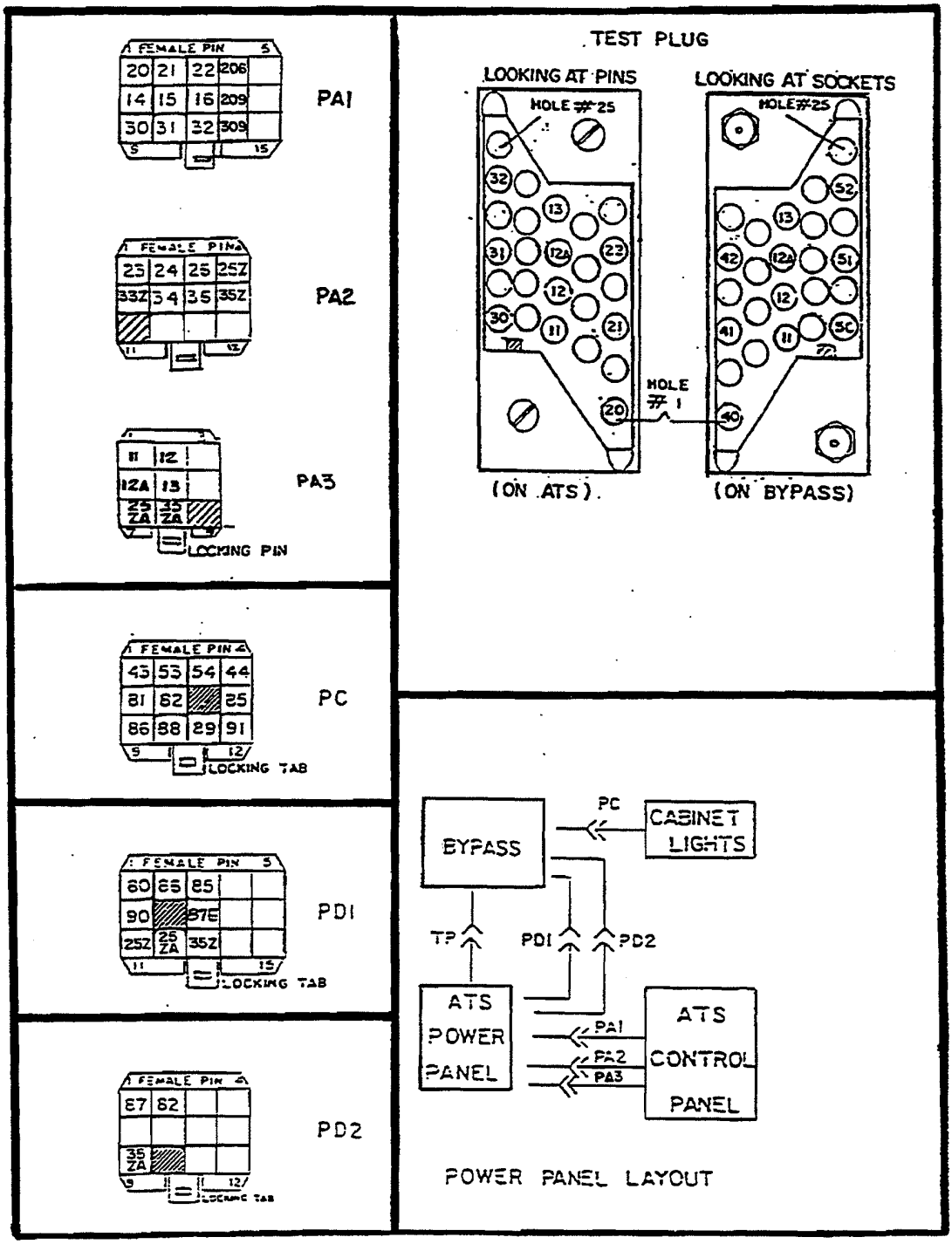
LUG BOLTING TORQUE

BOLT DIA. (inch)	TORQUE (ft. - lb.)
1/4 OR LESS	6
5/16	11
3/8	19
7/16	30
1/2	40
5/8 OR MORE	55



SWITCH, AMP, POLE	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S
ZBTSH 160-200A 3P	60	34 1/2	2 3/4	40	30 3/8	—	9 1/2	7 15/16	9 1/8	17 1/16	3/4	1 1/2	3	1 3/8	1/2	1 1/4	2 1/2
ZBTSH 160-200A 4P	60	44 1/4	2 3/8	50	30 3/8	7 5/8	7 5/8	7 15/16	9 1/8	17 1/16	3/4	1 1/2	3	1 3/8	1/2	1 1/4	2 1/2
ZBTSH 300A	72	34 1/2	2 3/4	40	30 3/8	—	9 1/2	9 5/16	9	26 15/16	1 1/8	2 3/4	3	1 3/8	9/16	1 1/4	2 1/2
ZBTSH 300	72	44 1/4	2 3/8	50	30 3/8	7 5/8	7 5/8	9 5/16	9	26 15/16	1 1/8	2 3/4		1 3/8	9/16	1 1/4	2 1/2

DISCONNECT PLUGS
ZBTSH 1600-3000 AMPS



FIELD NOTES

MODEL NO: _____

SERIAL NO: _____

DATE SHIPPED: _____

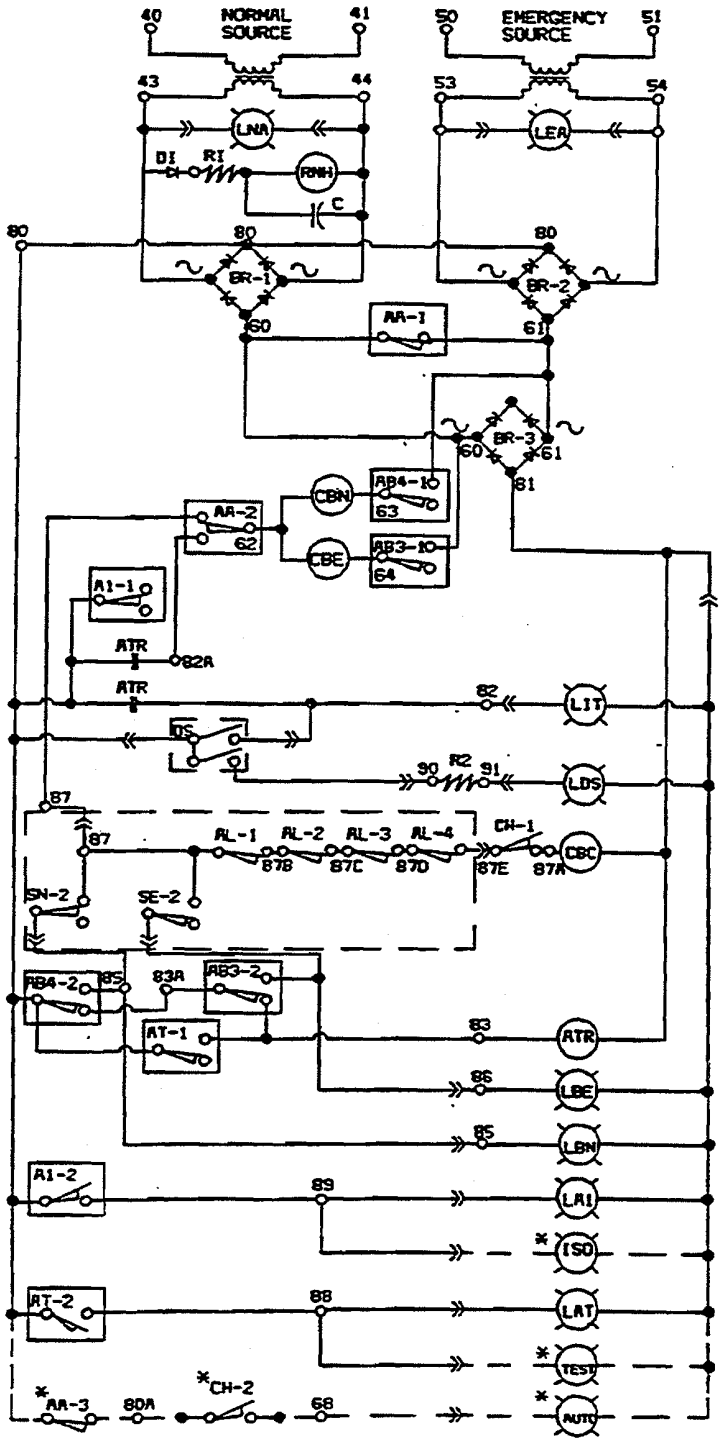
START-UP DATE: _____

DRAWING SUPPLIED: _____

_____

TEST AND MAINTENANCE NOTES:

DATE	TESTED	OBSERVATIONS	NOTES



LNA-NORMAL LIGHT AVAILABLE

LEA- EMERGENCY LAMP AVAILABLE

RNH- RELAY NORMAL HOLD. 4.28.30

AA-1.2.3-AUTO LIMIT SWITCH. 7.10.26

BR-1.2.3- BRIDGE RECTIFIER

CBN- NORMAL SOLENOID. 10

CBE- EMERGENCY SOLENOID. 11

A1-1.2- ISOLATE LIMIT SWITCH. 11.22

ATR- AUTO TEST RELAY. 13.19

LIT- LAMP INHIBIT TRANSFER. 13

LDS- LAMP DISCONNECT SWITCH "INHIBIT" POSITION. 15

CBC- CRANK SOLENOID. 16

AT-1.2- TEST LIMIT SWITCH. 19.23

CH-1.2- CRANK HANDLE LIMIT SWITCHES

LBE- LAMP BYPASS EMERGENCY. 19

LBN- LAMP BYPASS NORMAL. 20

LAT/ISO- LAMP ATS ISOLATE. 22

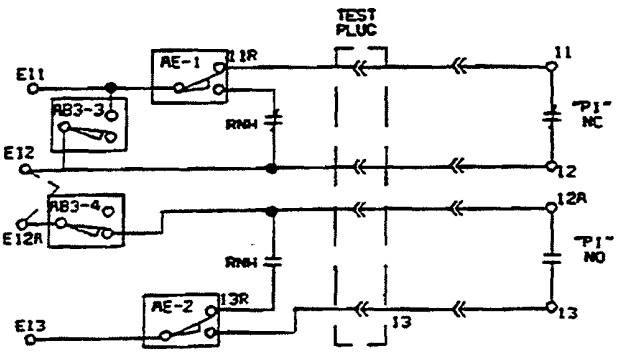
LAT/TEST- LAMP ATS TEST POS. 24

AUTO- LAMP ATS AUTO POS. 26

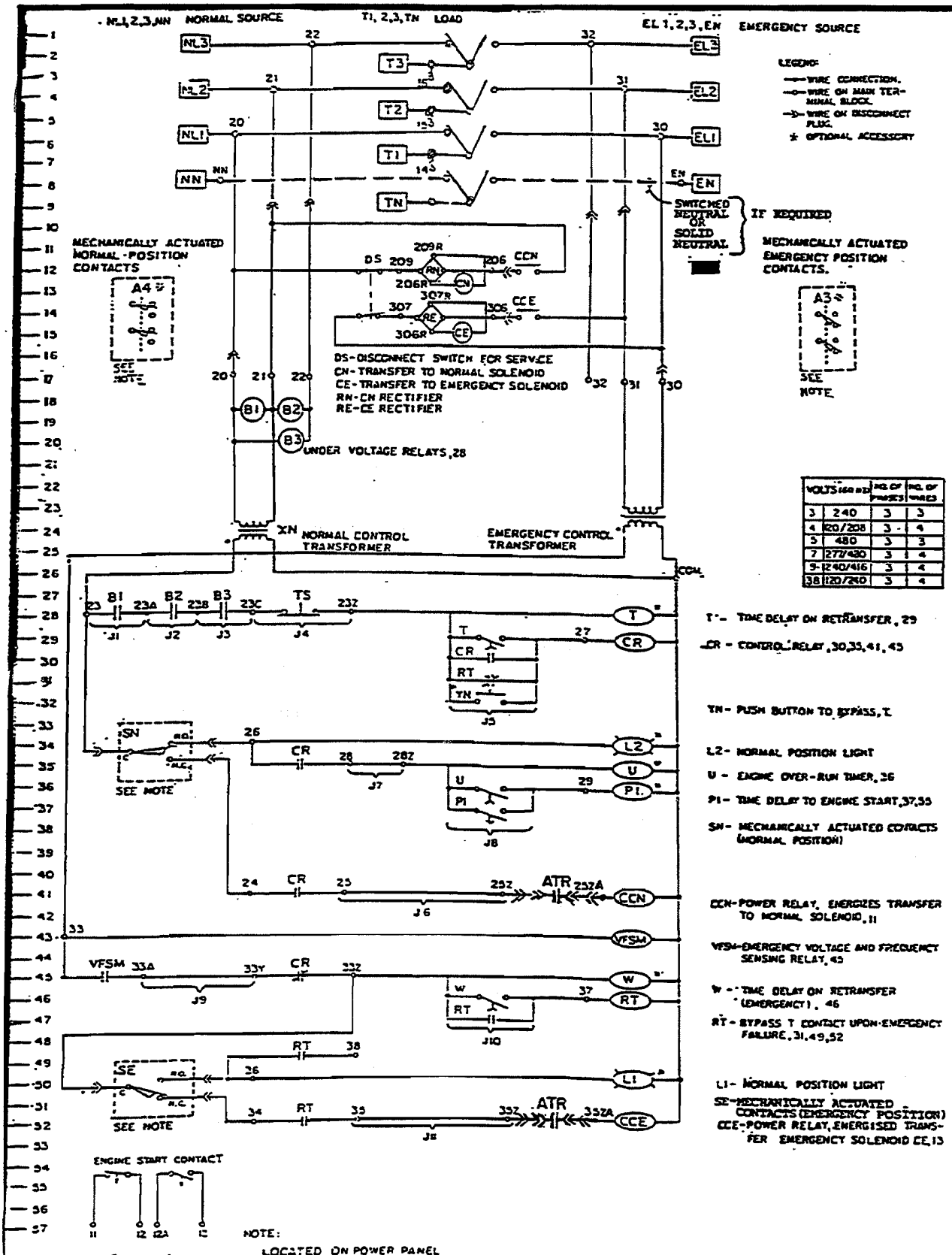
AB4-1.2- BYPASS NORMAL. 9.18

AB3-1.2.3.4- BYPASS EMERGENCY 10, 18, 28, 30

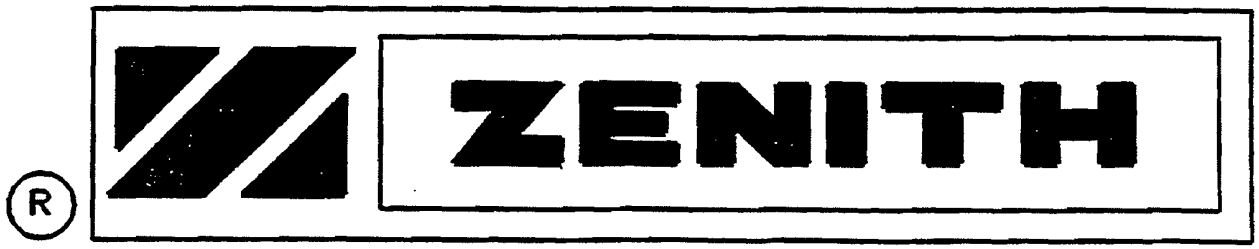
AL- 1.2.3.4- ATS LATCHED. 15



NOTES:
WIRE NUMBER E12 BECOMES WIRE NUMBER 12 AFTER THE TEST PLUG (TP). LOCATED ON ATS POWER PANEL.
* OPTIONAL



VOLTS		NO. OF PHASES	NO. OF WIRES
3	240	3	3
4	120/208	3	4
5	480	3	3
7	277/480	3	4
9	1240/416	3	4
38	120/240	3	4



CONTROLS INC.

830 West 40th Street: Chicago, Illinois 60609 (312)247-6400

ZBTSH SERIES
BYPASS/ISOLATION/TRANSFER SWITCH OPERATION
1600-3000 AMP

OPERATION: BYPASS/ISOLATION SWITCH

AUTOMATIC

1. Manually operated Bypass Switch contacts (BN/BE) are open and ATS is supplying load.
2. Disconnect Switch (DS) is in "AUTO".

TO BYPASS ATS

1. Open bottom cabinet door and turn DS to "INHIBIT".
2. Turn Bypass Selector Switch (BSS) to same power source as ATS.
3. Move the Manual Bypass Handle (MBH) upward.

TO TEST ATS

1. Bypass per above instructions.
2. Rotate crank mechanism counterclockwise until ATS TEST light is illuminated.
3. Turn DS to "AUTO".
4. Test Switch (TS) on bottom cabinet door will allow electrical operation of ATS.

TO ISOLATE ATS

1. Bypass per above instructions.
2. Rotate crank mechanism counterclockwise until ATS ISOLATED light is illuminated.

TO REMOVE ATS

1. Bypass and Isolate per above instructions.
2. Disconnect multipin plugs and external connections to ATS.
3. Slide four corner latches of ATS to innermost position.
4. ATS can now be removed from cabinet.

TO RECONNECT ATS

1. Roll cart back into cabinet.
2. Slide four corner latches of ATS to outermost position.
3. Turn DS Switch to "INHIBIT".
4. Manually position ATS into same source as Bypass Switch.
5. Reconnect multipin plugs and external connections to ATS.
6. Rotate crank mechanism clockwise until ATS TEST light is illuminated.
7. Turn DS Switch to "AUTO" and use TS to electrically operate ATS.
8. Turn DS to "INHIBIT".
9. Rotate crank mechanism clockwise until ATS location pointer is aligned with "AUTO" mark on location indicator. (ATS must be in same source as Bypass).
10. Turn DS to "AUTO" and open Bypass with MBH.
11. ATS is now fully automatic (Figure 1).

NOTES:

1. DS in "INHIBIT" will prevent ATS electrical operation.
2. DO NOT use excessive force on mechanical handles.
3. Above Figures depict Bypass NORMAL. Sequence is same for Bypass EMERGENCY.
4. When ATS is in TEST or ISOLATE, Bypass Switch is a manual transfer switch to either available source. (Indicated on light panel).
5. To operate Bypass Switch when ATS is in TEST or ISOLATE:
   a) Move MBH downward (to open Bypass Contacts BN/BE).
   b) Turn BSS to opposite power source.
   c) Move MBH upward to close into selected power source.

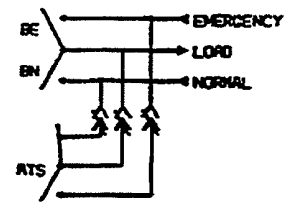


FIG. 1 BP IS OPEN WITH ATS IN NORMAL

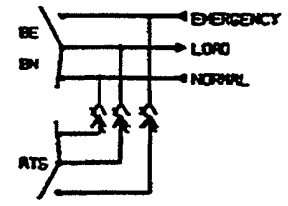


FIG. 2 BP IN NORMAL WITH ATS IN NORMAL

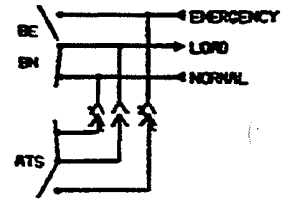


FIG. 3 BP IN NORMAL WITH ATS IN TEST (LOAD CONNECTIONS ARE OPEN)

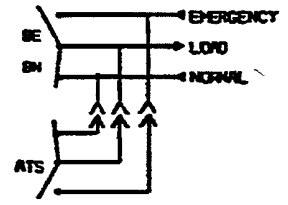


FIG. 4 BP IN NORMAL WITH ATS ISOLATED

NOTES:
1. BP—Bypass switch (indicated by contacts BN/BE) is a 3 position switch.
2. ATS—Automatic Transfer Switch

CONTROLLED

ZENITH CONTROLS, INC

REVISIONS:	MODEL: ZBTSH160/300 (1600-3000 AMP)	
	DRFT: BRB	APP'D: CS/SS
	DATE: 4/8/92	DWG DIR: ZE3
	SCALE:	

TITLE: BYPASS/ISOLATION TRANSFER SWITCH OPERATION

DRAWING NO.: 40R-0502 SHEET 1 OF 3 — REV

LEGEND: BYPASS/ISOLATION SWITCH (BP)

I. (BP) BYPASS/ISOLATION SWITCH: MECHANICAL COMPONENTS

N1,2,3,(N).....Normal Line connections
E1,2,3,(N).....Emergency Line connections
T1,2,3,(N).....Load Line connections
BE.....Bypass Emergency contacts
BN.....Bypass Normal contacts
BSS.....Bypass Selector Switch
MBH.....Manual Bypass Handle

II. (BP) BYPASS/ISOLATION: ELECTRICAL COMPONENTS

AA-1,2.....Limit switch held actuated in Auto location of ATS, Non-actuated Test and Isolated locations.
AB3,-1,2,3,4.....Limit switch, actuated in Bypass Emergency position
AB4-1,2.....Limit switch, actuated in Bypass Normal position
AE-1,2.....Limit switch, switches Engine Start from ATS control to bypass control during ATS Isolate
AI-1,2.....Limit switch, actuated in Isolate location
AT-1,2.....Limit switch, actuated in Test location
ATR.....Auto/Test Relay. Energized in AUTO and TEST locations
BR.....Bridge Rectifier
C.....Capacitor: RNH
CBC.....Crank Solenoid
CBE.....Emergency Bypass Permissive Solenoid
CBN.....Normal Bypass Permissive Solenoid
CH-1.....Limit switch actuated when crankhandle is engaged
D1.....Diode
RNH.....Relay normally held, 24 VDC coil, 3PDT
R1.....Resistor: RNH
R2.....Resistor: LDS
XBE.....Emergency line control transformer
XBN.....Normal line control transformer

III. (BP) BYPASS/ISOLATION SWITCH: INDICATOR LIGHTS

LNA.....Normal available
LEA.....Emergency available
LBN(NOTE 1).....Bypass Normal (BN closed)
LBE(NOTE 1).....Bypass Emergency (BE closed)
LAT(NOTE 1).....ATS in Test location
LAI(NOTE 1).....ATS in Isolate location
LIT(NOTE 1).....ATS Inhibit
LDS(NOTE 1).....ATS DS switch in INHIBIT position

CONTROLLED

NOTES:
1. Indicator off during automatic operation of ATS.
2. Four pole includes neutral lugs.

REVISIONS:	MODEL: ZBTSH160/300 (1600-3000 AMPS)		ZENITH CONTROLS, INC.	
	DRFT: BRB	APP'D: FS/SB	TITLE: BYPASS/ISOLATION SW. LEGEND	
	DATE: 4/8/92	DWG DIR: ZE3	DRAWING NO.: 40R-0502 SHEET 2 OF 3	REV: -
	SCALE:			

LEGEND & OPERATION: AUTOMATIC TRANSFER SWITCH (ATS)

A. LEGEND

B1,2,3.....Solid State Phase Relay(s)
Dropout _____%
Pickup _____%
CCE.....CE Control Relay, Emergency
CCN.....CN Control Relay, Normal
CE.....Emergency Main Transfer Operator
CN.....Normal Main Transfer Operator
CR.....Normal Control Relay
DS.....Disconnect Switch
E.....Engine Start Contact
GND.....Ground
RE.....Bridge Rectifier, Emergency
RN.....Bridge Rectifier, Normal
RT.....Emergency Control Relay
NB.....Neutral Bar (if required)
SE.....Cutout Switch, Emergency
SE-2.....Aux. Cutout Switch, Emergency
SN-2.....Aux. Cutout Switch, Normal
SN.....Cutout Switch, Normal
TS.....Test Switch,Momentary,Not Keyed
VFSM.....Emergency Volt-Freq. Relay
Pickup { 90% of rated Voltage, and 95% of rated Frequency
XE.....Control Transformer, Emergency
XN.....Control Transformer, Normal

B. OPERATION

When the Normal Line falls to the preset dropout point, the phase relays will dropout disconnecting the CR relay.

When the Emergency Line voltage & frequency reach the preset pick up point, the VFSM relay picks up. RT relay picks up to operate the CCE relay through the SE cutout switch causing the emergency main transfer operator CE to operate. The load is now transferred to the emergency line supply. The SE limit switch operates to disconnect the CCE relay and CE emergency main transfer operator. The transfer switch is now mechanically locked. Limit switch SN operates to complete the circuit for the next closing operation to Normal.

When the Normal Line voltage exceeds the preset pick up point, the phase relays B1, B2 & B3 pick up. CR relay picks up to operate the CCN relay through the SN cutout switch, causing the main transfer operator CN to operate. The load is now re-transferred back to the Normal line. The SN limit switch operates to disconnect the CCN relay and CN normal main transfer operator. The transfer switch is now mechanically locked. Limit switch SE operates to complete the circuit for the next closing operation to Emergency.

DS - Disconnect Switch
When the Disconnect Switch is placed in the INHIB. position the circuit to the main transfer operators CN and CE is opened and transfer cannot take place.

TS - Test Switch
The Test Switch simulates a normal line failure when activated.
To test, activate the Test Switch allowing the transfer switch to transfer to the EMERGENCY position. De-activate the Test Switch. The transfer switch will reset to the NORMAL position. Testing at least once a month is recommended. For hospital emergency systems, test once a week.

NOTES:

1. ⚠ CAUTION: In using a 3 phase, 4 wire delta or open delta power supply (usually 120/240 volts, sometimes listed as 120/208 volts) with one leg having a grounded center tap, one line will be 160 to 208 volts to ground. When such a system is used it is necessary to connect the high leg to N2. DO NOT CONNECT 120 VOLT LOAD CIRCUIT TO THE HIGH LEG.
2. GROUNDING TERMINAL: A grounding terminal (GND) is provided. When installing open type switches connect this to the metal enclosure or conduit.
3. ⚠ WARNING - TO ENSURE AGAINST SHOCK OR ACCIDENT HAZARD, DISCONNECT ALL SOURCES OF SUPPLY BEFORE SERVICING.
4. ON SINGLE PHASE UNITS WHERE THE EMERGENCY SOURCE IS A UTILITY LINE, CONNECT EMERGENCY LINE SO THAT MINIMUM VOLTAGE IS MEASURED FROM N1 TO E1.
5. ON SINGLE PHASE (2 POLE) UNITS, CENTER POLE AND PHASE RELAYS (B2,B3) ARE NOT SUPPLIED.

CONTROLLED

ECN S-5004: 8-7-92

ZENITH CONTROLS, INC

TITLE: ATS LEGEND & OPERATION

DRAWING NO.: 40R-0502 SHEET 3 OF 3 | REV -

ACCESSORIES

The ZTS series switches are wired so that accessories can be easily added to the switch. The following is a description of the basic accessories. Those checked are supplied on this unit, see additional pages for complete legend & operation.

☐ A1 Auxiliary contact, S.P.D.T., operates on normal line failure.

☐ A1E Auxiliary contact, S.P.D.T., operates on emergency line failure.

☐ A3 Auxiliary contact closes when the transfer switch is in the Emergency position.

☐ A4 Auxiliary contact closes when the transfer switch is in Normal position.

☐ A6 Motor Disconnect. To de–energize external motor control circuit 5 seconds (adjustable) prior to transfer in either direction.

☐ C Plant Exercisor. Automatically starts generator for selected time intervals.

☐ C/D Plant Exercisor. Automatically starts generator to run unloaded or simulate a power failure and starts generator to run under load.

☐ E Engine Start Contact: 1 Normally Open
1 Normally Closed.

☐ F Auxiliary Fan Contact, S.P.N.O. Closes when generator is running.

☐ H Time delay to engine start, non–adjustable. Factory set 1 or 3 seconds. When the Normal line fails the relay de–energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ J1 Adjustable under frequency sensor.

☐ J2 Adjustable over/under frequency sensor.

☐ K Frequency meter to indicate load frequency.

☐ L1 Pilot Light. Switch in Emergency Position.

☐ L2 Pilot Light. Switch in Normal Position.

☐ L3 Pilot Light. Normal source available.

☐ L4 Pilot Light. Emergency source available.

☐ M1 Ammeter; Single phase.

☐ M2 Ammeter; Three phase

☐ M3 Voltmeter; Single phase.

☐ M4 Voltmeter; Three phase.

☐ P1 Time Delay to Engine Start (solid state). Adjustable over time range .5 to 6 seconds. When the Normal line fails the relay de–energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ P2 Time Delay to Engine Start (Pneumatic). Adjustable over time range 1/6 to 300 seconds. When the Normal line fails, the relay de–energizes. After the set time delay its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ Q2 Connections for remote peak shave or area protection relays. Includes bypass for automatic return to Normal if Emergency line fails and Normal is present.

☐ R1 Solid State Adjustable Overvoltage Relay(s). Set at 110% of pickup, 105% of dropout of nominal Line rate, unless otherwise specified.

☐ R4 In–Phase monitor. Prevents transfer until two sources are in–phase. For use of isochronous governors.

☐ R43 In–phase monitor. Prevents transfer until two sources are in–phase. For use with mechanical. governors.

☐ S1 Four–position Engine Control Selector Switch. "STOP", "HAND CRANK", "TEST", "AUTOMATIC".

☐ T Time delay, re–transfer to Normal. When the Normal line restores and the phase relays operate, the T timer is energized. After the set time delay, its contacts close the circuit to the CR relay which operates to restore the load to the Normal line. RT relay is supplied to bypass T contacts if Emergency is de–energized during timing. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ T3 W3 Presignal auxiliary Contact, S.P.D.T: Operates 0–30 seconds (adjustable) prior to transfer in either direction.

☐ U Time delay, engine cool–down. When the transfer switch is restored to the Normal position and the engine is signaled to shut down, the U timer operates to maintain the engine start circuit closed. At the end of the set time, the engine contacts open to shut down the engine. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ W Time delay, transfer to Emergency. When the Normal line fails and the engine has started, the VFSM relay energizes. The W timer energizes. After the set time delay, its contacts close to energize the RT relay. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ YE Pushbutton, Transfer to Emergency. Provides manual control of transfer to emergency source. If time delay accessory W is supplied pushbutton bypasses time delay for immediate transfer; otherwise, transfer to emergency will be automatic after time delay. If time delay accessory W is not supplied, transfer will be non–automatic (by pushbutton only).

☐ YN Pushbutton, Retransfer to Normal. Provides manual control of retransfer to normal source. If time delay accessory T is supplied, pushbutton bypasses time delay for immediate retransfer; otherwise, retransfer to normal will be automatic after time delay. If time delay accessory T is not supplied, retransfer will be non–automatic (by pushbutton only).

☐ Other:_____

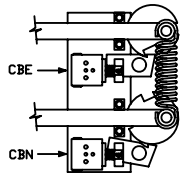
_____

_____

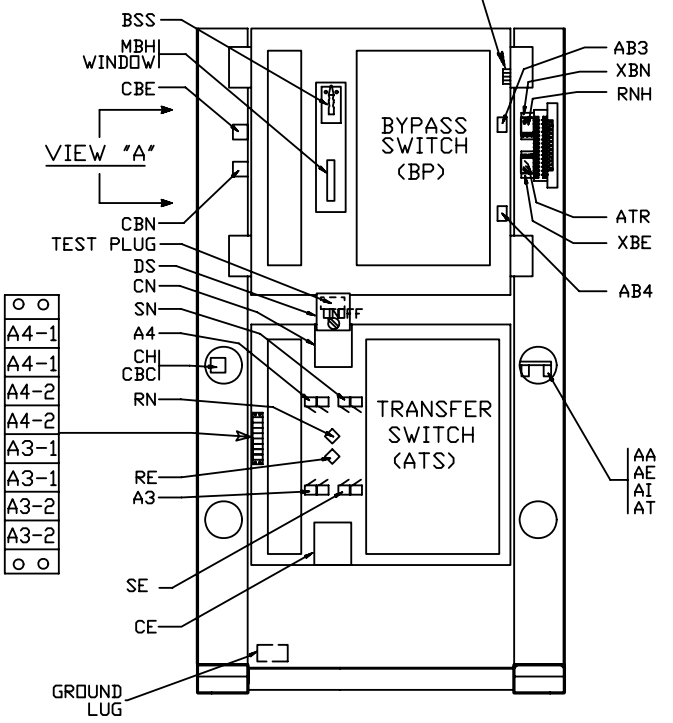
ZENITH® CONTROLS, INC.

TITLE: ACCESSORIES

DRAWING NO.: 40R–0900 — REV

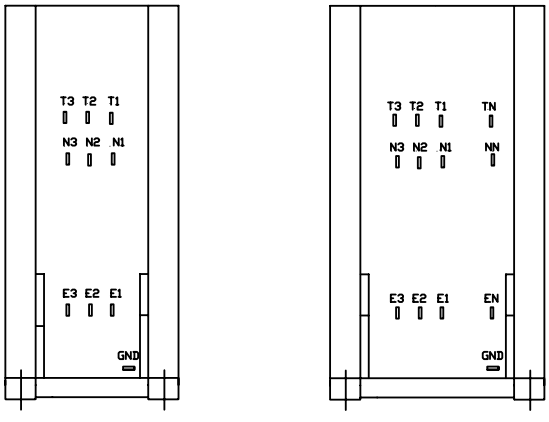


VIEW "A"



DEVICE TAG	TERMINAL MARKINGS WIRE NUMBER					
TRANSFORMERS	X1	X2	H1	H2	H3	H4
XBE	53	54	50			51
XBN	43	44	40			41
SOLENOIDS	NO MARKINGS					
CBE	64		62			
CBN	63		62			
CBC	87A		81			
CN	206R		209R			
CE	306R		307R			
SWITCHES	NO		NC		NC	
DS			20	209		
			30	307		
	80	82				
	80	90				
LIMIT SWITCHES	C	NC	NO	C	NC	NO
AA-1,2	60		61	62	82A	87
AB3-1,2	64		60	83A	83	86
AB3-3,4	E12		E11	E12A	12A	
AB4-1,2	63		61	80	83A	85
AE-1,2	E11	11	11R	E13	13	13R
AI-1,2	80		82A	80		89
AT-1,2	80		83	80		88
CH-1	87	87A				
SE	33	34	36			
SN	23	24	26			
SE-2	86		87			
SN-2	85		87			
RECTIFIERS	AC	AC	+	-		
RN	209	206	206R	209R		
RE	307	306	306R	307R		

STANDARD LUG CONFIGURATION
(CONSULT FACTORY FOR OPTIONAL CONFIGURATIONS)
REAR VIEW OF ENCLOSURE



2/3-POLE SWITCH

4-POLE SWITCH

REVISIONS:
F S-6008 02/16/95 SG/JC

REFER TO 40R-0502 FOR LEGEND & OPERATION
FOR MANUFACTURING:
SEE PAGE 5 FOR CONTROL PANEL
SEE 40R-0900 FOR ACCESSORIES.

MODEL: ZBTSH160/300 (1600-3000 AMPS)
DRN BY: FHB CHK'D:
DATE: 07/22/94 APP'D:
SCALE: N/A

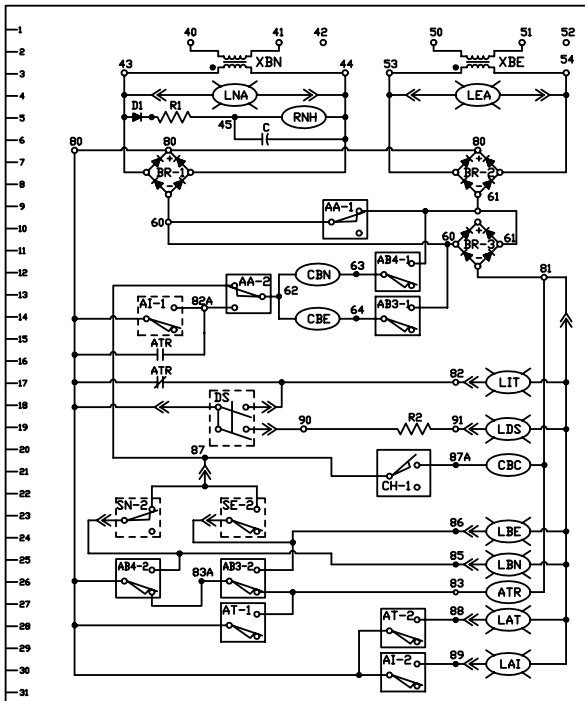
ZENITH CONTROLS, INC.

TITLE: BP & ATS COMPONENT LOCATIONS

DRAWING NO.: 46A-3000 SHEET 1 OF 5

F REV

ORIGINAL



LNA - NORMAL AVAILABLE LIGHT
LEA - EMERGENCY AVAILABLE LIGHT
RNH - NORMAL VOLTAGE RELAY

BR-1,- BRIDGE RECTIFIER
2,3

AA-1 - LIMIT SWITCH, ATS AUTO LOCATION

AB4-1- LIMIT SWITCH, BYPASS NORMAL
CBN - NORMAL TRANSFER OPERATOR

AA-2 - LIMIT SWITCH, ATS IN AUTO

CBE - EMERGENCY TRANSFER OPERATOR
AB3-1- LIMIT SWITCH, BYPASS EMERGENCY
AI-1 - LIMIT SWITCH, ATS IN ISOLATE

LIT - ATS INHIBIT LIGHT

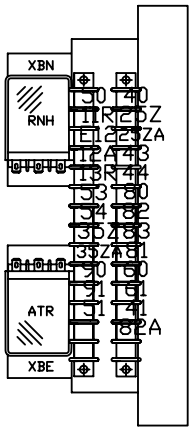
DS - DISCONNECT SWITCH

LDS - DISCONNECT SWITCH LIGHT
R2 - RESISTOR, LDS
CBC - CRANK SOLENOID
CH-1 - LIMIT SWITCH

LBE - BYPASS EMERGENCY LIGHT
AB4-2- LIMIT SWITCH, BYPASS NORMAL
LBN - BYPASS NORMAL LIGHT
AB3-2- LIMIT SWITCH, BYPASS EMERGENCY
ATR - AUTO/TEST RELAY
AT-1 - LIMIT SWITCH, ATS TEST LOCATION
LAT - ATE TEST LOCATION LIGHT
AT-2 - LIMIT SWITCH, ATS TEST LOCATION

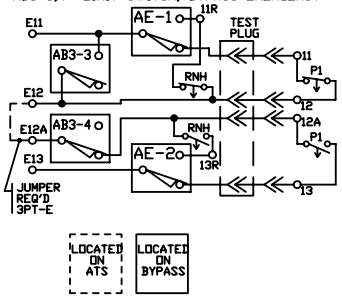
LAI - ATS ISOLATE LIGHT
AI-2 - LIMIT SWITCH, ATS IN ISOLATE

BYPASS SUBPANEL

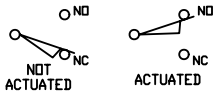


ENGINE START CIRCUIT

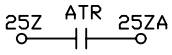
AE-1,2 - LIMIT SWITCH, ENGINE START TRANSFER
AB3-3,4- LIMIT SWITCH, BYPASS EMERGENCY



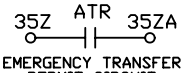
LIMIT SWITCHES



PERMIT CIRCUITS



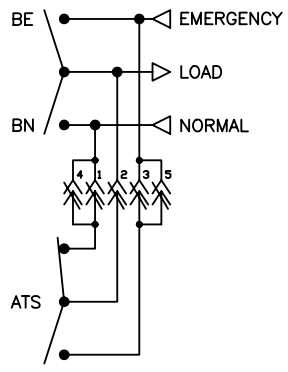
NORMAL TRANSFER PERMIT CIRCUIT IN AUTO AND TEST POSITIONS

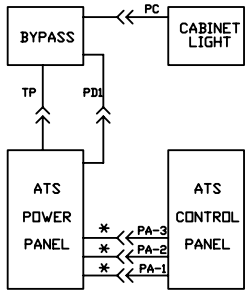


EMERGENCY TRANSFER PERMIT CIRCUIT IN AUTO AND TEST POSITIONS

LIMIT SWITCH CHART

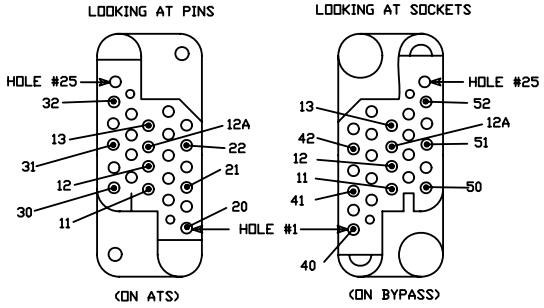
X = ACTUATED	ATS LOCATION				ATS MODE		BYPASS MODE		
	AUTO	TEST	ISO	REMOVE	NORM	EMERG.	NORM	EMERG.	OPEN
AA	X								
AT		X							
AI			X	X					
AE			X	X					
SN					X				
SE						X			
AB4							X		
AB3								X	

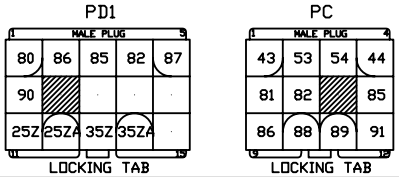




* SEE ATS POWER CIRCUIT SCHEMATIC, LIGHTS & PLUGS.

ATS TEST PLUG (TP)





ATS LOCATION	LOAD CARRYING CONTACTS			ATS TEST PLUG (TP)	
	1	2	3	4	5
AUTO	X	X	X	X	X
TEST	O	O	O	X	X
ISOLATE	O	O	O	O	O

X = CLOSED
O = OPEN

REVISIONS:
F S-6008 02/16/95 SG/JC

NOTES:
ATS SHOWN IN NORMAL POSITION,
BYPASS OPEN WITH NO POWER AVAILABLE.

MODEL: ZBTSH160/300 (1600-3000 AMPS)

DRN BY: FHB | CHK'D:
DATE: 07/22/94 | APP'D:
SCALE: N/A

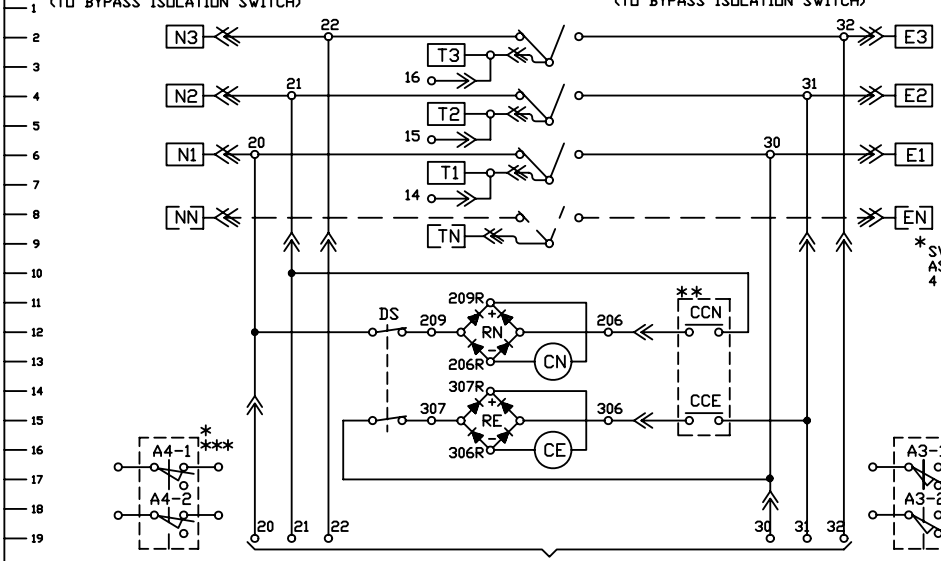
ZENITH CONTROLS, INC.

TITLE: BYPASS CONTROL CIRCUIT SCHEMATIC, SUBPANEL & PLUGS

DRAWING NO.: 46A-3000 SHEET 2 OF 5 | REV F

ORIGINAL

POWER CIRCUIT SCHEMATIC



TO CONTROL CIRCUIT SCHEMATIC – SHEET 4

VOLTAGE SYSTEMS

	VOLTS	NO. OF PHASES	NO. OF WIRES
-3	240V, 60HZ	3	3
-31	208, 60HZ	3	3
-38	120/240,60HZ	3	4
-4	120/208,60HZ	3	4
-5	480,60HZ	3	3
-7	277/480,60HZ	3	4
-9	240/416,60HZ	3	4
-91	220/380V,60HZ	3	4
-92	220/380V,50HZ	3	4

*SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEMS.

DS – DISCONNECT SWITCH FOR SERVICING

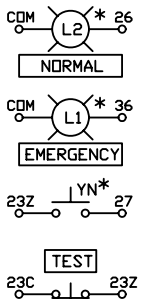
CN – NORMAL TRANSFER OPERATOR (TRANSFER TO NORMAL)

CE – NORMAL TRANSFER OPERATOR (TRANSFER TO EMERGENCY)

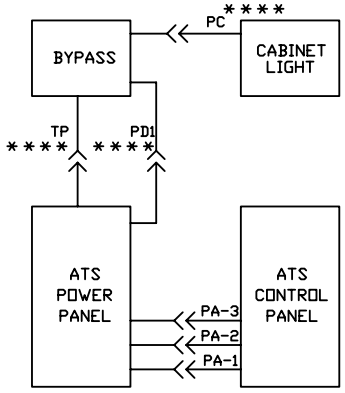
RN – BRIDGE RECTIFIER, NORMAL

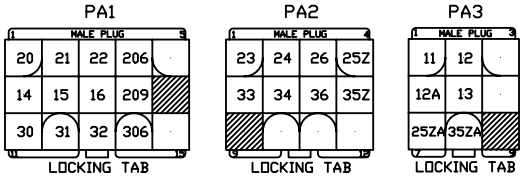
RE – BRIDGE RECTIFIER, EMERGENCY

CABINET FRONT



INTERCONNECT PLUGS





REVISIONS:

F S-6008 02/16/95 SG/JC

NOTES:

1. ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.
2. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3,A4,E,L1, L2,P,T,U,W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.

LEGEND

- WIRE CONNECTION
- WIRE ON MAIN TERMINAL BLOCK
- WIRE IN DISCONNECT PLUG
- * OPTIONAL
- ** LOCATED ON CONTROL PANEL
- *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL
- **** SEE BYPASS CONTROL SUBPANEL AND PLUGS

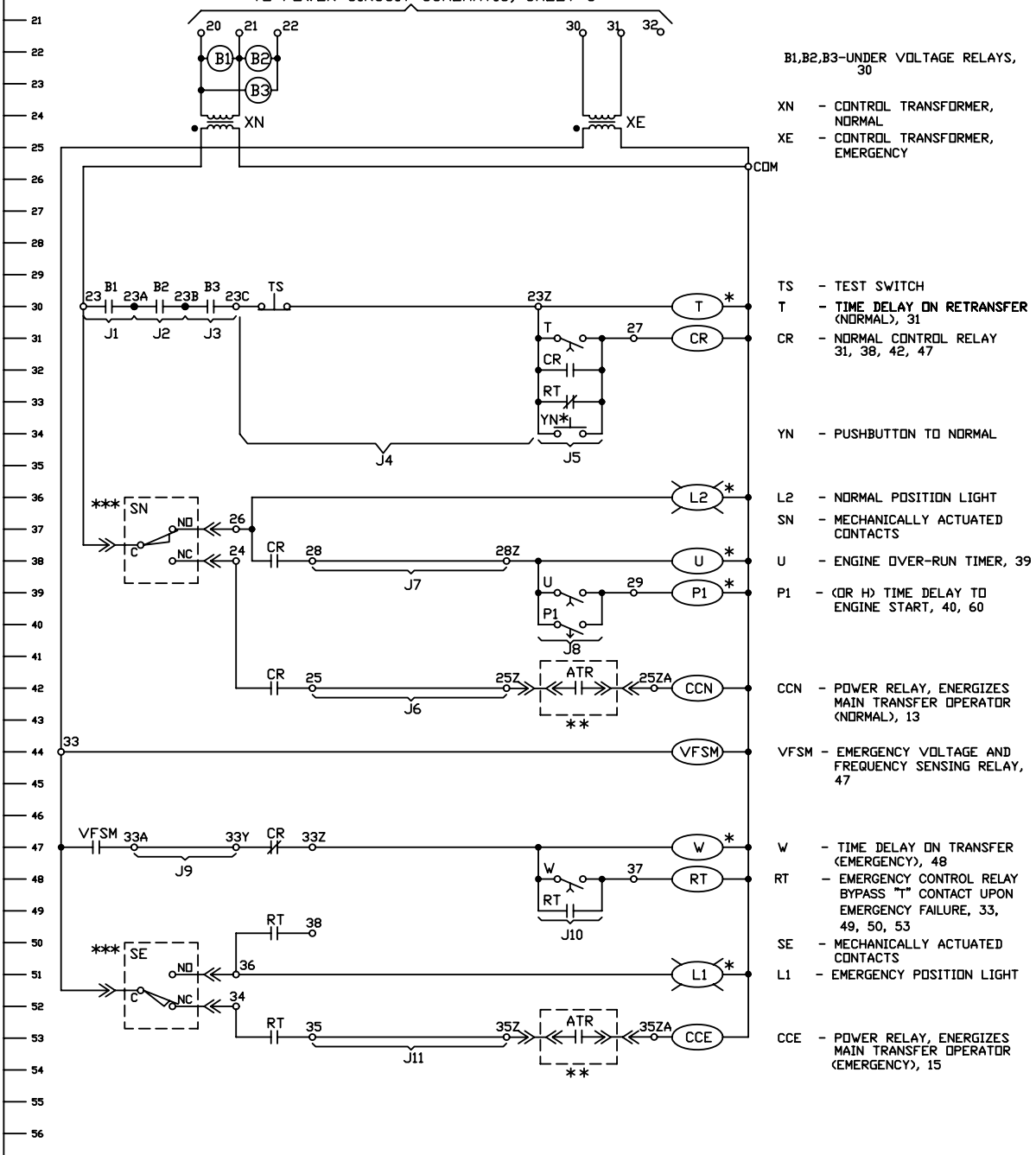
ZENITH CONTROLS, INC.

TITLE:	ATS POWER CIRCUIT SCHEMATIC, LIGHTS, & PLUGS	
MODEL:	ZBTSH160/300 (1600-3000 AMP)	
DRFT:	FHB	APP'D:
DATE:	07/22/94	
DRAWING NO.:	46A-3000 SHEET 3 OF 5	F REV

ORIGINAL

CONTROL CIRCUIT SCHEMATIC

TO POWER CIRCUIT SCHEMATIC, SHEET 3



B1,B2,B3-UNDER VOLTAGE RELAYS, 30

XN - CONTROL TRANSFORMER, NORMAL

XE - CONTROL TRANSFORMER, EMERGENCY

TS - TEST SWITCH

T - TIME DELAY ON RETRANSFER (NORMAL), 31

CR - NORMAL CONTROL RELAY 31, 38, 42, 47

YN - PUSHBUTTON TO NORMAL

L2 - NORMAL POSITION LIGHT

SN - MECHANICALLY ACTUATED CONTACTS

U - ENGINE OVER-RUN TIMER, 39

P1 - (OR H) TIME DELAY TO ENGINE START, 40, 60

CCN - POWER RELAY, ENERGIZES MAIN TRANSFER OPERATOR (NORMAL), 13

VFSM - EMERGENCY VOLTAGE AND FREQUENCY SENSING RELAY, 47

W - TIME DELAY ON TRANSFER (EMERGENCY), 48

RT - EMERGENCY CONTROL RELAY BYPASS "T" CONTACT UPON EMERGENCY FAILURE, 33, 49, 50, 53

SE - MECHANICALLY ACTUATED CONTACTS

L1 - EMERGENCY POSITION LIGHT

CCE - POWER RELAY, ENERGIZES MAIN TRANSFER OPERATOR (EMERGENCY), 15

CUSTOMER CONNECTIONS

A3,A4
SEE ATS POWER CIRCUIT SCHEMATIC & BP & ATS COMPONENT LOCATIONS

ENGINE START
SEE BP CONTROL CIRCUIT SCHEMATIC & BP & ATS COMPONENT LOCATIONS

CONTACT RATING		
RELAY	CONTACT	RATING
H	E	10AMP @ 28VDC
P1	E	10AMP @ 32VDC
	A3, A4	20AMP, 125, 250 VAC

JUMPER	CONNECT POINTS	REMOVE JUMPER WHEN ACCESSORIES USED
J1	23, 23A	B1
J2	23A, 23B	B2
J3	23B, 23C	B3
J4	23C, 23Z	J1N, TS, C/D
J5	23Z, 27	T, YN
J6	25, 25Z	T3, R4
J7	28, 28Z	C, C/D
J8	28Z, 29	P1, U
J9	33A, 33Y	J1E, ER1, 2, 3
J10	33Z, 37	W
J11	35, 35Z	W3, R4

NOTES:
1. ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.
2. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3, A4, E, L1, L2, P, T, U, W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.

LEGEND
- WIRE CONNECTION
- WIRE ON MAIN TERMINAL BLOCK
- WIRE IN DISCONNECT PLUG
- * OPTIONAL
- ** LOCATED ON BYPASS SUBPANEL
- *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL

REVISIONS:
F S-6008 02/16/95 SG/JC

ZENITH CONTROLS, INC.

TITLE: ATS CONTROL CIRCUIT SCHEMATIC

MODEL: ZBTSH160/300 (1600-3000 AMP)

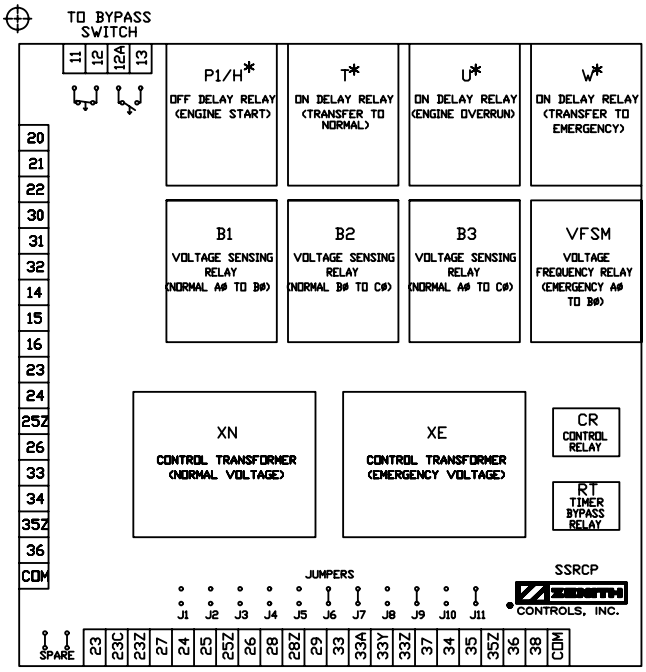
DRFT: FHB | APP'D:

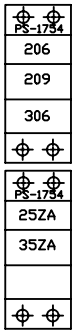
DATE: 07/22/94

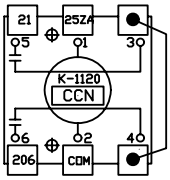
DRAWING NO.: 46A-3000 SHEET 4 OF 5 | F REV

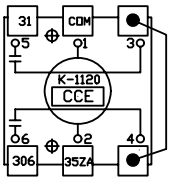
ORIGINAL

CONTROL PANEL LAYOUT









(18" X 29")
(457mm X 737mm)

REVISIONS:
F S-6008 02/16/95 SG/JC

NOTES:
1. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3, A4, E, L1, L2, P, T, U, W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.
2. ⊕ OPTIONAL

MODEL: ZBTSH160/300 (1600-3000 AMPS)

DRFT: FHB | APP'D:

DATE: 07/22/94

SCALE: 1/2 = 1

ZENITH CONTROLS, INC.

TITLE: CONTROL PANEL LAYOUT

DRAWING NO.: 46A-3000 SHEET 5 OF 5

REV: F

ORIGINAL

ZENITH
CONTROLS, INC.

46R-5000C
Revised October, 1996

OPERATION AND MAINTENANCE MANUAL

BYPASS/ ISOLATION DELAYED TRANSITION TRANSFER SWITCH

ZBTSDH SERIES 100 THRU 400 AMPS

MODEL NUMBER _____

SERIAL NUMBER _____

ZENITH CONTROLS, INC., 830 W. 40th St., Chicago, IL 60609

TABLE OF CONTENTS

Storage, Installation 1

Cabinet (exterior, front view) 2

Parts list (electrical) 3

Top and lower panels, front view.
Switch details 4

Bypass and ATS Power Panels — Parts list 5

Bypass and ATS Control Panel Layout 6

Bypass and ATS Control Panel — Parts list 7

Operation of Bypass/Isolation Switch 8

Definitions and Operation Notes 9

ZBTSDH Operation, Maintenance 10, 11

ARSM and Timer Adj., Lubrication 12

Torque Requirements 13

Cabinet Dimensions 14

Control Disconnect Plugs 15

Field Notes 16

Bypass Control Panel Schematic Drawing 17

Typical Bypass and ATS Schematic Drawing 18

STORAGE:

The ZBTSDH should be stored in a clean dry area. AVOID STORAGE BENEATH STEAM OR WATER PIPES. Excessive moisture may damage the unit. The switch should only be stored on a level (horizontal) surface.

INSTALLATION:

1. **Lifting:**

   To lift and manuever the Bypass Switch use lifting angles. See Fig. 1 (below). CAUTION: Depending upon the model, a ZBTSDH weighs between 700—750 lbs. Use adequate machinery and cables to handle the load.

2. **Equipment Preparation:**

   a). Check nameplate to assure switch system voltage and amperage is correct. Any discrepancy should be immediately reported to a Zenith representative.

   b). Lock open breakers to normal and emergency lines.

3. **Cabinet Preparation:**

   a). A small amount of cabinet work is required before the cables are connected. **Cover the switch and the controls to avoid metal fragments from entering mechanical and electrical components.** Visually verify that metal filings are removed from top bus support. (Use vacuum if necessary).

   b). Standard cable entry is through the top or bottom of the cabinet. Fig. 2 below shows one suggested knockout order. For a guide to assist in the hole layout, refer to page 15.

4. **Cable and Wire Connections:**

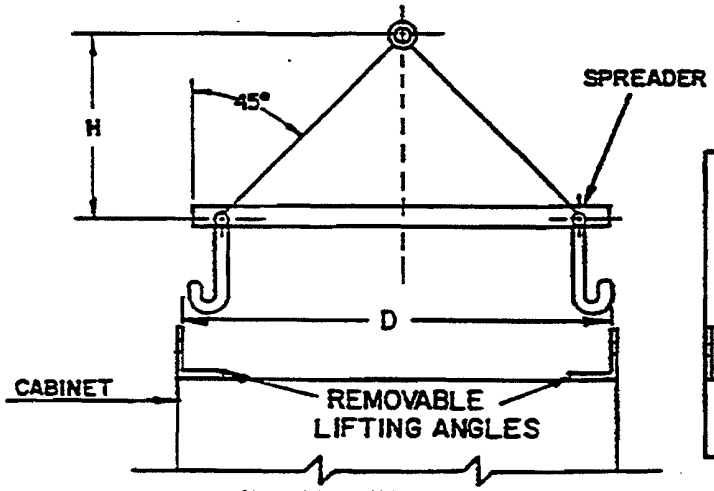
   a). To remove possible oxide, clean cable conductor with a wire brush and apply a contact oxide inhibitor. Insert cables into appropriate lugs.

   b). Connect all auxiliary wires for external electrical operation. Example: E-start, remote alarm lights or buzzers, motor control contacts, etc. Allow enough slack in wires to allow movement of the ATS to isolate position (approx. 1 ft.).

5. **Prior to the Unit's Energization:**

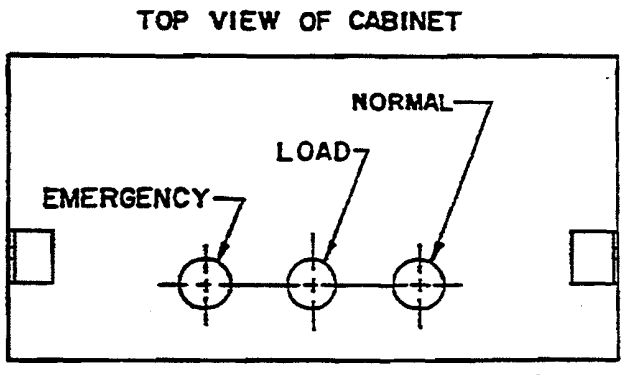
   a). Remove any debris incurred due to installation (cut cable strands, metal filings, etc.).

   b). Inspect the unit and verify torque of cable and wire connections.

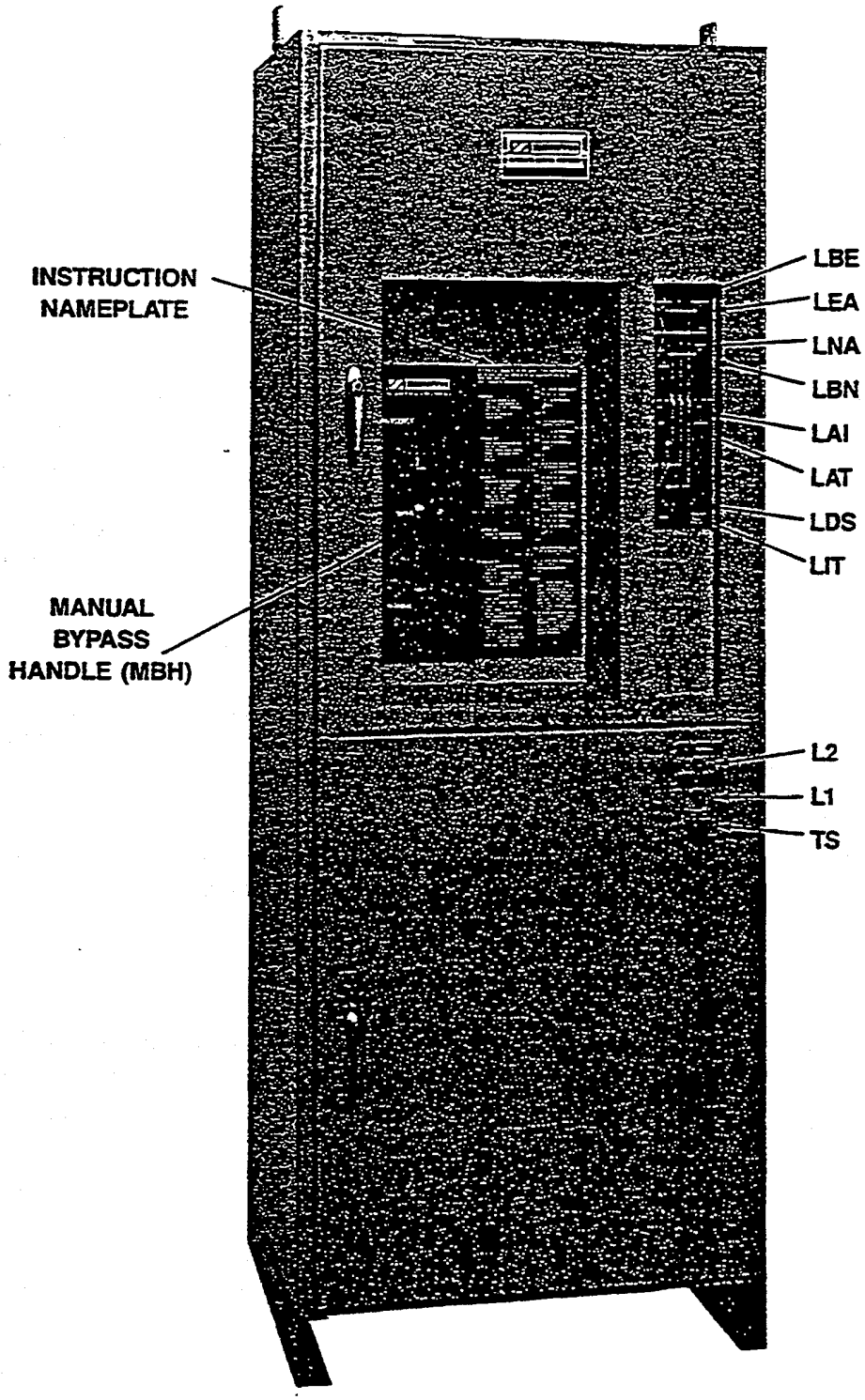


Note: When lifting the switch, a spreader must be used. The height H must be equal to D/2.

FIG. 1

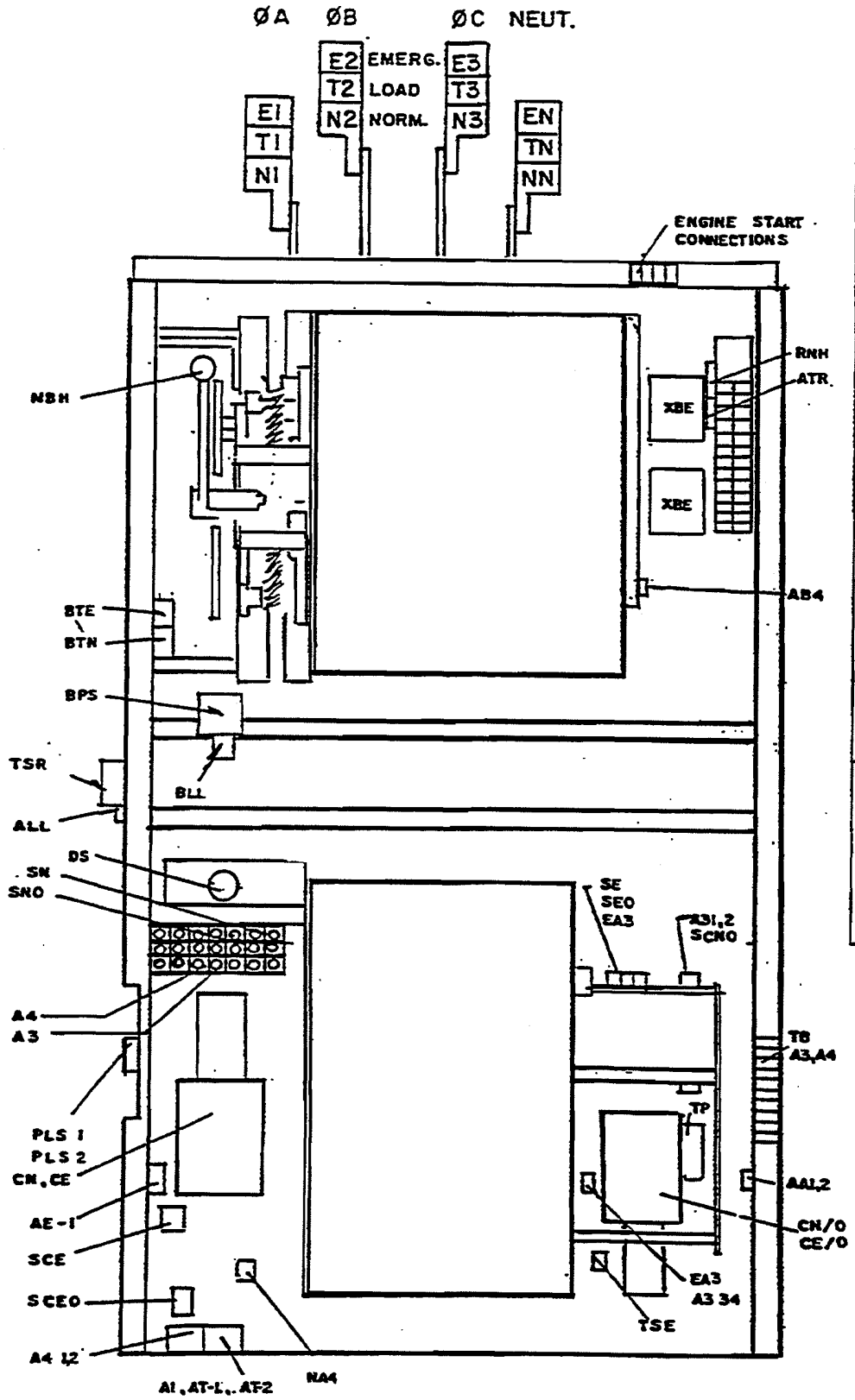


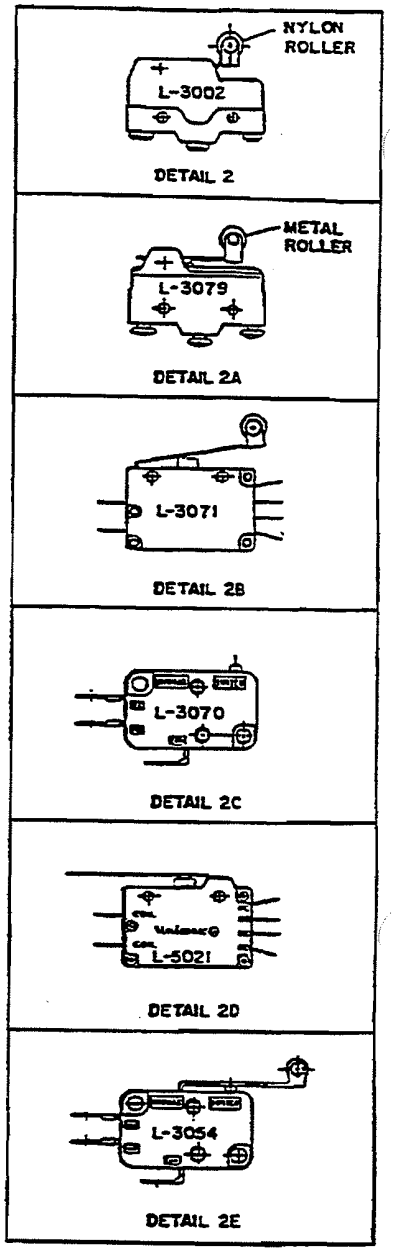
TYPICAL LAYOUT FIG. 2


INSTRUCTION NAMEPLATE
MANUAL BYPASS HANDLE (MBH)
LBE
LEA
LNA
LBN
LAI
LAT
LDS
LIT
L2
L1
TS

A. CABINET ELECTRICAL PARTS

TAG	DESCRIPTION	PART NUMBER
LNA	Normal Available Indicator (G)	
LEA	Emergency Available Indicator (R)	
LBN	Bypass Normal Location Indicator (G)	
LBE	Bypass Emergency Location Indicator (R)	
LAT	ATS Test Position Indicator (A)	
LAI	ATS Isolate Position Indicator (A)	
LIT	ATS Inhibit Indicator (R)	
LDS	ATS Disconnect Switch "Off" Indicator (R) Flashing Bulb	PS-1272
	COMMON PARTS BYPASS INDICATORS	
	Bulb	Y500005
	Socket	PS-5046
	Red Lens (R)	PS-5047
	Green Lens (G)	PS-5048
	Amber Lens (A)	PS-5049
L1	ATS Emergency Position Indicator	
L2	ATS Normal Position Indicator	
	Green Lens (Normal)	PS-5048
	Red Lens (Emergency)	PS-5047
	Bulb Socket	PS-5046
	Normal/ Emergency Nameplate	V-1502
	Emergency Bulb	PS-5105
	Normal Bulb	PS-5105
TS	Test Switch	
	Operator, Momentary	L-1025
	Contact Block N.C.	L-1029
	Name Plate	V-1503
	Contact Mounting Base	PS-3473





SWITCH DETAILS

B. BP-BYPASS AND ATS AUTOMATIC TRANSFER SWITCH POWER PANEL

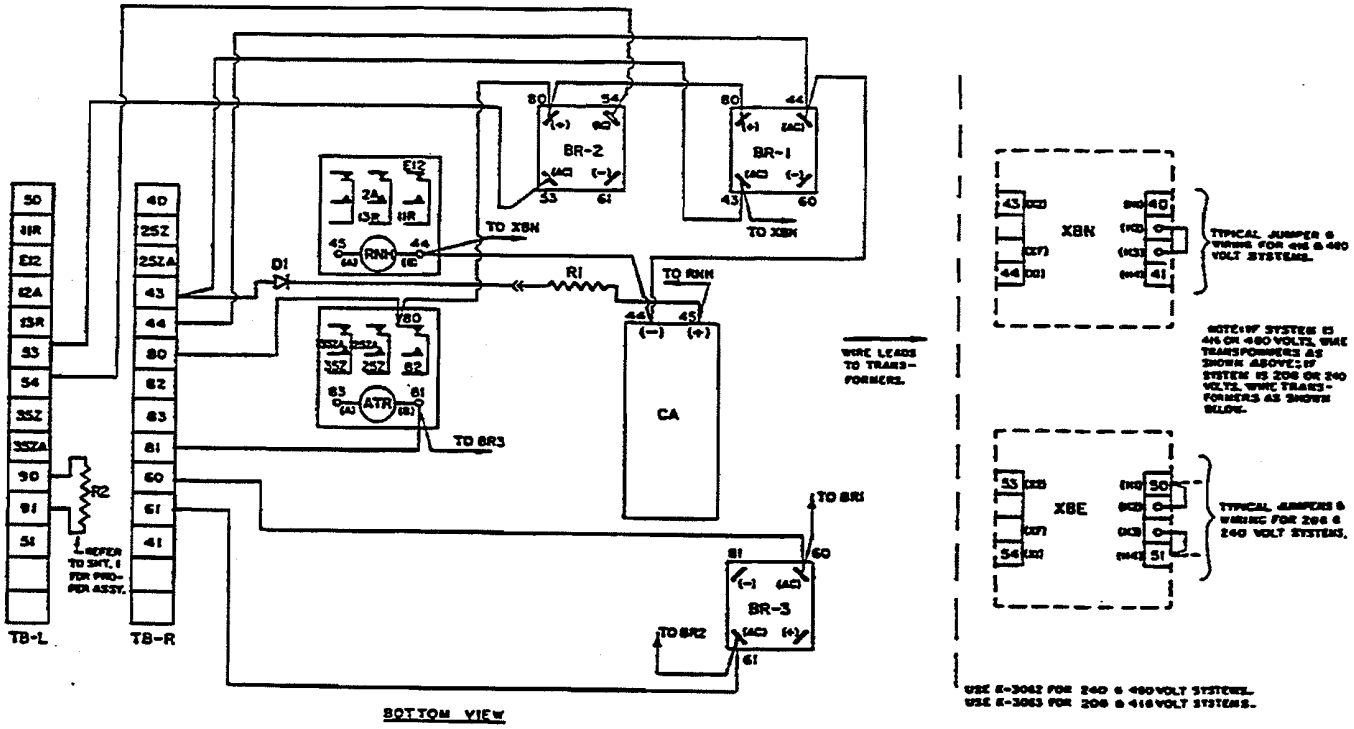
TAG	DESCRIPTION	PART NUMBER BY AMPERAGE				
Bypass		100	150	225	260	400
N1, 2, 3, N E1, 2, 3, N T1, 2, 3, N	Normal Emergency Load } LUGS	PS-4418	PS-4418	PS-4418	S-1422	S-1422
BYPASS	Contact Assembly	(Movable & Stationary for 3 Pole Units)				
N1, 2, 3	Normal	46P-1104A	46P-1104B	46P-1104C	46P-1104D	46P-1104E
N	(Sw. Neut. Norm.)	46P-1105A	46P-1105B	46P-1105C	46P-1105D	46P-1105E
E1, 2, 3	Emergency	46P-1106A	46P-1106B	46P-1106C	46P-1106D	46P-1106E
N	(Sw. Neut. Emerg.)	46P-1107A	46P-1107B	46P-1107C	46P-1107D	46P-1107E
ATS	Contact Assembly	(Movable & Stationary for 3 Pole Units)				
NL1, 2, 3	Normal	46P-1100A	46P-1100B	46P-1100C	46P-1100D	46P-1100E
N	(Sw. Neut. Norm)	46P-1101A	46P-1101B	46P-1101C	46P-1101D	46P-1101E
EL1, 2, 3	Emergency	46P-1102A	46P-1102B	46P-1102C	46P-1102D	46P-1102E
N	(Sw. Neut. Emerg.)	46P-1103A	46P-1103B	46P-1103C	46P-1103D	46P-1103E
Arc Grid Assy.		46P-1099				

XBN, XBE	Bypass Step-Down Transformer 25VA Secondary 24V	VOLTAGE	PART NO.
		120/240	K-3061
		208/416	K-3063
		220/440	K-3064
		240/480	K-3062
		380	K-3067
		575	K-3065
		600	K-3066

CN/O CE/O	Main ATS Operating Coils Voltage Systems						
	No.	Volts	Ph	Wire	Coil Volts	Poles	PART NO.
	-1	120	1	2	120	2	K-2178
	-2	120/240	1	3	240	2,3	K-2189
	-3	240	3	3	240	3	K-2189
	-38	120/240	3	4	240	3,4	K-2189
	-4	120/208	3	4	208	3,4	K-2177
	-5	480	3	3	480	3	K-2176
	-6	575/600	3	3	575/600	3	SPO
	-7	277/480	3	4	480	3,4	K-2176
	-9	240/416	3	4	416	3,4	SPO
	-91	220/380	3	4	380	3,4	K-2188

SN/O	CN/O Limit Switches	L-3080
SE/O	CE/O Limit Switches	
A3	ATS Emergency Position Switch	
A4	ATS Normal Position Switch	
SCN/O,SCE/O	CN/O, CE/O Limit Switches	L-3079 (Detail 2a)
AA AE1, 2 PLS1, 2	ATS Auto Location Switch ATS Isolate/Remove Location Switch Position Lever Switch	L-3071 (Detail 2b)
AI AT1, 2	ATS Isolate Location Switch ATS Test Location Switch	L-3070 (Detail 2c)
AB3/ABE AB4/ABN NA4 EA3	Bypass Emergency Position Switch Bypass Normal Position Switch Normal TRS Limit Switch Emergency TRS Limit Switch	L-5021 (Detail 2d)
BTE BTN TSE BLL ALL	Bypass Emergency Position Switch Bypass Normal Positiion Switch ATS Engaged Switch Bypass Lock Location Switch ATS Lock Location Switch	L-3054 (Detail 2e)
DS	ATS Solenoid Disconnect Switch Operator 2-Position Maintain Contact Block N.C. (1) Contact Block N.O. (2) Contact Block Mounting Plate	L-4018 L-1029 L-1028 PS-3473
BPS TRS	Bypass Interlock Solenoid Transfer Release Solenoid	K-2180 K-2180

C. BYPASS CONTROL PANEL



D. ATS CONTROL PANEL (SSRCP)

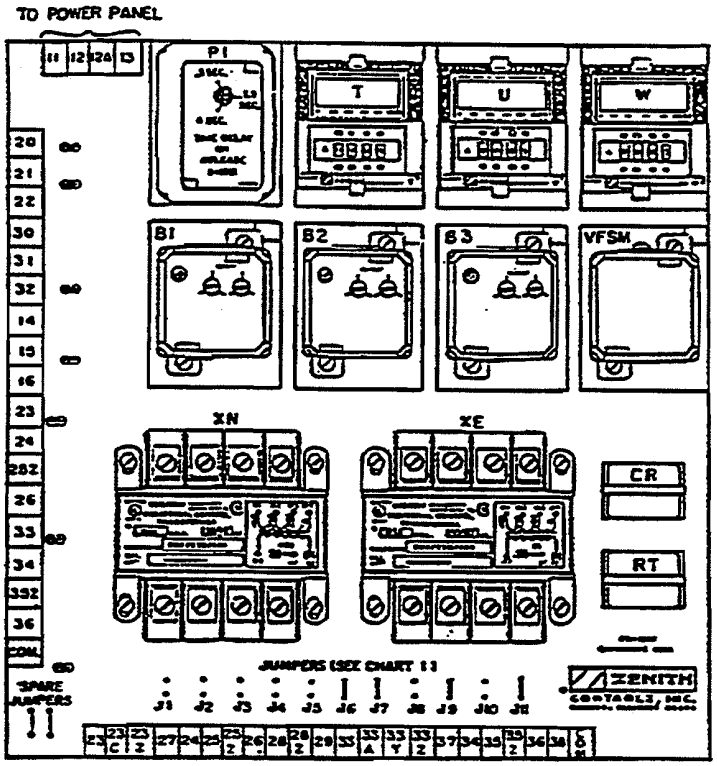


CHART 1

Jumper	Connects Points	Remove When Accessories Used
J1	23,23A	B1
J2	23A, 23B	B2
J3	23B, 23C	B3
J4	23C, 23Z	JIN, TS, C/D
J5	23Z, 27	T, YN
J6	25, 25Z	T3, R4
J7	28, 28Z	SI, C, C/D
J8	28Z, 29	PI & U
J9	33A, 33Y	ER1, 2, 3, J1E
J10	33Z,37	W
J11	35, 35Z	R4, W3

C. BYPASS CONTROL PANEL (46P-1079) INCLUDES PARTS BELOW

TAG	DESCRIPTION	PART NUMBER
BR1, 2, 3	Bridge Rectifier	PS-5076
RNH	Normal Voltage Relay	Y260000
R1	Resistor RNH, 30 ohm	PS-4056
R2	Resistor LDS, 120 ohm	PS-4057
D1	Diode	PS-4812
CA	Capacitor RNH	PS-4058
ATR	Auxilary Test Relay	Y260000

D. ATS CONTROL PANEL (SSRCP) STANDARD ITEMS

TAG	DESCRIPTION	VOLTAGE 50/60 HZ	PART NO.
XN, XE	Control Transformers (See Note 1)	120V	K-3076
		208V	K-3070
		240 or 480V	K-3071
		416V	K-3089
B-1, 2, 3	Phase Relays Solid State (See Note 1)	120V	K-1185
		208 or 240V	K-1186
		480V	K-1188
VFSM	Voltage Frequency Sensor	120V	K-1192
CR	Control Relay	120V	K-1204
RT	Bypass T Relay	120V	K-1204
CNI,CNO,CEI,CEO	CN/O,CE/O Transfer Relays (not shown)	120V	K-1120
J1-J11	Jumpers		PS-5067
DT	Time Delay Neutral to Normal	120V	OSA-A-T
DW	Time Delay Neutral to Emergency	120V	OSA-A-T

(OPTIONAL ITEMS)

TAG	DESCRIPTION	VOLTAGE	PART NUMBER
T	Time Delay to Normal, Timer Solid State	120V .1 Sec. to 9990 Hrs. (Adj.)	OSA-A-T
U	Engine Cool Down, Timer Solid State	120V .1 Sec. to 9990 Hrs. (Adj.)	OSA-A-U
W	Time Delay Emergency, Timer Solid State	120V .1 Sec. to 9990 Hrs. (Adj.)	OSA-A-W
P1	Time Delay Engine Start, Timer	120V (.5 to 6 sec. Adjustable)	K-1201
P2	Optional (Mounted below SSRCP)	120V (300 Sec. Adjustable)	K-1061

Notes:

1. If -6 voltage system (575/600V) is supplied, then XN, XE is K-3087 and B1,2, 3 is K-1185 (120V) supplied with XB (575:600V/120V) 3 phase transformer assembly. B1, 2, 3 mounted below SSRCP.

BYPASS/ISOLATION SWITCH OPERATION

BP — Bypass Switch, Indicated by Contacts BN/BE, is a 3 Position Switch
ATS — Automatic Transfer Switch

1. Automatic

1. Manually operated Bypass Switch contacts (BN/BE) are open and the ATS is supplying the load. (Fig. 1).
2. Disconnect Switch (DS) is in "Auto" position.

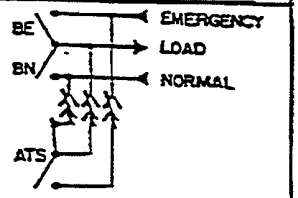


FIG.1 BP IS OPEN WITH ATS IN NORMAL POSITION.

2. To Bypass ATS

1. Open bottom cabinet door and turn DS to "Inhibit".
2. Position Manual Bypass Handle (MBH) to same power source as ATS (Fig. 2).

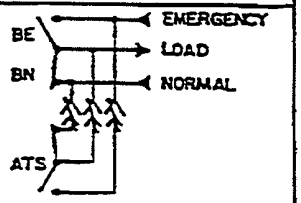


FIG.2 BP IS BYPASS NORMAL WITH ATS IN NORMAL POSITION.

3. To Test ATS

1. Bypass per above instructions.
2. Move ATS Location Handle (ALH) to "Test" location.
3. Turn DS to "Auto".
4. Test Switch (TS) on bottom cabinet door will allow electrical testing of ATS. (Fig. 3).

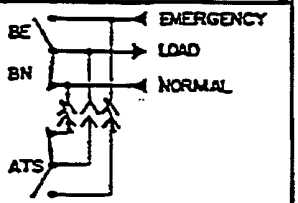


FIG.3 BP IS BYPASS NORMAL WITH ATS IN TEST LOCATION (ATS LOAD CONNECTION IS OPEN)

4. To Isolate ATS

1. Bypass per above instructions.
2. Move ALH to "Isolate" location.

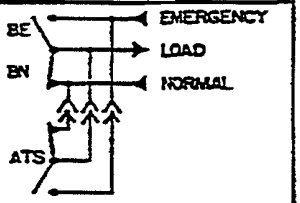


FIG.4 BP IS BYPASS NORMAL WITH ATS IN ISOLATE LOCATION.

5. To Remove ATS

1. Bypass and Isolate per above instructions.
2. Move ALH to "Release" location.
3. Disconnect multi-pin plugs and external connections.
4. Lift ATS out of drawer.

6. To Reconnect ATS

1. Place ATS into drawer slots, (front rollers first).
2. Turn DS to "Inhibit" position.
3. Position ATS to same source as Bypass Switch.
4. Reconnect Multi-pin plugs and external connections.
5. Push ATS inward to engage carriage.
6. Move ALH to "Test" location (as indicated by light).
7. Turn DS to "Auto" position and use TS to electrically operate ATS.
8. Turn DS to "Inhibit" position.
9. Move ALH to "Auto" location.
10. Turn DS to "Auto" and position MBH to "Open".
11. ATS now fully automatic (Fig. 1).

7. Notes

1. DS in "Inhibit" position will prevent ATS electrical operation.
2. Do not use excessive force on mechanical handles (interlocks prevent incorrect sequencing).
3. When ATS is in Test or Isolate, Bypass Switch is a manual transfer switch to either available power source.
4. To operate Bypass Switch when ATS is in Test or Isolate, position MBH to available power source (indicated on light panel).
5. Above figures depict Bypass Normal; sequence is same for Bypass Emergency.

DEFINITIONS:

BP — Bypass/Isolation Switch

It is a manually operated device used in conjunction with an Automatic Transfer Switch (ATS) to provide a means of directly connecting load conductors to a power source, and of disconnecting the Automatic Transfer Switch.

The BP can also be used as a Manual Transfer Switch in the event of a power failure while the ATS is in the TEST, ISOLATE, or RELEASE positions.

ATS — Automatic Transfer Switch

Is a self-acting equipment for transferring one or more load conductor connections from one power source to another.

DS — Disconnect Switch

Inhibits operation of ATS main coils (CN/O,CE/O). In the "AUTO" position, the ATS operates normally. In the "INHIBIT" position the main coils(CN/O,CE/O) cannot be energized, and automatic transfer in either direction cannot take place.

MBH — Manual Bypass Handle

Actuates the Bypass Operator.
Center for Bypass Open.
Down for Normal Bypass.
Up for Emergency Bypass.

TS — Test Switch

Simulates Normal line failure when open.

OPERATION NOTES:

1. The ATS will not operate if:
   a). Harness plugs are not connected.
   b). DS is in the 'INHIBIT' position.
   c). ATS is not in 'AUTO' or 'TEST' location.
   d). ATS is in 'AUTO' location and BYPASS SWITCH is not open.

2. The MBH will not operate if:
   a). ALH is not engaged in one of the following: AUTO — TEST — ISOLATE.
   b). If source selected is opposite of the ATS position while in the AUTO location.
   c). ATS is in 'TEST' or 'ISOLATE' location and source selected is not available.

3. The ALH (ATS Location Handle) will not operate if:
   a). BP and ATS are not positioned to same source.
   b). Power is not available.
   c). Harness Plugs are not connected.
   d). ATS has reached limit of travel to 'AUTO' or 'ISOLATE'.

READ THE FOLLOWING PARAGRAPHS BEFORE PROCEEDING TO "TEST PROCEDURE". (THIS PROCEDURE IS ONLY TO BE PERFORMED BY AUTHORIZED PERSONNEL)

CAUTION:

Loads controlled by Bypass/Isolation Transfer Switch may cause PERSONAL INJURY by UNAUTHORIZED PERSONNEL operating or testing this equipment.

Check all wiring diagrams that have been supplied for added options that may affect external equipment: For example; Starting and Stopping of Elevators and Motors.

A 'Control Panel Test' or a test with the ATS in the TEST LOCATION runs the EMERGENCY SOURCE with no load. A no load operation may be detrimental to the engine, and the Engine/Generator Manufacturer should be consulted.

Allow sufficient time on the U timer for engine to safely cool down.

RECOMMENDED TIMER SETTINGS:

T— Restoration to Normal.....30 minutes (Factory set)
U — Engine Cooldown/Stop.....5 minutes (Factory set)
W— Engine Warmup .....5 seconds (Factory set)
P1—Engine Start .....3 seconds (Factory set)

TEST PROCEDURE

The ATS can be tested in either of two locations:

1). AUTO LOCATION
2). TEST LOCTION

1. "AUTO LOCATION":

Full Transfer Test - This test checks the complete operation of the ATS by transferring an interrupting the load's power source from "Normal" to "Emergency"

Depress TS (Test Switch): First the generator starts, then the "W" timer times out (timer will indicate ON). The ATS will open. After the "DW" timer times out, the ATS will transfer to Emergency. Engine/Generator will shut down after timer "U" times out. Full Transfer Test is now complete.

2. "TEST LOCATION":

This procedure is recommended for Preventative Maintenance (PM) of the ATS without interrupting the load thru the BYPASS/ISOLATION SWITCH.
Refer to Page 8(step 3).

NOTE: TEST LOCATION is recommended after maintenance of ATS.

OPERATION OF AUTOMATIC TRANSFER SWITCH

When the normal line (NL) falls to the preset dropout point, or if any normal phase fails, the phase relay(s) will drop out disconnecting the CR relay. P1 drops out after .5 to 6 seconds (adjustable) and signals the generator to start.

When emergency line (EL) voltage and frequency reach at least 90% of rated value, the VFSM relay is energized. The RT relay is now energized to operate the CNO relay thru the SE cutout switch causing the main transfer coil CN/O to operate thru the SCNO limit switch. The load is now transferred to the Open position. The SNO and SCNO limit switches operate to disconnect the CNO relay and CN/O transfer coil. The transfer switch is now locked mechanically Open. SNO now is deactivated. This energizes the DW timer. After time setting has lapsed, DW will energize CE1, which will energize main transfer coil thru SCE and CE1. The load is now transferred to the Emergency line supply. The SE and SCE limit switches operate to disconnect the CE1 relay and CE/O main transfer coil. The transfer switch is now locked mechanically in Emergency position.

When the normal line voltage restores to the preset value, the phase relay(s), (B1,2,3) operate to energize the normal restoration timer T. After the time setting has lapsed, the timer contact closes to energize CR relay. The CEO relay is now energized thru the SN and SEO limit switches, causing the main transfer coil CEO to operate thru the SCEO limit switch. The load is now transferred back to the Open position. The SEO and SCEO limit switches operate to disconnect the CEO relay and CE/O transfer coil. The transfer is now locked mechanically Open. SEO is now activated, enegizing DT timer. After time setting has lapsed, DT will energize CN1 which will energize main transfer coil thru CN1 and SCN. The load is now transferred to the Normal line supply. The SN and SCN limit switches operate to disconnect the CN1 relay and CN/O main transfer coil. The transfer switch is now locked mechanically into Normal posiiton.

MAINTENANCE

Electrical Test:

The ATS may be electrically tested for preventive maintenance (refer to page 10 "Test Procedure"). After completion of an electrical test, the ATS should be returned to the Auto Operation Mode.

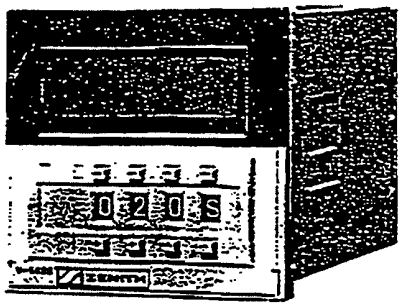
Inspection:

CONTACTS — The movable and stationary contacts are a vital part of the and must be kept clean. To inspect the ATS contacts, place ATS in Isolate location (see page 8). Examine the contacts.

Any surface deposits must be removed with a clean cloth (DO NOT USE EMERY CLOTH OR A FILE).

After the movable and stationary contacts are wiped clean (no discoloration or deposits), return the to Auto Mode.

CURRENT CARRYING PARTS — An easily detected but abnormal condition is the discoloration of current carrying parts (particularly copper). Discoloration appears as darkened materials or finishes. Any discolored parts should be cleaned. **WARNING: ANY MAINTENANCE SHOULD ONLY BE DONE WHILE THE POWER IS OFF!** If the discoloration persists, contact the factory.



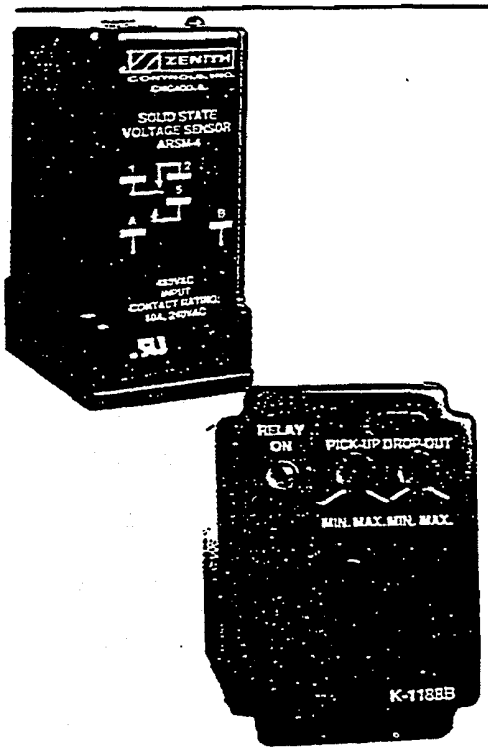
New Solid State Time Delay

Accessories T, U, W Solid State Timers Adjustable in Seconds, Minutes and Hours (Plug-In Style).

To select a time unit, operate the pushbuttons of the rightmost thumbwheel switch until the desired time unit is shown in window. The time unit can be selected by pushing the plus (+) bottom button or the minus (-) top button. The desired time is specified by operating the three thumbwheel switches in the middle of the front panel.

Setting of the timer at 000 will result in an infinite delay. The min. setting for OSA-A timers is $\frac{1}{10}$ of 1 second as shown. See instructions.

0	0	1	0.1 Sec.



Close Differential (ARSM) Relay Adjustment

The voltage points at which the relay operates are adjustable. When the relay pulls in, an audible click is heard, and the LED will come on.

Setting the Relay:

If the relay should be set with a variable voltage supply (Variac):

1. Turn pick-up control fully clockwise.
2. Turn drop-out control fully counterclockwise.
3. Set Variac pick-up voltage to desired level.
4. **Very slowly** rotate pick-up adjustment counterclockwise until relay picks up. (LED will energize).
5. Set Variac drop-out voltage to desired level.
6. **Very slowly** rotate drop-out adjustment clockwise until relay drops out (LED de-energizes).

Verify settings by raising voltage until relay picks up, then lower voltage until relay drops out, making sure that relay operates at desired voltage levels.

LUBRICATION

The cams of the ZBTSDH are lubricated with Super Lube PTFE grease, and gears with Dow Chemicals "Molykote" (321R or GN paste). These lubricants provide adequate lubrication for a clean and properly maintained switch's lifetime. Should debris contaminate the mechanism, clean and apply additional lubricants. Mobiltemp SHC-32 is used on isolating contacts.

LUBRICATION MAINTENANCE CHART

Date Inspected	Date Lubricated	Lubricant Used (Cams) (Gears)	Notes

TORQUE REQUIREMENTS FOR FIELD CONNECTIONS

NOTICE TIGHTENING TORQUES FOR FIELD WIRING TERMINALS	
Socket Size Across Flats, Inch	Tightening Torque Pound-Inches
1/8	45
5/32	100
3/16	120
7/32	150
1/4	200
5/16	275
3/8	375
1/2	500
9/16	600

TORQUE REQUIREMENTS FOR ELECTRICAL CONNECTIONS

All current carrying parts use compression washers and should be torqued to the values presented below. Caution: DO NOT OVERTORQUE WASHERS; follow the given torque values.

TORQUE REQUIREMENTS (inch - lb. except denoted by + are ft. - lb.)

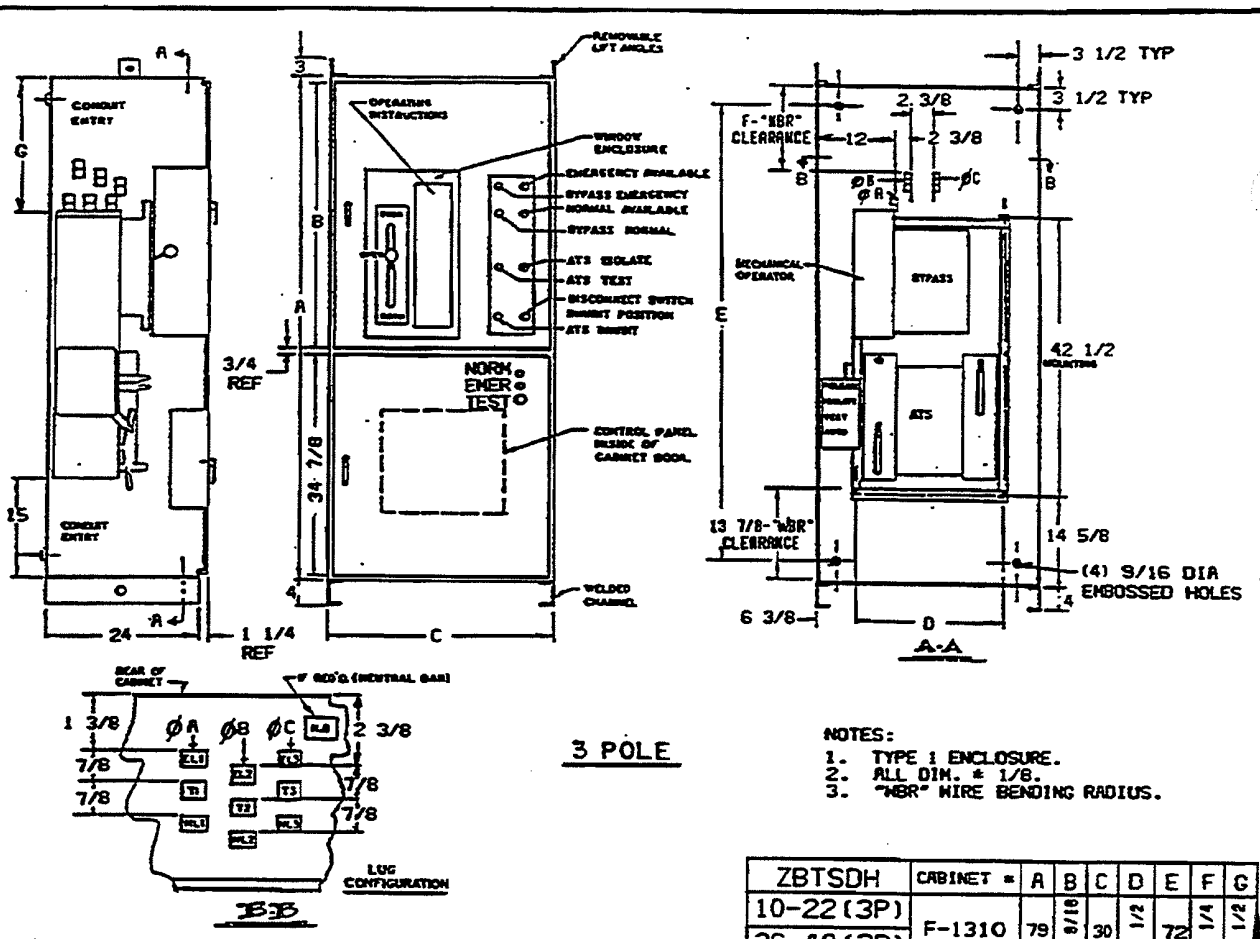
BOLT SIZE	GRADE 5	SOCKET HEAD	SET SCREW	COMPRESSION WASHERS	
				1	2
1/4 - 20	75	120	52	80	87
5/16 - 18	157	225	105	159	170
3/8 - 16	+23	412	165	+23	+26
1/2 - 13	+57	1030	386	+56	+59

WIRE CONNECTION TIGHTENING TORQUE

WIRE COND. SIZE AWG or MM	SCREW DRIVER TORQUE (inch - lb.)
18 - 16 AWG	19
14 - 8	19
6 - 4	36

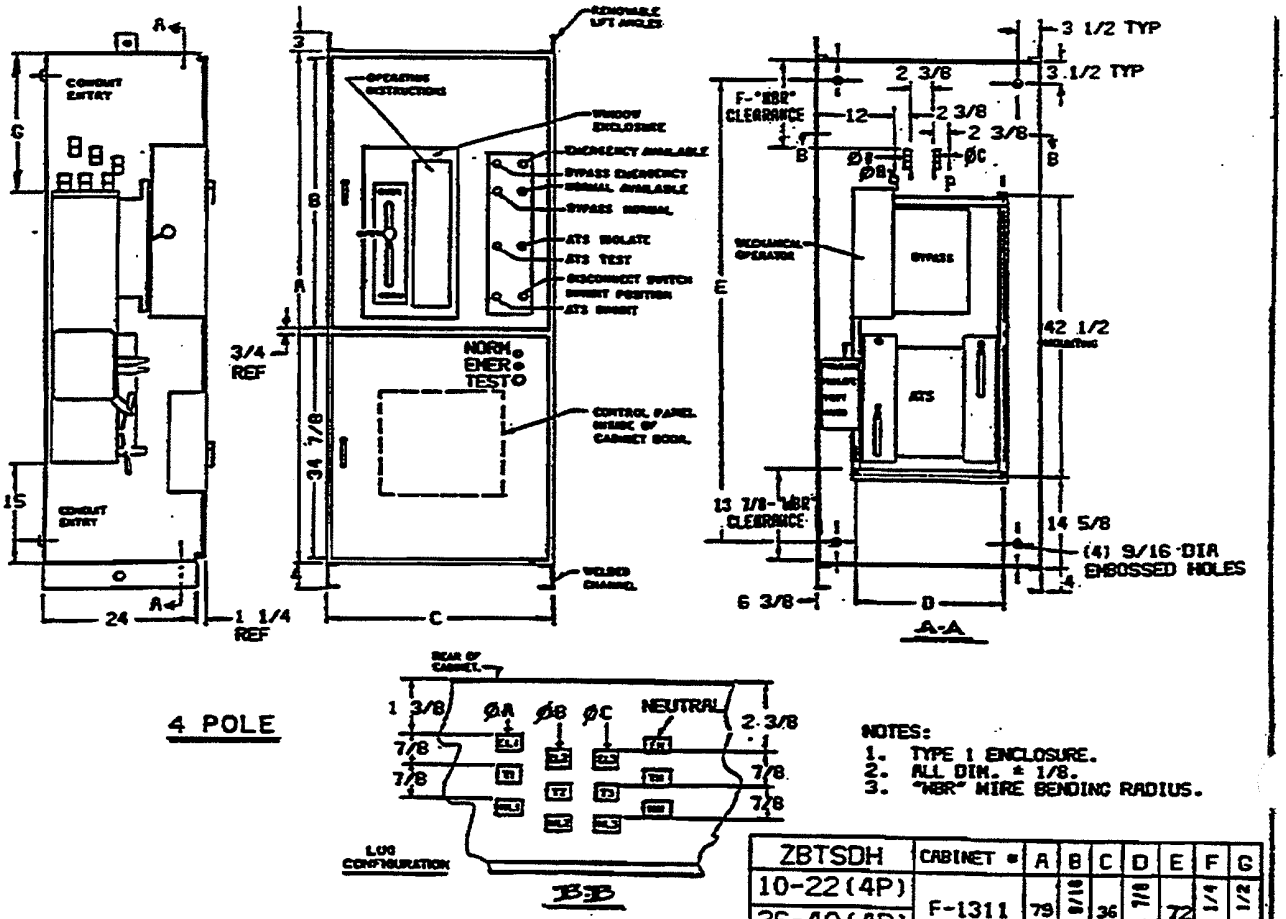
LUG BOLTING TORQUE

BOLT DIA. (inch)	TORQUE (ft. - lb.)
1/4 OR LESS	6
5/16	11
3/8	19
7/16	30
1/2	40
5/8 OR MORE	55



NOTES:
1. TYPE 1 ENCLOSURE.
2. ALL DIM. ± 1/8.
3. "NBR" WIRE BENDING RADIUS.

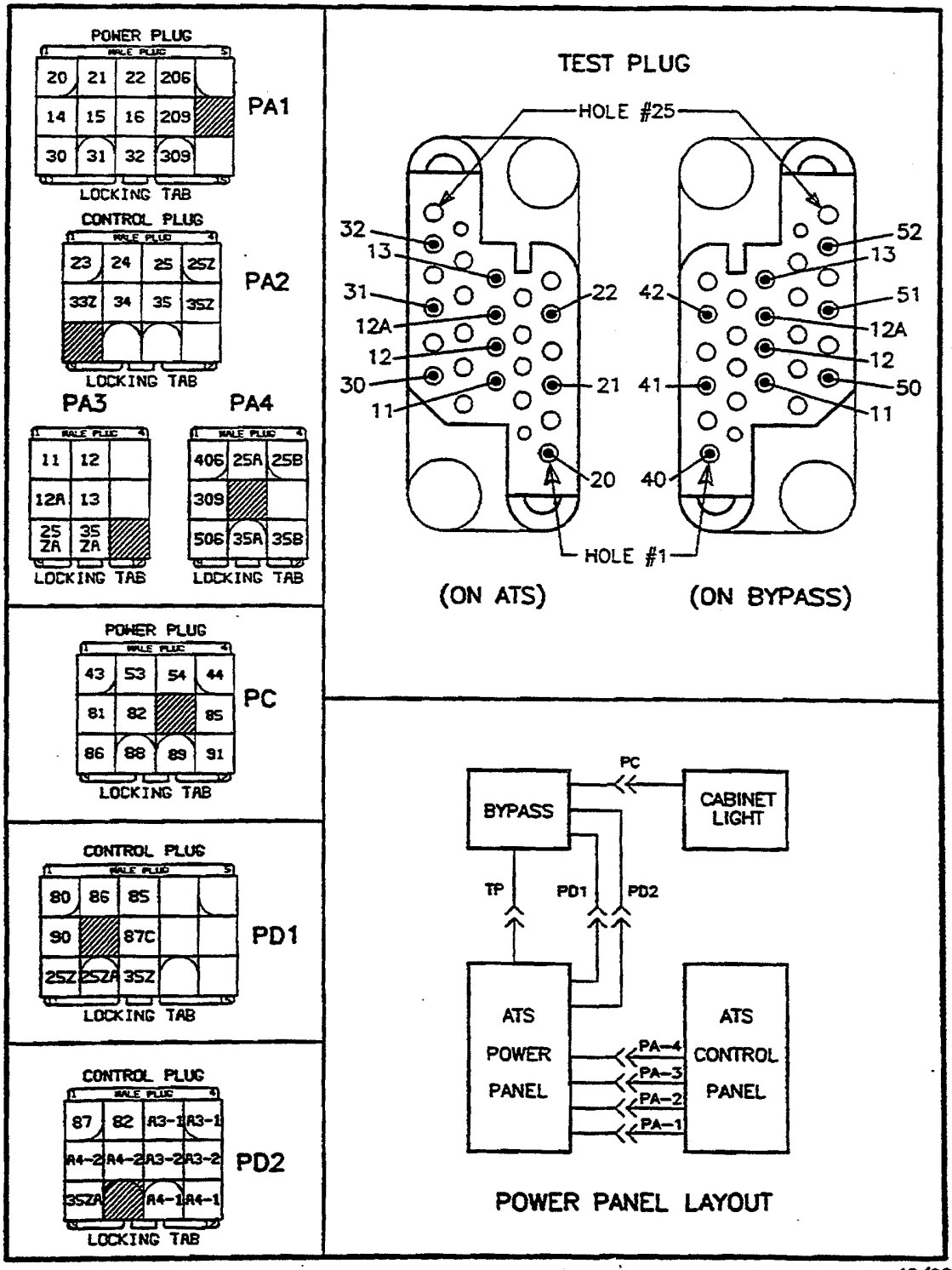
ZBTSDH	CABINET #	A	B	C	D	E	F	G
10-22(3P)	F-1310	79	42 9/16	30	21 1/2	72	15 1/4	21 1/2
26-40(3P)								



NOTES:
1. TYPE 1 ENCLOSURE.
2. ALL DIM. ± 1/8.
3. "NBR" WIRE BENDING RADIUS.

ZBTSDH	CABINET #	A	B	C	D	E	F	G
10-22(4P)	F-1311	79	42 9/16	36	23 7/8	72	15 1/4	21 1/2
26-40(4P)								

DISCONNECT PLUGS
ZBTSDH 100–400 AMPS



10/96

FIELD NOTES

MODEL NO: _____

SERIAL NO: _____

DATE SHIPPED: _____

START-UP DATE: _____

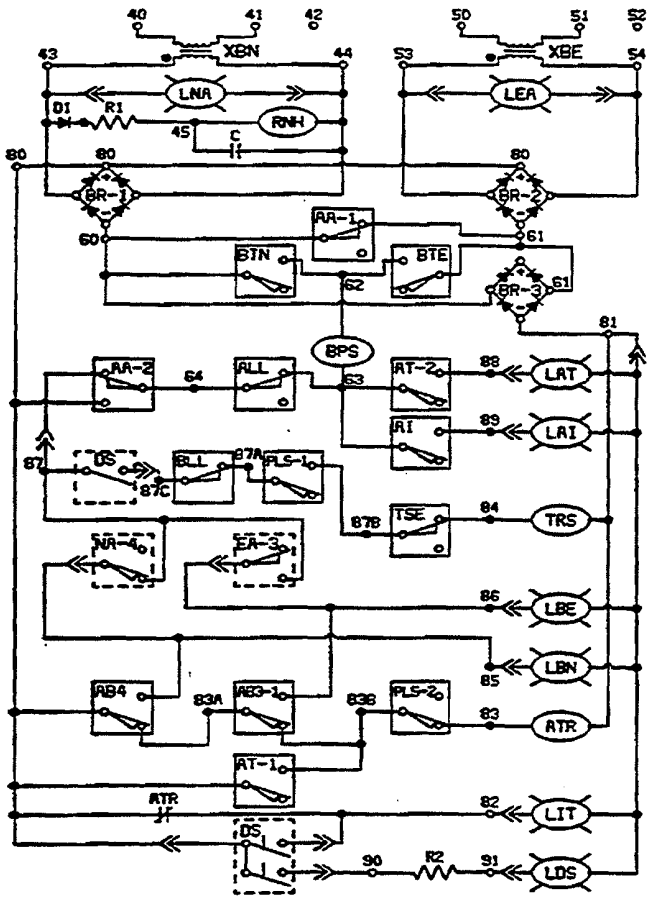
DRAWING SUPPLIED: _____

_____

TEST AND MAINTENANCE NOTES:

DATE	TESTED	OBSERVATIONS	NOTES

BYPASS CONTROL SCHEMATIC



LNA - NORMAL AVAILABLE LIGHT
LEA - EMERGENCY AVAILABLE LIGHT
RNH - NORMALLY HELD RELAY
D1 - DIODE
R1 - RESISTOR, RNH
C - CAPACITOR, RNH
BR-1,2,3 - BRIDGE RECTIFIER

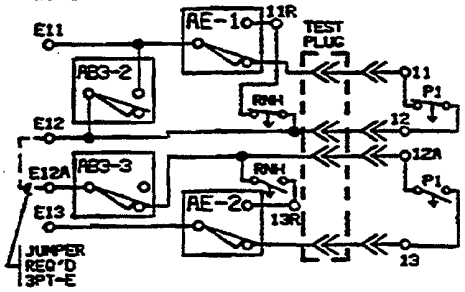
AA-1 - LIMIT SWITCH, ATS AUTO LOCATION
BTN - LIMIT SWITCH, BYPASS TRANSFER NORMAL (MBH MOVEMENT TO NORMAL)
BTE - LIMIT SWITCH, BYPASS TRANSFER EMERG. (MBH MOVEMENT TO EMERGENCY)
BPS - BYPASS SOLENOID
AA-2 - LIMIT SWITCH, ATS AUTO LOCATION
ALL - LIMIT SWITCH, ATS LOCK LOCATION
AT-2 - LIMIT SWITCH, ATS TEST LOCATION
LAT - LIGHT, ATS TEST LOCATION
AI - LIMIT SWITCH, ATS ISOLATE LOCATION
LAI - LIGHT, ATS ISOLATE LOCATION
BLL - LIMIT SWITCH, BYPASS LOCK LOCATION
PLS-1- PERMISSIVE LIMIT SWITCH
TSE - LIMIT SWITCH, TRANSFER SWITCH ENGAGED
TRS - SOLENOID, TRANSFER RELEASE
NA-4 - LIMIT SWITCH, ATS IN NORMAL
EA-3 - LIMIT SWITCH, ATS IN EMERGENCY
LBE - LIGHT, BYPASS EMERGENCY

LBN - LIGHT, BYPASS NORMAL
AB4 - LIMIT SWITCH, BYPASS NORMAL
AB3-1- LIMIT SWITCH, BYPASS EMERGENCY
PLS-2- PERMISSIVE LIMIT SWITCH
ATR - AUTO/TEST RELAY
AT-1 - LIMIT SWITCH, ATS TEST LOCATION

LIT - LIGHT, ATS INHIBIT
DS - ATS DISCONNECT SWITCH
R2 - RESISTOR, LDS
LDS - LIGHT, DISCONNECT SWITCH INHIBIT POSITION
ALH - ATS LOCATION HANDLE

ENGINE START CIRCUIT

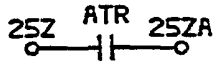
AE-1,2 - LIMIT SWITCH, ENGINE START TRANSFER
AB3-2,3- LIMIT SWITCH, BYPASS EMERGENCY



LIMIT SWITCH CHART

X = ACTUATED	ATS LOCATION				ATS MODE		BYPASS MODE		
	AUTO	TEST	ISO	REMOVE	NORM	EMERG.	NORM	EMERG.	OPEN
AA-1,2	X								
AT-1,2		X							
AI			X	X					
ALL	X	X	X	X					
TSE	X	X	X						
AE-1,2			X	X					
NA-4					X				
EA-3						X			
AB4							X		
AB3-1,2,3								X	
BLL							X	X	X
PLS-1,2	ACTIVATED WHEN ALH IS OPERATED								

PERMIT CIRCUITS

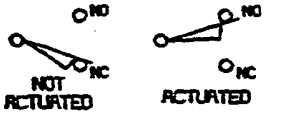


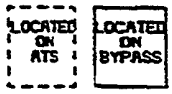
NORMAL TRANSFER PERMIT CIRCUIT IN AUTO AND TEST POSITIONS



EMERGENCY TRANSFER PERMIT CIRCUIT IN AUTO AND TEST POSITIONS

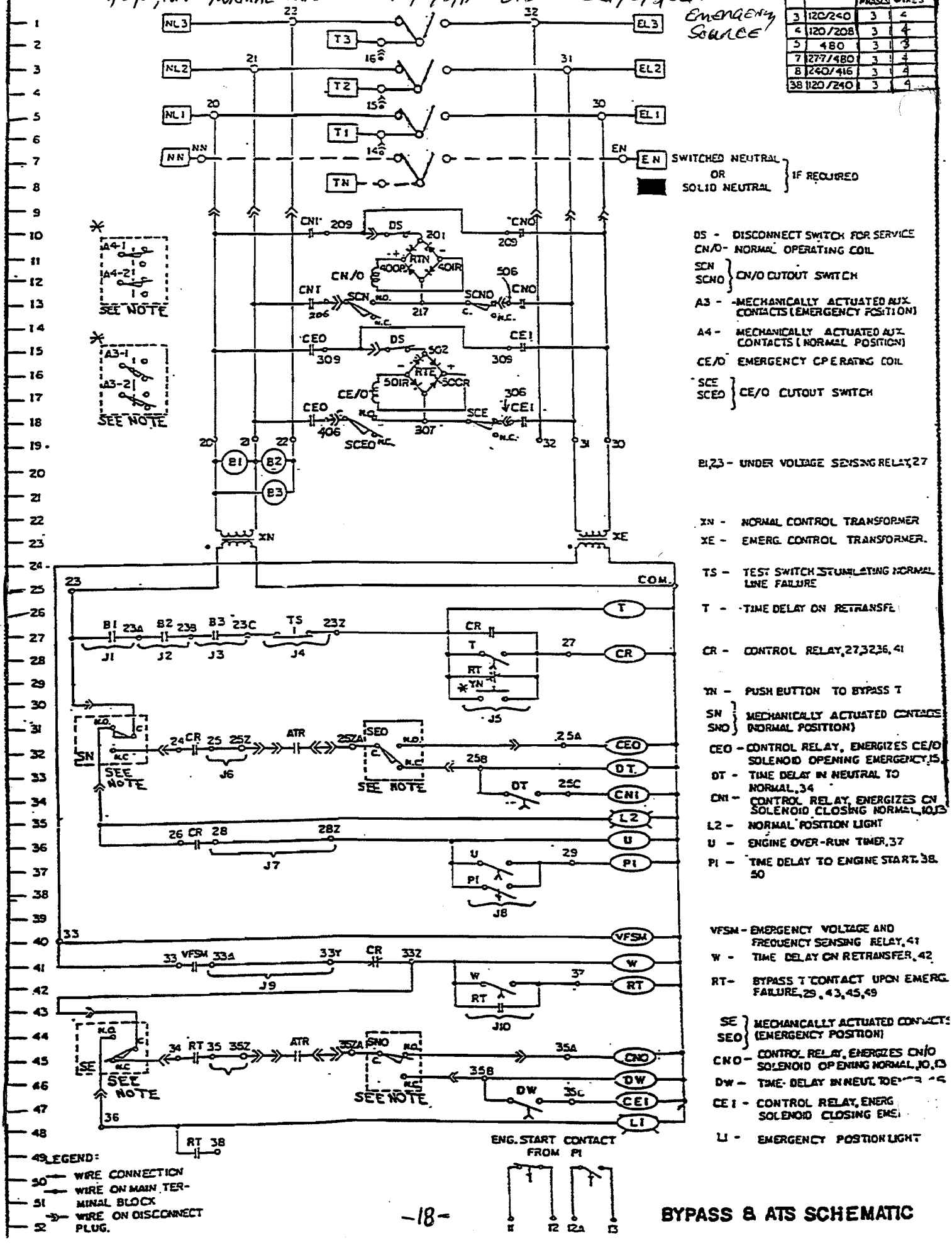
LIMIT SWITCHES





NL1, 2, 3, NN - NORMAL SOURCE T1, 2, 3, TN - LOAD EL1, 2, 3 EL N - EMERGENCY SOURCE

	VOLTS	NO PHASES	NO. WIRES
3	120/240	3	4
4	120/208	3	4
5	480	3	3
7	277/480	3	4
8	240/416	3	4
38	120/240	3	4



DS - DISCONNECT SWITCH FOR SERVICE
CN/O - NORMAL OPERATING COIL
SCN, SCNO } CN/O CUTOUT SWITCH
A3 - MECHANICALLY ACTUATED AUX. CONTACTS (EMERGENCY POSITION)
A4 - MECHANICALLY ACTUATED AUX. CONTACTS (NORMAL POSITION)
CE/O EMERGENCY OPERATING COIL
SCE, SCEO } CE/O CUTOUT SWITCH
B1,2,3 - UNDER VOLTAGE SENSING RELAY, 27
XN - NORMAL CONTROL TRANSFORMER
XE - EMERG. CONTROL TRANSFORMER.
TS - TEST SWITCH STIMULATING NORMAL LINE FAILURE
T - TIME DELAY ON RETRANSFER
CR - CONTROL RELAY, 27, 32, 36, 41
YN - PUSH BUTTON TO BYPASS T
SN, SNO } MECHANICALLY ACTUATED CONTACTS (NORMAL POSITION)
CEO - CONTROL RELAY, ENERGIZES CE/O SOLENOID OPENING EMERGENCY, 15
DT - TIME DELAY IN NEUTRAL TO NORMAL, 34
CN1 - CONTROL RELAY, ENERGIZES CN SOLENOID CLOSING NORMAL, 10, 13
L2 - NORMAL POSITION LIGHT
U - ENGINE OVER-RUN TIMER, 37
P1 - TIME DELAY TO ENGINE START, 38, 50
VFSM - EMERGENCY VOLTAGE AND FREQUENCY SENSING RELAY, 41
W - TIME DELAY ON RETRANSFER, 42
RT - BYPASS T CONTACT UPON EMERG. FAILURE, 25, 43, 45, 49
SE, SEO } MECHANICALLY ACTUATED CONTACTS (EMERGENCY POSITION)
CNO - CONTROL RELAY, ENERGIZES CN/O SOLENOID OPENING NORMAL, 10, 13
DW - TIME DELAY IN NEUT. TO EMERG.
CE1 - CONTROL RELAY, ENERG. SOLENOID CLOSING EMER.
L1 - EMERGENCY POSITION LIGHT

LEGEND:
WIRE CONNECTION
WIRE ON MAIN TERMINAL BLOCK
WIRE ON DISCONNECT PLUG.

BYPASS & ATS SCHEMATIC



830 West 40th Street
Chicago, IL 60609 USA

Phone: 773 247-6400
FAX: 773 247-7805

© 1996 Zenith Controls, Inc.

ZBTSDH SERIES
BYPASS/ISOLATION/DELAY TRANSFER SWITCH OPERATION
100–400 AMP

OPERATION: BYPASS/ISOLATION SWITCH

AUTOMATIC

1. Manually operated Bypass Switch contacts (BN/BE) are open and ATS is supplying load
2. Disconnect Switch (DS) is in "AUTO".

TO BYPASS ATS

1. Open bottom cabinet door & turn DS to "INHIBIT".
2. Position manual bypass handle (MBH) to same power source as ATS.

TO TEST ATS

1. Bypass per above insturctions.
2. Move ATS location handle (ALH) to "TEST" location.
3. Turn DS to "AUTO".
4. Test Switch (TS) on bottom cabinet door will allow electrical operation of ATS.

TO ISOLATE ATS

1. Bypass per above instructions.
2. Move ALH to "ISOLATE" location.

TO REMOVE ATS

1. Bypass and Isolate per above instructions.
2. Move ALH to "RELEASE" location.
3. Disconnect multipin plugs.
4. Lift ATS out of drawer.

TO RECONNECT ATS

1. Place ATS into drawer slots (front rollers first).
2. Turn DS to "INHIBIT".
3. Manually position ATS into same source as Bypass Switch.
4. Reconnect multipin plugs and external connections to ATS.
5. Push ATS inward to engage carriage.
6. Move ALH to "TEST" location (as indicated by light)
7. Turn DS to "AUTO" and use TS to electrically operate ATS.
8. Turn DS to "INHIBIT".
9. Move ALH to "AUTO" location.
10. Turn DS to "AUTO" & open Bypass with MBH.
11. ATS is now fully automatic (Fig.1).

NOTES:

1. DS in "INHIBIT" will prevent ATS electrical operation.
2. Do not use excessive force on mechanical handles.
3. Above Figures depict Bypass NORMAL. Sequence is same for Bypass EMERGENCY.
4. When ATS is in TEST or ISOLATE, Bypass Switch is manual transfer switch to either available source (indicated on light panel).
5. To operate Bypass Switch when ATS is in TEST or ISOLATE, position MBH to available power source.

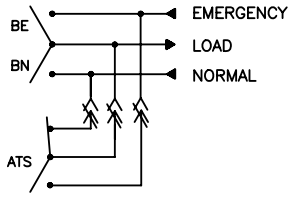


FIG. 1 BP IS OPEN WITH ATS IN NORMAL

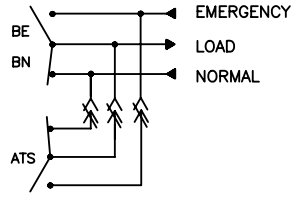


FIG. 2 BP IN NORMAL WITH ATS IN NORMAL

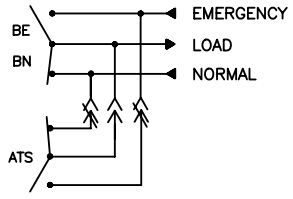


FIG. 3 BP IN NORMAL WITH ATS IN TEST (LOAD CONNECTIONS ARE OPEN)

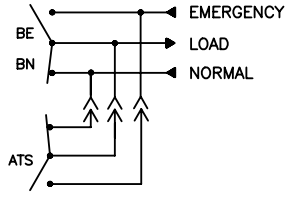


FIG. 4 BP IN NORMAL WITH ATS ISOLATED

NOTES:

1. BP–Bypass switch (indicated by contacts BN/BE) is a 3 position switch.
2. ATS–Automatic Transfer Switch

NOTES

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S–5004	ESTABLISH DWG.		
B	S–7350	02/23/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: BYPASS/ISOLATION TRANSFER SWITCH OPERATION

JOB/MODEL: ZBTSDH10–40 (100–400 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	40R–0503

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
KW	SB	05/18/92	–	1 OF 3	B

LEGEND: BYPASS/ISOLATION SWITCH (BP)

I. (BP) BYPASS/ISOLATION SWITCH: MECHANICAL COMPONENTS

N1,2,3(N)..... Normal Line connections_____
E1,2,3(N)..... Emergency Line connections_____
T1,2,3(N)..... Load Line connections_____
BE..... Bypass Emergency contacts
BN..... Bypass Normal contacts
MBH..... Manual Bypass Handle
ALH..... ATS Location Handle

II. (BP) BYPASS/ISOLATION: ELECTRICAL COMPONENTS

AA–1,2..... Limit switch held actuated in Auto location of ATS, Non–actuated Test and Isolated locations.
AB3–1,2,3..... Limit switch, actuated in Bypass Emergency position
AB4..... Limit switch, actuated in Bypass Normal position
ABE..... Auxiliary Bypass contact (Emergency)
ABN..... Auxiliary Bypass contact (Normal)
AE–1,2..... Limit switch, switches Engine Start from ATS control to bypass control during ATS Isolate
AI..... Limit switch, actuated in Isolate location
ALL..... Limit switch, ATS lock location
AT–1,2..... Limit switch, actuated in Test location
ATR..... Auto/Test Relay. Energized in AUTO and TEST locations
BLL..... Limit switch, Bypass lock location
BPS..... Bypass Solenoid
BR–1,2,3..... Bridge Rectifier
BTE..... Limit switch, Bypass Transfer Emergency (actuates during MBH movement to Emergency)
BTN..... Limit switch, Bypass Transfer Normal (actuates during MBH movement to Normal)
C..... Capacitor: RNH
D1..... Diode
EA–3..... Limit switch, ATS in Emergency
NA–4..... Limit switch, ATS in Normal
PLS–1,2..... Permissive limit switches
R1..... Resistor: RNH
R2..... Resistor: LDS
RNH..... Relay normally held, 24 VDC coil, 3PDT
TRS..... Transfer Release Solenoid
TSE..... Limit switch. Transfer switch engaged non–activated in remove position
XBE..... Emergency line control transformer
XBN..... Normal line control transformer

III. (BP) BYPASS/ISOLATION SWITCH: INDICATOR LIGHTS

LNA..... Normal available
LEA..... Emergency available
LBN (NOTE 1)..... Bypass Normal (BN closed)
LBE (NOTE 1)..... Bypass Emergency (BE closed)
LAT (NOTE 1)..... ATS in Test location
LAI (NOTE 1)..... ATS in Isolate location
LIT (NOTE 1)..... ATS Inhibit
LDS (NOTE 1)..... ATS DS switch in INHIBIT position

NOTES

1. Indicator off during automatic operation of ATS.
2. Four pole includes neutral lugs.

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S–5004	ESTABLISH DWG.		
B	S–7350	02/23/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION.
DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: BYPASS/ISOLATION SWITCH LEGEND
JOB/MODEL: ZBTSDH10–40 (100–400 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	40R–0503

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
KW	SB	05/18/92	–	2 OF 3	B

LEGEND & OPERATION: AUTOMATIC TRANSFER SWITCH (ATS)

A. LEGEND

B1,2,3..... Solid State Phase Relay(s)
Dropout _____ %
Pickup _____ %
CE1..... CE/O Control Relay, Emergency Closing
CEO..... CE/O Control Relay, Emergency Opening
CE/O..... Emergency Main Transfer Operator
CN1..... CN/O Control Relay, Normal Closing
CNO..... CN/O Control Relay, Normal Opening
CN/O..... Normal Main Transfer Operator
CR, RT..... Control Relays
DS..... Disconnect Switch
DT..... Timer, Delay Open To Normal
DW..... Timer, Delay Open To Emergency
E..... Engine Start Contact
GRD..... Ground
NB..... Neutral Bar (if required)
RT..... Emergency Control Relay
RTE..... Bridge Rectifier, CE/O
RTN..... Bridge Rectifier, CN/O
SCN,SCNO..... Limit Switches, CN/O
SCE,SCEO..... Limit Switches, CE/O
SE,SEO..... Cutout Switch, Emergency
SN,SNO..... Cutout Switch, Normal
TS..... Test Switch, Momentary, Not Keyed
VFSM..... Emergency Volt-Freq. Relay
Pickup { 90% of rated Voltage, and 95% of rated Frequency
XE..... Control Transformer, Emergency
XN..... Control Transformer, Normal

NOTES:

1. ⚠ CAUTION:In using a 3 phase, 4 wire delta or open delta power supply (usually 120/240 volts, sometimes listed as 120/208 volts) with one leg having a grounded center tap, one line will be 160 to 208 volts to ground. When such a system is used it is necessary to connect the high leg to N2.DO NOT CONNECT 120 VOLT LOAD CIRCUIT TO THE HIGH LEG.
2. GROUNDING TERMINAL: A grounding terminal (GND) is provided. When installing open type switches connect this to the metal enclosure or an equivalent earth ground.
3. ⚠ WARNING – TO ENSURE AGAINST SHOCK OR ACCIDENT HAZARD, DISCONNECT ALL SOURCES OF SUPPLY BEFORE SERVICING.
4. ON SINGLE PHASE UNITS WHERE THE EMERGENCY SOURCE IS A UTILITY LINE, CONNECT EMERGENCY LINE SO THAT MINIMUM VOLTAGE IS MEASURED FROM N1 TO E1.
5. ON SINGLE PHASE (2 POLE) UNITS, CENTER POLE AND PHASE RELAYS (B2,B3) ARE NOT SUPPLIED.

B. OPERATION

When the Normal Line falls to the preset dropout point, the phase relays will dropout disconnecting the CR relay.

When the Emergency Line voltage and frequency reach the preset pickup point, the VFSM relay picks up. RT relays picks up to operate the CNO relay thru the SE & SNO limit switches causing the main transfer operator CN/O to operate thru the SCNO limit switch. The load is now transferred to the Open position. The SNO and SCNO limit switches operate to disconnect the CNO relay and CN/O main transfer operator. The transfer switch is now mechanically locked open. Limit switch SNO is now deactivated, picking up the DW timer. After a set time delay, DW will pick up CE1 relay which will then pickup CE/O main transfer operator thru the SCE limit switch and CE1 relay. The load is now transferred to the Emergency line. The SE and SCE limit switches operate to disconnect the CE1 relay and CE/O main transfer operator. The transfer switch is now mechanically locked in Emergency.

When the normal Line voltage exceeds the preset pickup point, the phase relays B1, B2 & B3 pick up. CR relay picks up to operate the CEO relay thru the SN & SEO limit switches causing the main transfer operator CE/O to operate thru the SCEO limit switch. The load is now transferred to Open position. The SEO & SCEO limit switches operate to disconnect the CEO relay and CE/O main transfer operator. The transfer switch is now mechanically locked open. SEO is now activated picking up the DT timer. After a set time delay DT will pick up the CN1 relay which will then pick up CN/O main transfer operator thru the CN1 relay and SCN limit switch. The load is now re-transferred to the Normal line. The SN and SCN limit switches operate to disconnect the CN1 relay and CN/O main transfer operator. The transfer switch is now mechanically locked in Normal.

DS – Disconnect Switch
When the Disconnect Switch is placed in the INHIBIT position the circuit to the main transfer operators CN/O and CE/O is opened and transfer cannot take place.

TS – Test Switch
The Test Switch simulates a normal line failure when activated.
To test, activate the Test Switch allowing the transfer switch to transfer to the EMERGENCY position. De-activate the Test Switch. The transfer switch will reset to the NORMAL position. Testing at least once a month is recommended. For hospital emergency systems, test once a week.

NOTES

REVISIONS				
REV	ECN NO.	DATE	DFT	ENG
A	S-5004	ESTABLISH DWG.		
B	S-7350	02/23/00	SG	MES

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION.
DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: ATS LEGEND & OPERATION
JOB/MODEL: ZBTSDH10-40 (100-400 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:		DRAWING NUMBER:		
		ACAD	–		40R-0503		
		DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
		KW	SB	05/18/92	–	3 OF 3	B

ACCESSORIES

The ZTS series switches are wired so that accessories can be easily added to the switch. The following is a description of the basic accessories. Those checked are supplied on this unit, see additional pages for complete legend & operation.

☐ A1 Auxiliary contact, S.P.D.T., operates on normal line failure.

☐ A1E Auxiliary contact, S.P.D.T., operates on emergency line failure.

☐ A3 Auxiliary contact closes when the transfer switch is in the Emergency position.

☐ A4 Auxiliary contact closes when the transfer switch is in Normal position.

☐ A6 Motor Disconnect. To de–energize external motor control circuit 5 seconds (adjustable) prior to transfer in either direction.

☐ C Plant Exercisor. Automatically starts generator for selected time intervals.

☐ C/D Plant Exercisor. Automatically starts generator to run unloaded or simulate a power failure and starts generator to run under load.

☐ E Engine Start Contact: 1 Normally Open
1 Normally Closed.

☐ F Auxiliary Fan Contact, S.P.N.O. Closes when generator is running.

☐ H Time delay to engine start, non–adjustable. Factory set 1 or 3 seconds. When the Normal line fails the relay de–energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ J1 Adjustable under frequency sensor.

☐ J2 Adjustable over/under frequency sensor.

☐ K Frequency meter to indicate load frequency.

☐ L1 Pilot Light. Switch in Emergency Position.

☐ L2 Pilot Light. Switch in Normal Position.

☐ L3 Pilot Light. Normal source available.

☐ L4 Pilot Light. Emergency source available.

☐ M1 Ammeter; Single phase.

☐ M2 Ammeter; Three phase

☐ M3 Voltmeter; Single phase.

☐ M4 Voltmeter; Three phase.

☐ P1 Time Delay to Engine Start (solid state). Adjustable over time range .5 to 6 seconds. When the Normal line fails the relay de–energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ P2 Time Delay to Engine Start (Pneumatic). Adjustable over time range 1/6 to 300 seconds. When the Normal line fails, the relay de–energizes. After the set time delay its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ Q2 Connections for remote peak shave or area protection relays. Includes bypass for automatic return to Normal if Emergency line fails and Normal is present.

☐ R1 Solid State Adjustable Overvoltage Relay(s). Set at 110% of pickup, 105% of dropout of nominal Line rate, unless otherwise specified.

☐ R4 In–Phase monitor. Prevents transfer until two sources are in–phase. For use of isochronous governors.

☐ R43 In–phase monitor. Prevents transfer until two sources are in–phase. For use with mechanical. governors.

☐ S1 Four–position Engine Control Selector Switch. "STOP", "HAND CRANK", "TEST", "AUTOMATIC".

☐ T Time delay, re–transfer to Normal. When the Normal line restores and the phase relays operate, the T timer is energized. After the set time delay, its contacts close the circuit to the CR relay which operates to restore the load to the Normal line. RT relay is supplied to bypass T contacts if Emergency is de–energized during timing. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ T3 W3 Presignal auxiliary Contact, S.P.D.T: Operates 0–30 seconds (adjustable) prior to transfer in either direction.

☐ U Time delay, engine cool–down. When the transfer switch is restored to the Normal position and the engine is signaled to shut down, the U timer operates to maintain the engine start circuit closed. At the end of the set time, the engine contacts open to shut down the engine. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ W Time delay, transfer to Emergency. When the Normal line fails and the engine has started, the VFSM relay energizes. The W timer energizes. After the set time delay, its contacts close to energize the RT relay. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ YE Pushbutton, Transfer to Emergency. Provides manual control of transfer to emergency source. If time delay accessory W is supplied pushbutton bypasses time delay for immediate transfer; otherwise, transfer to emergency will be automatic after time delay. If time delay accessory W is not supplied, transfer will be non–automatic (by pushbutton only).

☐ YN Pushbutton, Retransfer to Normal. Provides manual control of retransfer to normal source. If time delay accessory T is supplied, pushbutton bypasses time delay for immediate retransfer; otherwise, retransfer to normal will be automatic after time delay. If time delay accessory T is not supplied, retransfer will be non–automatic (by pushbutton only).

☐ Other:_____

_____

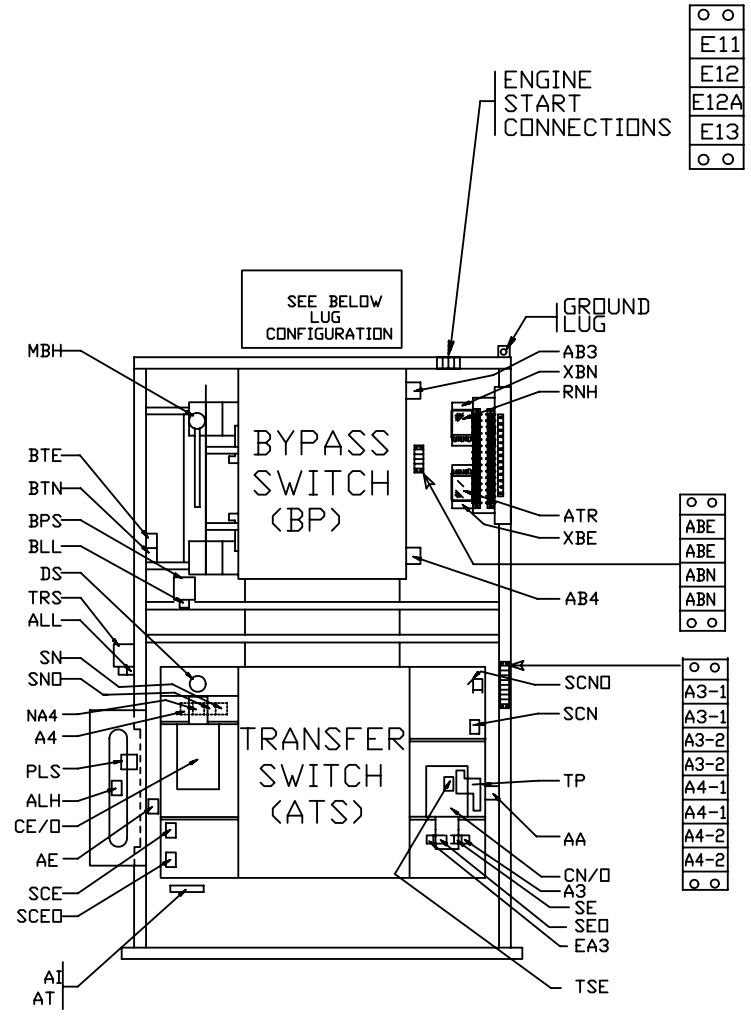
_____

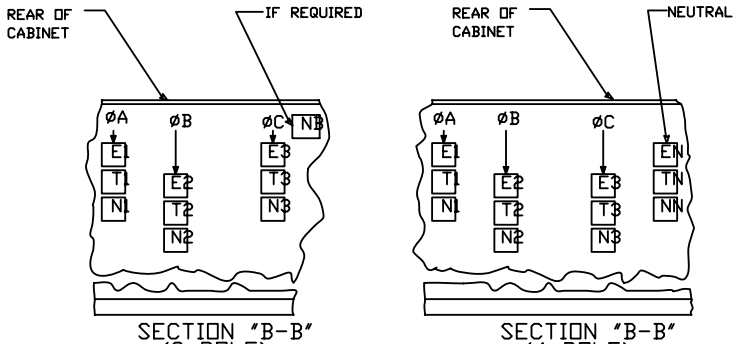
ZENITH® CONTROLS, INC.

TITLE: ACCESSORIES

DRAWING NO.: 40R–0900 — REV

DEVICE TAG	TERMINAL MARKINGS WIRE NUMBER					
TRANSFORMERS	X1	X2	H1	H2	H3	H4
XBE	53	54	50			51
XBN	43	44	40			41
SOLENOIDS	NO MARKINGS					
BPS	62	63				
TRS	84	81				
CN/O	400R	401R				
CE/O	500R	500R				
SWITCHES	NO		NC		NO	
DS	80	82	201	209	87	87C
	80	90	502	309		
LIMIT SWITCHES	C	NC	NO	C	NC	NO
AA-1,2	60		61	64	80	87
AB3-1	83A	83B	86			
AB3-2,3	E12		E11	E12A	12A	
AB4	80	83A	85			
AE-1,2	E11	11	11R	E13	13	13R
AI	63		89			
ALL	64		63			
AT-1,2	80		83B	63		88
BLL	87C		87A			
BTE	61		62			
BTN	60		62			
EA-3	86	87				
NA-4	85	87				
PLS-1,2	87A		87B	83B	83	
SCE	307		306			
SCEO	406		307			
SCN	206		217			
SCNO	217		506			
SE	33Z	36	34			
SEO	25ZA	25A	25B			
SN	23	26	24			
SNO	35ZA	35A	35B			
TSE	87B		84			
RECTIFIERS	AC	AC	+	−		
BR-1	43	44	80	60		
BR-2	53	54	80	61		
BR-3	60	61		81		





LUG CONFIGURATION

LEGEND	REFERENCE	NOTES
	REFER TO 40R-0503 FOR LEGEND & OPERATION FOR MANUFACTURING: SEE PAGE 5 FOR CONTROL PANEL SEE 40R-0900 FOR ACCESSORIES.	

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
–	S-5769	07/22/94	FHB	–
E	S-6240	02/28/96	BRB	SB

ZENITH CONTROLS, INC.

TITLE: BP & ATS COMPONENT LOCATIONS

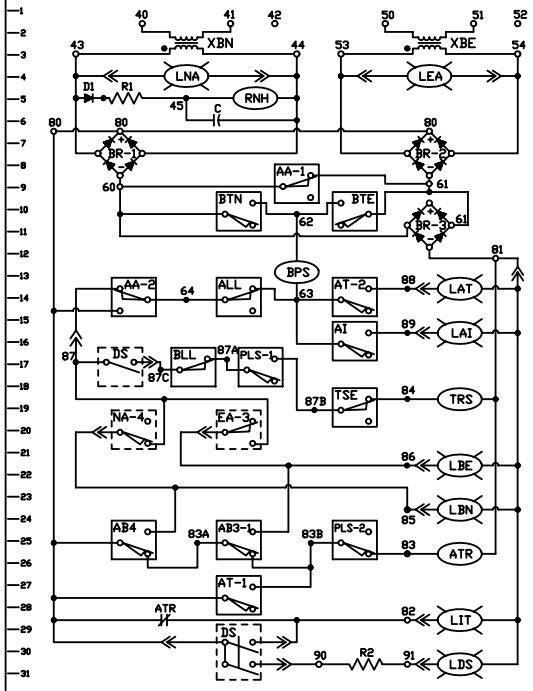
MODEL: ZBTSDH10/40 (100-400 AMPS)

DRFT: FHB	DATE:	SCALE:	CHK:	APPD:
ENGR: SB	07/22/94	N/A		

DWG NO.: 46A-5000 REV E

CADD: S5K SHT. 1 OF 5

ORIGINAL



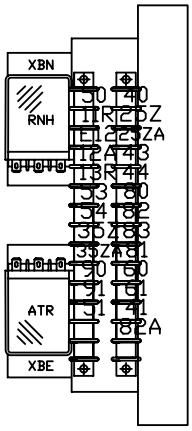
LNA - NORMAL AVAILABLE LIGHT
LEA - EMERGENCY AVAILABLE LIGHT
RNH - NORMALLY HELD RELAY
D1 - DIODE
R1 - RESISTOR, RNH
C - CAPACITOR, RNH
BR-1,2,3 - BRIDGE RECTIFIER

AA-1 - LIMIT SWITCH, ATS AUTO LOCATION
BTN - LIMIT SWITCH, BYPASS TRANSFER NORMAL (MBH MOVEMENT TO NORMAL)
BTE - LIMIT SWITCH, BYPASS TRANSFER EMERG. (MBH MOVEMENT TO EMERGENCY)
BPS - BYPASS SOLENOID
AA-2 - LIMIT SWITCH, ATS AUTO LOCATION
ALL - LIMIT SWITCH, ATS LOCK LOCATION
AT-2 - LIMIT SWITCH, ATS TEST LOCATION
LAT - LIGHT, ATS TEST LOCATION
AI - LIMIT SWITCH, ATS ISOLATE LOCATION
LAI - LIGHT, ATS ISOLATE LOCATION
BLL - LIMIT SWITCH, BYPASS LOCK LOCATION
PLS-1- PERMISSIVE LIMIT SWITCH
TSE - LIMIT SWITCH, TRANSFER SWITCH ENGAGED
TRS - SOLENOID, TRANSFER RELEASE
NA-4 - LIMIT SWITCH, ATS IN NORMAL
EA-3 - LIMIT SWITCH, ATS IN EMERGENCY
LBE - LIGHT, BYPASS EMERGENCY

LBN - LIGHT, BYPASS NORMAL
AB4 - LIMIT SWITCH, BYPASS NORMAL
AB3-1- LIMIT SWITCH, BYPASS EMERGENCY
PLS-2- PERMISSIVE LIMIT SWITCH
ATR - AUTO/TEST RELAY
AT-1 - LIMIT SWITCH, ATS TEST LOCATION

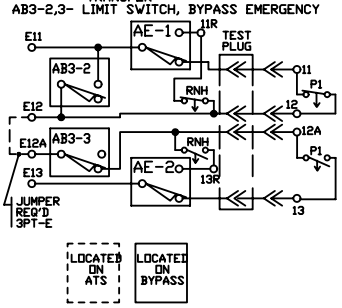
LIT - LIGHT, ATS INHIBIT
DS - ATS DISCONNECT SWITCH
R2 - RESISTOR, LDS
LDS - LIGHT, DISCONNECT SWITCH INHIBIT POSITION
ALH - ATS LOCATION HANDLE

BYPASS SUBPANEL

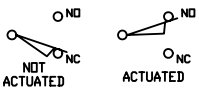


ENGINE START CIRCUIT

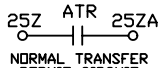
AE-1,2 - LIMIT SWITCH, ENGINE START TRANSFER
AB3-2,3- LIMIT SWITCH, BYPASS EMERGENCY



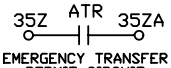
LIMIT SWITCHES



PERMIT CIRCUITS



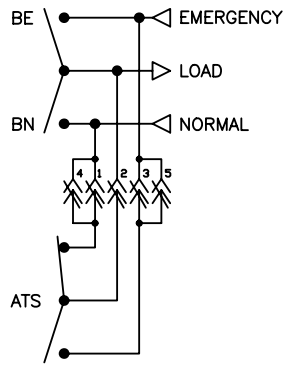
NORMAL TRANSFER PERMIT CIRCUIT IN AUTO AND TEST POSITIONS

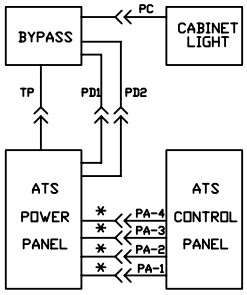


EMERGENCY TRANSFER PERMIT CIRCUIT IN AUTO AND TEST POSITIONS

LIMIT SWITCH CHART

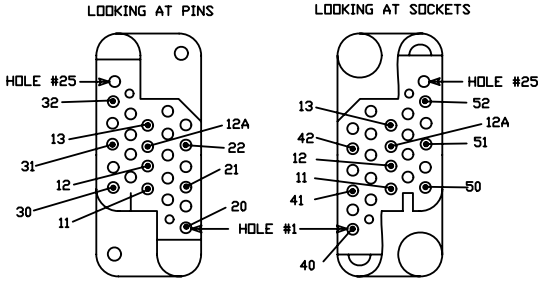
X = ACTUATED	ATS LOCATION: AUTO	TEST	ISO	REMOVE	ATS MODE: NORM	EMERG.	BYPASS MODE: NORM	EMERG.	OPEN
AA	X								
AT		X							
AI			X	X					
ALL	X	X	X	X					
TSE	X	X	X						
AE			X	X					
NA					X				
EA						X			
AB4							X		
AB3								X	
BLL								X	X
PLS	ACTIVATED WHEN ALH IS OPERATED								

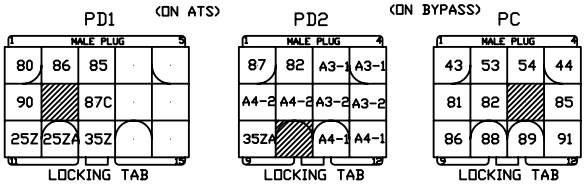




* SEE ATS POWER CIRCUIT SCHEMATIC, LIGHTS AND PLUGS

ATS TEST PLUG (TP)





ATS LOCATION	LOAD CARRYING CONTACTS 1	2	3	ATS TEST PLUG (TP) 4	5
AUTO	X	X	X	X	X
TEST	O	O	O	X	X
ISOLATE	O	O	O	O	O

X = CLOSED
O = OPEN

NOTES

ATS SHOWN IN NORMAL POSITION, BYPASS OPEN WITH NO POWER AVAILABLE.

REVISIONS RV	ECN NO.	DATE	DRF	ENG
–	S-5769	07/22/94	FHB	–
E	S-6240	02/28/96	BRB	SB

ZENITH CONTROLS, INC.

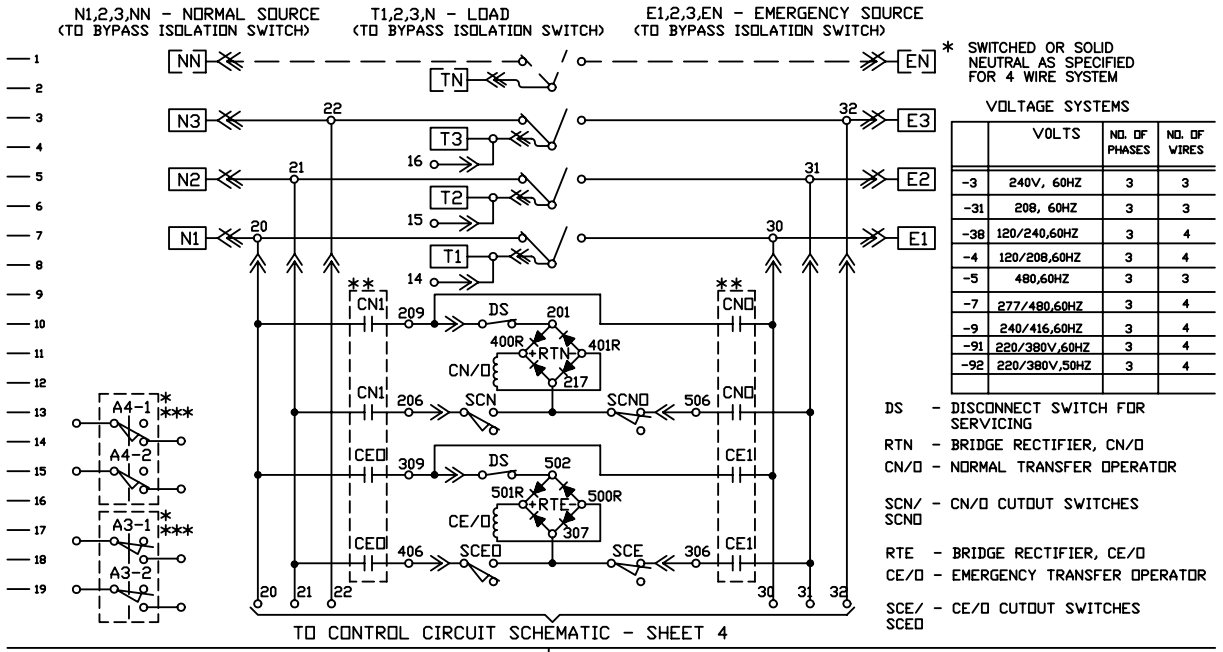
TITLE: BYPASS CONTROL CIRCUIT SCHEMATIC
MODEL: ZBTSDH10/40 (100–400 AMPS)

DRFT: FHB	DATE:	SCALE:	CHK:	APPD:
ENGR: SB	07/22/94	N/A		

DWG NO.: 46A-5000 REV: E
CADD: S5K SHT. 2 OF 5

ORIGINAL

POWER CIRCUIT SCHEMATIC



* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEM

VOLTAGE SYSTEMS

	VOLTS	NO. OF PHASES	NO. OF WIRES
-3	240V, 60HZ	3	3
-31	208, 60HZ	3	3
-38	120/240,60HZ	3	4
-4	120/208,60HZ	3	4
-5	480,60HZ	3	3
-7	277/480,60HZ	3	4
-9	240/416,60HZ	3	4
-91	220/380V,60HZ	3	4
-92	220/380V,50HZ	3	4

DS - DISCONNECT SWITCH FOR SERVICING

RTN - BRIDGE RECTIFIER, CN/D

CN/D - NORMAL TRANSFER OPERATOR

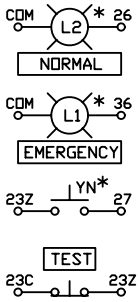
SCN/SCND - CN/D CUTOUT SWITCHES

RTE - BRIDGE RECTIFIER, CE/D

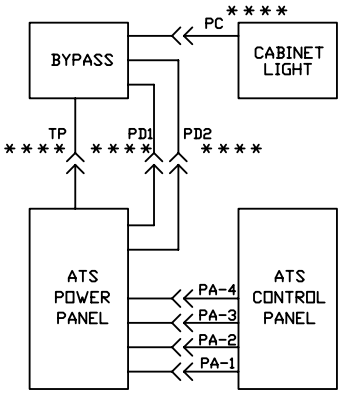
CE/D - EMERGENCY TRANSFER OPERATOR

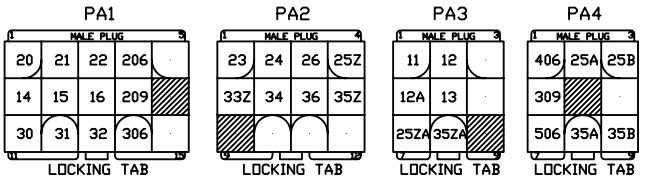
SCE/SCED - CE/D CUTOUT SWITCHES

CABINET FRONT



INTERCONNECT PLUGS





LEGEND

- WIRE CONNECTION
- WIRE ON MAIN TERMINAL BLOCK
- WIRE IN DISCONNECT PLUG
- * OPTIONAL
- ** LOCATED ON CONTROL PANEL
- *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL
- **** SEE BYPASS CONTROL SUBPANEL AND PLUGS

NOTES

1. ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.
2. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3,A4,E,L1, L2,P,T,U,W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.

REVISIONS

RV	ECN NO.	DATE	DRF	ENG
–	S-5769	07/22/94	FHB	–
E	S-6240	02/28/96	BRB	SB

ZENITH CONTROLS, INC.

TITLE: POWER CIRCUIT & CABINET FRONT

MODEL: ZBTSDH10/40 (100-400 AMPS)

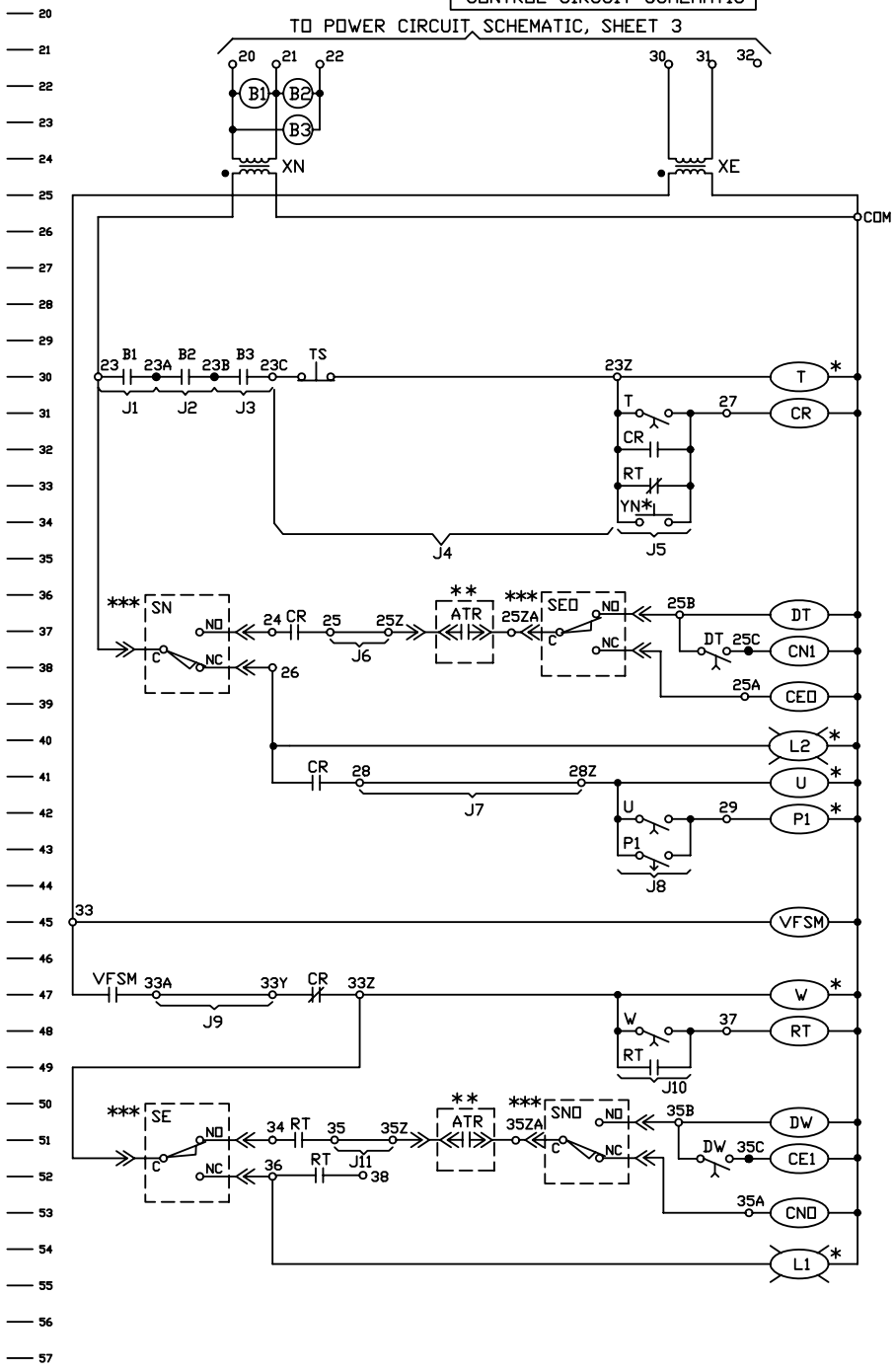
DRFT: FHB	DATE:	SCALE:	CHK:	APPD:
ENGR: SB	07/22/94	N/A		

DWG NO.: 46A-5000 REV E

CADD: S5K SHT. 3 OF 5

ORIGINAL

CONTROL CIRCUIT SCHEMATIC



CUSTOMER CONNECTIONS

A3,A4
SEE ATS POWER CIRCUIT SCHEMATIC & BP & ATS COMPONENT LOCATIONS

ENGINE START
SEE BP CONTROL CIRCUIT SCHEMATIC & BP & ATS COMPONENT LOCATIONS

CONTACT RATING		
RELAY	CONTACT	RATING
H	E	10AMP @ 28VDC
P1	E	10AMP @ 32VDC
	A3, A4	20AMP, 125, 250 VAC

JUMPER	CONNECT POINTS	REMOVE JUMPER WHEN ACCESSORIES USED
J1	23, 23A	B1
J2	23A, 23B	B2
J3	23B, 23C	B3
J4	23C, 23Z	J1N, TS, C/D
J5	23Z, 27	T, YN
J6	25, 25Z	T3, R4
J7	28, 28Z	C, C/D
J8	28Z, 29	P1, U
J9	33A, 33Y	J1E, ER1, 2, 3
J10	33Z, 37	W
J11	35, 35Z	W3, R4

NOTES:
1. ATS SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.
2. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3, A4, E, L1, L2, P, T, U, W), AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.

LEGEND
- WIRE CONNECTION
- WIRE ON MAIN TERMINAL BLOCK
- WIRE IN DISCONNECT PLUG
- * OPTIONAL
- ** LOCATED ON BYPASS SWITCH
- *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL

REVISIONS					
RV	ECN NO.	DATE	DRF	ENG	
-	S-5769	07/22/94	FHB	-	
E	S-6240	02/28/96	BRB	SB	

ZENITH CONTROLS, INC.

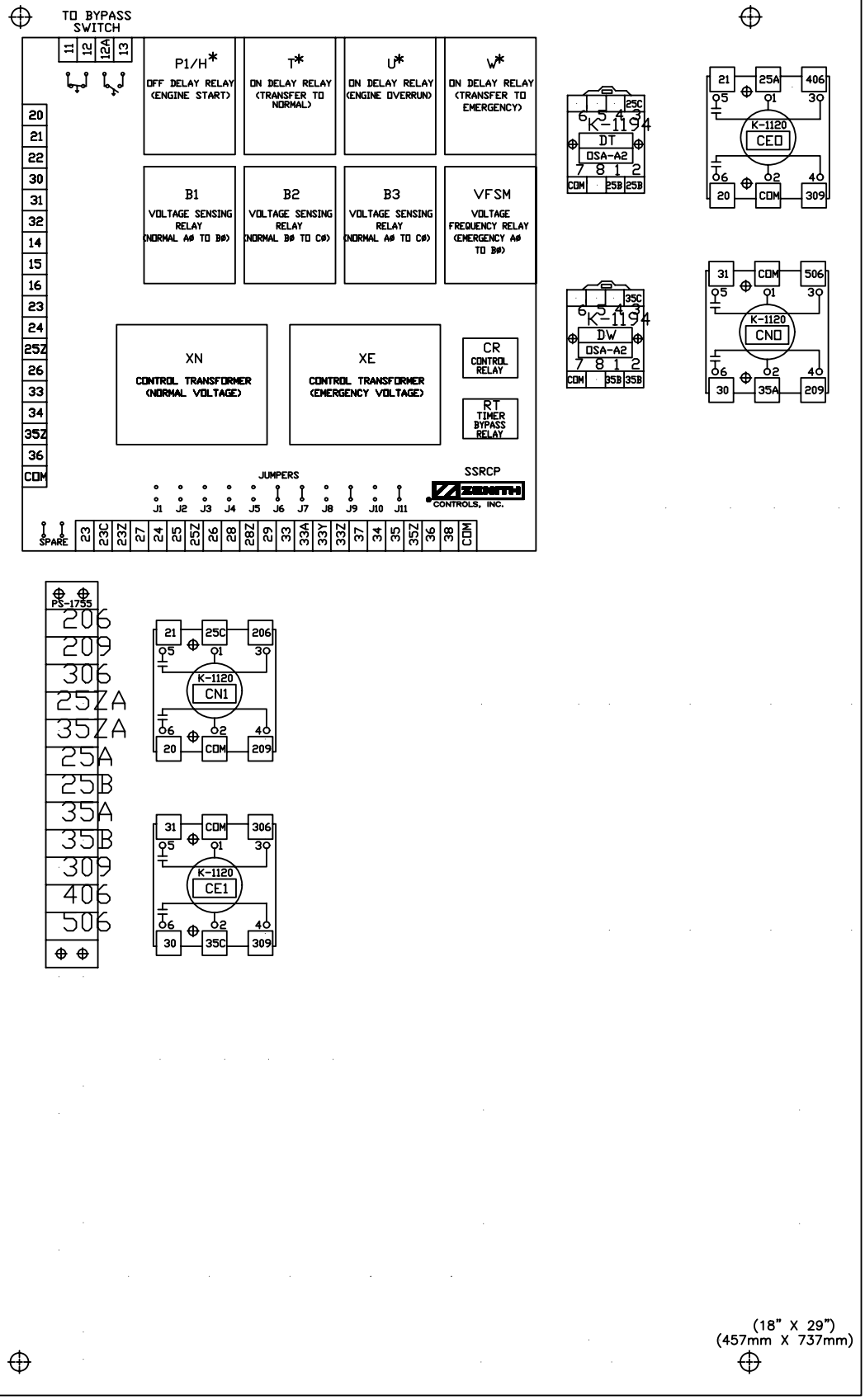
TITLE: CONTROL CIRCUIT SCHEMATIC, CUST. CONN.
MODEL: ZBTSDH10/40 (100-400 AMPS)

DRFT: FHB	DATE:	SCALE:	CHK:	APPD:
ENGR: SB	07/22/94	N/A		

DWG NO.: 46A-5000 E
CADD: S5K SHT. 4 OF 5 REV

ORIGINAL

CONTROL PANEL LAYOUT



(18" X 29")
(457mm X 737mm)

NOTES
1. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3, A4, E, L1, L2, P, T, U, W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.
2. (*) OPTIONAL

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
–	S-5769	07/22/94	FHB	–
E	S-6240	02/29/96	BRB	SB

MODEL: ZBTSDH10/40 (100–400 AMPS)

DRFT: FHB | SCALE: 1/2 = 1
ENGR: SB | CHK:
DATE: 07/22/94 | APP'D:

ZENITH CONTROLS, INC.

TITLE: CONTROL PANEL LAYOUT

DWG NO.: 46A–5000 | E REV
CADD: S5K SHT. 5 OF 5

ORIGINAL

ZENITH®
CONTROLS, INC.

46R-5003A
Revised March, 1996

OPERATION AND MAINTENANCE MANUAL

BYPASS/ ISOLATION DELAYED TRANSITION TRANSFER SWITCH

ZBTSDH SERIES 600 THRU 1200 AMPS

MODEL NUMBER _____

SERIAL NUMBER _____

ZENITH CONTROLS, INC., 830 W. 40th St., Chicago, IL 60609
(312)247-6400: FAX. (312)247-7805

TABLE OF CONTENTS

Storage, Installation 1

Cabinet (exterior, front view) 2

Parts list (electrical) 3

Top and lower panels, front view.
Switch details 4

Bypass and ATS Power Panels — Parts list 5

Bypass and ATS Control Panel Layout 6

Bypass and ATS Control Panel — Parts list 7

Operation of Bypass/Isolation Switch 8

Definitions and Operation Notes 9

ZBTSH Operation, Maintenance 10, 11

Troubleshooting Decisions 12

ARSM and Timer Adj., Lubrication 13

Torque Requirements 14

Cabinet Dimensions 15

Control Disconnect Plugs 16

Field Notes 17

Bypass Control Panel Schematic Drawing 18

Typical Bypass and ATS Schematic Drawing 19

STORAGE

The ZBTSH should be stored in a clean dry area. AVOID STORAGE BENEATH STEAM OR WATER PIPES. Excessive moisture may damage the unit. The switch should only be stored on a level (horizontal) surface.

INSTALLATION

1. HANDLING

   CAUTION: Depending upon the model, a ZBTSH weighs between 3000-5000 pounds. Use adequate machinery and cables to handle the load.

2. EQUIPMENT PREPARATION

   a) Check nameplate to assure switch system voltage and amperage is correct. Any discrepancy should be immediately reported to a Zenith representative.

   b) Lock open breakers to Normal and Emergency lines.

3. CABINET PREPARATION

   a) A small amount of cabinet work is required before the cables are connected. Cover the switch and the controls to avoid metal fragments from entering mechanical and electrical componets. Visually verify that metal filings are removed from bus support. (Use vacuum if necessary).

   b) Standard cable entry is through the top or bottom of cabinet. Fig. 1 shows one suggested knockout. For a guide to assist in the hole layout, refer to Appendix A for determining appropriate knockout arrangement.

4. CABLE AND WIRE CONNECTIONS

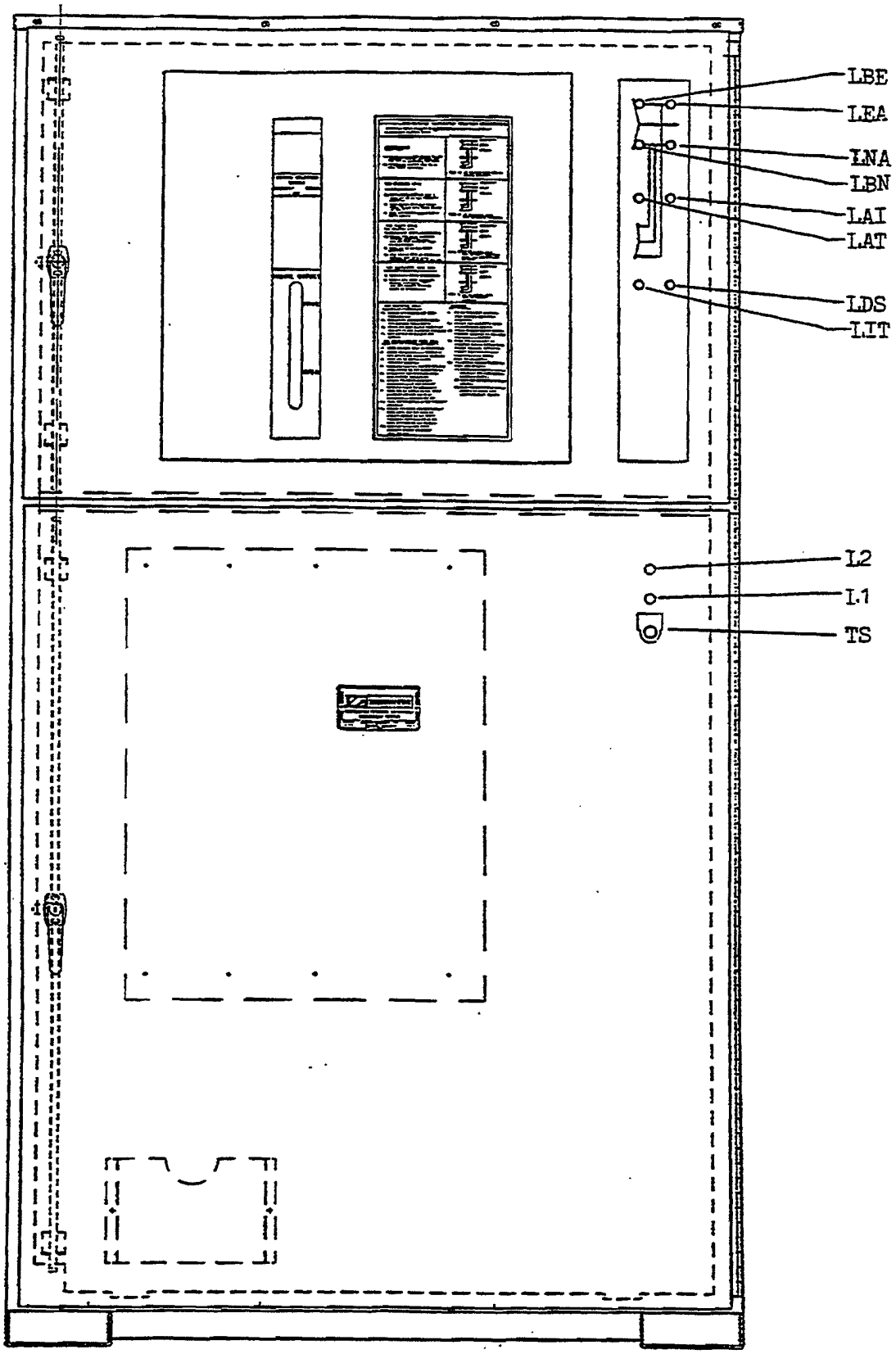
   a) To remove possible oxide, clean cable conductor with a wire brush and apply a contact oxide inhibitor. Insert cables into appropriate lugs.

   b) Connect all auxilliary wires for external electrical operation. Example: E-Start, remote alarm lights or buzzers, motor control contacts, etc. Allow enough slack in wires to allow movement of the ATS to Isolate Position.

5. PRIOR TO THE UNIT'S ENERGIZATION

   a) Remove any debris incurred due to installation (cut cable strands, metal filings, etc.)

   b) Inspect the unit and verify torque of cable and wire connections.


LBE
LEA
LNA
LBN
LAI
LAT
LDS
LIT
L2
L1
TS

EXAMPLE OF CABLE ENTRIES. TOP VIEW OF CABINET

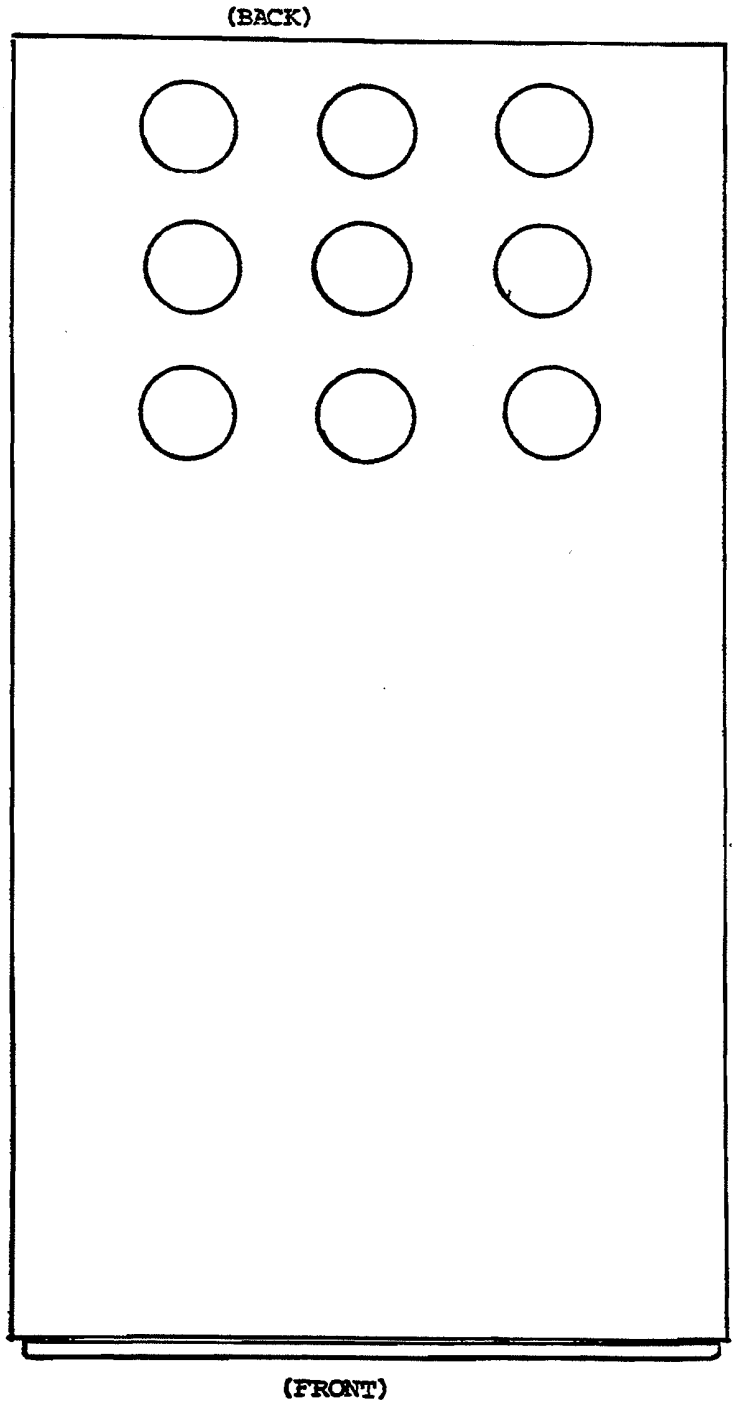
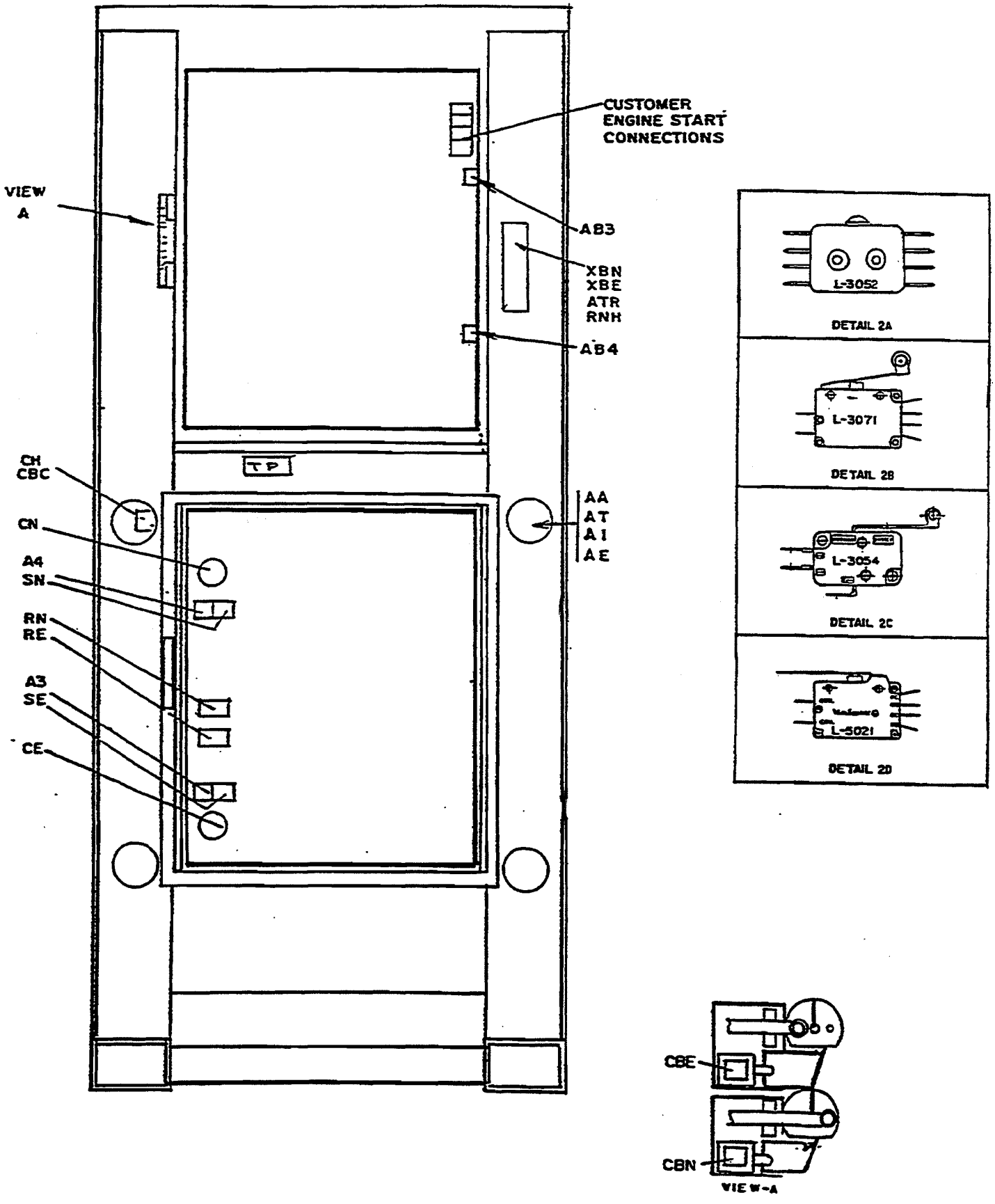


FIG. 1

A. CABINET ELECTRICAL PARTS

TAG	DESCRIPTION	PART NUMBER
LNA	Normal Available Indicator (G)	
LEA	Emergency Available Indicator (R)	
LBN	Bypass Normal Location Indicator (G)	
LBE	Bypass Emergency Location Indicator (R)	
LAT	ATS Test Position Indicator (A)	
LAI	ATS Isolate Position Indicator (A)	
LIT	ATS Inhibit Indicator (R)	
LDS	ATS Disconnect Switch "Off" Indicator (R)	
	Flashing Bulb	PS-1272
	COMMON PARTS BYPASS INDICATORS	
	Bulb	Y500005
	Socket	PS-5046
	Red Lens (R)	PS-5047
	Green Lens (G)	PS-5048
	Amber Lens (A)	PS-5049
L1	ATS Emergency Position Indicator	
L2	ATS Normal Position Indicator	
	Green Lens (Normal)	PS-5048
	Red Lens (Emergency)	PS-5047
	Bulb Socket	PS-5046
	Normal/ Emergency Nameplate	V-1502
	Emergency Bulb	PS-5105
	Normal Bulb	PS-5105
TS	Test Switch	
	Operator, Momentary	L-1025
	Contact Block N.C.	L-1029
	Name Plate	V-1503
	Contact Mounting Base	PS-3473


CUSTOMER
ENGINE START
CONNECTIONS
VIEW
A
AB3
XBN
XBE
ATR
RNH
AB4
TP
CH
CBC
CN
A4
SN
RN
RE
A3
SE
CE
AA
AT
AI
AE
L-3052
DETAIL 2A
L-3071
DETAIL 2B
L-3054
DETAIL 2C
L-3021
DETAIL 2D
CBE
CBN
VIEW-A

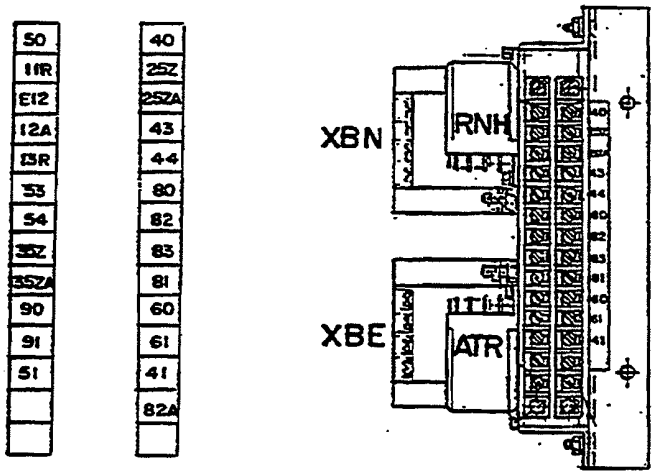
TAG	DESCRIPTION	PART NUMBER		
		STOCK NUMBER BY AMPERAGE		
		1600 A	2000 A	3000 A
NL1,2,3 L1,2,3 T1,2,3	Cable Connection at Rear	S-1392F(2) OPTIONAL (8)600MCM-2	S-1392F(2) OPTIONAL (8)600MCM-2	S-1392F(2) OPTIONAL (8)600MCM-2
STAT(BP)	Stationary Contact Assembly(Bypass)	S-2308	S-2308	S-2343
STAT(ATS)	Stationary Contact Assembly (ATS)	S-2308	S-2308	S-2343
ARC	Arc Grid Assembly	23P-1171	23P-1171	23P-1171
MOV	Movable Contact Assembly	23P-1400	23P-1400	23P-1344

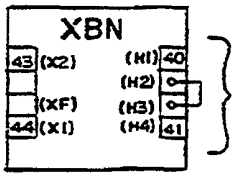
XBE,XBN	Bypass Step-Down Transformer 25VA Secondary 24V	VOLTAGE	PART NUMBER
		120/240 volts	K-3061
		208/416 volts	K-3063
		220/440 volts	K-3064
		240/480 volts	K-3062
		380 volts	K-3067
		575 volts	K-3065
		600 volts	K-3066

CN; CE	Main Operating Coils VOLTAGE SYSTEM							
No.	Volts	Ph	Wire	Coil Volts	Pole	1600A	2000A	3000A
-2	120/240	1	3	240	3	K-2123	K-2123	K-2123
-3	240	3	3	240	3	K-2123	K-2123	K-2123
			4		4	K-2127	K-2127	K-2127
-4	120/208	3	4	208	3	K-2125	K-2125	K-2125
					4	K-2128	K-2128	K-2128
-5	480	3	3	480	3	K-2120	K-2120	K-2120
-7	277/480	3	4	480	3	K-2120	K-2120	K-2120
					4	K-2130	K-2130	K-2130
-9	240/416	3	4	416	3	K-2126	K-2126	K-2126

SN	ATS Normal Position Coil Cutout Sw.	26P-1311
SE	ATS Emerg. Position Coil Cutout Sw.	26P-1312
A3	ATS Emergency Position Switch	23P-1352,1353,1354,1355
A4	ATS Normal Position Switch	23P-1356,1357,1358,1359
CH	Crank Handle Limit Switch	L-3052 (Detail 2A)
AA1,2,3,4	ATS Auto Location Switch	L-3071 (Detail 2b)
AE1,2	ATS Isolate/Remove Location Switch	L-3052 (Detail 2A)
AI1,2	ATS Isolate Location Switch	L-3071 (Detail 2b)
AT1,2	ATS Test Location Switch	
AB3/A	Bypass Emergency Position Switch	L-5021 (Detail 2d)
AB4/A	Bypass Normal Position Switch	
AL-1,2,3,4	ATS Latched Limit Switch	L-3054 (Detail 2c)
DS	ATS Solenoid Disconnect Switch	
	Operator 2-Position Maintain	L-4018
	Contact Block N.C. (1)	L-1029
	Contact Block N.O. (2)	L-1028
	Contact Block Mounting Plate	PS-3473
CBN,CBE	Bypass Interlock Solenoid	K-2192
CBC	Crank Enable Solenoid	K-2159R

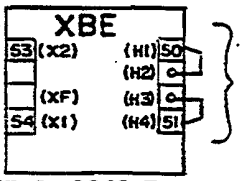
C. BYPASS CONTROL PANEL





TYPICAL JUMPER WIRING FOR 480 VOLT SYST.

NOTE: IF SYSTEM IS 416 OR 480 VOLTS WIRE TRANSFORMERS AS SHOWN ABOVE; IF SYSTEM IS 208 OR 240 VOLTS, WIRE TRANSFORMERS AS SHOWN BELOW.



TYPICAL JUMPERS & WIRING FOR 208 & 240 VOLT SYSTEMS

USE K-3062 FOR 240 & 480V SYSTEMS.
USE K-3063 FOR 208 & 240V SYSTEMS

D. ATS CONTROL PANEL

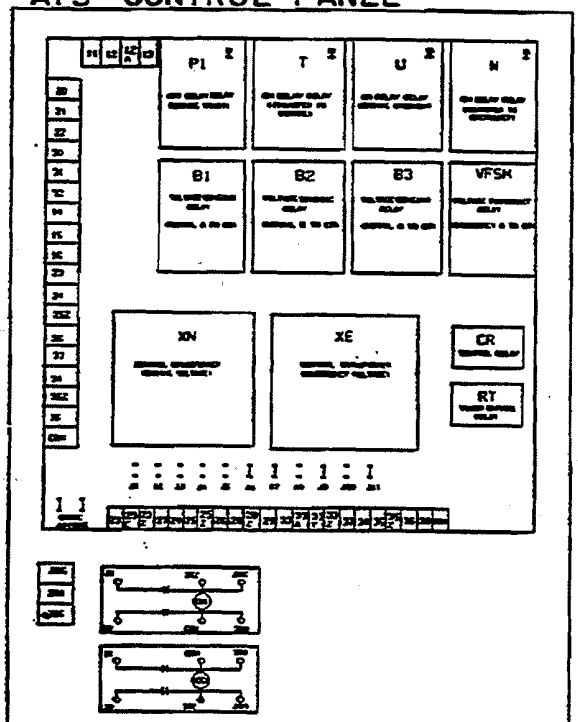


CHART 1

JUMPER	CONNECTS POINTS	REMOVE WHEN ACCESSORIES USED
J1	23,23A	B1
J2	23A,23B	B2
J3	23B,23C	B3
J4	23C,23Z	J1N,TS,C/D
J5	23Z,27	T,YN
J6	25,25Z	T3,R4
J7	28,28Z	S1,C,C/D
J8	28Z,29	P1 & U
J9	33A,33Y	ER1,2,3,J1E
J10	33Z,37	W
J11	35,35Z	R4,W3

C. BYPASS CONTROL PANEL (46P-1079) INCLUDES PARTS BELOW

TAG	DESCRIPTION	PART NUMBER
BR,1,2,3	Bridge Rectifier	PS-5076
RNH	Normal Voltage Relay	K-1218
R1	Resistor RNH, 30 ohm	PS-4056
R2	Resistor LDS, 120 ohm	PS-4057
D1	Diode	PS-4812
CA	Capacitor RNH	PS-4058
ATR	Auxiliary Test Relay	K-1218

D. ATS CONTROL PANEL (SSRCP) STANDARD ITEMS

TAG	DESCRIPTION	VOLTAGE 50/60 HZ	PART NUMBER
XN,XE	Control Transformers (see Note 1)	120 Volts	K-3076
		208 Volts	K-3070
		240 or 480 Volts	K-3071
		416 Volts	K-3089
B1,2,3	Phase Relays, Solid State (See Note 1)	120 Volts	K-1185
		208 or 240 Volts	K-1186
		480 Volts	K-1188
VFSM	Voltage Frequency Sensor	120VVolts	K-1192
CR	Control Relay	120 Volts	K-1204
RT	Bypass T Relay	120 Volts	K-1204
J1-J11	Jumpers		PS-5067
CCN/CCE	CN/CE Transfer Control Relays	120 Volts	K-1120

(OPTIONAL ITEMS)

TAG	DESCRIPTION	VOLTAGE	PART NUMBER	REPLACED BY
T	Time Delay to Normal, Timer Solid State .	120V .1 Sec. to 9990 Hrs. (Adj.)	OSA-A-T	OSA-A2-T
U	Engine Cool Down, Timer Solid State	120V .1 Sec. to 9990 Hrs. (Adj.)	OSA-A-U	OSA-A2-U
W	Time Delay Emergency, Timer Solid State	120V .1 Sec to 9990 Hrs. (Adj.)	OSA-A-W	OSA-A2-W
P1	Time Delay Engine Start, Timer	120V (.5 to 6 sec. Adjustable)	K-1201	
P2	Optional (Mounted below SSRCP)	120V (300 Sec. Adjustable)	K-1061	

Notes:

1. If -6 voltage system (575/600V) is supplied, then XN, XE is K-3087 and B1,2, 3 is K-1185 (120V) supplied with XB (575;600V/120V) 3 phase transformer assembly. B1, 2, 3 mounted below SSRCP.

BYPASS/AUTOMATIC TRANSFER SWITCH OPERATION

BP-BYPASS SWITCH INDICATED BY CONTACTS BN/BE IS A 3 POSITION SWITCH
ATS-AUTOMATIC TRANSFER SWITCH

AUTOMATIC

1. Manually operated Bypass Switch contacts (BN/BE) are open and the ATS is supplying the Load.
2. Disconnect switch (DS) is in the "AUTO" position.

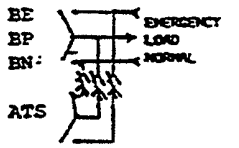


FIG. 1 BP IN OPEN WITH ATS IN NORMAL POSITION.

TO BYPASS ATS

1. Open bottom cabinet door & turn ATS DS to the "INHIBIT" position.
2. Turn Bypass Selector Switch (BSS) to the same Power Source as the ATS.
3. Move the Manual Bypass Handle (MBH) upward.

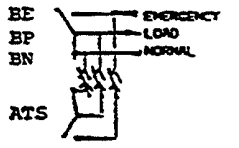


FIG. 2 BP IN NORMAL WITH ATS IN NORMAL POSITION.

TO TEST ATS

1. Bypass per above instructions.
2. Rotate the crank mechanism counter clockwise until the ATS TEST POSITION light is illuminated.
3. Turn the DS to the "AUTO" position.
4. Test Switch (TS) on the bottom cabinet door will allow electrical operation of the ATS.

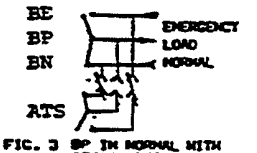


FIG. 3 BP IN NORMAL WITH ATS IN TEST LOCATION (ATS LOAD CONNECTIONS IS OPEN)

TO ISOLATE THE ATS

1. Bypass per above instructions.
2. Rotate the crank mechanism counter clockwise until the ATS ISOLATE POSITION light is illuminated.

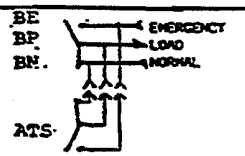


FIG. 4 BP IN NORMAL WITH ATS IN ISOLATE LOCATION

TO REMOVE ATS

1. Bypass and Isolate per above instructions.
2. Disconnect the multi-pin plugs and external connections.
3. Slide the four corner latches of the ATS to the innermost position.
4. ATS can now be removed from cabinet.

TO RECONNECT THE ATS

1. Roll the cart back in the cabinet
2. Slide the four corner latches of the ATS to the outermost position.
3. Turn the DS switch to the "INHIBIT" position.
4. Manually position the ATS into the same source as the Bypass Switch.
5. Re-connect the multi-pin plugs and external connections.
6. Rotate the crank mechanism clockwise until the ATS TEST POSITION light is illuminated.
7. Turn the DS switch to the "AUTO" position and use the TS to electrically operate the ATS.
8. Turn the DS switch to the "INHIBIT" position.
9. Rotate the crank mechanism clockwise until the ATS location pointer points to the "AUTO" location. (ATS must be in the same position as the Bypass.)
10. Turn the DS to the "AUTO" position & open the Bypass with the MBH.

NOTES:

1. DS in "INHIBIT" position will prevent electrical operation.
2. Do not use excessive force on mechanical handles.
3. Above figures depict Bypass NORMAL; Sequence is the same for Bypass EMERGENCY.
4. When ATS is in TEST or ISOLATE, Bypass Switch is a manual transfer switch to either available source. (opposite power source must be available).
5. To operate Bypass Switch in TEST and ISOLATE.
   a) Move manual Bypass Handle downward (to open Bypass contacts BN/BE).
   b) Turn BSS to opposite power source.
   c) Move Manual Bypass Handle upward to close into selected power source.

V-4587

DEFINITIONS:

BP - Bypass/Isolation Switch

It is a manually operated device used in conjunction with an Automatic Transfer Switch (ATS) to provide a means of directly connecting load conductors to a power source, and of disconnecting the Automatic Transfer Switch.

The BP can also be used as a Manual Transfer SWitch in the event of power failure while the ATS is in the TEST or ISOLATE positions.

ATS - Automatic Transfer Switch

Is a self-acting equipment for transferring one or more load conductor connections from one power source to another.

DS - Disconnect Switch

Inhibits operation of ATS Main Coils(CN-CE). In the "AUTO" position, the ATS operates normally. In the "INHIBIT" position the main coils (CN-CE) cannot be energized, and automatic transfer in either direction cannot take place.

BSS - Bypass Selector Switch

Selects position to bypass.

MBH - Manual Bypass Handle

Actuates the Bypass Operator
Down for Bypass Open
UP for bypass Normal and Bypass Emergency

TS - Test Switch

Simulates Normal Line failure when open.

OPERATION NOTES:

1. The ATS will not operate if:
   a) Harness plugs are not connected.
   b) DS is in the "INHIBIT" position.
   c) ATS is not in "AUTO" location with bypass switch open or ATS is not in "TEST".
   d) ATS is in "AUTO" location and BYPASS SWITCH is not open.
2. The MBH will not close the Bypass if:
   a) The BSS is turned to the opposite source that the ATS is in.
3. The MBH will not open the Bypass if:
   a) ATS is not engaged in one of the following; AUTO - TEST- ISOLATE.
   b) ATS is in "TEST" or "ISOLATE" location and the opposite source is not available.
4. The CH (CRANK HANDLE) will not operate if:
   a) BP and ATS are not positioned to same source.
   b) Power is not available.
   c) Harness Plugs are not connected.
   d) ATS has reached limit of travel to "AUTO" or "ISOLATE" (Clutch device on the crank mechanism slips.)

READ THE FOLLOWING PARAGRAPHS BEFORE PROCEEDING TO "TEST PROCEDURE". (THIS PROCEDURE IS ONLY TO BE PERFORMED BY AUTHORIZED PERSONNEL)

CAUTION:

Loads controlled by Bypass/Isolation Transfer Switch may cause PERSONAL INJURY by UNAUTHORIZED PERSONNEL operating or testing this equipment.

Check all wiring diagrams that have been supplied for added options that may affect external equipment: For example; Starting and Stopping of Elevators and Motors.

A 'Control Panel Test' or a test with the ATS in the TEST LOCATION runs the EMERGENCY SOURCE with no load. A no load operation may be detrimental to the engine, and the Engine/Generator Manufacturer should be consulted.

Allow sufficient time on the U timer for engine to safely cool down.

RECOMMENDED TIMER SETTINGS:

T — Restoration to Normal.....30 minutes (Factory set)
U — Engine Cooldown/Stop.....5 minutes (Factory set)
W— Engine Warmup .....5 seconds (Factory set)
P1—Engine Start .....3 seconds (Factory set)

TEST PROCEDURE

The ATS can be tested in either of two locations:

1). AUTO LOCATION
2). TEST LOCTION

1). "AUTO LOCATION":

Full Transfer Test — This test checks the complete operation of the ATS by transferring and and interrupting the load's power source from 'Normal' to 'Emergency'.

Depress TS (Test Switch) until Generator starts and the 'W' timer times out (timer will indicate ON). ATS will transfer to Emergency.

Release TS (this resets TS to AUTO). Normal restoration timer 'T' will time out (will indicate ON) which will energize the CR relay causing ATS to retransfer back to Normal.

Engine/Generator will shut down after timer U times out. Full Transfer Test is now complete.

2). "TEST LOCATION":

This procedure is recommended for Preventive Maintenance (PM) of ATS without interrupting the Load thru the BYPASS/ISOLATION SWITCH.

NOTE: TEST LOCATION is recommended after maintenance of ATS.

OPERATION OF AUTOMATIC TRANSFER SWITCH (ATS)

ERATION OF ZENITH ACCESSORY MODULE 9

When the Normal Line (NL) voltage falls to the preset dropout point, or if any phase fails, the phase relays (B1,B2,B3) will dropout disconnecting the CR relay. This will de-energize the P1 timer. The P1 timer signals the generator to start.

When the Emergency Line (EL) voltage and frequency reach at least 90% of rated value, the VFSM relay will energize. The W timer then energizes. After the W timer times out the RT relay will now energize to operate the CCE relay thru the SE limit switch. The CCE then energizes the CE solenoids. The load is now transferred to the EL supply. The SE limit switch operates to disconnect the CCE relay and the CE solenoid. The ATS is now locked mechanically only. Limit switch SN operates to enable the next transfer back to Normal when NL returns. When NL returns B1, B2 and B3 pick-up to energize the T timer. After the set time delay the T timer contact closes to energize the CR relay. The CR relay will now operate the CCN relay thru the SN limit switch. The CCN energizes the CN solenoid. The load is now transferred to NL supply. The SN limit switch operates to disconnect the CCN relay and the CN solenoid. The ATS is now locked mechanically only. Limit Switch SE operates to enable the next transfer back to Emergency when NL fails.

MAINTENANCE

ELECTRICAL TEST:

The ATS may be electrically tested for preventative maintenance (refer to page 10, "Test Procedure"). After completion of an electrical test, the ATS should be returned to the Auto Operation Mode. If the ATS malfunctions, troubleshoot the switch, referring to page 12, and replace any faulty part(s) immediately.

INSPECTION

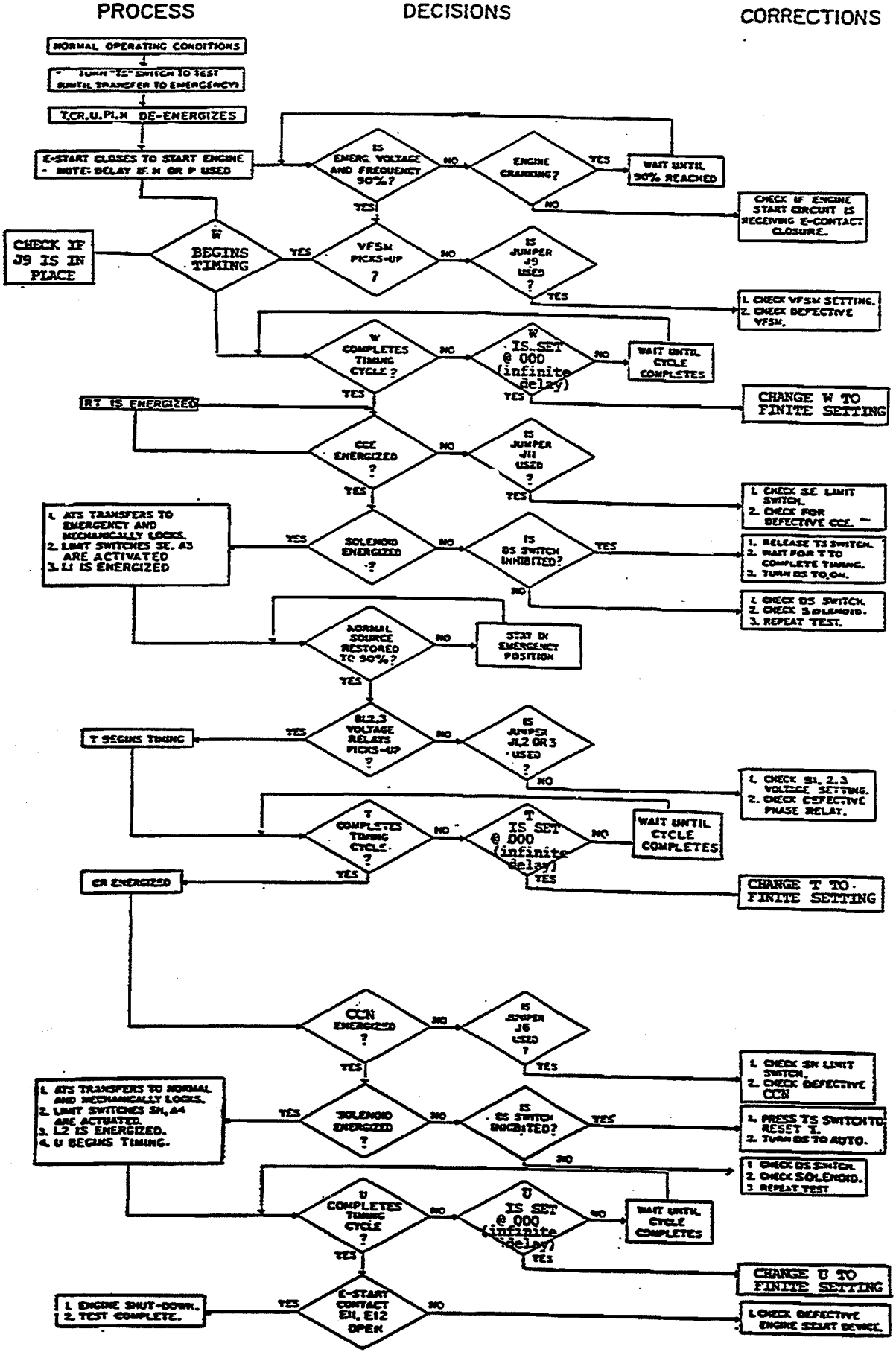
CONTACTS - The movable and stationary contacts are a vital part of the ZBTSH and must be kept clean. To inspect the ATS contacts, place ATS in Isolate location (see page 8). Examine the contacts.

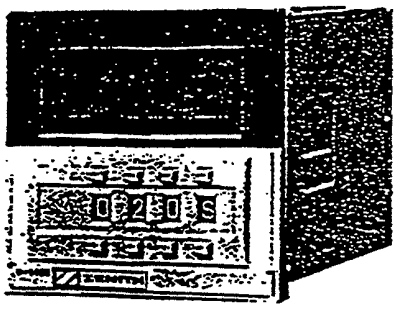
Any surface deposits must be removed with a clean cloth (DO NOT USE EMERY CLOTH OR A FILE).

After the movable and stationary contacts are wiped clean (no discoloration or deposits) return the ZBTSH to Auto Mode.

CURRENT CARRYING PARTS - An easily detected but abnormal condition is the discoloration of current carrying parts (particularly copper). Discoloration appears as darkened materials or finishes. Any discolored parts should be cleaned. WARNING: ANY MAINTENANCE SHOULD ONLY BE DONE WHILE THE POWER IS OFF! If the discoloration persists, consult the factory.

TABLE 3 "TROUBLE SHOOTING"





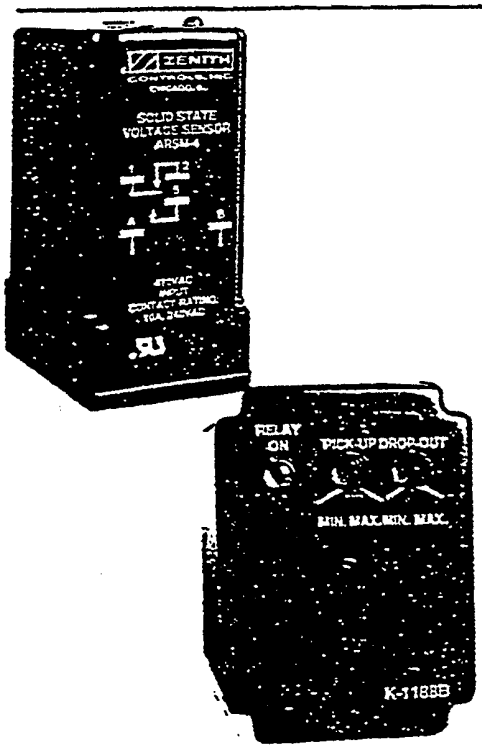
New Solid State Time Delay

Accessories T, U, W Solid State Timers Adjustable IN Seconds, Minutes and Hours (Plug-In Style).

To select a time unit, operate the pushbuttons of the rightmost thumbwheel switch until the desired time unit is shown in window. The time unit can be selected by pushing the plus (+) bottom button or the minus (-) top button. The desired time is specified by operating the three thumbwheel switches in the middle of the front panel.

Setting of the timer at 000 will result in an infinite delay. The min. setting for OSA-A timers is 1/10 of 1 second as shown. See instructions.

0	0	1	0.1 Sec.



Close Differential (ARSM) Relay Adjustment

The voltage points at which the relay operates are adjustable. When the relay pulls in, an audible click is heard, and the LED will come on.

Setting the Relay:

If the relay should be set with a variable voltage supply (Variac):

1. Turn pick-up control fully clockwise.
2. Turn drop-out control fully counterclockwise.
3. Set Variac pick-up voltage to desired level.
4. Very slowly rotate pick-up adjustment counterclockwise until relay picks up. (LED will energize).
5. Set Variac drop-out voltage to desired level.
6. Very slowly rotate drop-out adjustment clockwise until relay drops out (LED de-energizes).

Verify settings by raising voltage until relay picks up, then lower voltage until relay drops out, making sure that relay operates at desired voltage levels.

LUBRICATION

The cams and gears of the ZBTSH are lubricated with Dow Chemicals "Molykote" (321R or GN paste). These lubricants provide adequate lubrication for a clean and properly maintained switch's lifetime. Should debris contaminate the mechanism, clean and apply additional lubricants. Mobiltemp SHC-32 is used on isolating contacts.

LUBRICATION MAINTENANCE CHART

Date Inspected	Date Lubricated	Lubricant Used (Cams) (Gears)	Notes

TORQUE REQUIREMENTS FOR FIELD CONNECTIONS

NOTICE
TIGHTENING TORQUES FOR FIELD WIRING TERMINALS

Socket Size Across Flats, Inch	Tightening Torque Pound-Inches
1/8	45
5/32	100
3/16	120
7/32	150
1/4	200
5/16	275
3/8	375
1/2	500
9/16	600

TORQUE REQUIREMENTS FOR ELECTRICAL CONNECTIONS

All current carrying parts use compression washers and should be torqued to the values presented below. Caution: DO NOT OVERTORQUE WASHERS; follow the given torque values.

TORQUE REQUIREMENTS (inch - lb. except denoted by + are ft. - lb.)

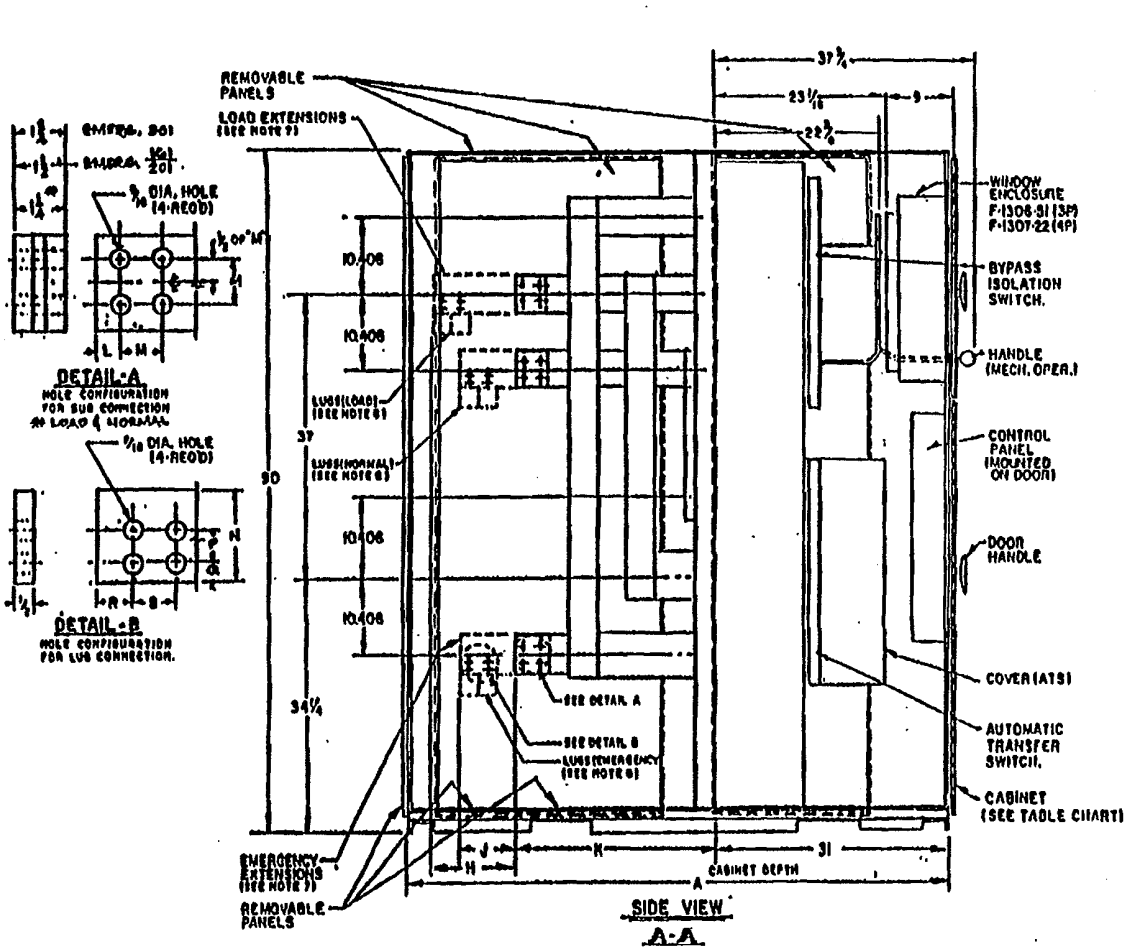
BOLT SIZE	GRADE 5	SOCKET HEAD	SET SCREW	COMPRESSION WASHERS	
				1	2
1/4 - 20	75	120	52	80	87
5/16 - 18	157	225	105	159	170
3/8 - 16	+23	412	165	+23	+26
1/2 - 13	+57	1030	386	+56	+59

WIRE CONNECTION TIGHTENING TORQUE

WIRE COND. SIZE AWG or MM	SCREW DRIVER TORQUE (inch - lb.)
18 - 16 AWG	19
14 - 8	19
6 - 4	36

LUG BOLTING TORQUE

BOLT DIA. (inch)	TORQUE (ft. - lb.)
1/4 OR LESS	6
5/16	11
3/8	19
7/16	30
1/2	40
5/8 OR MORE	55

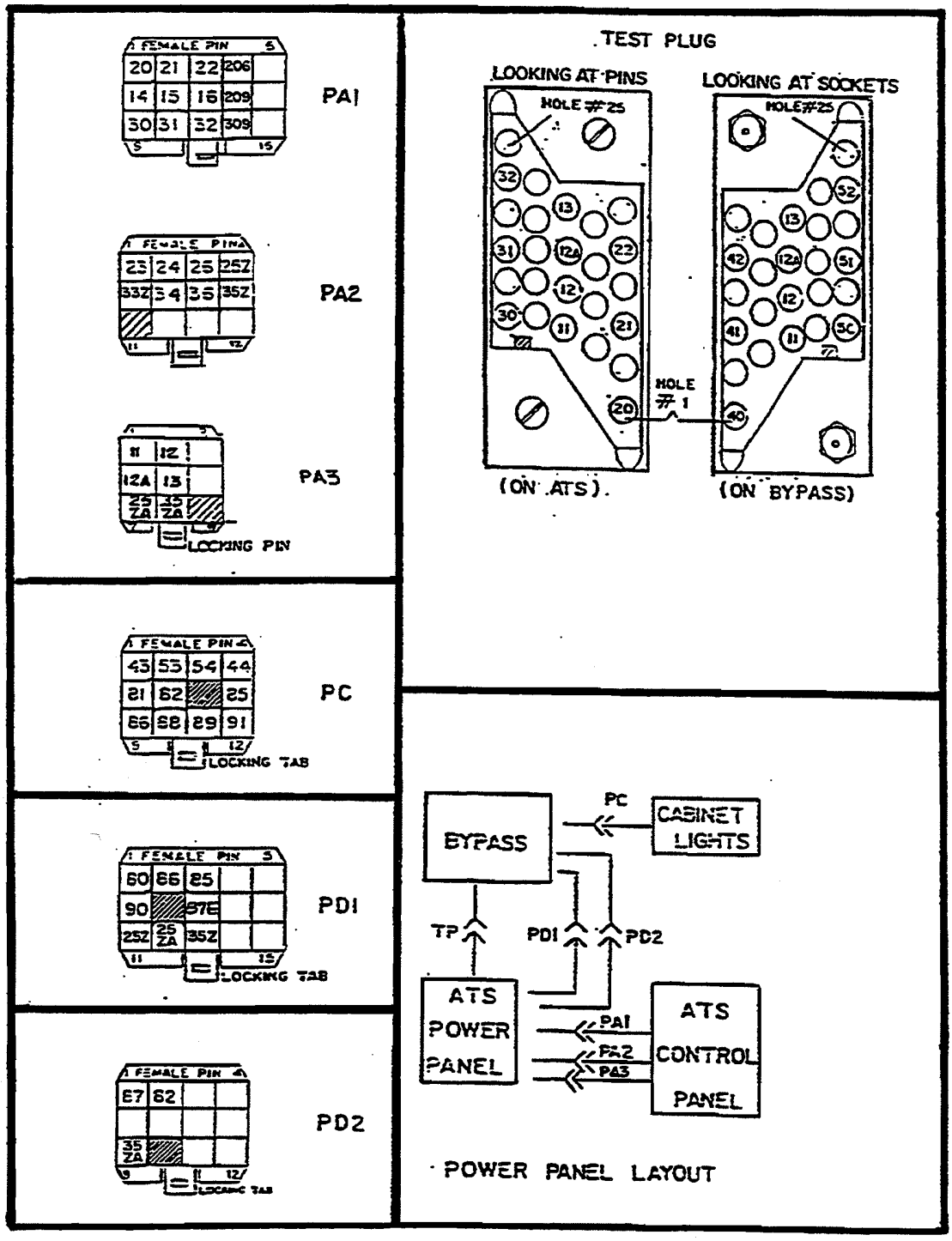


NOTES

1) NEMA1 ENCLOSURE.
2) ALL DIMENSIONS ± 1/8
3) STANDARD UNIT SUPPLIED AS BUS CONNECTED.
4) NOTIFY FACTORY OF SPECIFIC JOB REQUIREMENTS (ENTRY LOCATION, CABLE SIZE & QTY, FOR LUGS).
5) WINDOW ENCLOSURE & LIGHT TROUGH ASSEMBLIES ARE FURNISHED WITH EACH UNIT.
6) OPTIONAL LUGS MAY BE ORIENTED TO ACCEPT CABLING FROM TOP, AS WELL AS BOTTOM ENTRY, AS SHOWN.
7) SIDE VIEW DEPICTS BOTTOM CABLE ENTRY. FOR TOP CABLE ENTRY, LOAD AND NORMAL EXTENSION WILL BE REVERSED.

SWITCH, AMP, POLE	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S
ZBTSH 160-200A 3P	60	34 1/2	2 3/4	40	30 3/8	—	9 1/2	7 19/16	5 1/8	17 1/16	3/4	1 1/2	3	1 3/8	1/2	1 1/4	2 1/2
ZBTSH 160-200A 4P	60	44 1/4	2 7/8	50	30 3/8	7 3/8	7 3/8	7 19/16	5 1/8	17 1/16	3/4	1 1/2	3	1 3/8	1/2	1 1/4	2 1/2
ZBTSH 300A · 3P	72	34 1/2	2 3/4	40	30 3/8	—	9 1/2	9 5/16	5	26 13/16	1 1/8	2 3/4	3	1 3/8	5/16	1 1/4	2 1/2
ZBTSH 300A 4P	72	44 1/4	2 7/8	50	30 3/8	7 3/8	7 3/8	9 5/16	5	26 13/16	1 1/8	2 3/4	3	1 3/8	5/16	1 1/4	2 1/2

DISCONNECT PLUGS
ZBTSH 1600-3000 AMPS



FIELD NOTES

MODEL NO: _____

SERIAL NO: _____

DATE SHIPPED: _____

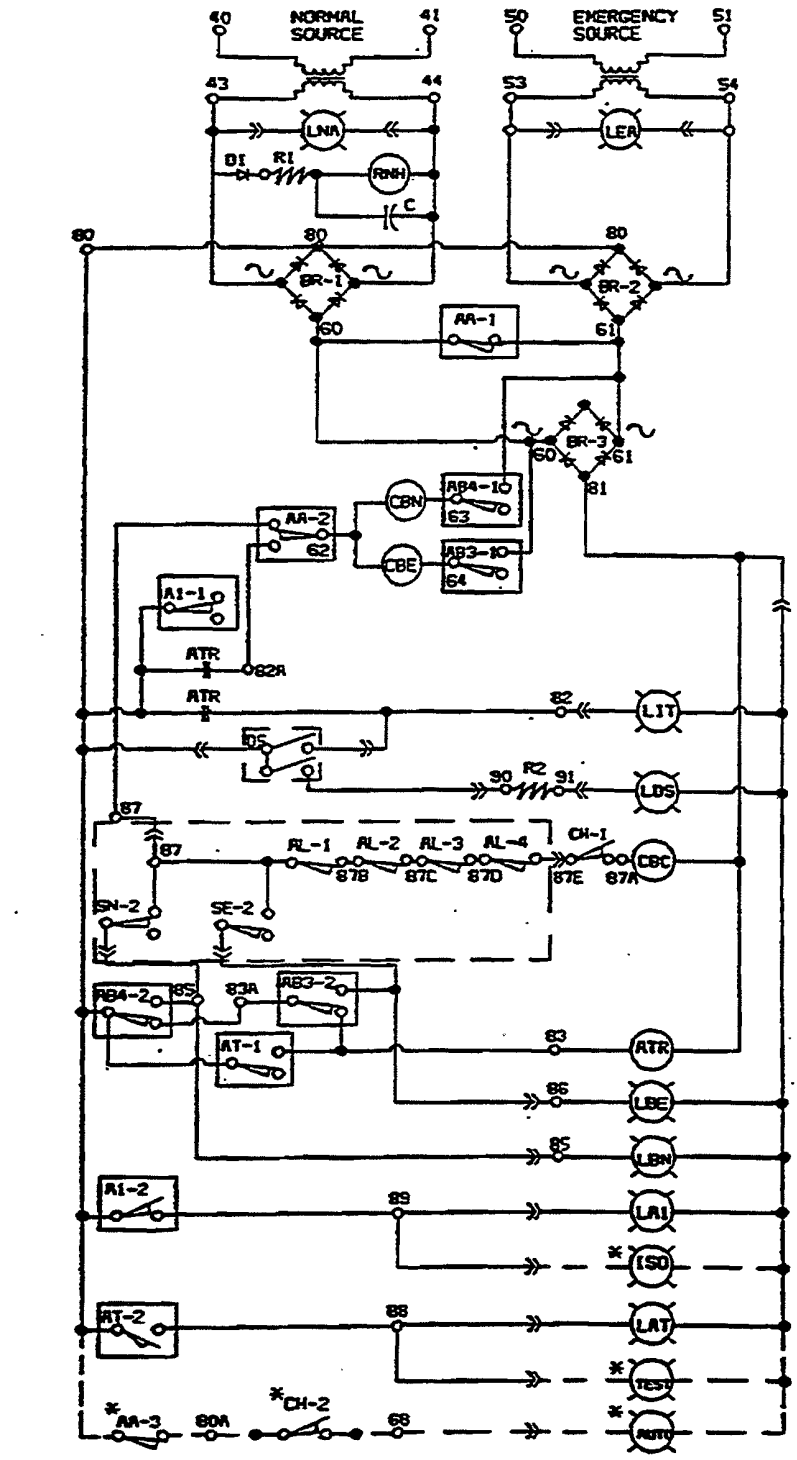
START-UP DATE: _____

DRAWING SUPPLIED: _____

_____

TEST AND MAINTENANCE NOTES:

DATE	TESTED	OBSERVATIONS	NOTES



LNA-NORMAL LIGHT AVAILABLE

LEA- EMERGENCY LAMP AVAILABLE

RNH- RELAY NORMAL HOLD. 4.28.30

AA-1.2.3-AUTO LIMIT SWITCH. 7.10.26

BR-1.2.3- BRIDGE RECTIFIER

CBN- NORMAL SOLENOID. 10

CBE- EMERGENCY SOLENOID. 11

A1-1.2- ISOLATE LIMIT SWITCH. 11.22

ATR- AUTO TEST RELAY. 13.19

LIT- LAMP INHIBIT TRANSFER. 13 —

LDS- LAMP DISCONNECT SWITCH "INHIBIT" POSITION. 15

CBC- CRANK SOLENOID. 16

AT-1.2- TEST LIMIT SWITCH. 19.23

CH-1.2- CRANK HANDLE LIMIT SWITCHES

LBE- LAMP BYPASS EMERGENCY. 19

LBN- LAMP BYPASS NORMAL. 20

LAT/ISO- LAMP ATS ISOLATE. 22

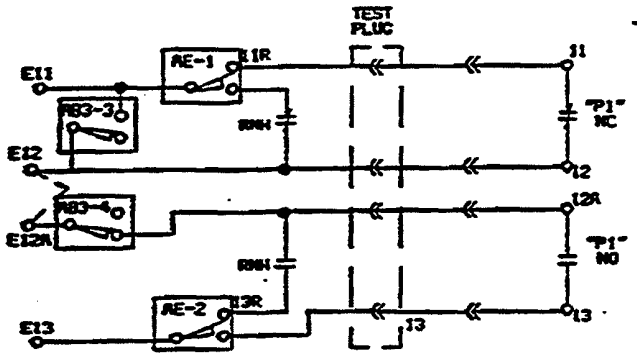
LAT/TEST- LAMP ATS TEST POS. 24

AUTO- LAMP ATS AUTO POS. 26

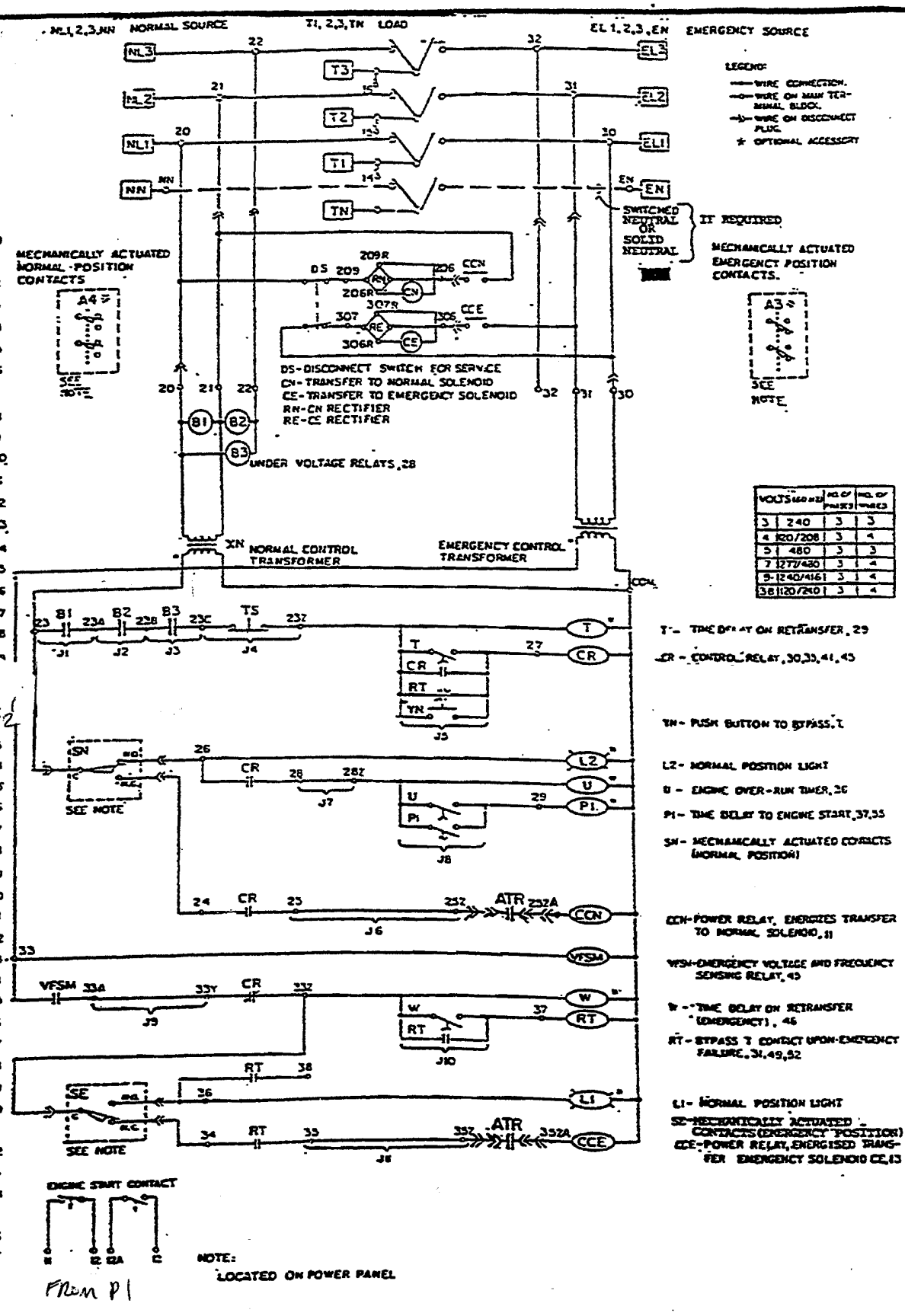
AB4-1.2- BYPASS NORMAL. 9.18

AB3-1.2.3.4- BYPASS EMERGENCY 10. 18. 28. 3C

AL- 1.2.3.4- ATS LATCHED. 15



NOTES:
WIRE NUMBER E12 BECOMES WIRE NUMBER 12 AFTER THE TEST PLUG (TP). LOCATED ON ATS POWER PANEL.
* OPTIONAL



VOLTS	NO. OF PHASES	NO. OF WIRES
3	240	3	3
4	120/208	3	4
5	480	3	3
7	277/480	3	4
9	240/416	3	4
38	120/240	3	4

From P1



CONTROLS INC.

830 West 40th Street Chicago, Illinois 60609 (312)247-6400

ZBTSDH SERIES
BYPASS/ISOLATION/DELAY TRANSFER SWITCH OPERATION
600-1200 AMP

OPERATION: BYPASS/ISOLATION SWITCH

AUTOMATIC

1. Manually operated Bypass Switch contacts (BN/BE) are open and ATS is supplying load.
2. Disconnect Switch (DS) is in "AUTO".

TO BYPASS ATS

1. Open bottom cabinet door and turn DS to "INHIBIT".
2. Turn Bypass Selector Switch (BSS) to same power source as ATS.
3. Move the Manual Bypass Handle (MBH) upward.

TO TEST ATS

1. Bypass per above instructions.
2. Rotate crank mechanism counterclockwise until ATS TEST light is illuminated.
3. Turn DS to "AUTO".
4. Test Switch (TS) on bottom cabinet door will allow electrical operation of ATS.

TO ISOLATE ATS

1. Bypass per above instructions.
2. Rotate crank mechanism counterclockwise until ATS ISOLATED light is illuminated.

TO REMOVE ATS

1. Bypass and Isolate per above instructions.
2. Disconnect multipin plugs and external connections to ATS.
3. Rotate four power panel latches to vertical position, slide ATS forward & lock mechanism in place.
4. ATS can now be removed from cabinet.

TO RECONNECT ATS

1. Place ATS in slide mechanism.
2. Unlock slide mechanism. Slide ATS over power panel latches and rotate latches to horizontal position.
3. Turn DS Switch to "INHIBIT".
4. Manually position ATS into same source as Bypass Switch.
5. Reconnect multipin plugs and external connections to ATS.
6. Rotate crank mechanism clockwise until ATS TEST light is illuminated.
7. Turn DS Switch to "AUTO" and use TS to electrically operate ATS.
8. Turn DS to "INHIBIT".
9. Rotate crank mechanism clockwise until ATS location pointer is aligned with "AUTO" mark on location indicator. (ATS must be in same source as Bypass).
10. Turn DS to "AUTO" and open Bypass with MBH.
11. ATS is now fully automatic (Figure 1).

NOTES:

1. DS in "INHIBIT" will prevent ATS electrical operation.
2. DO NOT use excessive force on mechanical handles.
3. Above Figures depict Bypass NORMAL. Sequence is same for Bypass EMERGENCY.
4. When ATS is in TEST or ISOLATE, Bypass Switch is a manual transfer switch to either available source. (Indicated on light panel).
5. To operate Bypass Switch when ATS is in TEST or ISOLATE:
   a) Move MBH downward (to open Bypass Contacts BN/BE).
   b) Turn BSS to opposite power source.
   c) Move MBH upward to close into selected power source.

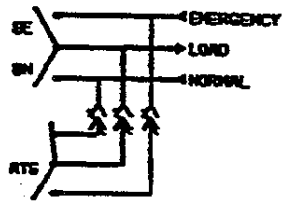


FIG. 1 BP IS OPEN WITH ATS IN NORMAL

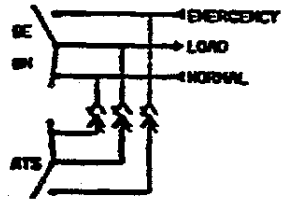


FIG. 2 BP IN NORMAL WITH ATS IN NORMAL

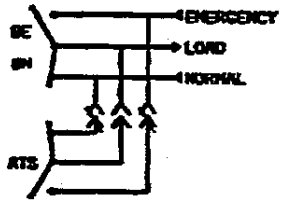


FIG. 3 BP IN NORMAL WITH ATS IN TEST (LOAD CONNECTIONS ARE OPEN)

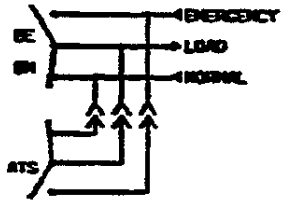


FIG. 4 BP IN NORMAL WITH ATS ISOLATED

NOTES:
1. BP-Bypass switch (indicated by contacts BN/BE) is a 3 position switch.
2. ATS-Automatic Transfer Switch

CONTROLLED

ZENITH CONTROLS, INC

REVISIONS:	MODEL: ZBTSDH60/120 (600-1200 AMP)		TITLE: BYPASS/ISOLATION TRANS. SWITCH OPERATION	
	DRFT: KW	APP'D: FS/18		
	DATE: 5/18/92	DWG DIR: ZE3	DRAWING NO.: 40R-0504 SHEET 1 OF 3	REV -
	SCALE:			

LEGEND: BYPASS/ISOLATION SWITCH (BP)

I. (BP) BYPASS/ISOLATION SWITCH: MECHANICAL COMPONENTS

N1,2,3(N).....Normal Line connections
E1,2,3(N).....Emergency Line connections
T1,2,3(N).....Load Line connections
BE.....Bypass Emergency contacts
BN.....Bypass Normal contacts
BSS.....Bypass Selector Switch
MBH.....Manual Bypass Handle

II. (BP) BYPASS/ISOLATION: ELECTRICAL COMPONENTS

AA-1,2.....Limit switch held actuated in Auto location of ATS, Non-actuated Test and Isolated locations.
AB3-1,2,3,4.....Limit switch, actuated in Bypass Emergency position
AB4-1,2.....Limit switch, actuated in Bypass Normal position
ACU,ACD.....Limit Switch actuated when crankhandle is engaged
AE-1,2.....Limit switch, switches Engine Start from ATS control to bypass control during ATS Isolate
AI-1,2,3.....Limit switch, actuated in Isolate location
AT-1,2.....Limit switch, actuated in Test location
ATR.....Auto/Test Relay. Energized in AUTO and TEST locations
BR-1,2,3.....Bridge Rectifier
C.....Capacitor: RNH
CBC.....Crank Solenoid
CBE.....Emergency Bypass Permissive Solenoid
CBN.....Normal Bypass Permissive Solenoid
D1.....Diode
R1.....Resistor: RNH
R2.....Resistor: LDS
RNH.....Relay normally held, 24 VDC coil, 3PDT
XBE.....Emergency line control transformer
XBN.....Normal line control transformer

III. (BP) BYPASS/ISOLATION SWITCH: INDICATOR LIGHTS

LNA.....Normal available
LEA.....Emergency available
LBN(NOTE 1).....Bypass Normal (BN closed)
LBE(NOTE 1).....Bypass Emergency (BE closed)
LAT(NOTE 1).....ATS in Test location
LAI(NOTE 1).....ATS in Isolate location
LIT(NOTE 1).....ATS Inhibit
LDS(NOTE 1).....ATS DS switch in INHIBIT position

NOTES:
1. Indicator off during automatic operation of ATS.
2. Four pole includes neutral lugs.

CONTROLLED

REVISIONS:	MODEL: ZBTSH60/120 (600-1200 AMP)		ZENITH CONTROLS, INC.
	DRFT: KW	APP'D: FS/SB	TITLE: BYPASS/ISOLATION SW. LEGEND
	DATE: 5/18/92	DWG DIR: ZE3	DRAWING NO.: 40R-0504 SHEET 2 OF 3 — REV
	SCALE:		

LEGEND & OPERATION: AUTOMATIC TRANSFER SWITCH (ATS)

A. LEGEND

B1,2,3.....Solid State Phase Relay(s)
Dropout _____%
Pickup _____%
CE.....Main Transfer Operator, Close into Emergency
CEO.....Main Transfer Operator, Open from Emergency
CN.....Main Transfer Operator, Close into Normal
CNO.....Main Transfer Operator, Open from Normal
CCE.....CE Control Relay, Emergency Closing
CCEO.....CEO Control Relay, Emergency Opening
CCN.....CN Control Relay, Normal Closing
CCNO.....CNO Control Relay, Normal Opening
CR.....Normal Control Relay,
DS.....Disconnect Switch
DT.....Timer, Delay Open To Normal
DW.....Timer, Delay Open To Emergency
E.....Engine Start Contact
GRD.....Ground
NB.....Neutral Bar (only on 3 Pole)
RE.....Bridge Rectifier, CNO
REO.....Bridge Rectifier, CEO
RN.....Bridge Rectifier, CN
RNO.....Bridge Rectifier, CE
RT.....Emergency Control Relay
SE,SEO.....Cutout Switch, Emergency
SE-2.....Aux. Cutout Switch, Emergency
SN,SNO.....Cutout Switch, Normal
SN-2.....Aux. Cutout Switch, Normal
TS.....Test Switch, Momentary, Not Keyed
VFSM.....Emergency Volt-Freq. Relay
Pickup {90% of rated Voltage, and 95% of rated Frequency
XE.....Control Transformer, Emergency
XN.....Control Transformer, Normal

B. OPERATION

When the Normal Line falls to the preset dropout point, the phase relays will dropout disconnecting the CR relay.
When the Emergency Line voltage & frequency reach the preset pickup point, the VFSM relay picks up. RT relay picks up to operate the CCNO relay through the SE & SNO cutout switches causing the emergency main transfer operator CNO to operate. The load is now transferred to the Open position. The SNO limit switch operates to disconnect the CCNO relay and CNO main transfer operator. The transfer switch is now mechanically locked open. Limit switch SNO is now activated, picking up the DW timer. After a set time delay, DW will pick up the CCE relay which will then pick up CE main transfer operator. The load is now transferred to the Emergency line. The SE limit switch operates to disconnect the CCE relay and CE main transfer operator. The transfer switch is now mechanically locked in Emergency.

When the Normal Line voltage exceeds the preset pick up point, the phase relays B1, B2, & B3 pick up. CR relay picks up to operate the CCEO relay through the SN & SEO cutout switches, causing the main transfer operator CEO to operate. The load is now transferred to the Open position. The SEO limit switch operates to disconnect the CCEO relay and CNO main transfer operator. The transfer switch is now mechanically locked Open. Limit switch SEO is now activated, picking up the DT timer. After a set time delay, DT will pick up the CCN relay which will then pick up the CN main transfer operator. The load is now re-transferred back to the Normal line. The SN limit switch operates to disconnect the CCN relay and CN main transfer operator. The transfer switch is now mechanically locked in Normal.

DS - Disconnect Switch

When the Disconnect Switch is placed in the INHIBIT position the circuit to the main transfer operators CN and CE is opened and transfer cannot take place.

TS - Test Switch

The Test Switch simulates a normal line failure when activated.
To test, activate the Test Switch allowing the transfer switch to transfer to the EMERGENCY position. De-activate the Test Switch. The transfer switch will reset to the NORMAL position. Testing at least once a month is recommended. For hospital emergency systems, test once a week.

NOTES:

1. ⚠ CAUTION: In using a 3 phase, 4 wire delta or open delta power supply (usually 120/240 volts, sometimes listed as 120/208 volts) with one leg having a grounded center tap, one line will be 160 to 208 volts to ground. When such a system is used it is necessary to connect the high leg to N2. DO NOT CONNECT 120 VOLT LOAD CIRCUIT TO THE HIGH LEG.
2. GROUNDING TERMINAL: A grounding terminal (GND) is provided. When installing open type switches connect this to the metal enclosure or conduit.
3. ⚠ WARNING - TO ENSURE AGAINST SHOCK OR ACCIDENT HAZARD, DISCONNECT ALL SOURCES OF SUPPLY BEFORE SERVICING.
4. ON SINGLE PHASE UNITS WHERE THE EMERGENCY SOURCE IS A UTILITY LINE, CONNECT EMERGENCY LINE SO THAT MINIMUM VOLTAGE IS MEASURED FROM N1 TO E1.
5. ON SINGLE PHASE (2 POLE) UNITS, CENTER POLE AND PHASE RELAYS (B2,B3) ARE NOT SUPPLIED.

CONTROLLED

ECN S-5004: 8-7-92

ZENITH CONTROLS, INC.

TITLE: ATS LEGEND & OPERATION

DRAWING NO.: 40R-0504 SHEET 3 OF 3 | REV -

ACCESSORIES

The ZTS series switches are wired so that accessories can be easily added to the switch. The following is a description of the basic accessories. Those checked are supplied on this unit, see additional pages for complete legend & operation.

☐ A1 Auxiliary contact, S.P.D.T., operates on normal line failure.

☐ A1E Auxiliary contact, S.P.D.T., operates on emergency line failure.

☐ A3 Auxiliary contact closes when the transfer switch is in the Emergency position.

☐ A4 Auxiliary contact closes when the transfer switch is in Normal position.

☐ A6 Motor Disconnect. To de–energize external motor control circuit 5 seconds (adjustable) prior to transfer in either direction.

☐ C Plant Exercisor. Automatically starts generator for selected time intervals.

☐ C/D Plant Exercisor. Automatically starts generator to run unloaded or simulate a power failure and starts generator to run under load.

☐ E Engine Start Contact: 1 Normally Open
1 Normally Closed.

☐ F Auxiliary Fan Contact, S.P.N.O. Closes when generator is running.

☐ H Time delay to engine start, non–adjustable. Factory set 1 or 3 seconds. When the Normal line fails the relay de–energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ J1 Adjustable under frequency sensor.

☐ J2 Adjustable over/under frequency sensor.

☐ K Frequency meter to indicate load frequency.

☐ L1 Pilot Light. Switch in Emergency Position.

☐ L2 Pilot Light. Switch in Normal Position.

☐ L3 Pilot Light. Normal source available.

☐ L4 Pilot Light. Emergency source available.

☐ M1 Ammeter; Single phase.

☐ M2 Ammeter; Three phase

☐ M3 Voltmeter; Single phase.

☐ M4 Voltmeter; Three phase.

☐ P1 Time Delay to Engine Start (solid state). Adjustable over time range .5 to 6 seconds. When the Normal line fails the relay de–energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ P2 Time Delay to Engine Start (Pneumatic). Adjustable over time range 1/6 to 300 seconds. When the Normal line fails, the relay de–energizes. After the set time delay its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.

☐ Q2 Connections for remote peak shave or area protection relays. Includes bypass for automatic return to Normal if Emergency line fails and Normal is present.

☐ R1 Solid State Adjustable Overvoltage Relay(s). Set at 110% of pickup, 105% of dropout of nominal Line rate, unless otherwise specified.

☐ R4 In–Phase monitor. Prevents transfer until two sources are in–phase. For use of isochronous governors.

☐ R43 In–phase monitor. Prevents transfer until two sources are in–phase. For use with mechanical. governors.

☐ S1 Four–position Engine Control Selector Switch. "STOP", "HAND CRANK", "TEST", "AUTOMATIC".

☐ T Time delay, re–transfer to Normal. When the Normal line restores and the phase relays operate, the T timer is energized. After the set time delay, its contacts close the circuit to the CR relay which operates to restore the load to the Normal line. RT relay is supplied to bypass T contacts if Emergency is de–energized during timing. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ T3 W3 Presignal auxiliary Contact, S.P.D.T: Operates 0–30 seconds (adjustable) prior to transfer in either direction.

☐ U Time delay, engine cool–down. When the transfer switch is restored to the Normal position and the engine is signaled to shut down, the U timer operates to maintain the engine start circuit closed. At the end of the set time, the engine contacts open to shut down the engine. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ W Time delay, transfer to Emergency. When the Normal line fails and the engine has started, the VFSM relay energizes. The W timer energizes. After the set time delay, its contacts close to energize the RT relay. CAUTION–DO NOT SET TIMER AT THE "0" POINT.

☐ YE Pushbutton, Transfer to Emergency. Provides manual control of transfer to emergency source. If time delay accessory W is supplied pushbutton bypasses time delay for immediate transfer; otherwise, transfer to emergency will be automatic after time delay. If time delay accessory W is not supplied, transfer will be non–automatic (by pushbutton only).

☐ YN Pushbutton, Retransfer to Normal. Provides manual control of retransfer to normal source. If time delay accessory T is supplied, pushbutton bypasses time delay for immediate retransfer; otherwise, retransfer to normal will be automatic after time delay. If time delay accessory T is not supplied, retransfer will be non–automatic (by pushbutton only).

☐ Other:_____

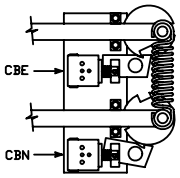
_____

_____

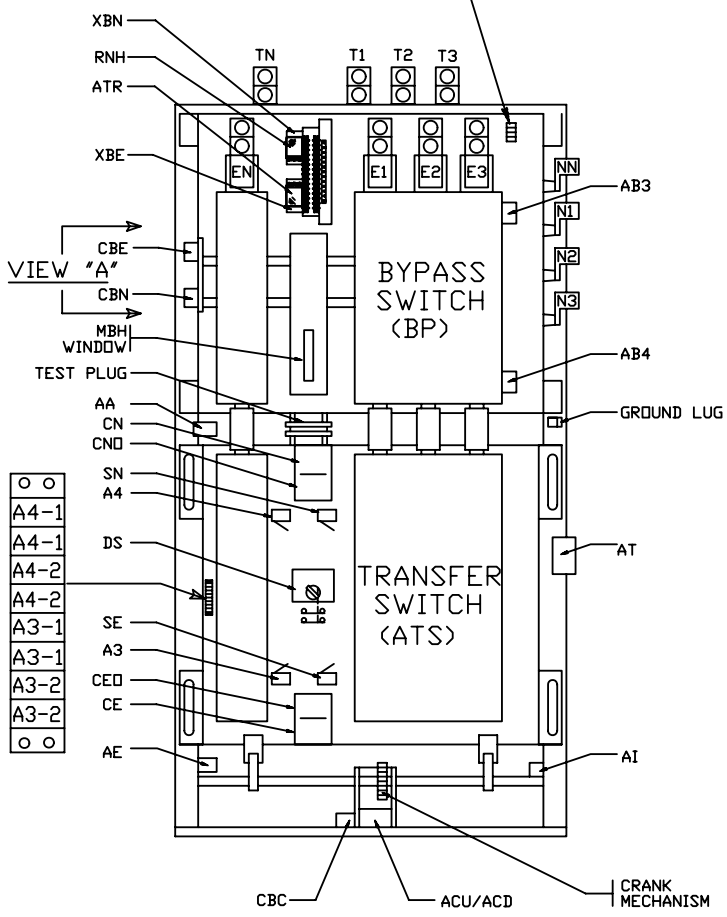
ZENITH® CONTROLS, INC.

TITLE: ACCESSORIES

DRAWING NO.: 40R–0900 — REV



VIEW "A"



DEVICE TAG	TERMINAL MARKINGS WIRE NUMBER					
TRANSFORMERS	X1	X2	H1	H2	H3	H4
XBE	53	54	50			51
XBN	43	44	40			41
SOLENOIDS	NO MARKINGS					
CBC	87A		81			
CBE	64		62			
CBN	63		62			
CE	206R		307R			
CED	209R		406R			
CN	206R		208R			
CND	308R		506R			
SWITCHES	NO		NC			
DS	80	82	20	209		
	80	90	30	307		
LIMIT SWITCHES	C	NC	NO	C	NC	NO
AA-1,2	60		61	62	82A	87
AA-3	87	92				
AB3-1,2	64		60	83A	83	86
AB3-3,4	E12		E11	E12A	12A	
AB4-1,2	63		61	80	83A	85
ACU	92		87A			
ACD	93		87A			
AE-1,2	E11	11	11R	E13	13	13R
AI-1,2	80		82A	80		89
AI-3	87	93				
AT-1,2	80		83	80		88
SE	33	34	36			
SE-2	86		87			
SED	25ZA	25A	25B			
SN	23	24	26			
SN-2	85		87			
SND	35ZA	35A	35B			
RECTIFIERS	AC	AC	+	-		
BR-1	43	44	80	60		
BR-2	53	54	80	61		
BR-3	60	61		81		

NOTES

REFER TO 40R-0504 FOR LEGEND & OPERATION FOR MANUFACTURING SEE PAGE 5 FOR CONTROL PANEL
SEE 40R-0900 FOR ACCESSORIES.

REVISIONS				
REV	ECN NO.	DATE	DWN	ENG
D	S-7032	11/05/98	EC	SB

DWG TITLE: BP & ATS COMPONENT LOCATIONS

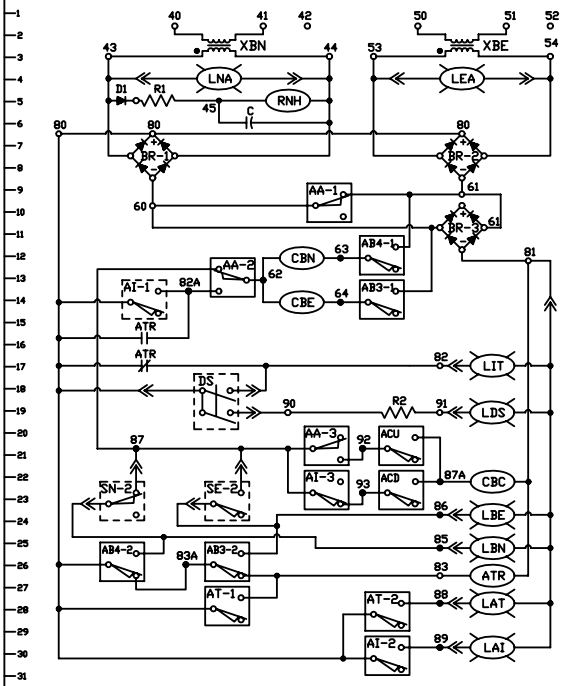
JOB/MODEL: ZBTSDH60-120

CHKD	APPD	CADD	ORDER NUMBER	DRAWING NUMBER
		S5K	N/A	46A-5003

DRWN	ENGR	DATE	SCALE	SHEET	REV
FHB	SB	07/22/94	N/A	1 OF 5	D

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION.
DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.



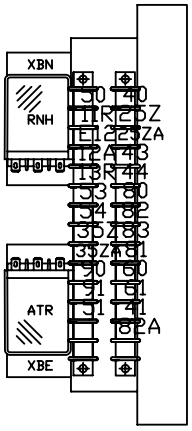
LNA - NORMAL AVAILABLE LIGHT
LEA - EMERGENCY AVAILABLE LIGHT
RNH - NORMAL VOLTAGE RELAY
D1 - DIODE
R1 - RESISTOR, RNH
C - CAPACITOR, RNH
BR-1,- BRIDGE RECTIFIER 2,3

AA-1 - LIMIT SWITCH, ATS AUTO LOCATION

AB4-1- LIMIT SWITCH, BYPASS NORMAL
CBN - NORMAL TRANSFER OPERATOR
AA-2 - LIMIT SWITCH, ATS IN AUTO
AB3-1- LIMIT SWITCH, BYPASS EMERGENCY
CBE - EMERGENCY TRANSFER OPERATOR

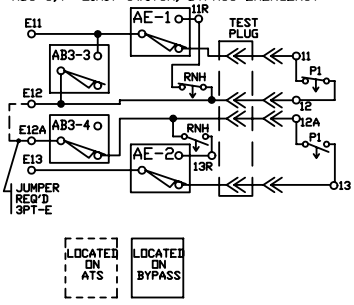
LIT - ATS INHIBIT LIGHT
AI-1 - LIMIT SWITCH, ATS IN ISOLATE
LDS - DISCONNECT SWITCH
DS - ATS DISCONNECT SWITCH
R2 - RESISTOR, LDS
AA-3 - LIMIT SWITCH, ATS IN AUTO
ACD - LIMIT SWITCH, CRANK HANDLE ACU ENGAGED
AI-3 - LIMIT SWITCH, ATS IN ISOLATE
CBC - CRANK SOLENOID
LBE - BYPASS EMERGENCY
LBN - BYPASS NORMAL LIGHT
AB4-2- LIMIT SWITCH, BYPASS NORMAL
AB3-2- LIMIT SWITCH, BYPASS EMERGENCY
ATR - AUTO/TEST RELAY
AT-1 - LIMIT SWITCH, ATS TEST LOCATION
LAT - ATS TEST LOCATION
AT-2 - LIMIT SWITCH, ATS IN TEST
LAI - ATS ISOLATE LIGHT
AI-2 - LIMIT SWITCH, ATS IN ISOLATE

BYPASS SUBPANEL

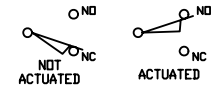


ENGINE START CIRCUIT

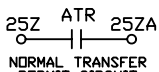
AE-1,2 - LIMIT SWITCH, ENGINE START TRANSFER
AB3-3,4- LIMIT SWITCH, BYPASS EMERGENCY



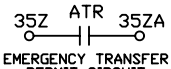
LIMIT SWITCHES



PERMIT CIRCUITS



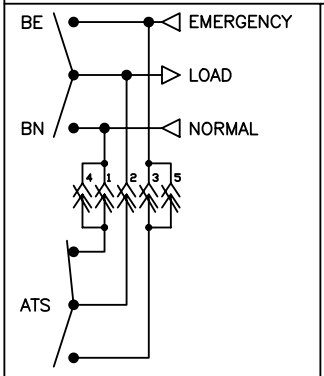
NORMAL TRANSFER PERMIT CIRCUIT IN AUTO AND TEST POSITIONS



EMERGENCY TRANSFER PERMIT CIRCUIT IN AUTO AND TEST POSITIONS

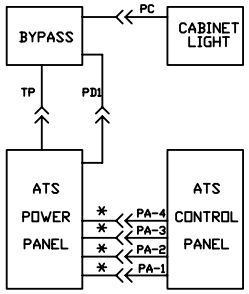
LIMIT SWITCH CHART

X = ACTUATED	ATS LOCATION				ATS MODE		BYPASS MODE		
	AUTO	TEST	ISO	REMOVE	NORM	EMERG.	NORM	EMERG.	OPEN
AA	X								
AT		X							
AI			X	X					
AE			X	X					
SN					X				
SE						X			
AB4							X		
AB3								X	



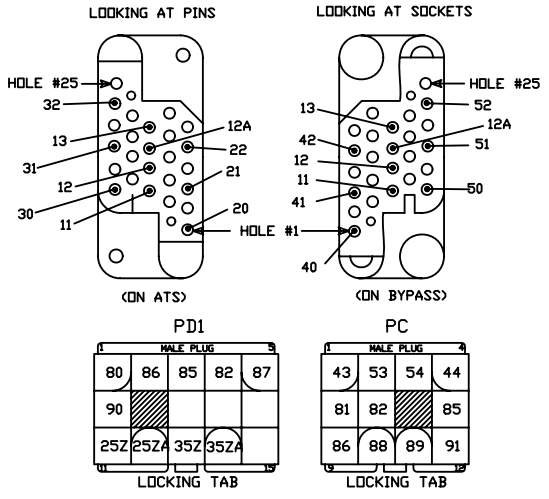
ATS LOCATION	LOAD CARRYING CONTACTS			ATS TEST PLUG (TP)	
	1	2	3	4	5
AUTO	X	X	X	X	X
TEST	O	O	O	X	X
ISOLATE	O	O	O	O	O

X = CLOSED
O = OPEN



* SEE ATS POWER CIRCUIT SCHEMATIC, LIGHTS AND PLUGS.

ATS TEST PLUG (TP)

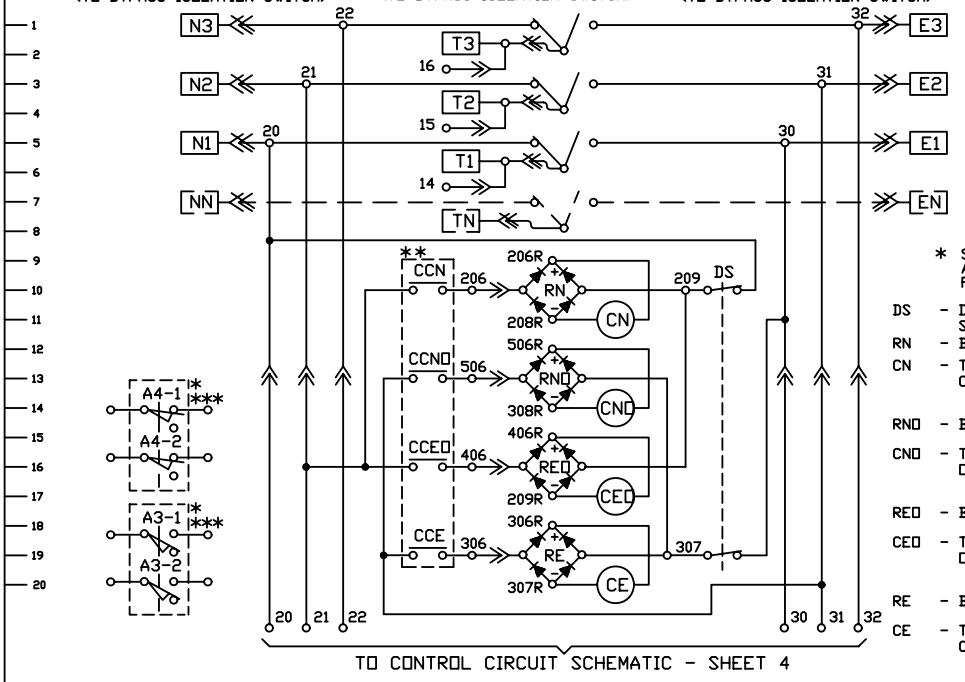


NOTES	REVISIONS					DWG TITLE: BYPASS CTRL CIRCUIT SCHEMATIC, SUPBANEL & PLUGS							
ATS SHOWN IN NORMAL POSITION, BYPASS OPEN WITH NO POWER AVAILABLE	REV	ECN NO.	DATE	DWN	ENG	JOB/MODEL: ZBTSDH60-120							
	D	S-7052	11/05/98	EC	SB	CHKD:	APPD:	CADD: S5K	ORDER NUMBER: N/A	DRAWING NUMBER: 46A-5003			
								DRWN: FHB	ENGR: SB	DATE: 07/22/98	SCALE: N/A	SHEET: 2 OF 5	REV: D

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

POWER CIRCUIT SCHEMATIC



VOLTAGE SYSTEMS	VOLTS	NO. OF PHASES	NO. OF WIRES
-3	240V, 60HZ	3	3
-31	208, 60HZ	3	3
-38	120/240,60HZ	3	4
-4	120/208,60HZ	3	4
-5	480,60HZ	3	3
-7	277/480,60HZ	3	4
-9	240/416,60HZ	3	4
-91	220/380V,60HZ	3	4
-92	220/380V,50HZ	3	4

* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEM

DS - DISCONNECT SWITCH FOR SERVICING

RN - BRIDGE RECTIFIER, CN

CN - TRANSFER OPERATOR, CLOSE INTO NORMAL

RNO - BRIDGE RECTIFIER, CNO

CNO - TRANSFER OPERATOR, OPEN FROM NORMAL

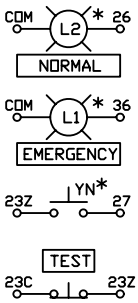
REO - BRIDGE RECTIFIER, CEO

CEO - TRANSFER OPERATOR, OPEN FROM EMERGENCY

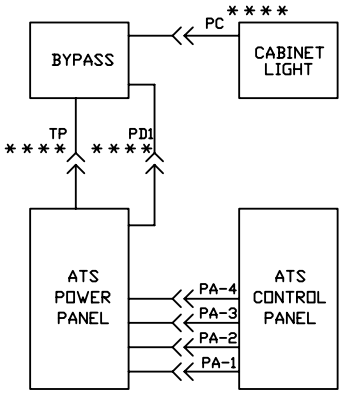
RE - BRIDGE RECTIFIER, CE

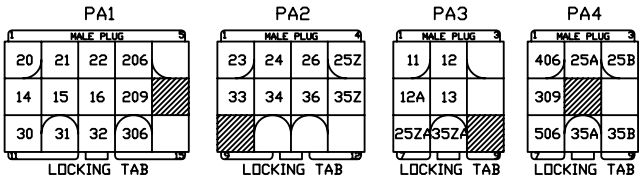
CE - TRANSFER OPERATOR, CLOSE INTO EMERGENCY

CABINET FRONT



INTERCONNECT PLUGS





LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —○— WIRE ON MAIN TERMINAL BLOCK —≫— WIRE IN DISCONNECT PLUG * OPTIONAL ** LOCATED ON CONTROL PANEL *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL **** SEE BYPASS CONTROL SUBPANEL AND PLUGS		1. ZTSDH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE. 2. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE(A3,A4,E,L1,L2,P, T,U,W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.

REVISIONS				
REV	ECN NO.	DATE	DWN	ENG
D	S-7032	11/05/95	EC	SB

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

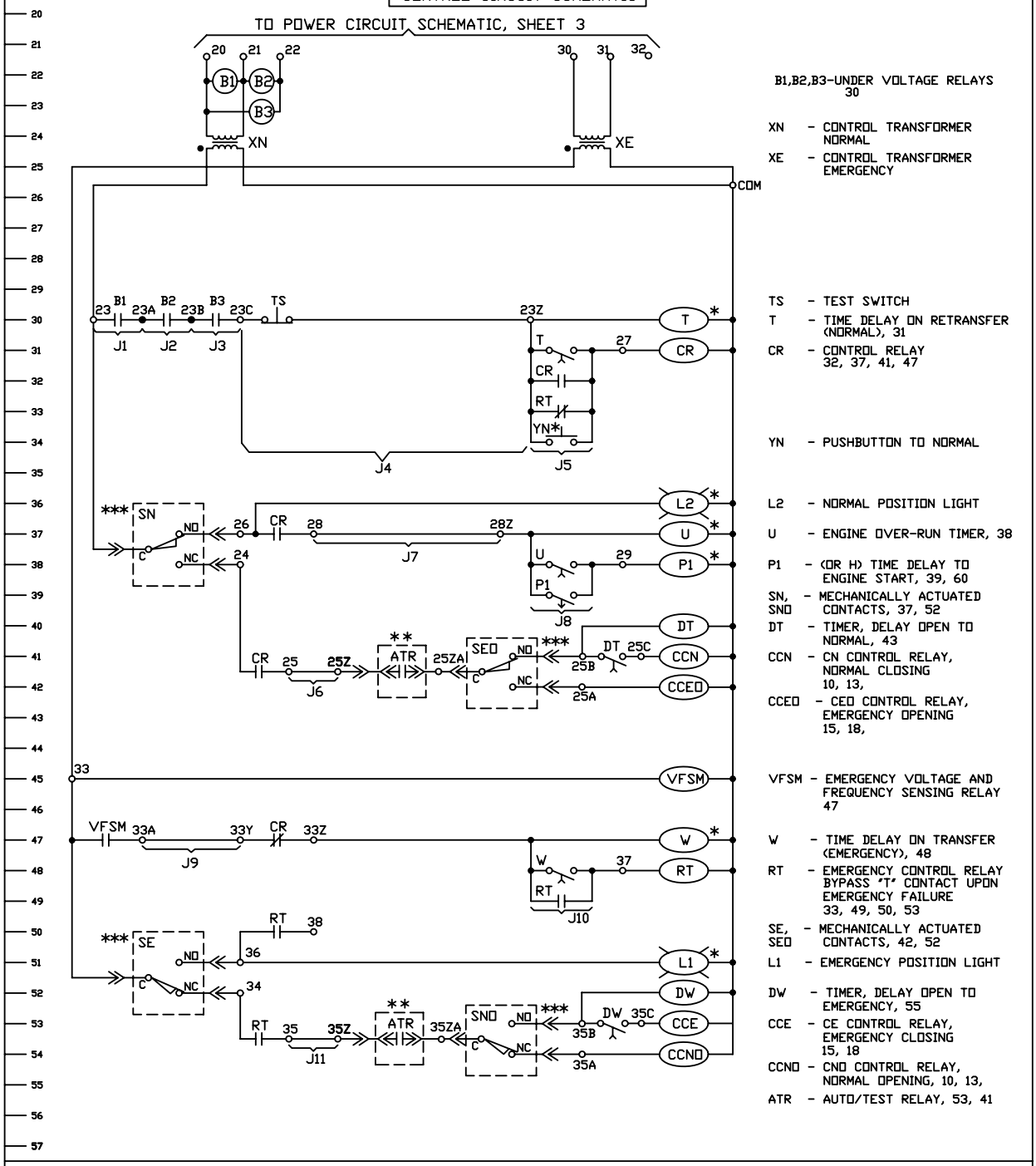
DWG TITLE: POWER CIRCUIT & CABINET FRONT

JOB/MODEL: ZBTSDH60-120

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		S5K	N/A	46A-5003

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
FHB	SB	07/22/94	N/A	3 OF 5	D

CONTROL CIRCUIT SCHEMATIC



CUSTOMER CONNECTIONS

A3,A4
SEE ATS POWER CIRCUIT SCHEMATIC & BP & ATS COMPONENT LOCATIONS

ENGINE START
SEE BP CONTROL CIRCUIT SCHEMATIC & BP & ATS COMPONENT LOCATIONS

CONTACT RATING		
RELAY	CONTACT	RATING
H	E	10AMP 28VDC
P1	E	10AMP 32VDC
	A3, A4	20AMP, 125, 250 VAC

JUMPER	CONNECT POINTS	REMOVE JUMPER WHEN ACCESSORIES USED
J1	23, 23A	B1
J2	23A, 23B	B2
J3	23B, 23C	B3
J4	23C, 23Z	J1N, TS, C/D
J5	23Z, 27	T, YN
J6	25, 25Z	T3, R4
J7	28, 28Z	C, C/D
J8	28Z, 29	P1, U
J9	33A, 33Y	J1E, ER1, 2, 3
J10	33Z, 37	W
J11	35, 35Z	W3, R4

LEGEND
- WIRE CONNECTION
- WIRE ON MAIN TERMINAL BLOCK
- WIRE IN DISCONNECT PLUG
- * OPTIONAL
- ** LOCATED ON BYPASS SWITCH
- *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL

NOTES
1. ZTSDH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.
2. DRAWING DHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3,A4,E,L1,L2,P, T,U,W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.

REVISIONS				
REV	ECN NO.	DATE	DWN	ENG
D	S-7032	11/05/96	EC	SB

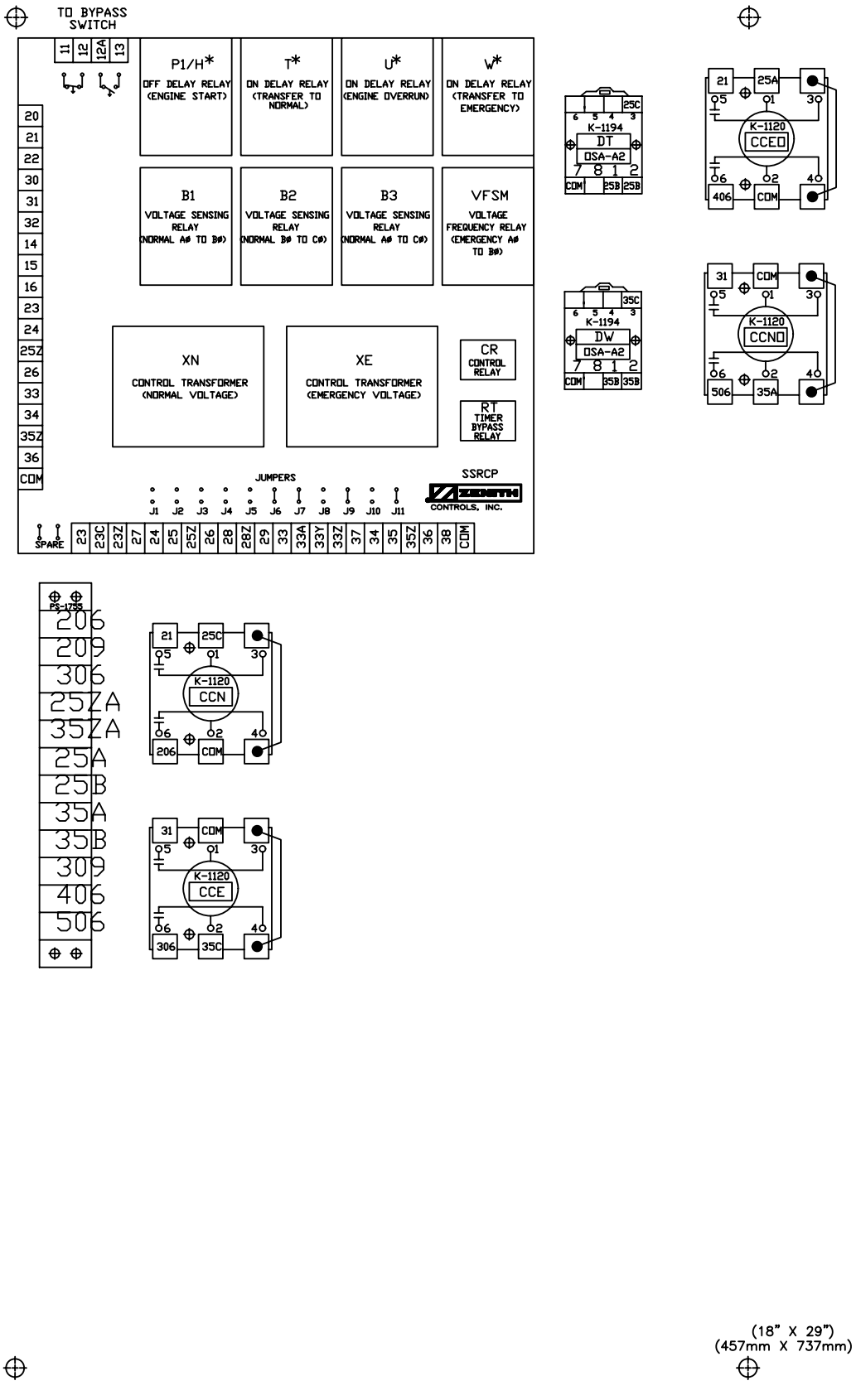
ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: CTRL. CIRCUIT SCHEMATIC & CUST. CONNECTIONS
JOB/MODEL: ZBTSDH60-120

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:		
		S5K&	N/A	46A-5003		
DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:	
FHB	SB	07/22/94	N/A	4 OF 5	D	

CONTROL PANEL LAYOUT



(18" X 29")
(457mm X 737mm)

NOTES	REVISIONS					DWG TITLE: CONTROL PANEL LAYOUT							
1. DRAWING SHOWS ZENITH MODULE & ACCESSORY PACKAGE (A3, A4, E, L1, L2, P, T, U, W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES. 2. ( ) ø OPTIONAL	REV	ECN NO.	DATE	DWN	ENG	JOB/MODEL: ZBTSDH60/120							
	D	S-7032	11/05/93	EC	SB	CHKD:	APPD:	CADD: S5K	ORDER NUMBER: N/A	DRAWING NUMBER: 46A-5003			
								DRWN: FHB	ENGR: SB	DATE: 07/22/94	SCALE: 1/2 : 1	SHEET: 5 OF 5	REV: D

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

ZENITH CONTROLS, INC.

46R-5001C
Revised March, 1996

OPERATION AND MAINTENANCE MANUAL

**BYPASS/
ISOLATION
DELAYED
TRANSITION
TRANSFER SWITCH**

**ZBTSDH SERIES
1600 THRU 3000 AMPS**

CONTROLLED

MODEL NUMBER _____

SERIAL NUMBER _____

ZENITH CONTROLS, INC., 830 W. 40th St., Chicago, IL 60609
(312)247-6400: FAX. (312)247-7805

TABLE OF CONTENTS

Storage, Installation 1

Cabinet (exterior, front view) 2

Parts list (electrical) 3

Top and lower panels, front view.
Switch details 4

Bypass and ATS Power Panels — Parts list 5

Bypass and ATS Control Panel Layout 6

Bypass and ATS Control Panel — Parts list 7

Operation of Bypass/Isolation Switch 8

Definitions and Operation Notes 9

ZBTSDH Operation, Maintenance 10, 11

Troubleshooting Decisions 12

ARSM and Timer Adj., Lubrication 13

Torque Requirements 14

Cabinet Dimensions 15

Control Disconnect Plugs 16

Field Notes 17

Bypass Control Panel Schematic Drawing 18

Typical Bypass and ATS Schematic Drawing 19

STORAGE

The ZBTSDH should be stored in a clean dry area. AVOID STORAGE BENEATH STEAM OR WATER PIPES. Excessive moisture may damage the unit. The switch should only be stored on a level (horizontal) surface.

INSTALLATION

1. HANDLING

   CAUTION: Depending upon the model, a ZBTSDH weighs between 3000-5000 pounds. Use adequate machinery and cables to handle the load.

2. EQUIPMENT PREPARATION

   a) Check nameplate to assure switch system voltage and amperage is correct. Any discrepancy should be immediately reported to a Zenith representative.

   b) Lock open breakers to Normal and Emergency lines.

3. CABINET PREPARATION

   a) A small amount of cabinet work is required before the cables are connected. Cover the switch and the controls to avoid metal fragments from entering mechanical and electrical componets. Visually verify that metal filings are removed from bus support. (Use vacuum if necessary).

   b) Standard cable entry is through the top or bottom of cabinet. Fig. 1 shows one suggested knockout. For a guide to assist in the hole layout, refer to Appendix A for determining appropriate knockout arrangement.

4. CABLE AND WIRE CONNECTIONS

   a) To remove possible oxide, clean cable conductor with a wire brush and apply a contact oxide inhibitor. Insert cables into appropriate lugs.

   b) Connect all auxilliary wires for external electrical operation. Example: E-Start, remote alarm lights or buzzers, motor control contacts, etc. Allow enough slack in wires to allow movement of the ATS to Isolate Position.

5. PRIOR TO THE UNIT'S ENERGIZATION

   a) Remove any debris incurred due to installation (cut cable strands, metal filings, etc.)

   b) Inspect the unit and verify torque of cable and wire connections.

EXAMPLE OF CABLE ENTRIES. TOP VIEW OF CABINET

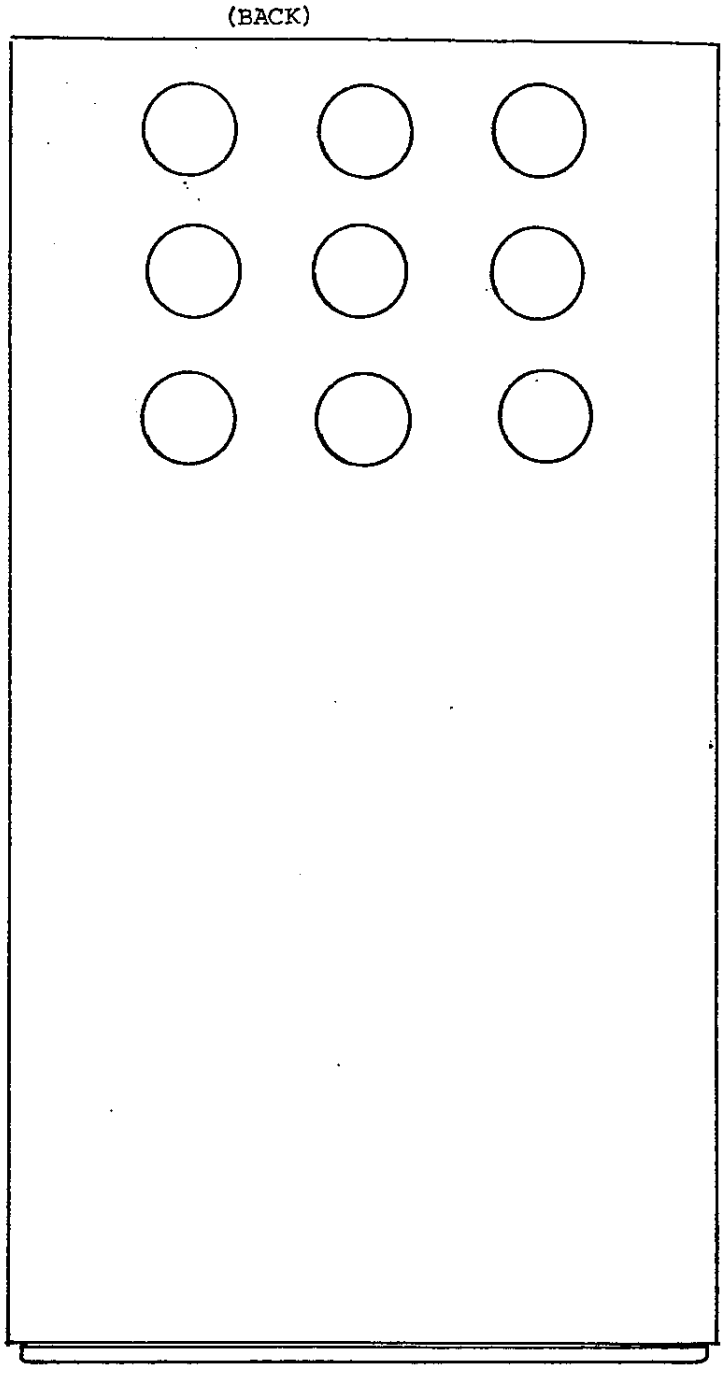
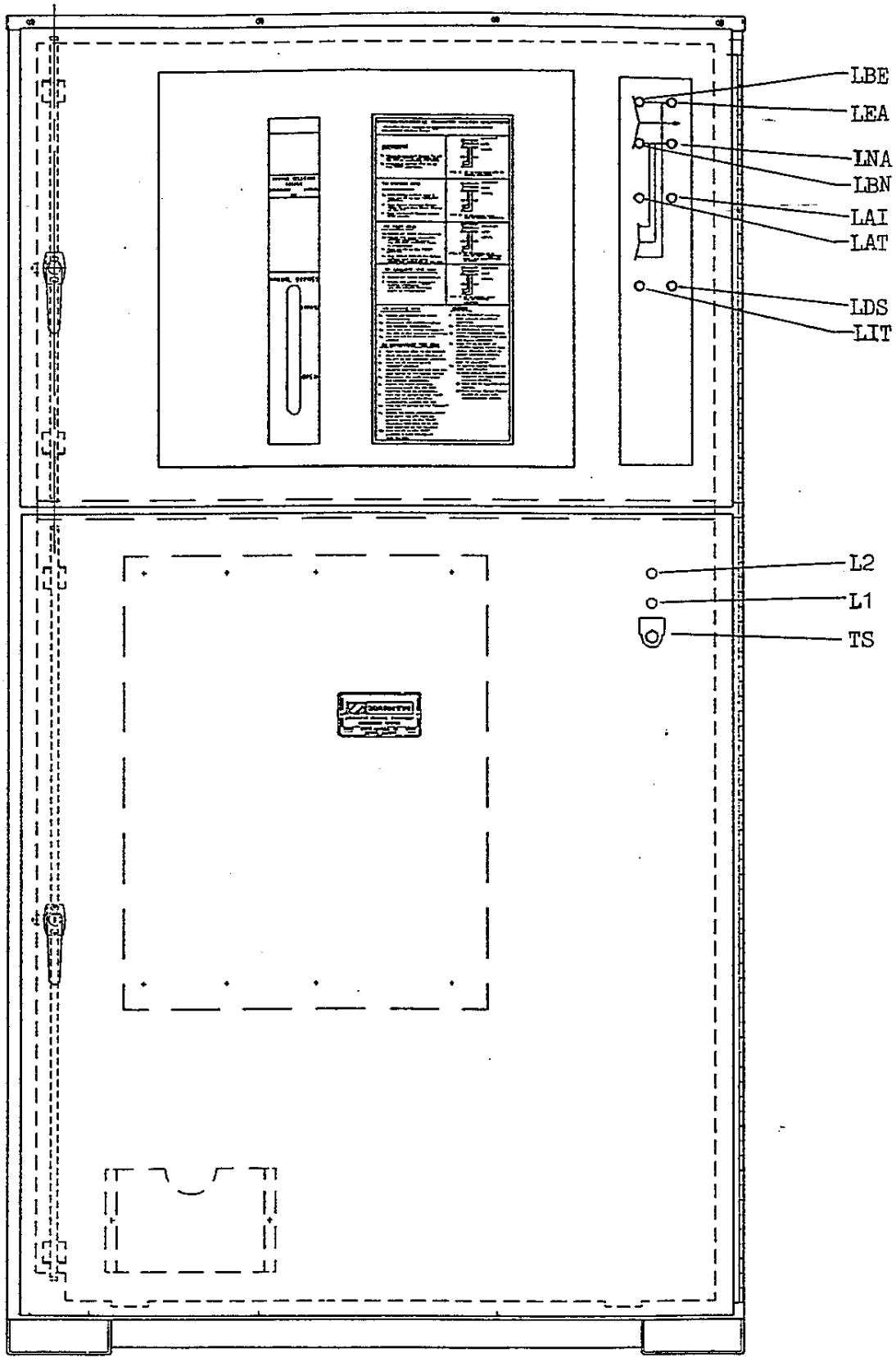
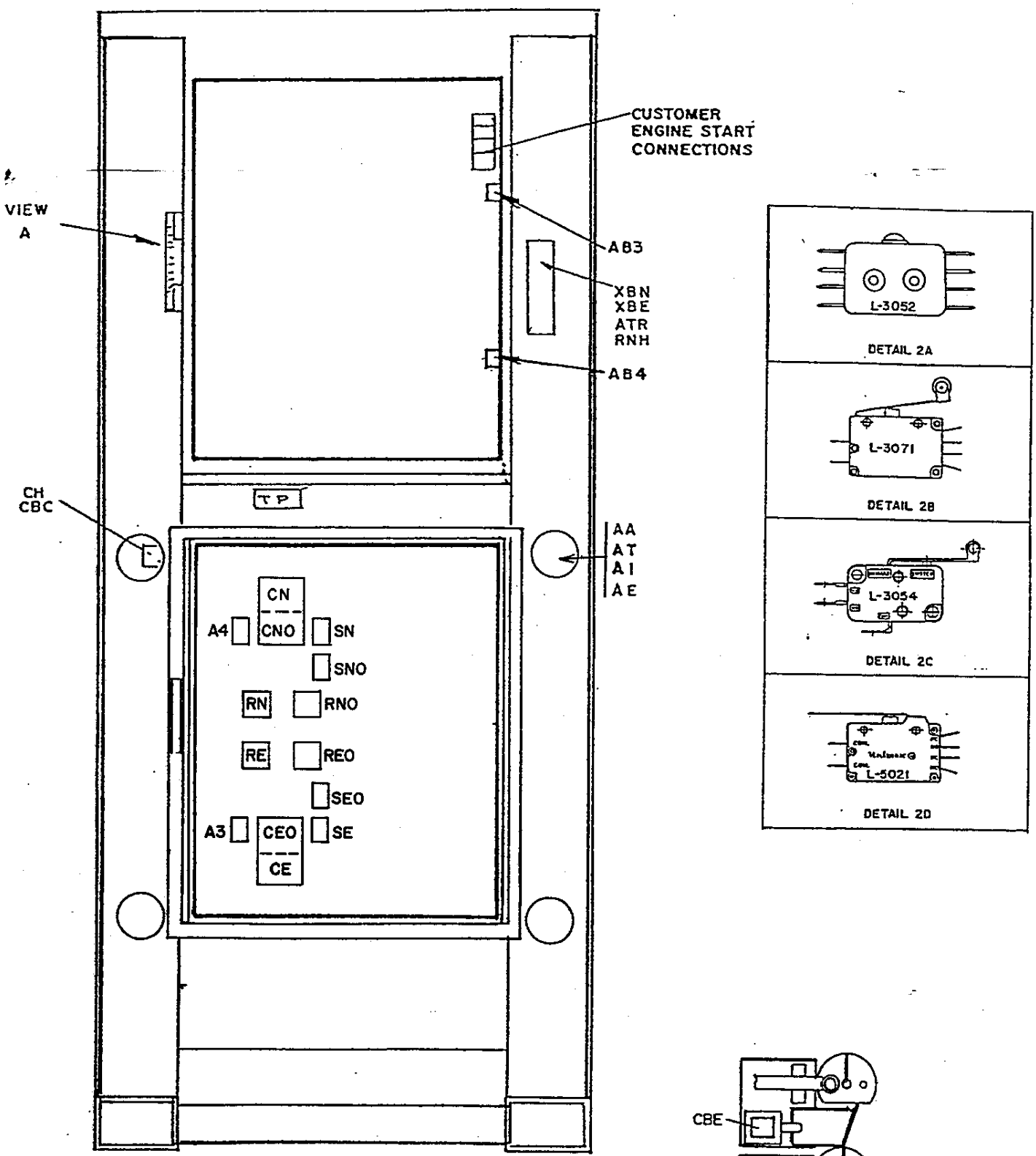


FIG. 1

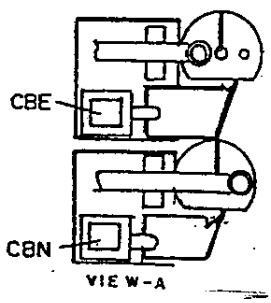

LBE
LEA
LNA
LBN
LAI
LAT
LDS
LIT
L2
L1
TS

A. CABINET ELECTRICAL PARTS

TAG	DESCRIPTION	PART NUMBER
LNA	Normal Available Indicator (G)	
LEA	Emergency Available Indicator (R)	
LBN	Bypass Normal Location Indicator (G)	
LBE	Bypass Emergency Location Indicator (R)	
LAT	ATS Test Position Indicator (A)	
LAI	ATS Isolate Position Indicator (A)	
LIT	ATS Inhibit Indicator (R)	
LDS	ATS Disconnect Switch "Inhibit" Indicator (R)	
	Flashing Bulb	PS-1272
	COMMON PARTS BYPASS INDICATORS	
	Bulb	Y500005
	Socket	PS-5046
	Red Lens (R)	PS-5047
	Green Lens (G)	PS-5048
	Amber Lens (A)	PS-5049
L1	ATS Emergency Position Indicator	
L2	ATS Normal Position Indicator	
	Green Lens (Normal)	PS-5048
	Red Lens (Emergency)	PS-5047
	Bulb Socket	PS-5046
	Normal/ Emergency Nameplate	V-1502
	Emergency Bulb	PS-5105
	Normal Bulb	PS-5105
TS	Test Switch	
	Operator, Momentary	L-1025
	Contact Block N.C.	L-1029
	Name Plate	V-1503
	Contact Mounting Base	PS-3473


CUSTOMER
ENGINE START
CONNECTIONS
VIEW
A
AB3
XBN
XBE
ATR
RNH
AB4
CH
CBC
TP
AA
AT
AI
AE
CN
A4
CNO
SN
SNO
RN
RNO
RE
REO
SEO
A3
CEO
CE
SE

L-3052
DETAIL 2A
L-3071
DETAIL 2B
L-3054
DETAIL 2C
L-5021
DETAIL 2D


CBE
CBN
VIEW-A

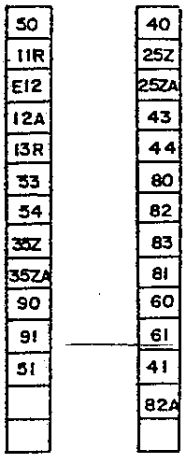
TAG	DESCRIPTION	PART NUMBER		
		STOCK NUMBER BY AMPERAGE		
		1600 A	2000 A	3000 A
NL1,2,3 EL1,2,3 T1,2,3	Cable Connection at Rear	S-1392F(2) OPTIONAL (8)600MCM-2	S-1392F(2) OPTIONAL (8)600MCM-2	S-1392F(2) OPTIONAL (8)600MCM-2
STAT(BP)	Stationary Contact Assembly(Bypass)	S-2308	S-2308	S-2343
STAT(ATS)	Stationary Contact Assembly (ATS)	S-2308	S-2308	S-2343
ARC	Arc Grid Assembly	23P-1171	23P-1171	23P-1171
MOV	Movable Contact Assembly	23P-1400	23P-1400	23P-1344

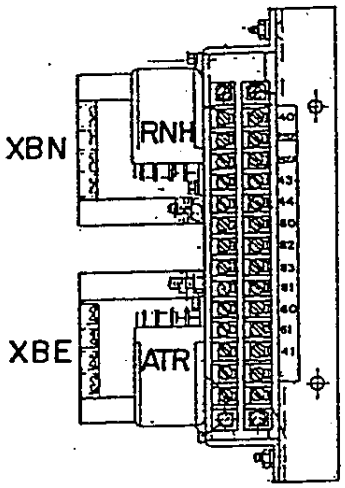
XBE,XBN	Bypass Step-Down Transformer 25VA Secondary 24V	VOLTAGE	PART NUMBER
		120/240 volts	K-3061
		208/416 volts	K-3063
		220/440 volts	K-3064
		240/480 volts	K-3062
		380 volts	K-3067
		575 volts	K-3065
		600 volts	K-3066

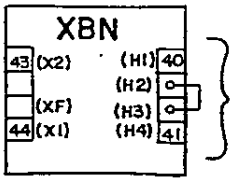
CN/CNO, CE/CEO	Main Operating Coils VOLTAGE SYSTEM							
No.	Volts	Ph	Wire	Coil Volts	Pole	1600A	2000A	3000A
-1	120	1	2	120	2	SPO	SPO	SPO
-2	120/240	1	3	240	2	K-2151	K-2151	K-2151
					3	K-2151	K-2151	K-2151
-3	240	3	3	240	3	K-2151	K-2151	K-2151
-4	120/208	3	4	208	3,4	K-2151	K-2151	K-2151
-5	480	3	3	480	3	K-2160	K-2160	K-2160
-6	575	3	3	575/600	3	SPO	SPO	SPO
-7	277/480	3	4	480	3	K-2160	K-2160	K-2160
					4	K-2160	K-2160	K-2160
-8	120/240	2	4	240	4	K-2151	K-2151	K-2151
-9	240/416	3	4	416	3	SPO	SPO	SPO

SN/SNO	ATS Normal Position Coil Cutout Sw.	26P-1250
SE/SEO	ATS Emerg. Position Coil Cutout Sw.	26P-1249
A3	ATS Emergency Position Switch	23P-1352,1353,1354,1355
A4	ATS Normal Position Switch	23P-1356,1357,1358,1359
CH	Crank Handle Limit Switch	L-3052 (Detail 2A)
AA1,2,3,4	ATS Auto Location Switch	L-3071 (Detail 2b)
AE1,2	ATS Isolate/Remove Location Switch	L-3052 (Detail 2A)
AI1,2	ATS Isolate Location Switch	L-3071 (Detail 2b)
AT1,2	ATS Test Location Switch	
AB3/A	Bypass Emergency Position Switch	L-5021 (Detail 2d)
AB4/A	Bypass Normal Position Switch	
AL-1,2,3,4	ATS Latched Limit Switch	L-3054 (Detail 2c)
DS	ATS Solenoid Disconnect Switch	
	Operator 2-Position Maintain	L-4018
	Contact Block N.C. (1)	L-1029
	Contact Block N.O. (2)	L-1028
	Contact Block Mounting Plate	PS-3473
CBN,CBE	Bypass Interlock Solenoid	K-2192
CBC	Crank Enable Solenoid	K-2159R

C. BYPASS CONTROL PANEL

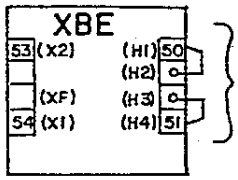






TYPICAL JUMPER & WIRING FOR 416 & 480 VOLT SYSTEMS

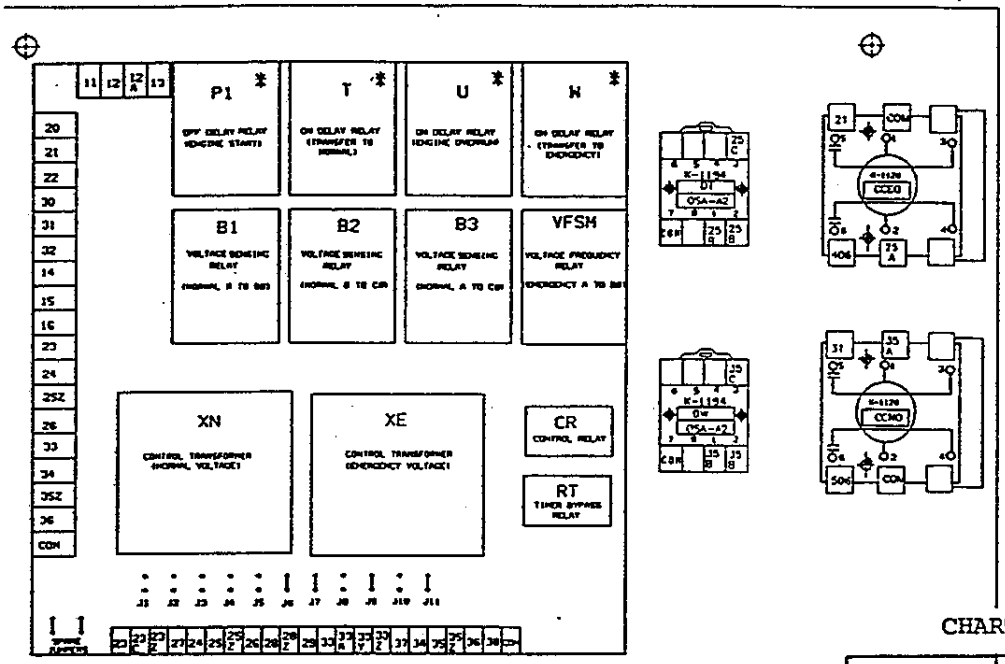
NOTE: IF SYSTEM IS 416 OR 480 VOLTS, WIRE TRANSFORMERS AS SHOWN ABOVE; IF SYSTEM IS 208 OR 240 VOLTS, WIRE TRANSFORMERS AS SHOWN BELOW.

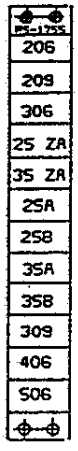


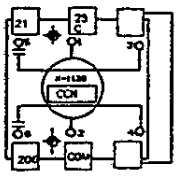
TYPICAL JUMPERS & WIRING FOR 208 & 240 VOLT SYSTEMS

USE K-3062 FOR 240 & 480V SYSTEMS.
USE K-3063 FOR 208 & 240V SYSTEMS

D. ATS CONTROL PANEL







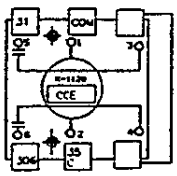


CHART 1

JUMPER	CONNECTS POINTS	REMOVE WHEN ACCESSORIES USED
J1	23,23A	B1
J2	23A,23B	B2
J3	23B,23C	B3
J4	23C,23Z	J1N,TS,C/D
J5	23Z,27	T,YN
J6	25,25Z	T3,R4
J7	28,28Z	S1,C,C/D
J8	28Z,29	P1 & U
J9	33A,33Y	ER1,2,3,J1E
J10	33Z,37	W
J11	35,35Z	R4,W3

C. BYPASS CONTROL PANEL (46P-1079) INCLUDES PARTS BELOW

TAG	DESCRIPTION	PART NUMBER
BR,1,2,3	Bridge Rectifier	PS-5076
RNH	Normal Voltage Relay	K-1218
R1	Resistor RNH, 30 ohm	PS-4056
R2	Resistor LDS, 120 ohm	PS-4057
D1	Diode	PS-4812
CA	Capacitor RNH	PS-4058
ATR	Auxiliary Test Relay	K-1218

D. ATS CONTROL PANEL (SSRCP) STANDARD ITEMS

TAG	DESCRIPTION	VOLTAGE 50/60 HZ	PART NUMBER
XN,XE	Control Transformers (see Note 1)	120 Volts	K-3076
		208 Volts	K-3070
		240 or 480 Volts	K-3071
		416 Volts	K-3089
B1,2,3	Phase Relays, Solid State (See Note 1)	120 Volts	K-1185
		208 or 240 Volts	K-1186
		480 Volts	K-1188
VFSM	Voltage Frequency Sensor	120VVolts	K-1192
CR	Control Relay	120 Volts	K-1204
RT	Bypass T Relay	120 Volts	K-1204
J1-J11	Jumpers		PS-5067
CCN/CCE	CN/CE Transfer Control Relays	120 Volts	K-1120
CNO/CEO	CNO/CEO Transfer Control Relays		
DT/DW	Time Delay Neutral to Normal/Emergency	120 Volts	K-1230

(OPTIONAL ITEMS)

TAG	DESCRIPTION	VOLTAGE	PART NUMBER	REPLACED BY
T	Time Delay to Normal, Timer Solid State	120V .1 Sec. to 9990 Hrs. (Adj.)	OSA-A-T	OSA-A2-T
U	Engine Cool Down, Timer Solid State	120V .1 Sec. to 9990 Hrs. (Adj.)	OSA-A-U	OSA-A2-U
W	Time Delay Emergency, Timer Solid State	120V .1 Sec to 9990 Hrs. (Adj.)	OSA-A-W	OSA-A2-W
P1	Time Delay Engine Start, Timer	120V (.5 to 6 sec. Adjustable)	K-1201	
P2	Optional (Mounted below SSRCP)	120V (300 Sec. Adjustable)	K-1061	

Notes:

1. If -6 voltage system (575/600V) is supplied, then XN, XE is K-3087 and B1,2, 3 is K-1185 (120V) supplied with XB (575;600V/120V) 3 phase transformer assembly. B1, 2, 3 mounted below SSRCP.

BYPASS/AUTOMATIC TRANSFER SWITCH OPERATION

BP-BYPASS SWITCH INDICATED BY CONTACTS BN/BE IS A 3 POSITION SWITCH
ATS-AUTOMATIC TRANSFER SWITCH

AUTOMATIC

1. Manually operated Bypass Switch contacts (BN/BE) are open and the ATS is supplying the Load.
2. Disconnect switch (DS) is in the "AUTO" position.

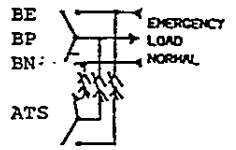


FIG. 1 BP IN OPEN WITH ATS IN NORMAL POSITION.

TO BYPASS ATS

1. Open bottom cabinet door & turn ATS DS to the "INHIBIT" position.
2. Turn Bypass Selector Switch (BSS) to the same Power Source as the ATS.
3. Move the Manual Bypass Handle (MBH) upward.

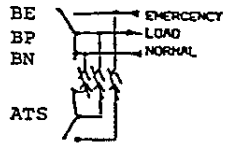


FIG. 2 BP IN NORMAL WITH ATS IN NORMAL POSITION.

TO TEST ATS

1. Bypass per above instructions.
2. Rotate the crank mechanism counter clockwise until the ATS TEST POSITION light is illuminated.
3. Turn the DS to the "AUTO" position.
4. Test Switch (TS) on the bottom cabinet door will allow electrical operation of the ATS.

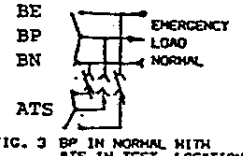


FIG. 3 BP IN NORMAL WITH ATS IN TEST LOCATION (ATS LOAD CONNECTIONS IS OPEN)

TO ISOLATE THE ATS

1. Bypass per above instructions.
2. Rotate the crank mechanism counter clockwise until the ATS ISOLATE POSITION light is illuminated.

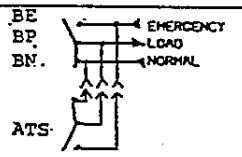


FIG. 4 BP IN NORMAL WITH ATS IN ISOLATE LOCATION

TO REMOVE ATS

1. Bypass and Isolate per above instructions.
2. Disconnect the multi-pin plugs and external connections.
3. Slide the four corner latches of the ATS to the innermost position.
4. ATS can now be removed from cabinet.

TO RECONNECT THE ATS

1. Roll the cart back in the cabinet
2. Slide the four corner latches of the ATS to the outermost position.
3. Turn the DS switch to the "INHIBIT" position.
4. Manually position the ATS into the same source as the Bypass Switch.
5. Re-connect the multi-pin plugs and external connections.
6. Rotate the crank mechanism clockwise until the ATS TEST POSITION light is illuminated.
7. Turn the DS switch to the "AUTO" position and use the TS to electrically operate the ATS.
8. Turn the DS switch to the "INHIBIT" position.
9. Rotate the crank mechanism clockwise until the ATS location pointer points to the "AUTO" location. (ATS must be in the same position as the Bypass.)
10. Turn the DS to the "AUTO" position & open the Bypass with the MBH.

NOTES:

1. DS in "INHIBIT" position will prevent electrical operation.
2. Do not use excessive force on mechanical handles.
3. Above figures depict Bypass NORMAL) Sequence is the same for Bypass EMERGENCY.
4. When ATS is in TEST or ISOLATE, Bypass Switch is a manual transfer switch to either available source. (opposite power source must be available).
5. To operate Bypass Switch in TEST and ISOLATE.
   a) Move manual Bypass Handle downward (to open Bypass contacts BN/BE).
   b) Turn BSS to opposite power source.
   c) Move Manual Bypass Handle upward to close into selected power source.

V-1587

DEFINITIONS:

BP - Bypass/Isolation Switch

It is a manually operated device used in conjunction with an Automatic Transfer Switch (ATS) to provide a means of directly connecting load conductors to a power source, and of disconnecting the Automatic Transfer Switch.

The BP can also be used as a Manual Transfer SWitch in the event of power failure while the ATS is in the TEST or ISOLATE positions.

ATS - Automatic Transfer Switch

Is a self-acting equipment for transferring one or more load conductor connections from one power source to another.

DS - Disconnect Switch

Inhibits operation of ATS Main Coils(CN-CE). In the "AUTO" position, the ATS operates normally. In the "INHIBIT" position the main coils (CN-CE) cannot be energized, and automatic transfer in either direction cannot take place.

BSS - Bypass Selector Switch

Selects position to bypass.

MBH - Manual Bypass Handle

Actuates the Bypass Operator
Down for Bypass Open
UP for bypass Normal and Bypass Emergency

TS - Test Switch

Simulates Normal Line failure when open.

OPERATION NOTES:

1. The ATS will not operate if:
   a) Harness plugs are not connected.
   b) DS is in the "INHIBIT" position.
   c) ATS is not in "AUTO" location with bypass switch open or ATS is not in "TEST".
   d) ATS is in "AUTO" location and BYPASS SWITCH is not open.
2. The MBH will not close the Bypass if:
   a) The BSS is turned to the opposite source that the ATS is in.
3. The MBH will not open the Bypass if:
   a) ATS is not engaged in one of the following; AUTO - TEST- ISOLATE.
   b) ATS is in "TEST" or "ISOLATE" location and the opposite source is not available.
4. The CH (CRANK HANDLE) will not operate if:
   a) BP and ATS are not positioned to same source.
   b) Power is not available.
   c) Harness Plugs are not connected.
   d) ATS has reached limit of travel to "AUTO" or "ISOLATE" (Clutch device on the crank mechanism slips.)

READ THE FOLLOWING PARAGRAPHS BEFORE PROCEEDING TO "TEST PROCEDURE". (THIS PROCEDURE IS ONLY TO BE PERFORMED BY AUTHORIZED PERSONNEL)

CAUTION:

Loads controlled by Bypass/Isolation Transfer Switch may cause PERSONAL INJURY by UNAUTHORIZED PERSONNEL operating or testing this equipment.

Check all wiring diagrams that have been supplied for added options that may affect external equipment: For example; Starting and Stopping of Elevators and Motors.

A 'Control Panel Test' or a test with the ATS in the TEST LOCATION runs the EMERGENCY SOURCE with no load. A no load operation may be detrimental to the engine, and the Engine/Generator Manufacturer should be consulted.

Allow sufficient time on the U timer for engine to safely cool down.

RECOMMENDED TIMER SETTINGS:

T — Restoration to Normal.....30 minutes (Factory set)
U — Engine Cooldown/Stop.....5 minutes (Factory set)
W— Engine Warmup .....5 seconds (Factory set)
P1—Engine Start .....3 seconds (Factory set)

TEST PROCEDURE

The ATS can be tested in either of two locations:

1). AUTO LOCATION
2). TEST LOCTION

1). "AUTO LOCATION":

Full Transfer Test — This test checks the complete operation of the ATS by transferring and and interrupting the load's power source from 'Normal' to 'Emergency'.

Depress TS (Test Switch) until Generator starts and the 'W' timer times out (timer will indicate ON). ATS will transfer to Emergency.

Release TS (this resets TS to AUTO). Normal restoration timer 'T' will time out (will indicate ON) which will energize the CR relay causing ATS to retransfer back to Normal.

Engine/Generator will shut down after timer U times out. Full Transfer Test is now complete.

2). "TEST LOCATION":

This procedure is recommended for Preventive Maintenance (PM) of ATS without interrupting the Load thru the BYPASS/ISOLATION SWITCH.

NOTE: TEST LOCATION is recommended after maintenance of ATS.

OPERATION OF AUTOMATIC TRANSFER SWITCH (ATS)

When the normal line (NL) falls to the preset dropout point, or if any normal phase fails, the phase relay(s) will drop out disconnecting the CR relay. P1 drops out after .5 to 6 seconds (adjustable) and signals generator to start.

When the emergency line (EL) voltage and frequency reach at least 90% of rated value, the VFSM relay is energized. The RT relay is now energized to operate the CCNO relay thru the SE cutout switch causing the main transfer coil CNO to operate. The load is now transferred to the OPEN position. The SNO limit switch operates to disconnect the CCNO relay and CNO transfer coil. The transfer switch is now locked mechanically open. SNO now is activated. This energizes the DW timer. After time setting has lapsed, DW will energize CCE, which will energize main transfer coil CE. The load is now transferred to the emergency line supply. The SE limit switch operates to disconnect the CCE relay and CEO main transfer coil. The transfer switch is now locked mechanically in Emergency position.

When the normal line voltage restores to the preset value, the phase relay(s) (B1,2,3) operate to energize the normal restoration timer T. After the time setting has lapsed, the timer contact closes to energize CR relay. The CCEO relay is now energized thru the SN and SEO limit switches, causing the main transfer coil CEO to operate. The load is now transferred back to the Open position. The SEO limit switch operates to disconnect the CCEO relay and CEO transfer coil. The transfer switch is now locked mechanically open. SEO is now activated, energizing DT timer. After time setting has lapsed, DT will energize CCN which will energize main transfer coil. The load is now transferred to the Normal line supply. The SN limit switch operates to disconnect the CCN relay and CN main transfer coil. The transfer switch is now locked mechanically into Normal position.

MAINTENANCE

ELECTRICAL TEST:

The ATS may be electrically tested for preventative maintenance (refer to page 10, "Test Procedure"). After completion of an electrical test, the ATS should be returned to the Auto Operation Mode. If the ATS malfunctions, troubleshoot the switch, referring to page 12, and replace any faulty part(s) immediately.

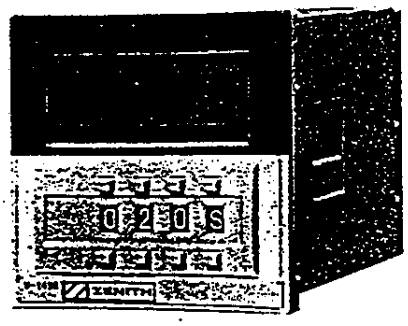
INSPECTION

CONTACTS - The movable and stationary contacts are a vital part of the ZBTSDH and must be kept clean. To inspect the ATS contacts, place ATS in Isolate location (see page 8). Examine the contacts.

Any surface deposits must be removed with a clean cloth (DO NOT USE EMERY CLOTH OR A FILE).

After the movable and stationary contacts are wiped clean (no discoloration or deposits) return the ZBTSDH to Auto Mode.

CURRENT CARRYING PARTS - An easily detected but abnormal condition is the discoloration of current carrying parts (particularly copper). Discoloration appears as darkened materials or finishes. Any discolored parts should be cleaned. WARNING: ANY MAINTENANCE SHOULD ONLY BE DONE WHILE THE POWER IS OFF! If the discoloration persists, consult the factory.



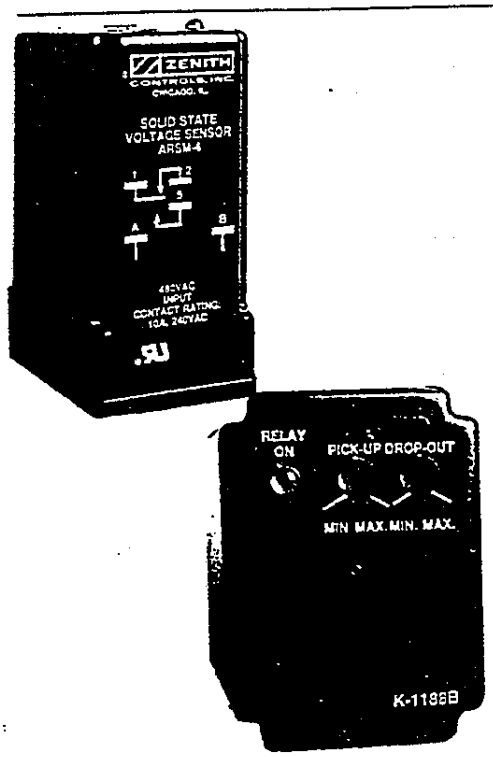
New Solid State Time Delay

Accessories T, U, W Solid State Timers Adjustable in Seconds, Minutes and Hours (Plug-In Style).

To select a time unit, operate the pushbuttons of the rightmost thumbwheel switch until the desired time unit is shown in window. The time unit can be selected by pushing the plus (+) bottom button or the minus (-) top button. The desired time is specified by operating the three thumbwheel switches in the middle of the front panel.

Setting of the timer at 000 will result in an infinite delay. The min. setting for OSA-A timers is 1/10 of 1 second as shown. See instructions.

0	0	1	0.1 Sec.



Close Differential (ARSM) Relay Adjustment

The voltage points at which the relay operates are adjustable. When the relay pulls in, an audible click is heard, and the LED will come on.

Setting the Relay:

If the relay should be set with a variable voltage supply (Variac):

1. Turn pick-up control fully clockwise.
2. Turn drop-out control fully counterclockwise.
3. Set Variac pick-up voltage to desired level.
4. **Very slowly** rotate pick-up adjustment counterclockwise until relay picks up. (LED will energize).
5. Set Variac drop-out voltage to desired level.
6. **Very slowly** rotate drop-out adjustment clockwise until relay drops out (LED de-energizes).

Verify settings by raising voltage until relay picks up, then lower voltage until relay drops out, making sure that relay operates at desired voltage levels.

LUBRICATION

The cams and gears of the ZBTSDH are lubricated with Dow Chemicals "Molykote" (321R or GN paste). These lubricants provide adequate lubrication for a clean and properly maintained switch's lifetime. Should debris contaminate the mechanism, clean and apply additional lubricants. Mobiltemp SHC-32 is used on isolating contacts.

LUBRICATION MAINTENANCE CHART

Date Inspected	Date Lubricated	Lubricant Used (Cams) (Gears)	Notes

TORQUE REQUIREMENTS FOR FIELD CONNECTIONS

NOTICE
TIGHTENING TORQUES FOR FIELD WIRING TERMINALS

Socket Size Across Flats, Inch	Tightening Torque Pound-Inches
1/8	45
5/32	100
3/16	120
7/32	150
1/4	200
5/16	275
3/8	375
1/2	500
9/16	600

TORQUE REQUIREMENTS FOR ELECTRICAL CONNECTIONS

All current carrying parts use compression washers and should be torqued to the values presented below.
Caution: DO NOT OVERTORQUE WASHERS; follow the given torque values.

TORQUE REQUIREMENTS (inch - lb. except denoted by + are ft. - lb.)

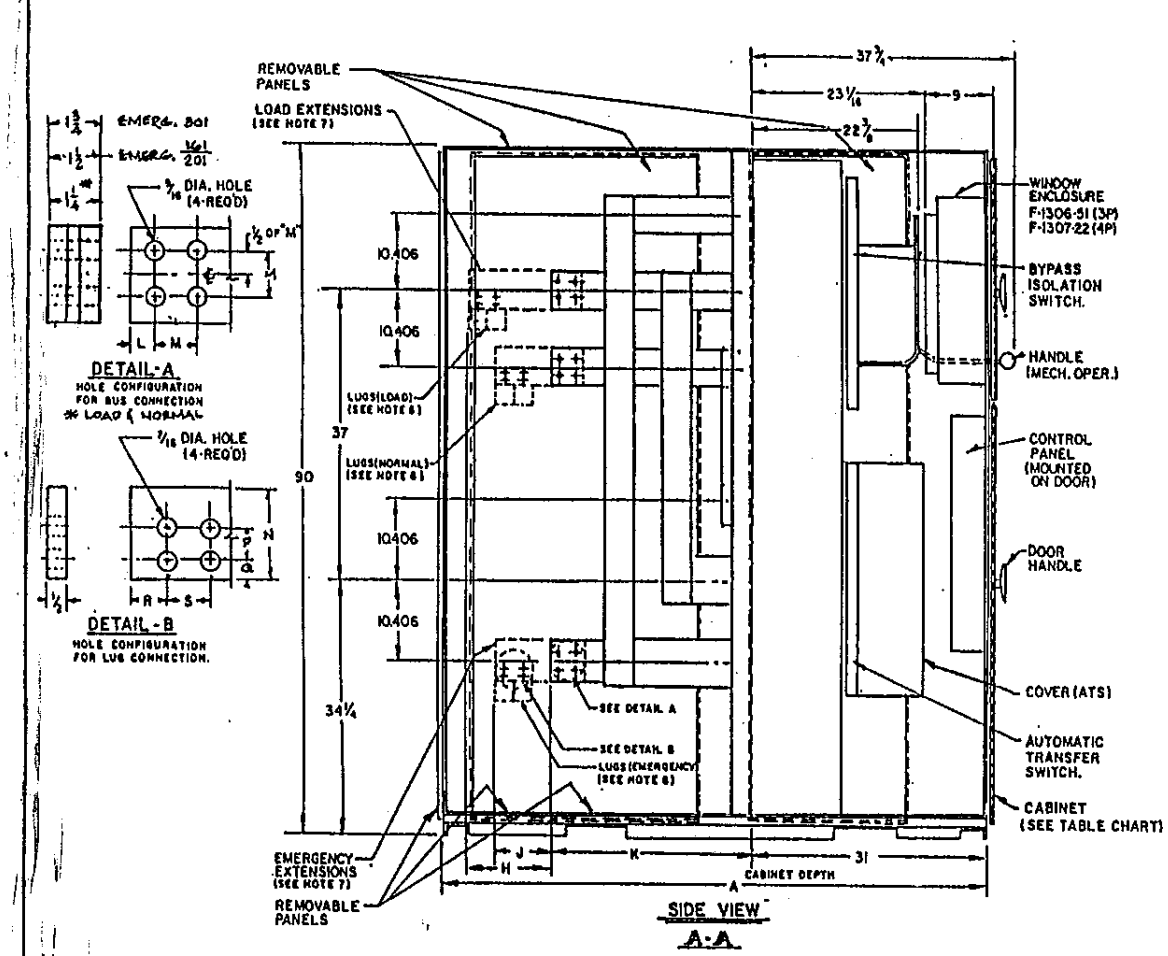
BOLT SIZE	GRADE 5	SOCKET HEAD	SET SCREW	COMPRESSION WASHERS	
				1	2
1/4 - 20	75	120	52	80	87
5/16 - 18	157	225	105	159	170
3/8 - 16	+23	412	165	+23	+26
1/2 - 13	+57	1030	386	+56	+59

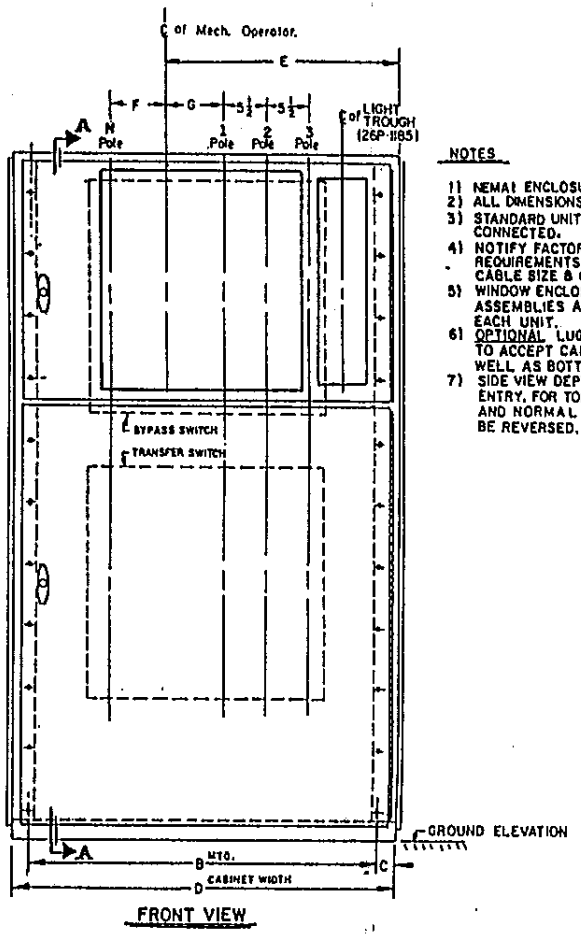
WIRE CONNECTION TIGHTENING TORQUE

WIRE COND. SIZE AWG or MM	SCREW DRIVER TORQUE (inch - lb.)
18 - 16 AWG	19
14 - 8	19
6 - 4	36

LUG BOLTING TORQUE

BOLT DIA. (inch)	TORQUE (ft. - lb.)
1/4 OR LESS	6
5/16	11
3/8	19
7/16	30
1/2	40
5/8 OR MORE	55



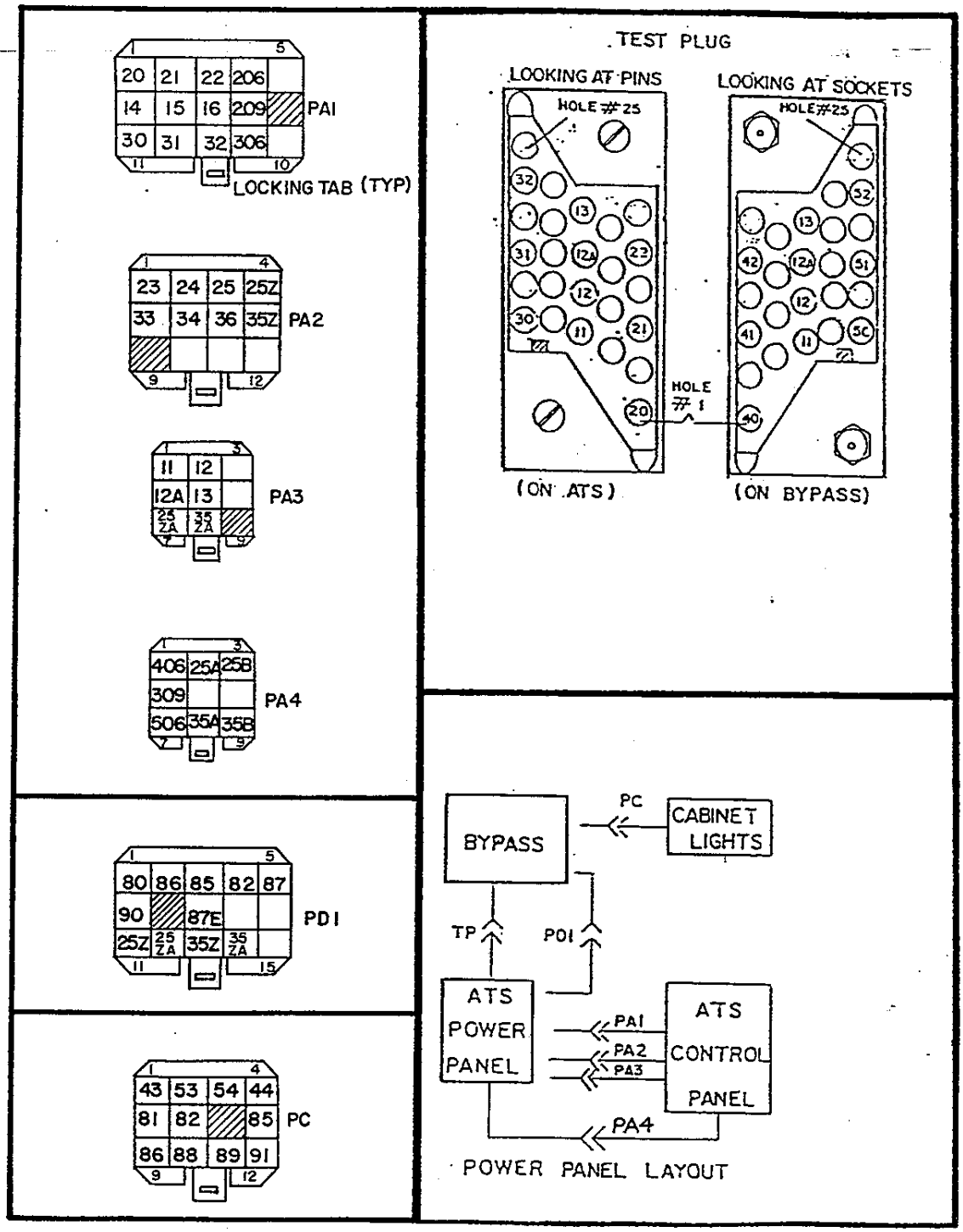


NOTES

1) NEMA1 ENCLOSURE.
2) ALL DIMENSIONS ± ⅛.
3) STANDARD UNIT SUPPLIED AS BUS CONNECTED.
4) NOTIFY FACTORY OF SPECIFIC JOB REQUIREMENTS (ENTRY LOCATION, CABLE SIZE & QTY, FOR LUGS).
5) WINDOW ENCLOSURE & LIGHT TROUGH ASSEMBLIES ARE FURNISHED WITH EACH UNIT.
6) OPTIONAL LUGS MAY BE ORIENTED TO ACCEPT CABLING FROM TOP, AS WELL AS BOTTOM ENTRY, AS SHOWN.
7) SIDE VIEW DEPICTS BOTTOM CABLE ENTRY. FOR TOP CABLE ENTRY, LOAD AND NORMAL EXTENSION WILL BE REVERSED.

SWITCH, AMP, POLE	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S
ZBTSDH 160-200A,3P	60	34½	2¾	40	30⅜	—	5½	7 15/16	5⅛	17 1/16	¾	1½	3	1⅜	½	1¼	2½
ZBTSDH 160-200A,4P	60	44¼	2⅞	50	30⅜	7⅝	7⅝	7 15/16	5⅛	17 1/16	¾	1½	3	1⅜	½	1¼	2½
ZBTSDH 300A, 3P	72	34½	2¾	40	30⅜	—	5½	9 5/16	5	26 13/16	1⅛	2¾	5	1⅜	9/16	1¼	2½
ZBTSDH 300A, 4P	72	44¼	2⅞	50	30⅜	7⅝	7⅝	9 5/16	5	26 13/16	1⅛	2¾	5	1⅜	9/16	1¼	2½

DISCONNECT PLUGS
ZBTSDH 1600-3000 AMPS



FIELD NOTES

MODEL NO: _____

SERIAL NO: _____

DATE SHIPPED: _____

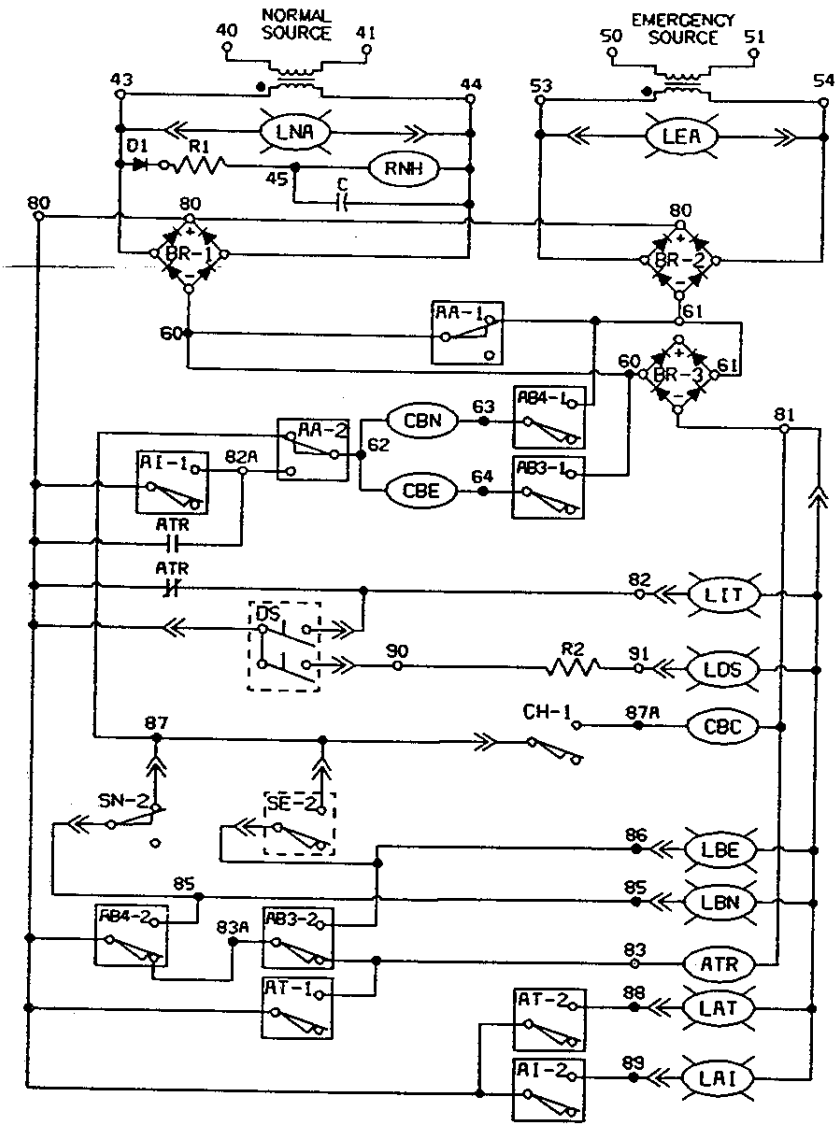
START-UP DATE: _____

DRAWING SUPPLIED: _____

_____

TEST AND MAINTENANCE NOTES:

DATE	TESTED	OBSERVATIONS	NOTES



LNA - NORMAL AVAILABLE LIGHT
LEA - EMERGENCY AVAILABLE LIGHT
RNH - RELAY NORMAL HOLD, 29, 31

BR-1,- BRIDGE RECTIFIER 2,3

AA-1,2 - AUTO LIMIT SWITCH, 7, 10

CBN - NORMAL SOLENOID

CBE - EMERGENCY SOLENOID

AI-1,2 - ISOLATE LIMIT SWITCH, 11, 23

LIT - LAMP INHIBIT TRANSFER

LDS - LAMP DISCONNECT SWITCH INHIBIT POSITION

CBC - CRANK SOLENOID

CH-1 - CRANK HANDLE LIMIT SWITCH

LBE - LAMP BYPASS EMERGENCY

LBN - LAMP BYPASS NORMAL

ATR - AUTO/TEST RELAY, 12, 13

LAT - LAMP ATS TEST POSITION

AT-1,2 - TEST LIMIT SWITCH, 21, 22

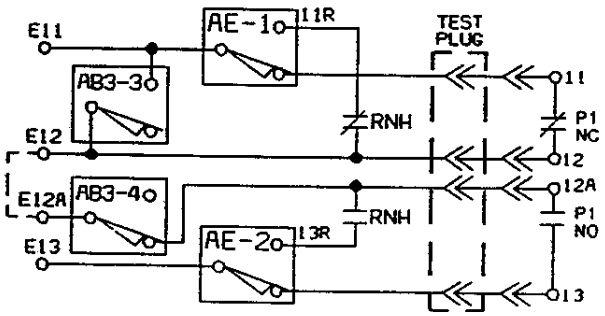
LAI - LAMP ATS ISOLATE

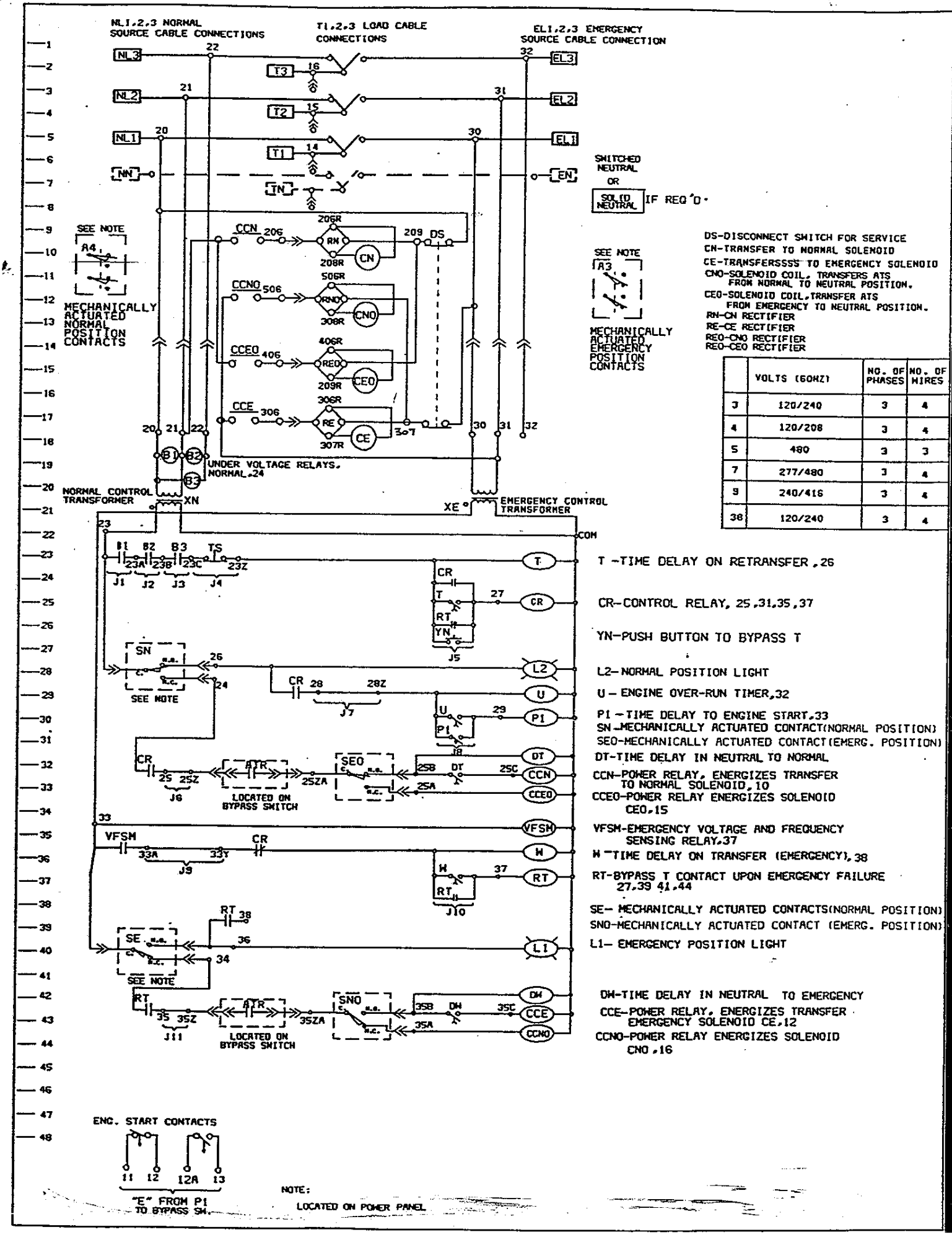
AB3-1,2,3,4 - BYPASS EMERGENCY, 11, 20, 29, 31

AB4-1,2 - BYPASS NORMAL, 9, 20

NOTE:

WIRE NUMBER E12 BECOMES WIRE NUMBER 12 AFTER THE TEST PLUG (TP).





DS-DISCONNECT SWITCH FOR SERVICE
CN-TRANSFER TO NORMAL SOLENOID
CE-TRANSFERSSSS TO EMERGENCY SOLENOID
CNO-SOLENOID COIL, TRANSFERS ATS FROM NORMAL TO NEUTRAL POSITION.
CEO-SOLENOID COIL, TRANSFER ATS FROM EMERGENCY TO NEUTRAL POSITION.
RN-CN RECTIFIER
RE-CE RECTIFIER
REO-CNO RECTIFIER
REO-CEO RECTIFIER

	VOLTS (60HZ)	NO. OF PHASES	NO. OF WIRES
3	120/240	3	4
4	120/208	3	4
5	480	3	3
7	277/480	3	4
9	240/416	3	4
38	120/240	3	4

T -TIME DELAY ON RETRANSFER ,26

CR-CONTROL RELAY, 25,31,35,37

YN-PUSH BUTTON TO BYPASS T

L2-NORMAL POSITION LIGHT

U - ENGINE OVER-RUN TIMER,32

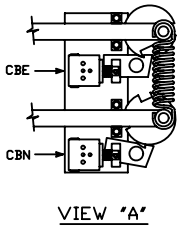
P1 -TIME DELAY TO ENGINE START,33
SN -MECHANICALLY ACTUATED CONTACT(NORMAL POSITION)
SEO-MECHANICALLY ACTUATED CONTACT(EMERG. POSITION)
DT-TIME DELAY IN NEUTRAL TO NORMAL
CCN-POWER RELAY, ENERGIZES TRANSFER TO NORMAL SOLENOID,10
CCEO-POWER RELAY ENERGIZES SOLENOID CEO,15
VFSM-EMERGENCY VOLTAGE AND FREQUENCY SENSING RELAY,37
W -TIME DELAY ON TRANSFER (EMERGENCY),38
RT-BYPASS T CONTACT UPON EMERGENCY FAILURE 27,39 41,44
SE- MECHANICALLY ACTUATED CONTACTS(NORMAL POSITION)
SNO-MECHANICALLY ACTUATED CONTACT (EMERG. POSITION)
L1- EMERGENCY POSITION LIGHT

DW-TIME DELAY IN NEUTRAL TO EMERGENCY
CCE-POWER RELAY, ENERGIZES TRANSFER EMERGENCY SOLENOID CE,12
CCNO-POWER RELAY ENERGIZES SOLENOID CNO ,16

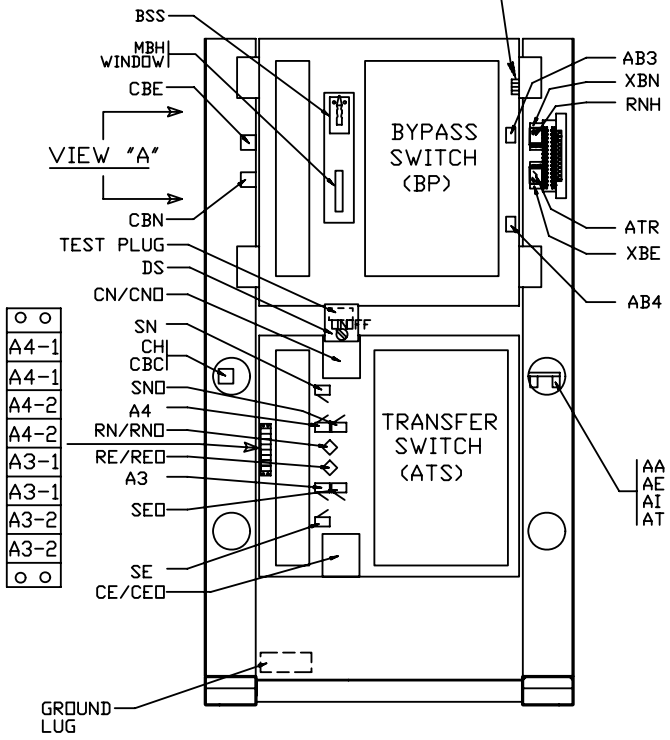


CONTROLS INC.

830 West 40th Street: Chicago, Illinois 60609 (312)247-6400

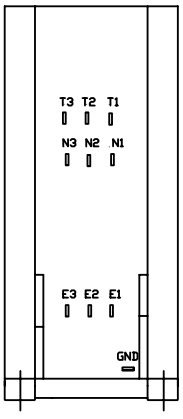


VIEW "A"

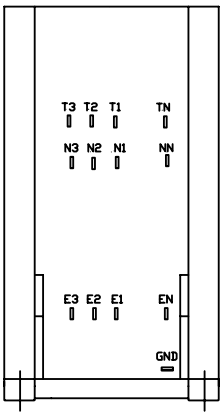


DEVICE TAG	TERMINAL MARKINGS WIRE NUMBER					
TRANSFORMERS	X1	X2	H1	H2	H3	H4
XBE	53	54	50			51
XBN	43	44	40			41
SOLENOIDS	NO MARKINGS					
CBC	87A		81			
CBE	64		62			
CBN	63		62			
CE	306R		307R			
CED	209R		406R			
CN	206R		208R			
CND	308R		506R			
SWITCHES	NO		NC		NC	
DS	80	82	20	209		
	80	90	30	307		
LIMIT SWITCHES	C	NC	NO	C	NC	NO
AA-1,2	60		61	62	82A	87
AB3-1,2	64		60	83A	83	86
AB3-3,4	E12		E11	E12A	12A	
AB4-1,2	63		61	80	83A	85
AE-1,2	E11	11	11R	E13	13	13R
AI-1,2	80		82A	80		89
AT-1,2	80		83	80		88
CH-1	87	87A				
SE	33	34	36			
SED	25ZA	25A	25B			
SE-2	86		87			
SN	23	24	26			
SN-2	85		87			
SND	35ZA	35A	35B			
RECTIFIERS	AC	AC	+	-		
RE	306	307	306R	307R		
RED	406	209	406R	209R		
RN	206	209	206R	208R		
RND	506	307	506R	306R		

STANDARD LUG CONFIGURATION
(CONSULT FACTORY FOR OPTIONAL CONFIGURATIONS)
REAR VIEW OF ENCLOSURE



2/3-POLE SWITCH



4-POLE SWITCH

REFERENCE

REFER TO 40R-0505 FOR LEGEND & OPERATION

FOR MANUFACTURING: SEE PAGE 5 FOR CONTROL PANEL
SEE 40R-0900 FOR ACCESSORIES.

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
D	S-5769	REDRAWN & REVISED		
E	S-5939	01/17/95	SG	SB
F	S-6008	02/16/95	SG	JC

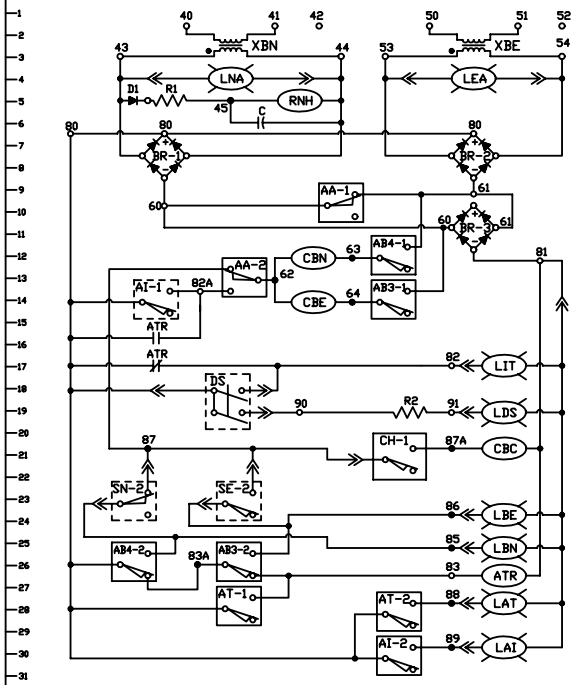
ZENITH CONTROLS, INC.

TITLE: BP & ATS COMPONENT LOCATIONS
MODEL: ZBTSDH 160-300 (1600-3000 AMP)

DRFT: FHB	DATE: 07/22/94	SCALE: -	CHK:	APPD:
ENGR: SB				

DWG NO.: 46A-5001 REV F
CADD: S5K SHT. 1 OF 5

ORIGINAL



LNA - NORMAL AVAILABLE LIGHT
LEA - EMERGENCY AVAILABLE LIGHT
RNH - NORMAL VOLTAGE RELAY

BR-1,- BRIDGE RECTIFIER
2,3

AA-1 - LIMIT SWITCH, ATS AUTO LOCATION

AB4-1- LIMIT SWITCH, BYPASS NORMAL
CBN - NORMAL TRANSFER OPERATOR

AA-2 - LIMIT SWITCH, ATS IN AUTO

CBE - EMERGENCY TRANSFER OPERATOR
AB3-1- LIMIT SWITCH, BYPASS EMERGENCY
AI-1 - LIMIT SWITCH, ATS IN ISOLATE

LIT - ATS INHIBIT LIGHT

DS - DISCONNECT SWITCH

LDS - LAMP DISCONNECT SWITCH
R2 - RESISTOR, LDS

CBC - CRANK SOLENOID

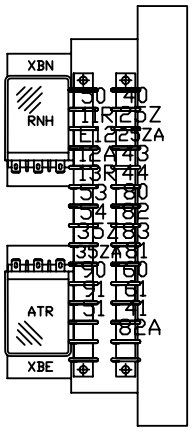
CH-1 - LIMIT SWITCH

LBE - BYPASS EMERGENCY
AB4-2- LIMIT SWITCH, BYPASS NORMAL

LBN - BYPASS NORMAL LIGHT
AB3-2- LIMIT SWITCH, BYPASS EMERGENCY
ATR - AUTO/TEST RELAY
AT-1 - LIMIT SWITCH, ATS TEST LOCATION
LAT - ATS TEST LOCATION
AT-2 - LIMIT SWITCH, ATS IN TEST

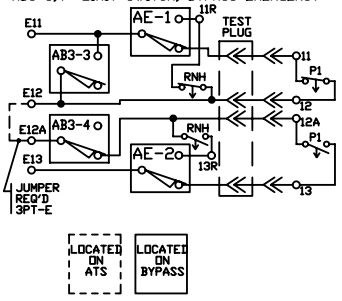
LAI - ATS ISOLATE LIGHT
AI-2 - LIMIT SWITCH, ATS IN ISOLATE

BYPASS SUBPANEL

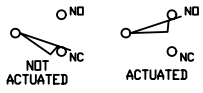


ENGINE START CIRCUIT

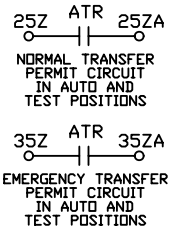
AE-1,2 - LIMIT SWITCH, ENGINE START TRANSFER
AB3-3,4- LIMIT SWITCH, BYPASS EMERGENCY



LIMIT SWITCHES

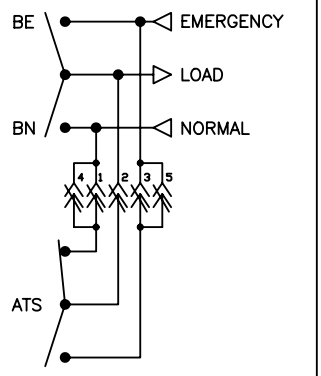


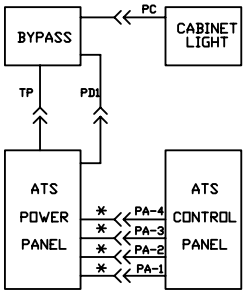
PERMIT CIRCUITS



LIMIT SWITCH CHART

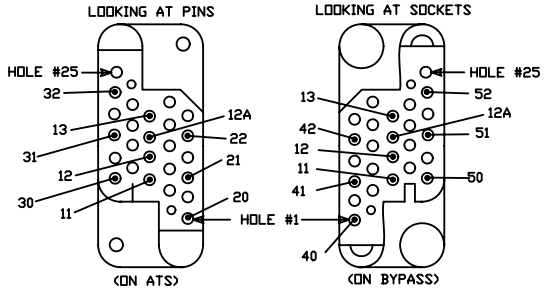
X = ACTUATED	ATS LOCATION				ATS MODE		BYPASS MODE		
	AUTO	TEST	ISO	REMOVE	NORM	EMERG.	NORM	EMERG.	OPEN
AA	X								
AT		X							
AI			X	X					
AE			X	X					
SN					X				
SE						X			
AB4							X		
AB3								X	

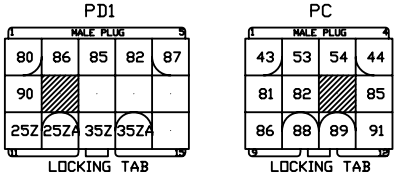




* SEE ATS POWER CIRCUIT SCHEMATIC, LIGHTS AND PLUGS.

ATS TEST PLUG (TP)





ATS LOCATION	LOAD CARRYING CONTACTS			ATS TEST PLUG (TP)	
	1	2	3	4	5
AUTO	X	X	X	X	X
TEST	O	O	O	X	X
ISOLATE	O	O	O	O	O

X = CLOSED
O = OPEN

NOTES

ATS SHOWN IN NORMAL POSITION, BYPASS OPEN WITH NO POWER

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
D	S-5769	REDRAWN & REVISED		
E	S-5939	01/17/95	SG	SB
F	S-6008	02/16/95	SG	JC

ZENITH CONTROLS, INC.

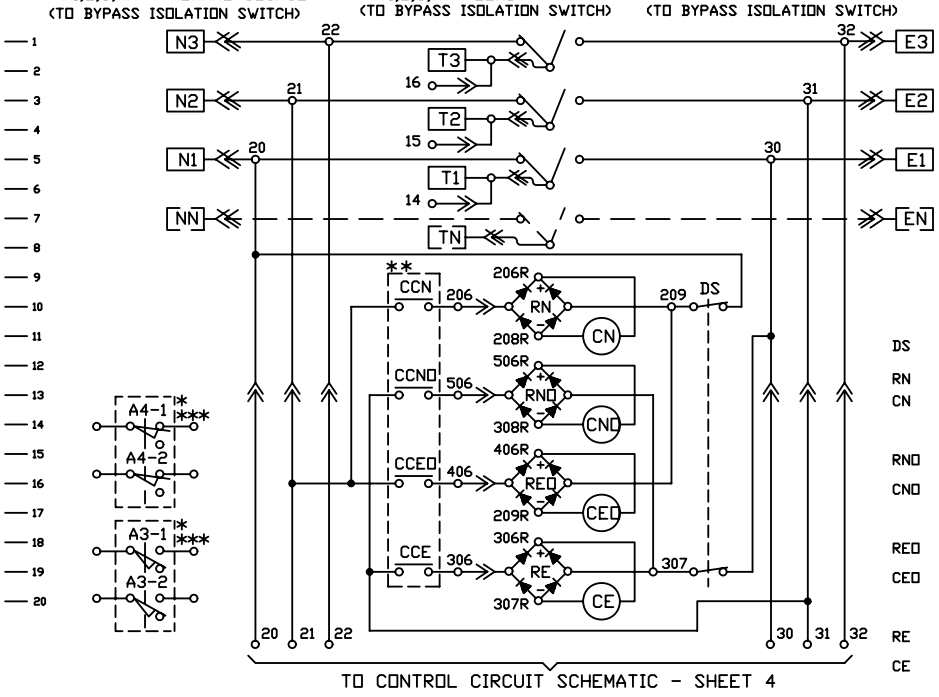
TITLE: BP CONTROL CIRCUIT, SUBPANEL, PLUGS
MODEL: ZBTSDH 160-300 (1600-3000 AMP)

DRFT: FHB	DATE:	SCALE:	CHK:	APPD:
ENGR: SB	07/22/94	-		

DWG NO.: 46A-5001 REV: F
CADD: S5K SHT. 2 OF 5

ORIGINAL

POWER CIRCUIT SCHEMATIC



VOLTAGE SYSTEMS

	VOLTS	NO. OF PHASES	NO. OF WIRES
-3	240V, 60HZ	3	3
-31	208, 60HZ	3	3
-38	120/240,60HZ	3	4
-4	120/208,60HZ	3	4
-5	480,60HZ	3	3
-7	277/480,60HZ	3	4
-9	240/416,60HZ	3	4
-91	220/380V,60HZ	3	4
-92	220/380V,50HZ	3	4

* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEM

DS - DISCONNECT SWITCH FOR SERVICING

RN - BRIDGE RECTIFIER, CN

CN - TRANSFER OPERATOR, CLOSE INTO NORMAL

RNO - BRIDGE RECTIFIER, CNO

CNO - TRANSFER OPERATOR, OPEN FROM NORMAL

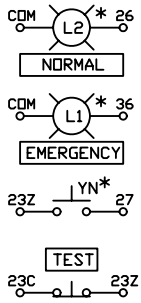
REO - BRIDGE RECTIFIER, CEO

CEO - TRANSFER OPERATOR, OPEN FROM EMERGENCY

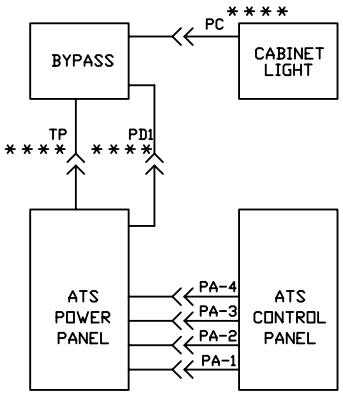
RE - BRIDGE RECTIFIER, CE

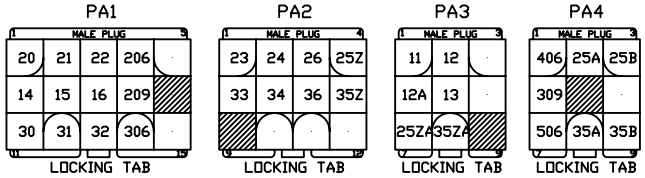
CE - TRANSFER OPERATOR, CLOSE INTO EMERGENCY

CABINET FRONT



INTERCONNECT PLUGS





LEGEND

- WIRE CONNECTION
- WIRE ON MAIN TERMINAL BLOCK
- WIRE IN DISCONNECT PLUG
- * OPTIONAL
- ** LOCATED ON CONTROL PANEL
- *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL
- **** SEE BYPASS CONTROL SUBPANEL AND PLUGS

NOTES

1. ZTSDH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.
2. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3,A4,E,L1, L2,P,T,U,W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.

REVISIONS

RV	ECN NO.	DATE	DRF	ENG
D	S-5769	REDRAWN & REVISED		
E	S-5939	01/17/95	SG	SB
F	S-6008	02/16/95	SG	JC

ZENITH CONTROLS, INC.

TITLE: POWER CIRCUIT & CABINET FRONT

MODEL: ZBTSDH 160-300 (1600-3000 AMP)

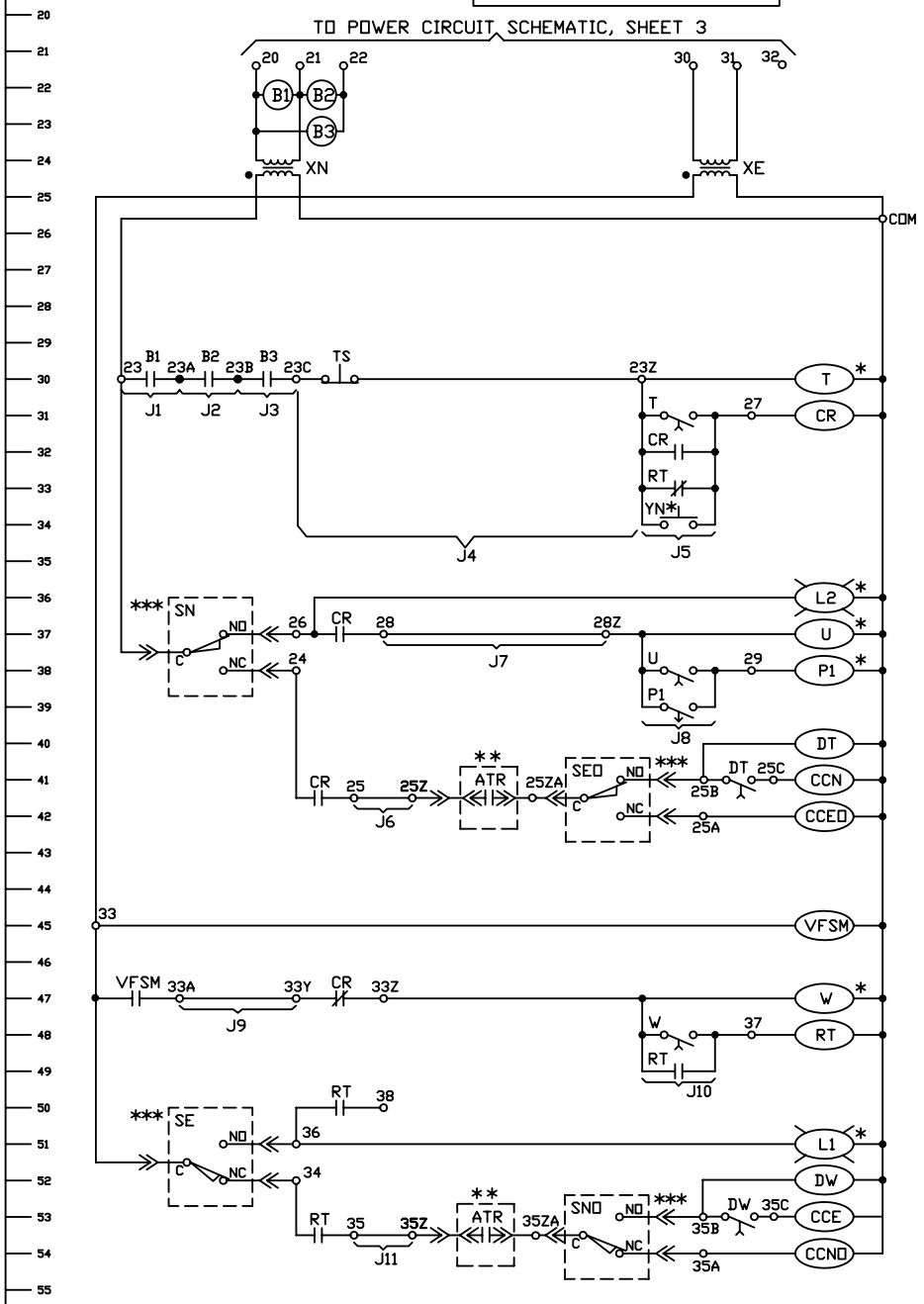
DRFT: FHB	DATE:	SCALE:	CHK:	APPD:
ENGR: SB	07/22/94	-		

DWG NO.: 46A-5001 REV F

CADD: S5K SHT. 3 OF 5

ORIGINAL

CONTROL CIRCUIT SCHEMATIC



B1,B2,B3-UNDER VOLTAGE RELAYS 30

XN - CONTROL TRANSFORMER NORMAL

XE - CONTROL TRANSFORMER EMERGENCY

TS - TEST SWITCH

T - TIME DELAY ON RETRANSFER (NORMAL), 31

CR - CONTROL RELAY 32, 37, 41, 47

YN - PUSHBUTTON TO NORMAL

L2 - NORMAL POSITION LIGHT

U - ENGINE OVER-RUN TIMER, 38

P1 - (OR H) TIME DELAY TO ENGINE START, 39, 60

SN, SNO - MECHANICALLY ACTUATED CONTACTS, 37, 52

DT - TIMER, DELAY OPEN TO NORMAL, 43

CCN - CN CONTROL RELAY, NORMAL CLOSING 10, 13,

CCEO - CEO CONTROL RELAY, EMERGENCY OPENING 15, 18,

VFSM - EMERGENCY VOLTAGE AND FREQUENCY SENSING RELAY 47

W - TIME DELAY ON TRANSFER (EMERGENCY), 48

RT - EMERGENCY CONTROL RELAY BYPASS 'T' CONTACT UPON EMERGENCY FAILURE 33, 49, 50, 53

SE, SEO - MECHANICALLY ACTUATED CONTACTS, 42, 52

L1 - EMERGENCY POSITION LIGHT

DW - TIMER, DELAY OPEN TO EMERGENCY, 55

CCE - CE CONTROL RELAY, EMERGENCY CLOSING 15, 18

CCNO - CNO CONTROL RELAY, NORMAL OPENING, 10, 13,

ATR - AUTO/TEST RELAY, 53, 41

NOTES

1. ZTSDH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.
2. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3, A4, E, L1, L2, P, T, U, W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.

CUSTOMER CONNECTIONS

A3,A4
SEE ATS POWER CIRCUIT SCHEMATIC & BP & ATS COMPONENT LOCATIONS

ENGINE START
SEE BP CONTROL CIRCUIT SCHEMATIC & BP & ATS COMPONENT LOCATIONS

CONTACT RATING		
RELAY	CONTACT	RATING
H	E	10AMP @ 28VDC
P1	E	10AMP @ 32VDC
	A3, A4	20AMP, 125, 250 VAC

JUMPER	CONNECT POINTS	REMOVE JUMPER WHEN ACCESSORIES USED
J1	23, 23A	B1
J2	23A, 23B	B2
J3	23B, 23C	B3
J4	23C, 23Z	J1N, TS, C/D
J5	23Z, 27	T, YN
J6	25, 25Z	T3, R4
J7	28, 28Z	C, C/D
J8	28Z, 29	P1, U
J9	33A, 33Y	J1E, ER1, 2, 3
J10	33Z, 37	W
J11	35, 35Z	W3, R4

LEGEND

- WIRE CONNECTION
- WIRE ON MAIN TERMINAL BLOCK
- WIRE IN DISCONNECT PLUG
- * OPTIONAL
- ** LOCATED ON BYPASS SWITCH
- *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL

REVISIONS

RV	ECN NO.	DATE	DRF	ENG
D	S-5769	REDRAWN & REVISED		
E	S-5939	01/17/95	SG	SB
F	S-6008	02/16/95	SG	JC

ZENITH CONTROLS, INC.

TITLE: ATS CONTROL CIRC. & CUST. CONNECTION

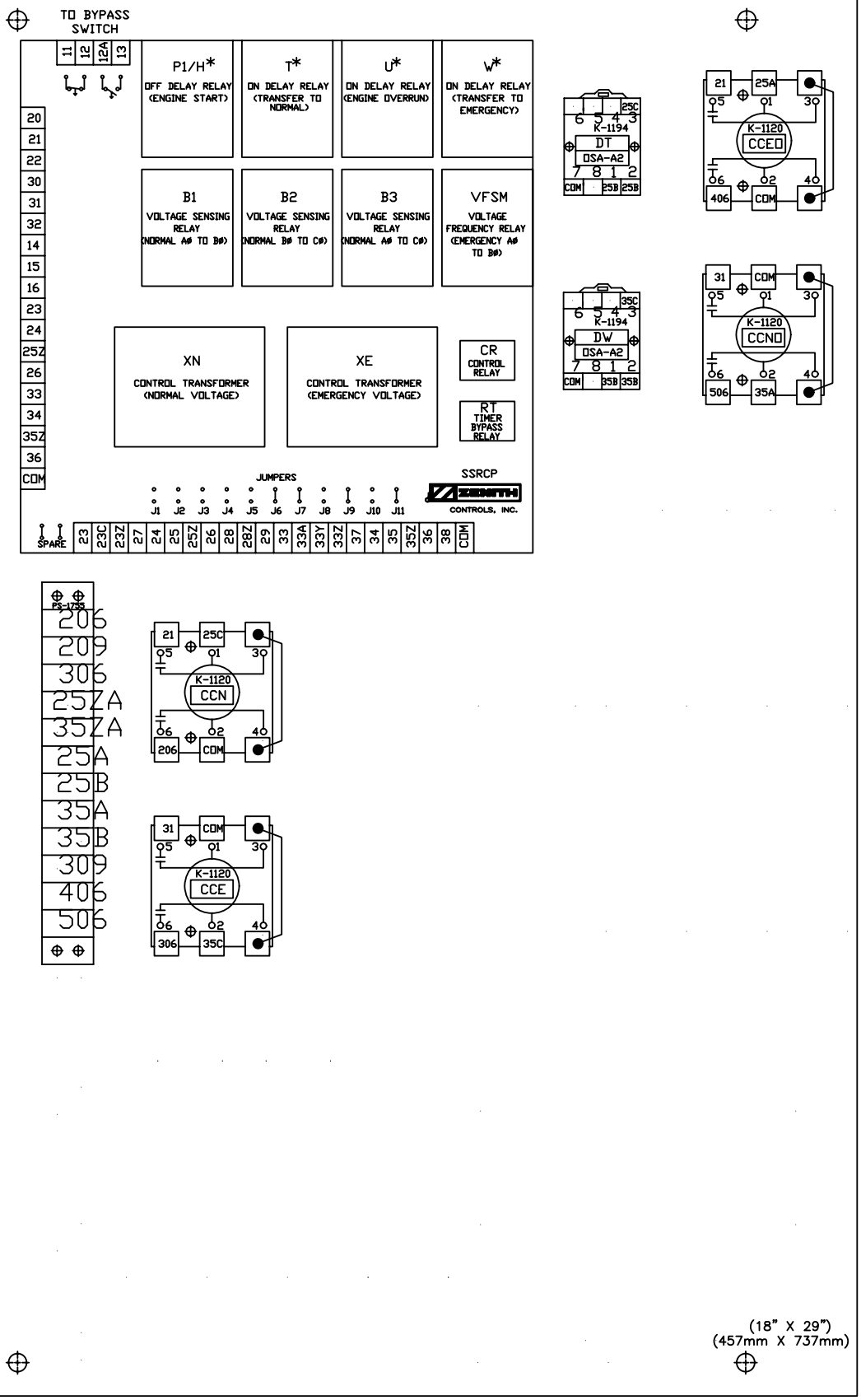
MODEL: ZBTSDH 160-300 (1600-3000 AMP)

DRFT: FHB	DATE:	SCALE:	CHK:	APPD:
ENGR: SB	07/22/94	-		

DWG NO.: 46A-5001 F

CADD: S5K SHT. 4 OF 5 REV

ORIGINAL



(18" X 29")
(457mm X 737mm)

NOTES	REVISIONS					
	RV	ECN NO.	DATE	DRF	ENG	
	D	S-5769	REDRAWN & REVISED			ZENITH CONTROLS, INC.
1. DRAWING SHOWS ZENITH MODULE 9 ACCESSORY PACKAGE (A3, A4, E, L1, L2, P, T, U, W) AND YN ACCESSORY. SEE SUBMITTAL COVER SHEET FOR APPLICABLE ACCESSORIES.	E	S-5939	01/17/95	SG	SB	
2. ( ) OPTIONAL	F	S-6008	02/16/95	SG	JC	TITLE: CONTROL PANEL LAYOUT
						MODEL: ZBTSDH 160-300 (1600-3000 AMP)
						DRFT: FHB | DATE: 07/22/94 | SCALE: 1/2 : 1 | CHK: | APPD:
						ENGR: SB
						DWG NO.: 46A-5001 F
						CADD: S5K SHT. 5 OF 5 REV

ORIGINAL

ZBTSDH SERIES
BYPASS/ISOLATION/DELAY TRANSFER SWITCH OPERATION
1600-3000 AMP

OPERATION: BYPASS/ISOLATION SWITCH

AUTOMATIC

1. Manually operated Bypass Switch contacts (BN/BE) are open and ATS is supplying load.
2. Disconnect Switch (DS) is in "AUTO".

TO BYPASS ATS

1. Open bottom cabinet door and turn DS to "INHIBIT".
2. Turn Bypass Selector Switch (BSS) to same power source as ATS.
3. Move the Manual Bypass Handle (MBH) upward.

TO TEST ATS

1. Bypass per above instructions.
2. Rotate crank mechanism counterclockwise until ATS TEST light is illuminated.
3. Turn DS to "AUTO".
4. Test Switch (TS) on bottom cabinet door will allow electrical operation of ATS.

TO ISOLATE ATS

1. Bypass per above instructions.
2. Rotate crank mechanism counterclockwise until ATS ISOLATED light is illuminated.

TO REMOVE ATS

1. Bypass and Isolate per above instructions.
2. Disconnect multipin plugs and external connections to ATS.
3. Rotate four power panel latches to vertical position, slide ATS forward & lock mechanism in place.
4. ATS can now be removed from cabinet.

TO RECONNECT ATS

1. Place ATS in slide mechanism.
2. Unlock slide mechanism. Slide ATS over power panel latches and rotate latches to horizontal position.
3. Turn DS Switch to "INHIBIT".
4. Manually position ATS into same source as Bypass Switch.
5. Reconnect multipin plugs and external connections to ATS.
6. Rotate crank mechanism clockwise until ATS TEST light is illuminated.
7. Turn DS Switch to "AUTO" and use TS to electrically operate ATS.
8. Turn DS to "INHIBIT".
9. Rotate crank mechanism clockwise until ATS location pointer is aligned with "AUTO" mark on location indicator. (ATS must be in same source as Bypass).
10. Turn DS to "AUTO" and open Bypass with MBH.
11. ATS is now fully automatic (Figure 1).

NOTES:

1. DS in "INHIBIT" will prevent ATS electrical operation.
2. DO NOT use excessive force on mechanical handles.
3. Above Figures depict Bypass NORMAL. Sequence is same for Bypass EMERGENCY.
4. When ATS is in TEST or ISOLATE, Bypass Switch is a manual transfer switch to either available source. (Indicated on light panel).
5. To operate Bypass Switch when ATS is in TEST or ISOLATE:
   a) Move MBH downward (to open Bypass Contacts BN/BE).
   b) Turn BSS to opposite power source.
   c) Move MBH upward to close into selected power source.

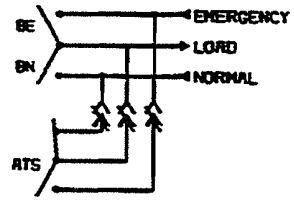


FIG. 1 BP IS OPEN WITH ATS IN NORMAL

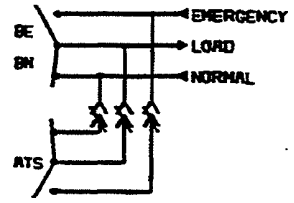


FIG. 2 BP IN NORMAL WITH ATS IN NORMAL

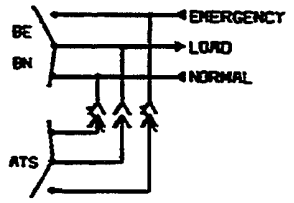


FIG. 3 BP IN NORMAL WITH ATS IN TEST (LOAD CONNECTIONS ARE OPEN)

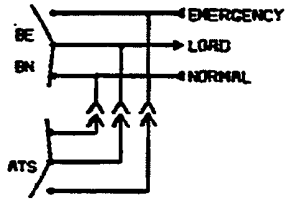


FIG. 4 BP IN NORMAL WITH ATS ISOLATED

NOTES:
1. BP–Bypass switch (indicated by contacts BN/BE) is a 3 position switch.
2. ATS–Automatic Transfer Switch

ZENITH CONTROLS, INC.

REVISIONS:	MODEL: ZBTSDH160/300 (1600-3000 AMPS)		TITLE: BYPASS/ISOLATION TRANSFER SWITCH OPERATION
	DRFT: KW	APP'D: FS/SB	
	DATE: 5/18/92	DWG DIR: ZE3	DRAWING NO.: 40R-0505 SHEET 1 OF 3 — REV
	SCALE:		

LEGEND: BYPASS/ISOLATION SWITCH (BP)

I. (BP) BYPASS/ISOLATION SWITCH: MECHANICAL COMPONENTS

N1,2,3(N).....Normal Line connections
E1,2,3(N).....Emergency Line connections
T1,2,3(N).....Load Line connections
BE.....Bypass Emergency contacts
BN.....Bypass Normal contacts
BSS.....Bypass Selector Switch
MBH.....Manual Bypass Handle

II. (BP) BYPASS/ISOLATION: ELECTRICAL COMPONENTS

AA-1,2.....Limit switch held actuated in Auto location of ATS, Non-actuated Test and Isolated locations.
AB3,-1,2,3,4.....Limit switch, actuated in Bypass Emergency position
AB4-1,2.....Limit switch, actuated in Bypass Normal position
AE-1,2.....Limit switch, switches Engine Start from ATS control to bypass control during ATS Isolate
AI-1,2.....Limit switch, actuated in Isolate location
AT-1,2.....Limit switch, actuated in Test location
ATR.....Auto/Test Relay. Energized in AUTO and TEST locations
BR-1,2,3.....Bridge Rectifier
C.....Capacitor: RNH
CBC.....Crank Solenoid
CBE.....Emergency Bypass Permissive Solenoid
CBN.....Normal Bypass Permissive Solenoid
CH-1.....Limit switch actuated when crankhandle is engaged
D1.....Diode
R1.....Resistor: RNH
R2.....Resistor: LDS
RNH.....Relay normally held, 24 VDC coil, 3PDT
XBE.....Emergency line control transformer
XBN.....Normal line control transformer

III. (BP) BYPASS/ISOLATION SWITCH: INDICATOR LIGHTS

LNA.....Normal available
LEA.....Emergency available
LBN(NOTE 1).....Bypass Normal (BN closed)
LBE(NOTE 1).....Bypass Emergency (BE closed)
LAT(NOTE 1).....ATS in Test location
LAI(NOTE 1).....ATS in Isolate location
LIT(NOTE 1).....ATS Inhibit
LDS(NOTE 1).....ATS DS switch in INHIBIT position

NOTES:
1. Indicator off during automatic operation of ATS.
2. Four pole includes neutral lugs.

REVISIONS:	MODEL: ZBTSDH160/300 (1600-3000 AMPS)		ZENITH CONTROLS, INC.	
	DRFT: KW	APP'D: FS/SB	TITLE: BYPASS/ISOLATION SW. LEGEND	
	DATE: 5/18/92	DWG DIR: ZE3	DRAWING No.: 40R-0505 SHEET 2 OF 3	REV: -
	SCALE:			

LEGEND & OPERATION: AUTOMATIC TRANSFER SWITCH (ATS)

A. LEGEND

B1,2,3.....Solid State Phase Relay(s)
Dropout _____%
Pickup _____%
CE.....Main Transfer Operator, Close into Emergency
CEO.....Main Transfer Operator, Open from Emergency
CN.....Main Transfer Operator, Close into Normal
CNO.....Main Transfer Operator, Open from Normal
CCE.....CE Control Relay, Emergency Closing
CCEO.....CEO Control Relay, Emergency Opening
CCN.....CN Control Relay, Normal Closing
CCNO.....CNO Control Relay, Normal Opening
CR.....Normal Control Relay,
DS.....Disconnect Switch
DT.....Timer, Delay Open To Normal
DW.....Timer, Delay Open To Emergency
E.....Engine Start Contact
GRD.....Ground
NB.....Neutral Bar (if required)
RE.....Bridge Rectifier, CNO
REO.....Bridge Rectifier, CEO
RN.....Bridge Rectifier, CN
RNO.....Bridge Rectifier, CE
RT.....Emergency Control Relay
SE,SEO.....Cutout Switch, Emergency
SE-2.....Aux Cutout Switch, Emergency
SN,SNO.....Cutout Switch, Normal
SN-2.....Aux. Cutout Switch, Normal
TS.....Test Switch, Momentary, Not Keyed
VFSM.....Emergency Volt-Freq. Relay
Pickup { 90% of rated Voltage, and 95% of rated Frequency
XE.....Control Transformer, Emergency
XN.....Control Transformer, Normal

B. OPERATION

When the Normal Line fails to the preset dropout point, the phase relays will dropout disconnecting the CR relay.
When the Emergency Line voltage & frequency reach the preset pickup point, the VFSM relay picks up. RT relay picks up to operate the CCNO relay through the SE & SNO cutout switches causing the emergency main transfer operator CNO to operate. The load is now transferred to the Open position. The SNO limit switch operates to disconnect the CCNO relay and CNO main transfer operator. The transfer switch is now mechanically locked open. Limit switch SNO is now activated, picking up the DW timer. After a set time delay, DW will pick up the CCE relay which will then pick up CE main transfer operator. The load is now transferred to the Emergency line. The SE limit switch operates to disconnect the CCE relay and CE main transfer operator. The transfer switch is now mechanically locked in Emergency.

When the Normal Line voltage exceeds the preset pick up point, the phase relays B1, B2, & B3 pick up. CR relay picks up to operate the CCEO relay through the SN & SEO cutout switches, causing the main transfer operator CEO to operate. The load is now transferred to the Open position. The SEO limit switch operates to disconnect the CCEO relay and CNO main transfer operator. The transfer switch is now mechanically locked Open. Limit switch SEO is now activated, picking up the DT timer. After a set time delay, DT will pick up the CCN relay which will then pick up the CN main transfer operator. The load is now re-transferred back to the Normal line. The SN limit switch operates to disconnect the CCN relay and CN main transfer operator. The transfer switch is now mechanically locked in Normal.

DS - Disconnect Switch
When the Disconnect Switch is placed in the INHIBIT position the circuit to the main transfer operators CN and CE is opened and transfer cannot take place.

TS - Test Switch
The Test Switch simulates a normal line failure when activated.
To test, activate the Test Switch allowing the transfer switch to transfer to the EMERGENCY position. De-activate the Test Switch. The transfer switch will reset to the NORMAL position. Testing at least once a month is recommended. For hospital emergency systems, test once a week.

NOTES:

1. ⚠ CAUTION: In using a 3 phase, 4 wire delta or open delta power supply (usually 120/240 volts, sometimes listed as 120/208 volts) with one leg having a grounded center tap, one line will be 160 to 208 volts to ground. When such a system is used it is necessary to connect the high leg to N2. DO NOT CONNECT 120 VOLT LOAD CIRCUIT TO THE HIGH LEG.
2. GROUNDING TERMINAL: A grounding terminal (GND) is provided. When installing open type switches connect this to the metal enclosure or conduit.
3. ⚠ WARNING - TO ENSURE AGAINST SHOCK OR ACCIDENT HAZARD, DISCONNECT ALL SOURCES OF SUPPLY BEFORE SERVICING.
4. ON SINGLE PHASE UNITS WHERE THE EMERGENCY SOURCE IS A UTILITY LINE, CONNECT EMERGENCY LINE SO THAT MINIMUM VOLTAGE IS MEASURED FROM N1 TO E1.
5. ON SINGLE PHASE (2 POLE) UNITS, CENTER TAP AND PHASE RELAYS (B2,B3) ARE NOT SUPPLIED

ECN S-5004. 8-7-92

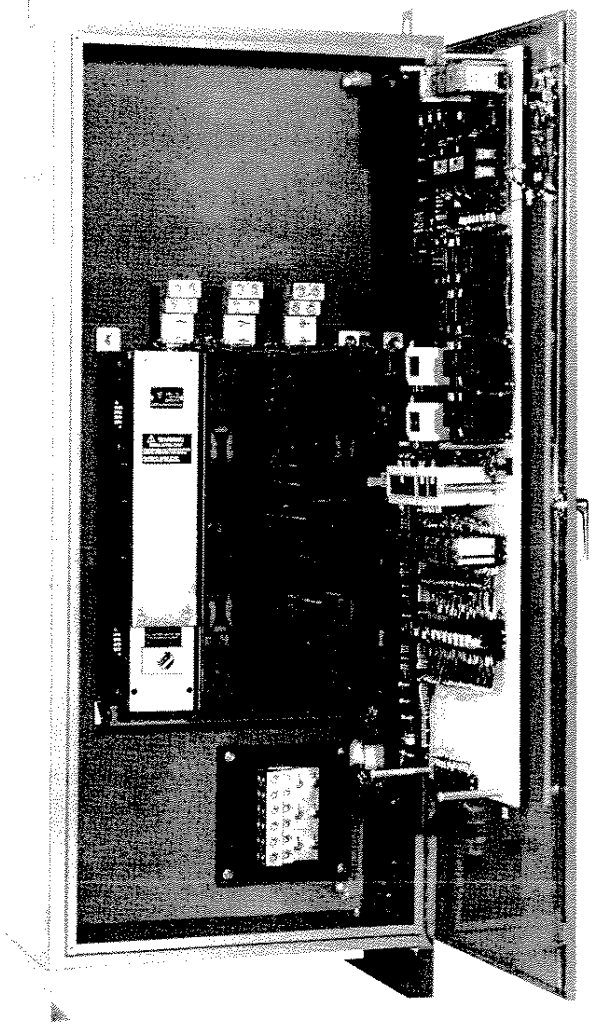
ZENITH CONTROLS, INC.

TITLE: LEGEND & OPERATION

DRAWING NO.: 40R-0505 SHEET 3 OF 3 REV -

ZENITH CONTROLS, INC.

OPERATION AND MAINTENANCE MANUAL
AUTOMATIC CLOSED TRANSITION TRANSFER SWITCH
40 - 3000 AMPS
ZTSCTH SERIES



ISO 9001 REGISTERED QUALITY SYSTEM

43R-7000C
Rev 5/96

INTRODUCTION

Zenith *Closed Transition Transfer Switches* are designed to transfer load between two available sources, without interrupting power to the load (make-before-break). Paralleling of the two sources occurs within a predefined window of synchronization and the initial source is then disconnected.

In the event that the load connected source falls below preset limits and the second source is available, the transfer switch automatically defaults to open transition (break-before-make) mode. In this mode, the transfer switch uses the power from the available source to open the switch from the dead source first, before closing the switch into the second source.

A transition mode selector switch (TMS) is provided on the front door to enable the user to operate the switch in either Open Transition or Closed Transition mode.

All Zenith transfer switches are designed for use on emergency or standby systems, and are rated for total system or motor loads. Transfer switches are UL Listed under Standard 1008 and CSA Certified under Standard C22.2 No. 178.

This manual provides information on the installation, operation, and maintenance of the switch. In addition, a complete information package is supplied with each transfer switch which details the features and accessories provided on that switch. The information package and the instruction manual should be kept in a readily accessible location to provide complete reference information on this critically important piece of equipment.

TABLE OF CONTENTS

Section I	INSTALLATION	2
	1. Requirements	2
	2. Equipment Inspection and Storage	2
	3. Mounting	2
	4. Power Connections	3
	5. Control Connections	4
	6. Final Equipment Inspection	4
	7. Functional Test	4
Section II	OPERATION AND FEATURES	6
	1. Sequence Of Operation	6
	2. Zenith Standard Package	8
	3. Zenith Optional Accessories	8
Section III	MAINTENANCE AND TESTING	9
	1. Inspection and Cleaning	9
	2. Servicing	9
	3. Testing	9
	4. Troubleshooting	10
	5. Emergency Service Procedure/Extended Parallel Time	11
Section IV	ADJUSTMENTS AND SETTINGS	13
	1. Paralleling Relay Settings	13
	2. Solid State Timers	13
	3. Voltage/Frequency Sensor (VFSM)	13
	4. Solid State Phase Relay (ARSM)	14
	5. Paralleling Window Under-Overvoltage Sensing Relay	14
	6. Electronic Time Switch Z2000-2A	14
Appendix A	TYPICAL SCHEMATIC DIAGRAMS	16
	1. 100-400 Amps	16
	2. 600-3000 Amps	17
	3. Alarm Circuit Schematic	18
	4. Three-Phase Control Sensing Schematic	18
Appendix B	REPLACEMENT PARTS	19
	1. Power Panel — 100-400 Amps	19
	2. Power Panel — 600-1200 Amps	20
	3. Power Panel — 1600-3000 Amps	21
	4. Control Panel Layout and Parts List	22
	5. Cabinet Door Pilot Devices	26

SECTION I - INSTALLATION

⚠ DANGER

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Each transfer switch is factory wired and tested. A complete information package is furnished with each switch which includes:

a. Sequence of Operation.
b. Description and Operation of all accessories supplied.
c. Power panel connection diagram and schematic.
d. Description and identification of all customer field connections.

Installation of Zenith transfer switches includes:

a. Mounting the transfer switch cabinet.
b. Connection of all Normal, Emergency, and Load cables or bus bars.
c. Connection of external control circuits as required.

1. REQUIREMENTS

⚠ WARNING

Closed transition transfer switches typically require momentary paralleling of utility and generator sources.

The customer should obtain approval from their utility before using a closed transition transfer switch.

The following requirements must be met to use a closed transition transfer switch:

a. Isochronous governor with a frequency range of 60 ± 0.2 Hz.
b. Shunt trip breaker on the genset with a response time not exceeding 50 milliseconds.

2. EQUIPMENT INSPECTION AND STORAGE

Immediately inspect the transfer switch when received to detect any damage which may have occurred during transit. If damage is found or suspected, file claims as soon as possible with the carrier and notify the nearest Zenith representative.

Before installation, it is necessary to store the transfer switch in a clean dry place, protected from dirt and water. Provide ample air circulation and heat, if necessary, to prevent condensation.

Storage Temperature:
-30°C to + 65°C (-22°F to +149°F)

Humidity:
5% to 95% (non-condensing)

3. MOUNTING

Adequate lifting means must be used to mount the transfer switch into place. The recommended method for moving the transfer switch using the lifting eyes and a spreader bar is illustrated in *Figure 1* below. Enough room should be allowed to open the cabinet doors fully for inspection and servicing of the switch per NEC and local codes.

Before drilling conduit entry holes or any accessory mounting holes, cover and protect the switch and control panel to prevent dirt and metal fragments from entering the mechanical and electrical components. Failure to do so may result in damage and malfunction of the switch.

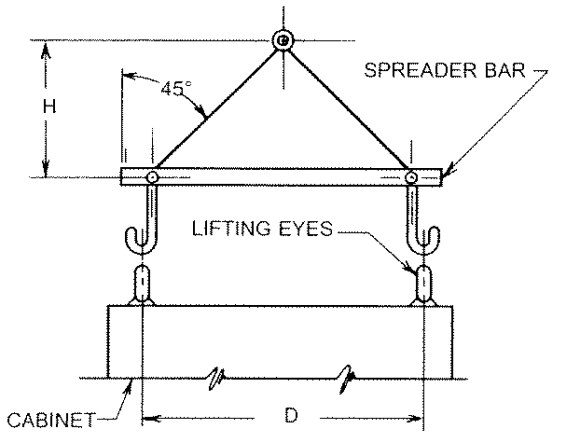


Figure 1

⚠ NOTICE

When lifting the switch using a spreader bar, height H must be equal to half of distance D.

3a. POWER CONNECTIONS

Screw Type Terminals for External Power Connections				
Switch Size (Amps)	Normal, Emergency & Load Terminals		Fully Rated Neutral Bar (When Required)	
	Cable Per Pole	Range of Wire Sizes	Number of Cables	Range of Wire Sizes
40	1	#14 to 2 AWG	3	#14 to 1/0 AWG
80	1	#14 to 1/0 AWG	3	#14 to 1/0 AWG
100	1	#14 to 1/0 AWG	3	#14 to 1/0 AWG
150	1	#8 to 3/0 AWG	3	#6 AWG to 300 MCM
225	1	#6 AWG to 250 MCM	3	#6 AWG to 300 MCM
260	1	#6 AWG to 350 MCM	3	#6 AWG to 300 MCM
400	1	#4 AWG to 600 MCM	4	#2 AWG to 600 MCM
600	2	#2 AWG to 600 MCM	8	#2 AWG to 600 MCM
800	4	#2 AWG to 600 MCM	12	#2 AWG to 600 MCM
1000	4	#2 AWG to 600 MCM	12	#2 AWG to 600 MCM
1200	4	#2 AWG to 600 MCM	12	#2 AWG to 600 MCM
1600 2000 3000 4000	Line and load terminals are located in rear and arranged for bus bar connection.		12	3/0 AWG to 750 MCM

Table 1

Tightening Torque for Lugs		
Socket Size Across Flats	Torque	
	Lb.-In.	Lb.-Ft.
1/8	45	4
5/32	100	8
3/16	120	10
7/32	150	12
1/4	200	17
5/16	275	23
3/8	375	31
1/2	500	42
9/16	600	50

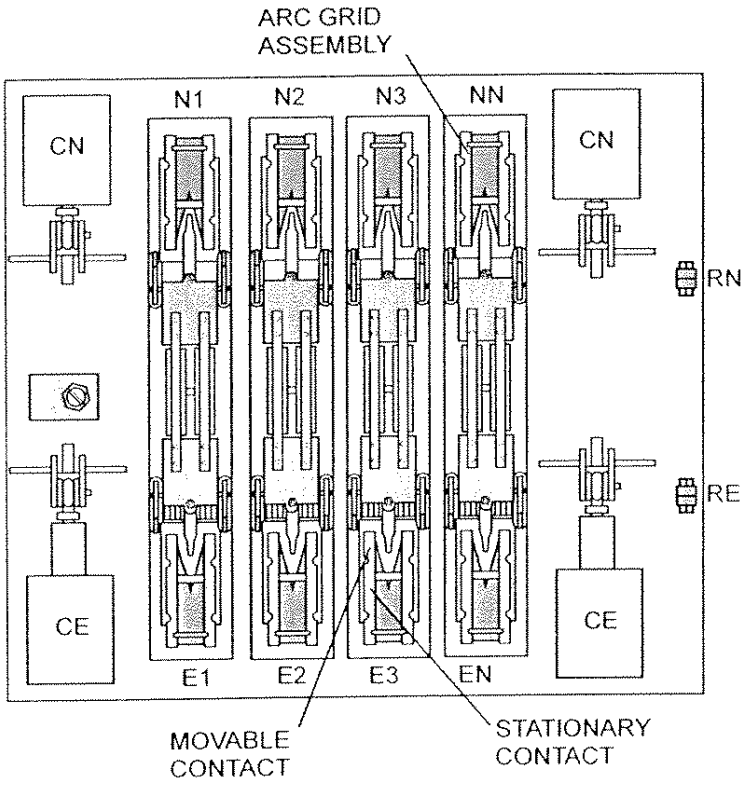
Table 2

Tightening Torque for Bus Bars		
Bolt Size	Torque Bolt (Grade 5)	
	Lb.-In.	Lb.-Ft.
1/4-20	72	6
5/16-18	132	11
3/8-16	300	25
1/2-13	720	60

Table 3

APPENDIX B - REPLACEMENT PARTS

4. POWER PANEL - 4000 AMPS



TAG	DESCRIPTION			STOCK NUMBERS
N1,2,3, N E1,2,3, N	Cable Connection at Rear			S-1511 (3) Optional
T1,2,3, N	Wire Size			(12) #2-600 MCM
	Stationary Contact Assembly Kit			23P-1655
	Arc Grid Assembly Kit			23P-1171
	Movable Contact Assembly Kit			23P-1640
CN, CE	Main Operating Coils	Coil Volts	Poles	
		240	3	K-2215
			4	K-2215
		208	3	K-2215
			4	K-2215
		575/600	3	K-2217
			4	K-2217
		480	3	K-2214
			4	K-2214
		416	3	K-2216
SN/SNO	CN Cut-out Switch	23P-1542		
SE/SEO	CE Cut-out Switch	23P-1543		
A3	Emergency Position Auxiliary Contact	23P-1541		
A4	Normal Position Auxiliary Contact	23P-1540		
DS	Disconnect Switch	Operator L-4009; Contact Block L-1020		
RN, RE	Rectifier	23P-1473 (Up to 240V); 23P-1582 (Up to 600V)		

4. POWER CONNECTIONS

Zenith transfer switches are supplied with UL listed solderless screw type terminals as standard for the Normal, Emergency, and Load power connections. *Table 1* lists the number and sizes of the cable lugs supplied as standard for each switch amp rating.

Connect the Normal, Emergency, and Load conductors to the clearly marked terminals on the transfer switch. Remove surface oxides from cables by cleaning with a wire brush. Verify that all connections are correct before tightening the lugs. All cable lug connections must be tightened to the proper torque values as shown in *Table 2.*

Do not run cables or wiring behind front-connected transfer switches.

In cases where the Normal, Emergency, and Load connections are made to a rear connected bus bar, a compression washer, flat washer, and a minimum grade 5 bolt must be used and torqued to the values in *Table 3.*

Screw Type Terminals for External Power Connections

Switch Size (Amps)	Normal, Emergency & Load Terminals		Fully Rated Neutral Bar (When Required)	
	Cable Per Pole	Range of Wire Sizes	Number of Cables	Range of Wire Sizes
100	1	#14 to 1/0 AWG	3	#14 to 1/0 AWG
150	1	#8 to 3/0 AWG	3	#6 AWG to 300 MCM
225	1	#6 AWG to 250 MCM	3	#6 AWG to 300 MCM
260	1	#6 AWG to 350 MCM	3	#6 AWG to 300 MCM
400	1	#4 AWG to 600 MCM	4	#2 AWG to 600 MCM
600	2	#2 AWG to 600 MCM	8	#2 AWG to 600 MCM
800	4	#2 AWG to 600 MCM	12	#2 AWG to 600 MCM
1000	4	#2 AWG to 600 MCM	12	#2 AWG to 600 MCM
1200	4	#2 AWG to 600 MCM	12	#2 AWG to 600 MCM
1600	Line and load terminals are located in rear and arranged for bus bar connection.		12	3/0 AWG to 750 MCM
2000			12	3/0 AWG to 750 MCM
3000			12	3/0 AWG to 750 MCM

Table 1

Tightening Torque for Lugs

Socket Size Across Flat	Torque	
	Lb.-In.	Lb.-Ft.
1/8	45	4
5/32	100	8
3/16	120	10
7/32	150	12
1/4	200	17
5/16	275	23
3/8	375	31
1/2	500	42
9/16	600	50

Table 2

Tightening Torque for Bus Bars

Bolt Size	Torque Bold (Grade 5)	
	Lb.-In.	Lb.-Ft.
1/4 - 20	72	6
5/16 - 18	132	11
3/8 - 16	300	25
1/2- 13	720	60

Table 3

5. CONTROL CONNECTIONS

A complete information package is furnished with each transfer switch including a complete connection diagram and schematic which details all necessary control circuit field connections.

The engine start control wires connect to the terminals specified in the upper left corner of the control panel. *Figure 2* below shows the location of these terminals on the standard SSRCP printed circuit board mounted on the steel backplate. These terminals are clearly identified by a pre-printed label attached to the steel control panel. In the case of manual transfer switches, or in other applications not requiring the standard control panel, clearly marked terminal blocks are provided in the upper left corner of the control panel for the engine start control wires.

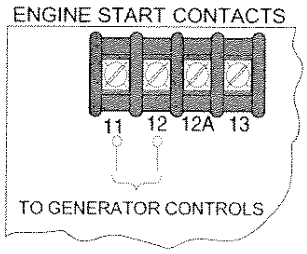
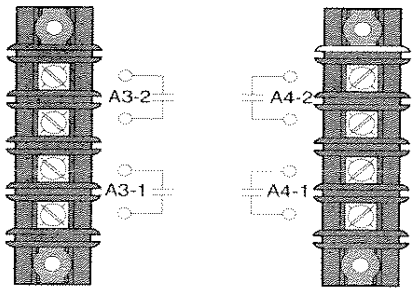


Figure 2

Terminals for field connections to the A3 Emergency auxiliary contacts and the A4 Normal auxiliary contacts are also provided. These terminals are clearly marked and appear on the left side of the power panel. On 400 amp units these terminals appear on the disconnect switch bracket above the operator handle, and are marked as illustrated in *Figure 3*.



400 AMP UNIT

Figure 3

Make all other necessary external control connections to the appropriate terminal blocks located on the control panel. Insure that all connections are tightened to the torque specified in *Table 4*.

Control Wire Connections	
Wire Size (AWG)	Torque Lb.-In.
18 - 16	19
14 - 8	19
6 - 4	36

Table 4

6. FINAL EQUIPMENT INSPECTION

Prior to energizing the transfer switch:

a. Remove any debris incurred due to shipment or installation. DO NOT use a blower since debris may become lodged in the electrical and mechanical components and cause damage. Use of a vacuum is recommended.
b. Verify that all cabled connections are correct and that phase rotation of both sources match.
c. Check engine start connections and verify the correct connection of all control wires.
d. Check settings of all timers and adjust as necessary. Also adjust any optional accessories as required.
e. Check the integrity of power connections by verifying actual lug torque values as specified in this manual.
f. Make sure that all covers and barriers are installed and properly fastened.

7. FUNCTIONAL TEST

The functional testing of the transfer switch consists of electrical tests described in this section. Before proceeding, refer to the information package supplied with the transfer switch. Read and understand all instructions and review the operation of all accessories provided.

Before starting the operation test, check the equipment rating nameplate on the transfer switch to verify the correct system voltage. An example of the equipment rating nameplate is shown in *Figure 4*.

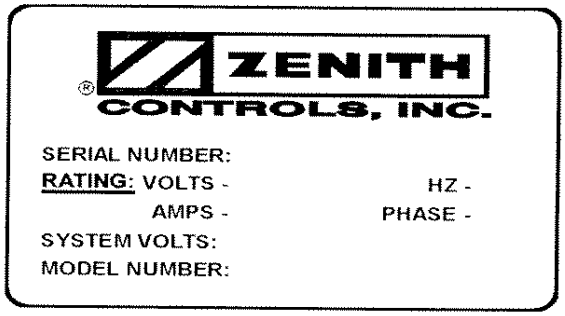


Figure 4

To begin the test, close the Normal source circuit breaker. The phase relays B1, B2, and B3 will pick up and the LED indicators will illuminate. Verify the phase to phase voltages at the Normal line terminals.

Next, close the Emergency source breaker and start the engine generator. The VFSM relay will pick up and the LED indicator will illuminate. Check the phase to phase voltages at the Emergency line terminals. Also, verify that the phase rotation of the Emergency source is the same as the phase rotation of the Normal source.

After the sources have been verified, shut down the engine generator, and put the starting control in the automatic position. Complete the visual inspection of the transfer switch, and close and lock the cabinet door.

Initiate the electrical transfer test by activating the test switch (TS). This de-energizes the engine start relay. The transfer switch closes into Emergency only after the sync-check relay ensures the proper phase relationship of both sources. After the transfer switch closes into Emergency, the SE limit switch becomes activated (de-activated in 400 Amp units) to de-energize the CCE relay and energize the CCNO relay. This opens the transfer switch out of Normal. When the transfer switch has opened out of Normal, the SNO-2 limit switch activates to de-energize the CCNO relay. The transfer switch has now closed into Emergency power without interrupting the load.

Turning the TS to AUTO initiates re-transfer to Normal. The transfer switch closes into Normal only after the sync-check relay ensures the proper phase relationship of both sources. After the transfer switch closes into Normal, the SN limit switch becomes activated (de-activated in 400 Amp units) to de-energize the CCN relay and energize the CCEO relay; the transfer switch opens out of Emergency. Then the SEO-2 limit switch activates to de-energize the CCEO relay. The transfer switch has now closed back into Normal power without interrupting the load.

The transfer switch defaults to an open transition transfer when the Normal source fails. Closed transition transfer is not possible with one source available. Open transition transfer for testing can be selected via the transition mode selector switch. (For a description of the Open Transition sequence of operation, refer to Section II - Operation and Features, page 6.)

A 24 VDC circuit is supplied to control the alarm and warning indicators. To insure continuous power to this circuit, a constant 24 VDC can be supplied by the customer from the engine start battery.

⚠ NOTICE

A periodic test of the transfer switch under load conditions is recommended to insure proper operation. (See National Electric Code articles 700 and 701.)

SECTION II - OPERATION AND FEATURES

1. SEQUENCE OF OPERATION

Figure 5 is a typical schematic diagram of a Zenith closed transition transfer switch. The information supplied with the transfer switch includes a schematic diagram and description of operation of all accessories provided.

Transfer of the load to the Emergency source begins automatically when any phase of the Normal source falls below the preset dropout point and this undervoltage failure condition is detected by solid state phase relays B1, B2, B3.

The phase relays drop out, de-energizing the Normal control relays CR & CR2, and engine start timer P1 begins its timing cycle. The P1 time delay is provided to override momentary outages and to prevent nuisance starting of the engine generator. If the Normal source voltage returns above the phase relays' pickup setting, the P1 timing cycle is reset to zero by re-energizing the CR relay.

If the Normal source voltage does not return before the P1 time delay is completed, the P1 timer drops out and sends a starting signal to the engine generator. An Emergency voltage and frequency sensing relay (VFSM) monitors the voltage and frequency of the Emergency source. When both the voltage and the frequency of the Emergency source reach the preset pickup points, the VFSM relay initiates transfer to the Emergency source and timer W begins it timing cycle. The W timer provides an adjustable transfer delay to the Emergency source as required.

When the W time is completed, the Emergency control relay RT energizes and picks up the CCNO relay. The CNO solenoid is then energized to open the transfer switch from normal position to neutral position. The SNO-1 limit switch activates to energize the DW time delay and de-energize the CCNO relay. The switch remains in the neutral position for the duration of the DW time delay. After the DW time delay is completed, the CCE relay energizes the CE solenoid to close the transfer switch into the emergency source. The SE limit switch activates to de-energize the CCE relay.

The sequence for retransfer to the Normal source begins automatically when the voltage on all phases of the Normal source reach the preset pickup point and this condition is detected by the solid state phase relays, B1, B2, B3.

When the Normal source restores and if the transition mode selector switch is in CT (Closed Transition), the transfer switch will return to the Normal source in a make-before-break sequence (this is described in the Testing section of this manual).

If the transition mode selector switch is in "OT" (Open Transition), the transfer switch will return to the normal source in a break-before-make sequence. When the Normal source restores, the solid state phase relays, B1, B2, B3, pick up. The T timer energizes, beginning its timing cycle. The T timer provides an adjustable delay to insure that the Normal source has stabilized before reconnection to the load. If the Normal source fails before the T time delay completes, the phase relays drop out and the T timing cycle is reset to zero.

When the T time delay is completed, the Normal control relay CR energizes and picks up the power relay CCEO. This energizes the CEO solenoid opening the transfer switch out of the emergency source. The SEO-1 limit switch activates to energize the DT time delay and de-energize the CCEO relay. After the DT time delay is completed, the CCN relay energizes the CN solenoid to retransfer the switch into the Normal source. The SN limit switch activates to de-energize the CCN relay. The SN limit switch also energizes the engine over-run timer U and begins its timing cycle. This timer provides a period of time for the engine generator to run without load and cool down before shutdown. After the U time delay is completed, the P1 timer is energized and the engine generator is shutdown.

NOTES:

1) The transition mode selector switch on the front door enables the user to operate the transfer switch in Open Transition mode, if so desired.

2) When in Closed Transition mode, if the transfer switch does not open the first source within 100 milliseconds, an alarm will sound, the transfer switch will open the last source it closed into and will lock out the control circuit from any transfer operation. After the condition has been corrected the control circuit should be reset by turning the Failed to Open Lockout Reset switch to the right.

3) The controls will provide a signal to shunt trip the generator breaker if the transfer switch remains closed into both sources for more than 325 ms. The load will then be fed by the utility source. The maximum time that the two sources would be parallel, under these conditions, is less than 0.5 sec. Before operating the Closed Transition transfer switch the condition must be corrected and the shunt trip reset. Refer to the procedure for servicing the switch after shunt tripping occurs. The shunt trip reset switch is provided on the front door. Alarm and lights on the front door provide indication of failure conditions.

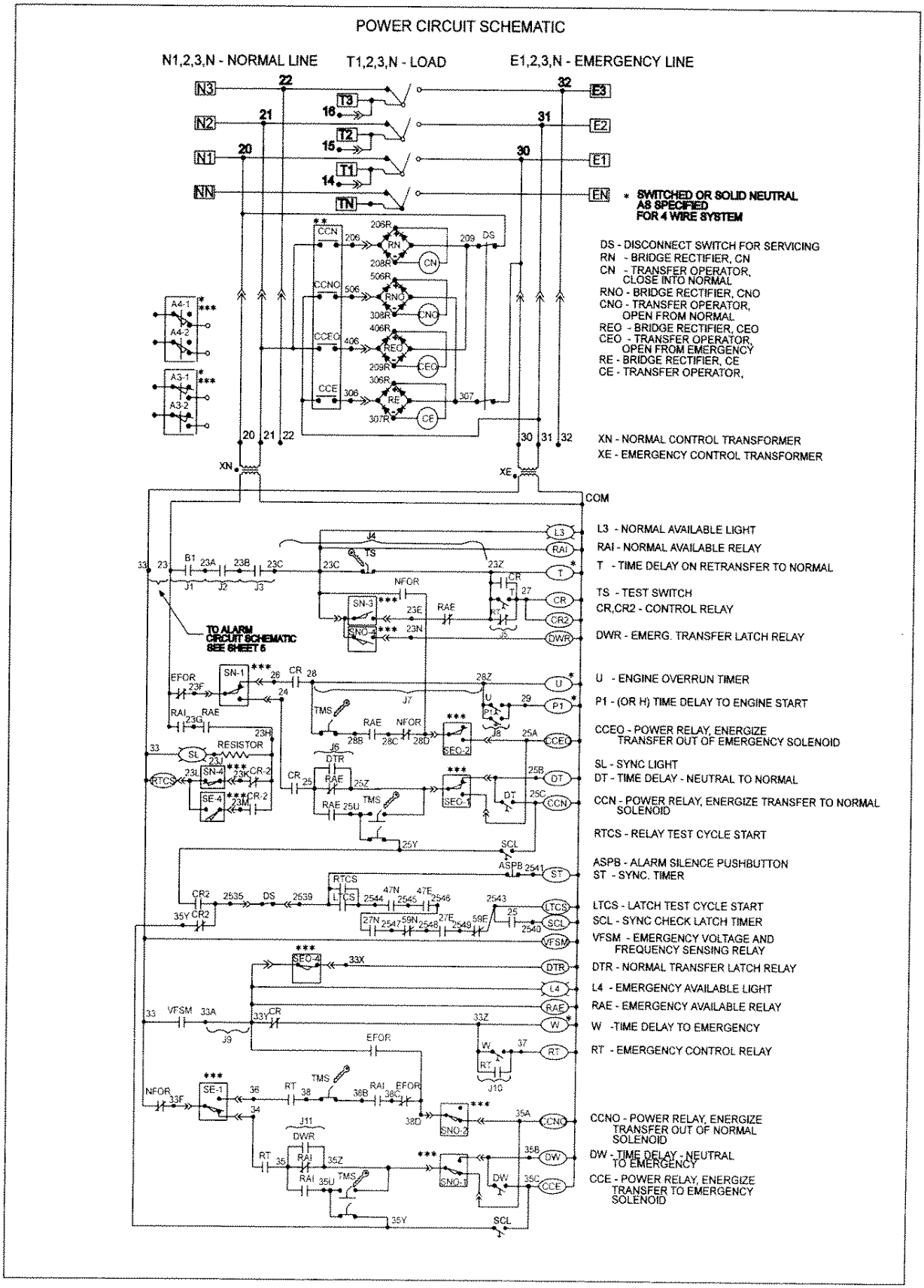

POWER CIRCUIT SCHEMATIC
N1,2,3,N - NORMAL LINE
T1,2,3,N - LOAD
E1,2,3,N - EMERGENCY LINE
* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEM
DS - DISCONNECT SWITCH FOR SERVICING
RN - BRIDGE RECTIFIER, CN
CN - TRANSFER OPERATOR, CLOSE INTO NORMAL
RNO - BRIDGE RECTIFIER, CNO
CNO - TRANSFER OPERATOR, OPEN FROM NORMAL
REO - BRIDGE RECTIFIER, CEO
CEO - TRANSFER OPERATOR, OPEN FROM EMERGENCY
RE - BRIDGE RECTIFIER, CE
CE - TRANSFER OPERATOR,
XN - NORMAL CONTROL TRANSFORMER
XE - EMERGENCY CONTROL TRANSFORMER
COM
L3 - NORMAL AVAILABLE LIGHT
RAI - NORMAL AVAILABLE RELAY
T - TIME DELAY ON RETRANSFER TO NORMAL
TS - TEST SWITCH
CR,CR2 - CONTROL RELAY
DWR - EMERG. TRANSFER LATCH RELAY
U - ENGINE OVERRUN TIMER
P1 - (OR H) TIME DELAY TO ENGINE START
CCEO - POWER RELAY, ENERGIZE TRANSFER OUT OF EMERGENCY SOLENOID
SL - SYNC LIGHT
DT - TIME DELAY - NEUTRAL TO NORMAL
CCN - POWER RELAY, ENERGIZE TRANSFER TO NORMAL SOLENOID
RTCS - RELAY TEST CYCLE START
ASPB - ALARM SILENCE PUSHBUTTON
ST - SYNC. TIMER
LTCS - LATCH TEST CYCLE START
SCL - SYNC CHECK LATCH TIMER
VFSM - EMERGENCY VOLTAGE AND FREQUENCY SENSING RELAY
DTR - NORMAL TRANSFER LATCH RELAY
L4 - EMERGENCY AVAILABLE LIGHT
RAE - EMERGENCY AVAILABLE RELAY
W - TIME DELAY TO EMERGENCY
RT - EMERGENCY CONTROL RELAY
CCNO - POWER RELAY, ENERGIZE TRANSFER OUT OF NORMAL SOLENOID
DW - TIME DELAY - NEUTRAL TO EMERGENCY
CCE - POWER RELAY, ENERGIZE TRANSFER TO EMERGENCY SOLENOID
TO ALARM CIRCUIT SCHEMATIC SEE SHEET 6

Figure 5

2. ZENITH STANDARD PACKAGE

The Zenith Closed Transition Switch comes with the following standard features:

A3 Auxiliary contact closes when the switch is in the Emergency position.

A4 Auxiliary contact closes when the switch is in the Normal position.

DT Adjustable time delay before closing into Normal source from open position (Open Transition Mode only).

DW Adjustable time delay before closing into Emergency source from open position (Open Transition Mode only).

E Engine start contact closes to start the engine generator when the Normal source fails. 1 N.O., 1 N.C. contact.

P1 Solid state adjustable timer with range from 0.5 to 6.0 seconds. The contact closes to start the engine generator.

T Adjustable time delay to transfer out of Emergency source and into open position after Normal source is restored.

U Adjustable time delay for engine cool down after engine generator is signaled to shut down.

W Adjustable time delay to transfer out of Normal source and into open position after Normal source failure.

3. ZENITH OPTIONAL ACCESSORIES

Many control accessories are available to meet specific and special requirements. **Your drawings indicate which accessories were ordered with your switch.**

SECTION III - MAINTENANCE AND TESTING

A preventive maintenance program will insure high reliability and long life for the transfer switch. The preventive maintenance program for the transfer switch should include the following items:

1. INSPECTION AND CLEANING

Before doing any work on the transfer switch, de-energize all sources of power. The switch should be inspected for any accumulation of dust, dirt, or moisture, and should be cleaned by vacuuming or wiping with a dry cloth or soft brush. DO NOT use a blower since debris may become lodged in the electrical and mechanical components and cause damage.

Remove the transfer switch barriers and check the condition of the contacts. Any surface deposits must be removed with a clean cloth (DO NOT USE EMERY CLOTH OR A FILE). If the contacts are pitted or worn excessively, they should be replaced. A general inspection of mechanical integrity should be made to include loose, broken or badly worn parts.

2. SERVICING

All worn or inoperative parts must be replaced using Zenith recommended replacement parts. Appendix B at the back of this manual includes replacement part information for typical power and control panel configurations. When ordering parts provide the model number or serial number from the transfer switch rating nameplate.

The operating mechanism of the transfer switch is lubricated with Lubriplate 105. The lubricant applied at the factory provides adequate lubrication for the lifetime of the switch. Should debris contaminate the mechanism, clean and apply additional Lubriplate.

3. TESTING

After completing the inspection, cleaning and servicing of the transfer switch, reinstall the switch cover, and close and lock the cabinet door. Reclose the circuit breakers feeding the utility and generator sources to the switch.

Initiate the electrical transfer test by activating the test switch (TS). This de-energizes the engine start relay. The transfer switch closes into Emergency only after the sync-check relay ensures the proper phase relationship of both sources. After the transfer switch closes into Emergency, the SE limit switch becomes activated to de-energize the CCE relay and energize the CCNO relay. This opens the transfer switch out of Normal. When the transfer switch has opened out of Normal, the SNO-2 limit switch activates to de-energize the CCNO relay. The transfer switch has now closed into Emergency power without interrupting the load.

Turning the TS to AUTO initiates re-transfer to Normal. The transfer switch closes into Normal, only after the sync-check relay ensures the proper phase relationship of both sources. After the transfer switch closes into Normal, the SN limit switch becomes activated to de-energize the CCN relay and energize the CCEO relay; the transfer switch opens out of Emergency. Then the SEO-2 limit switch activates to de-energize the CCEO relay. The transfer switch has now closed back into Normal power without interrupting the load.

The transfer switch defaults to an open transition transfer when the Normal source fails. Closed transition transfer is not possible with one source available. Open transition transfer for testing can be selected via the transition mode selector switch.

A 24 VDC circuit is supplied to control the alarm and warning indicators. To insure continuous power to this circuit, a constant 24 VDC can be supplied by the customer from the engine start battery.

⚠ NOTICE

A periodic test of the transfer switch under load conditions is recommended to insure proper operation. (See National Electric Code articles 700 and 701.)

4. TROUBLESHOOTING

Before beginning any troubleshooting activity, refer to the information package supplied with the transfer switch and review the description and operation of all accessories supplied. Also refer to Section II of this manual, Operation and Features.

Condition	Items To Be Checked
a. Engine Generator Does Not Start when Normal source fails or Test Switch (TS) is activated.	1) Verify the setting of the time delay P1. 2) Make sure timer P1 drops out and the engine-start contact closes after time delay is completed. 3) Make sure the starting battery is charged and connected to the engine generator. 4) Generator controls in "Automatic" mode. 5) Verify wiring of the engine start contact. 6) If the generator does not start, contact the generator dealer.
b. Does Not Transfer To Emergency after generator starts.	1) *If in Closed Transition Mode:* a) Verify that the phase angle difference between Normal and Emergency is < 5° (@ 0.1 Hz ∇ f) b) Verify that the frequency difference between Normal and Emergency is < 0.2 Hz (0.1 Hz is recommended). Also verify that the frequency difference is not 0 Hz. c) Verify that the voltage difference between Normal and Emergency is < ±5% of nominal. d) Verify that the phase sequence is the same for Normal and Emergency. 2) Emergency source breaker should be closed. 3) Emergency source voltage and frequency should meet the preset pickup values of the VFSM relay. 4) Make sure Emergency control relay RT picks up after time delay W.
c. Does Not Retransfer To Normal when Normal source restores or Test Switch (TS) is deactivated.	1) *If in Closed Transition Mode:* a) Verify that the phase angle difference between Normal and Emergency is < 5° (@ 0.1 Hz ∇ f) b) Verify that the frequency difference between Normal and Emergency is < 0.2 Hz (0.1 Hz is recommended). Also verify that the Frequency difference is not 0 Hz. c) Verify that the voltage difference between Normal and Emergency is < ±5% of nominal. d) Verify that the phase sequence is the same for Normal and Emergency. 2) Normal source voltage should meet the preset pickup value of the phase relays. 3) Make sure Normal control relay CR picks up after time delay T. 4) Verify the circuit connections from the power relay, CN1 or CCN, to the Normal switch operating circuit. 5) Verify the circuit connections from the power relay, CE1 or CCE, to the Emergency switch operating circuit.
d. Engine Generator Does Not Shutdown after retransfer to Normal.	1) Verify the setting of engine over run time delay U. 2) Make sure timer P1 picks up and the engine-start contact has opened. 3) Generator controls in Automatic mode. 4) Verify wiring of the engine start contact.

Table 5

5. EMERGENCY SERVICE PROCEDURE/EXTENDED PARALLEL TIME

An Emergency breaker shunt trip was triggered after an extended parallel time (malfunction) occurred. Follow these steps to open the transfer switch.

1. Disconnect all power sources from the transfer switch by opening all line breakers (Normal and Emergency).
2. Open the cabinet door and turn the disconnect switch to the OFF position.
3. Remove the service access cover on the left hand side of the transfer switch.
4. The manual operator and the manual handle will now be exposed. Insert the handle into the Emergency side operator. Open the Emergency side contacts.
5. Close the cabinet door.
6. Energize Normal power to supply the load until further repairs can be done.

FIELD NOTES

Model Number _____

Serial Number _____

Date Shipped _____

Start-Up Date _____

Drawings Supplied _____

Test And Maintenance Notes			
Date	Tested	Observations	Notes

SECTION IV - ADJUSTMENTS AND SETTINGS

1. PARALLELING RELAY SETTINGS

25, 27/59N & 27/59E are factory set to allow paralleling of the sources only when these conditions have been met:

a. Phase Angle Differences < 5° (@ 0.1 Hz △ f)
b. Frequency Difference < 0.2 Hz
c. Voltage Difference < ±5% Nominal

NOTES:

1) This system requires an isochronous governor with an operating frequency of 60 ± 0.2 Hz.
2) Requires a shunt trip breaker on generator set with a response time not exceeding 50 ms.

2. SOLID STATE TIMERS

Solid state timers are adjustable from 0.1 second to 100 hours. The red timing indicator in the upper left corner flashes as the timer progresses through the timing cycle. When the timing cycle is completed, the indicator remains illuminated. A flathead screwdriver is required to change the setting, as shown in *Figure 6* below.

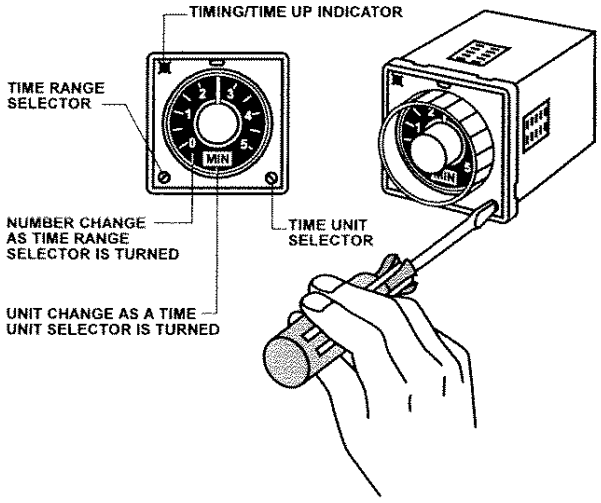


Figure 6

The time unit is selected by turning the rotary switch at the lower right of the timer. Four selections are available: "Seconds", "Minutes", "Hours", "10 Hours". The time unit selected is displayed in the window below the time setting dial.

The time range is selected by turning the rotary switch at the lower left of the timer. Four ranges are available: "0-0.5", "0-1.0", "0-5.0", "0-10.0". The dial digits appear in the windows around the time setting knob.

⚠ CAUTION

Do NOT change the setting while the timer is energized. Timer malfunction or damage may occur.

The factory setting of the solid state timers used in the Zenith standard package are shown in *Table 6* below.

Timer	Factory Setting
T	30 minutes
U	5 minutes
W	1 second
DT	5 seconds
DW	5 seconds
ST	1 second
PART	0.200 sec.
OLC	0.275 sec.
ETT	0.420 sec.
SCL	0.100 sec.

Table 6

3. VOLTAGE/FREQUENCY SENSOR (VFSM)

The pickup point may be adjusted by rotating the adjustment screw as shown in *Figure 7* below. Counter-clockwise rotation increases the pickup voltage.

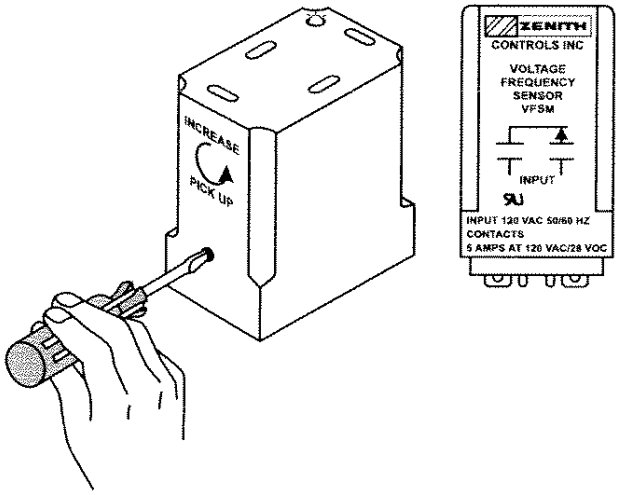


Figure 7

Pickup Voltage (at 100% Frequency):
Adjustable: 80% to 95%
Factory Set: 90%
Adjustable: 80% to 100%
Factory Set: 95%

4. SOLID STATE PHASE RELAY (ARSM)

The pickup and dropout points may be adjusted by using the following procedure. Use of a variable voltage supply (Variac) is required. The relay is illustrated in *Figure 8* below.

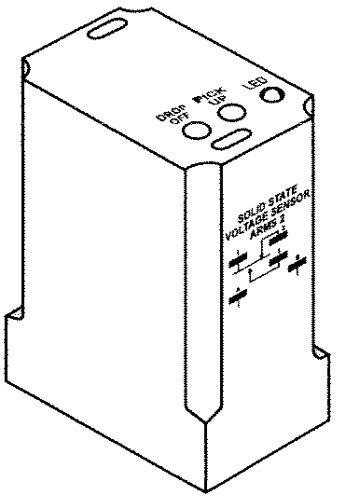


Figure 8

a. Turn the pickup adjustment fully clockwise.
b. Turn the dropout adjustment fully counterclockwise.
c. Set Variac to the desired pickup voltage.
d. Rotate the pickup adjustment counterclockwise very slowly until the relay picks up. The LED will illuminate.
e. Set Variac to the desired dropout voltage.
f. Rotate the dropout adjustment clockwise very slowly until the relay drops out. The LED will go out.
g. Verify the setting by raising the voltage until the relay picks up and lowering the voltage until the relay drops out.

Pickup Voltage: 75% to 115% of Nominal
Factory Set: 90% of Nominal
Dropout Voltage: 55% to 105% of Nominal
Factory Set: 80% of Nominal

5. PARALLELING WINDOW UNDER-OVERVOLTAGE SENSING RELAY

The pickup and dropout points may be adjusted by using the following procedure. Use of a variable voltage supply (Variac) is required. The relay is illustrated in *Figure 9*.

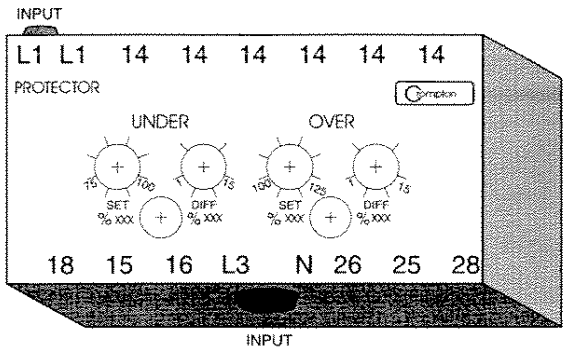


Figure 9

a. Turn both DIFF adjustments fully counterclockwise.
b. Undervoltage sensing—Use lowest phase to phase relationship on Variac to set the relay. Set Variac voltage to desired undervoltage setting. Turn undervoltage SET adjustment fully clockwise, then slowly counterclockwise until the LED illuminates.
c. Overvoltage sensing—Use the highest phase to phase voltage relationship on Variac to set the relay. Set Variac voltage to desired overvoltage. Turn overvoltage SET adjustment fully clockwise, then counterclockwise until LED illuminates.

Undervoltage: 75-100% of 120V
Factory Set: 95%
Overvoltage: 100-125% of 120V
Factory Set: 105%

6. ELECTRONIC TIME SWITCH Z2000-2A

This time switch is used for the C/D option. Time switch Z2000-1A is used for the C option.

A. Setting Time and Day:

Press and hold "🕘" button during the following adjustments:

a. Press "d" to set day pointer to correct day: 1 = Monday...7 = Sunday.
b. Press "h" to set the hour. The time of day is expressed in 24-hour military time: 04:00 = 4 a.m.....20:00 = 8 p.m.
c. Press "m" to set minutes.
d. Release "🕘" button. Clock is running.

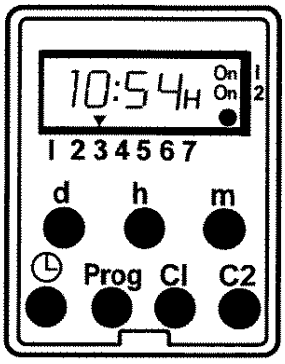


Figure 10

B. Programming:
Twenty-four total ON or OFF settings are available on one, several, or all days of the week.

a. Press "Prog" button. The blank program entry field will appear with two flashing points: "__:__"
b. Press either "C1" or "C2" depending on which channel you wish to program.
c. Next, select either "ON" or "OFF" by pressing "C1" or "C2" which toggles the ON/OFF mode.
d. You will now see the pointer flashing above "1" for Monday. To lock in Monday, press "Prog". If you want to enter further days, press "d" then "Prog" to lock them in. Solid pointers must be displayed over each day that the switching command is required.
e. Once the days are selected, press "h" button to enter the desired hour and press "m" to enter the desired minutes. To enter the program into the time switch, press "Prog" . When the programming is complete, press "🕘" to return the clock run mode. If the "🕘" button is not depressed, it will switch to the clock run mode after 60 seconds.

C. Program Review and Change:
Press "Prog" button to recall and review the "C1" and "C2" ON/OFF times. An "E" is displayed if all 24 positions are used or if the next available position is not filled. To change or clear a program, press "Prog" button to find the program to be changed or cleared. Change by pressing "d", "h" or "m" buttons as required. Clear the entire program by simultaneously pressing "h" and "m". Press "🕘" to return to the clock run mode.

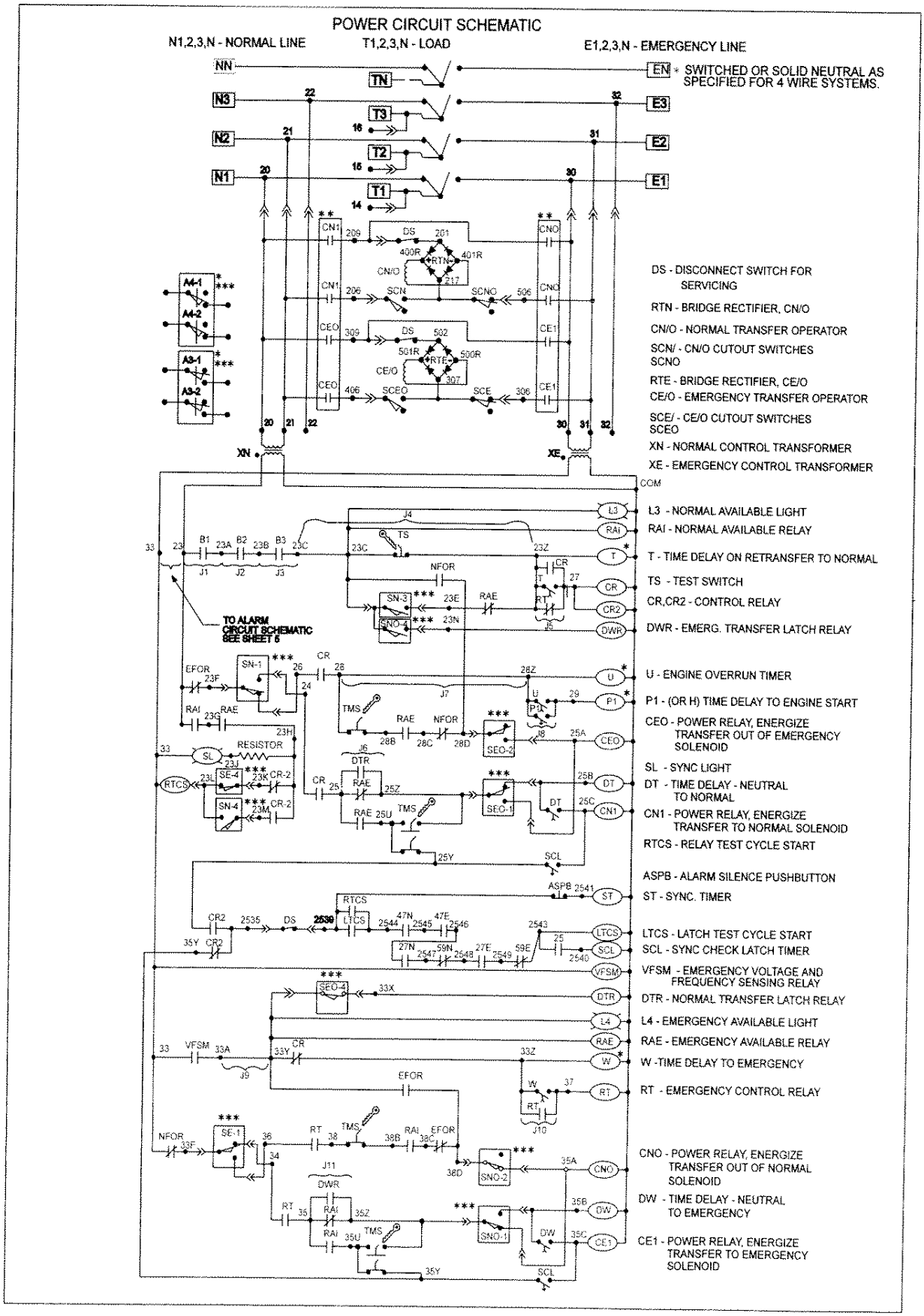
D. Program Override:
Each ON/OFF state can be manually changed by pressing "C1" or "C2". The next counteracting program cancels the manual override and resumes previous programming.

To continuously override automatic programming, press "m" and "C1" or "C2". The continuous override ON/OFF stat is preceded by a black dot on the display. To cancel, press "m" and "C1" or "C2" until the dot disappears.

The automatic program can be continuously overridden up to 47 days by pressing and holding "h" while pressing "C1" or "C2" until the display shows the number of days desired. Starting the following day at "0:00", the display will show a "0:00", both "C1" and "C2" off, and an "H" in the lower right hand corner.

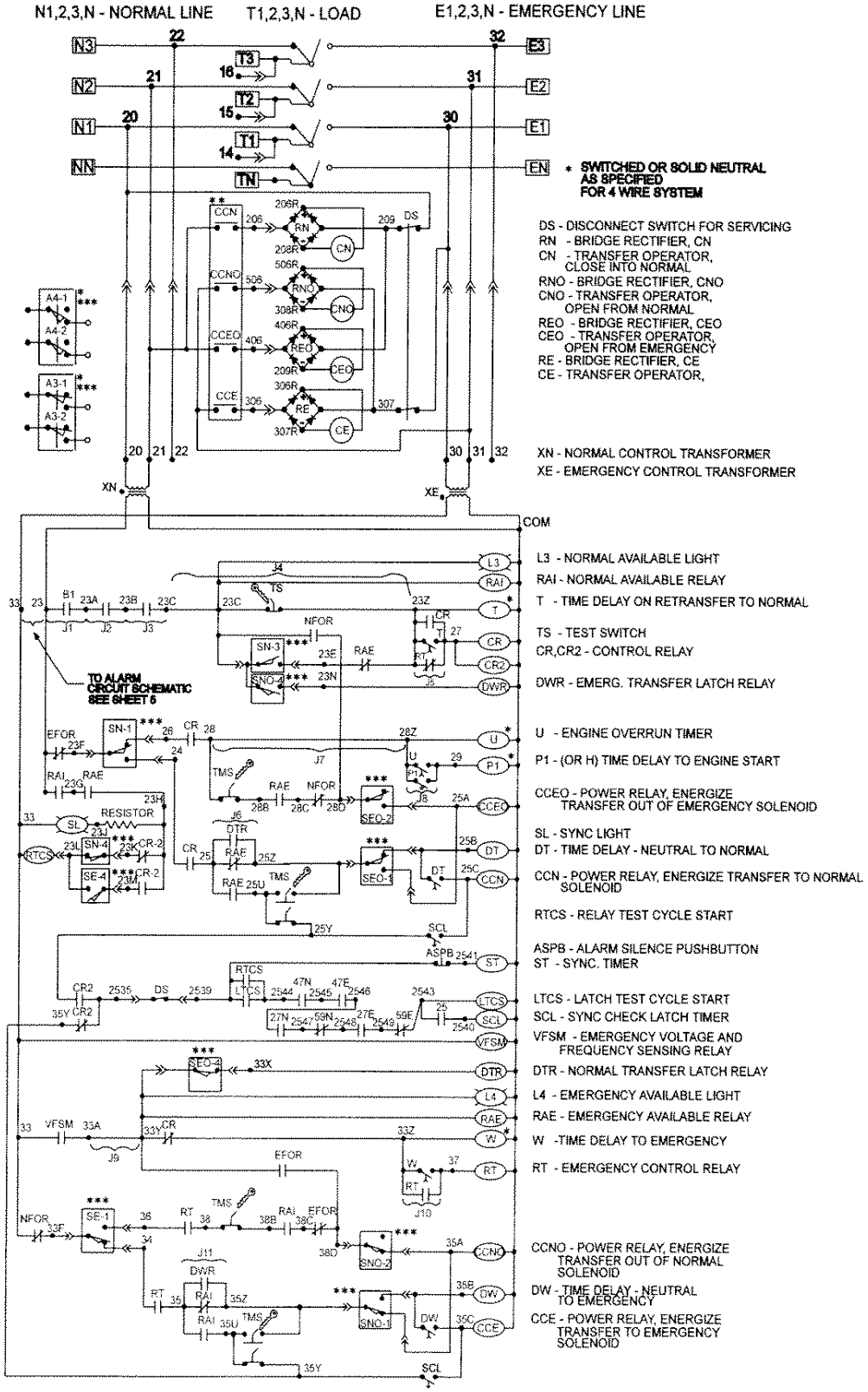
APPENDIX A - TYPICAL SCHEMATIC DIAGRAMS

1. 100-400 AMPS



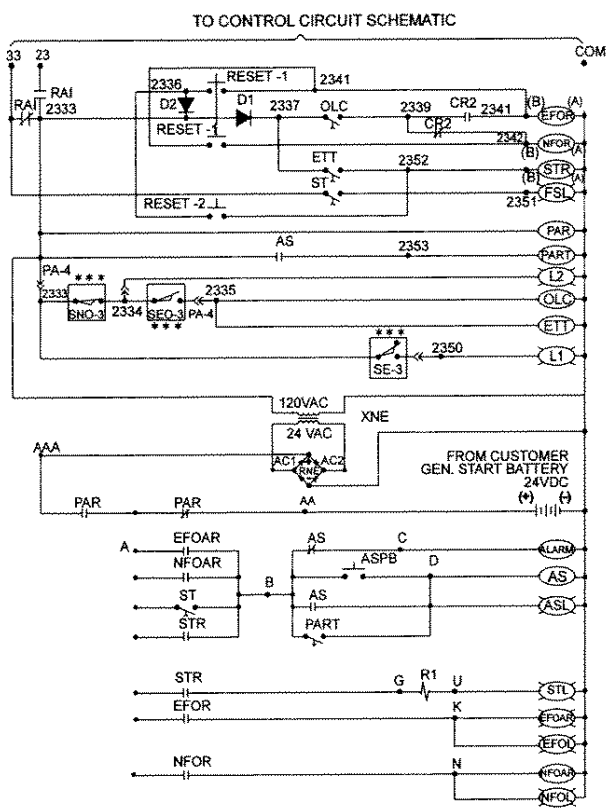
2. 600-3000 AMPS

POWER CIRCUIT SCHEMATIC



APPENDIX A - TYPICAL SCHEMATIC DIAGRAMS

3. ALARM CIRCUIT SCHEMATIC



RESET-1 - FAIL TO OPEN LOCKOUT RESET
RESET-2 - SHUNT TRIP RESET
EFOR - EMERGENCY FAIL TO OPEN RELAY (LATCH RELAY)
D1 - DIODE #1
D2 - DIODE #2
NFOR - NORMAL FAIL TO OPEN RELAY (LATCH RELAY)
STR - SHUNT TRIP RELAY
FSL - FAIL TO SYNC LIGHT

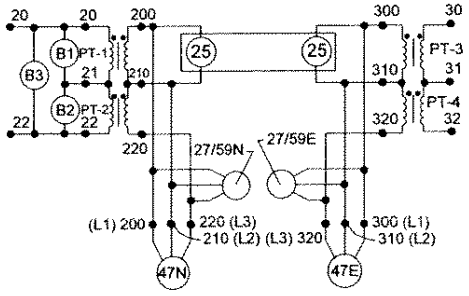
PAR - POWER AVAILABLE RELAY
PART - POWER AVAILABLE TIMER
L2 - NORMAL POSITION LIGHT
OLC - OPEN LAST CLOSE TIMER
ETT - EMERGENCY TRIP TIMER
L1 - EMERGENCY POSITION LIGHT

XNE - NORMAL/EMERGENCY CONTROL TRANSFORMER
RNE - BRIDGE RECTIFIER, XNE

ASPB - ALARM SILENCE PUSHBUTTON
AS - ALARM SILENCE
ASL - ALARM SILENCE LIGHT

STL - SHUNT TRIP LIGHT
EFOAR - EMERGENCY FAIL TO OPEN ALARM RELAY.
EFOL- EMERGENCY FAIL TO OPEN LIGHT
NFOAR- NORMAL FAIL TO OPEN ALARM RELAY.
NFOL - NORMAL FAIL TO OPEN LIGHT

4. 3ϕ CONTROL SENSING SCHEMATIC



DRAWING SHOWS 47N/47E CONNECTION FOR A-B-C PHASE ROTATION SEQUENCE. (PARENTHESIS = DEVICE TERMINAL #'s)
IF PHASE ROTATION SEQUENCE IS A-B-C
SWAP L2 & L3 TERMINAL INPUTS ON EACH 47 RELAY.

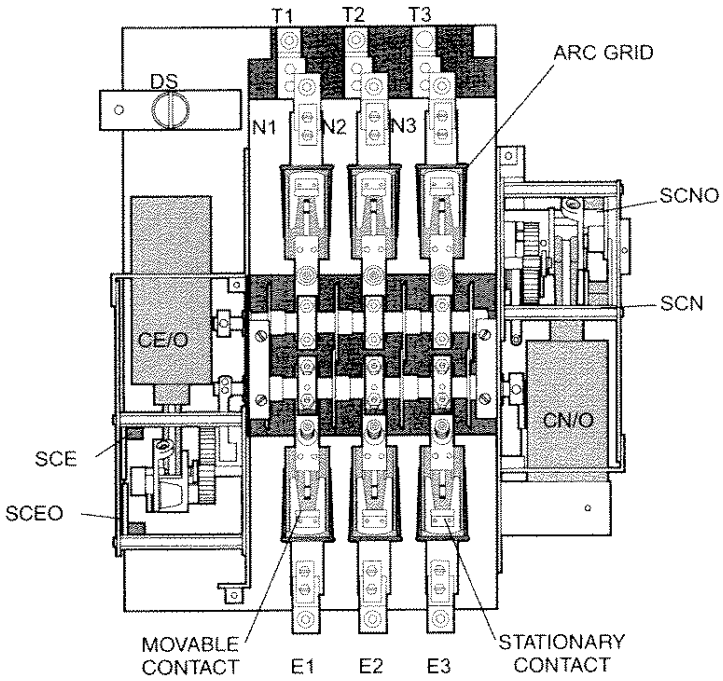
LEGEND:
PT- 1,2 - NORMAL POTENTIAL TRANSFORMERS
PT- 3,4 - EMERGENCY POTENTIAL TRANSFORMERS
B1,2,3 - UNDER VOLTAGE RELAYS
27/59N - NORMAL UNDER/OVER VOLTAGE RELAY
27/59E - EMERGENCY UNDER/OVER VOLTAGE RELAY
47N - PHASE SEQUENCING NORMAL
47E - PHASE SEQUENCING EMERGENCY
25 - SYNC CHECK RELAY

APPENDIX B - REPLACEMENT PARTS

⚠ NOTICE

Model number and serial number of switch must be included with all orders for replacement parts. Specify line voltages, drawing numbers and date of installation. When ordering parts not shown on the parts list, refer to this part part by its legend description in the wiring diagram.

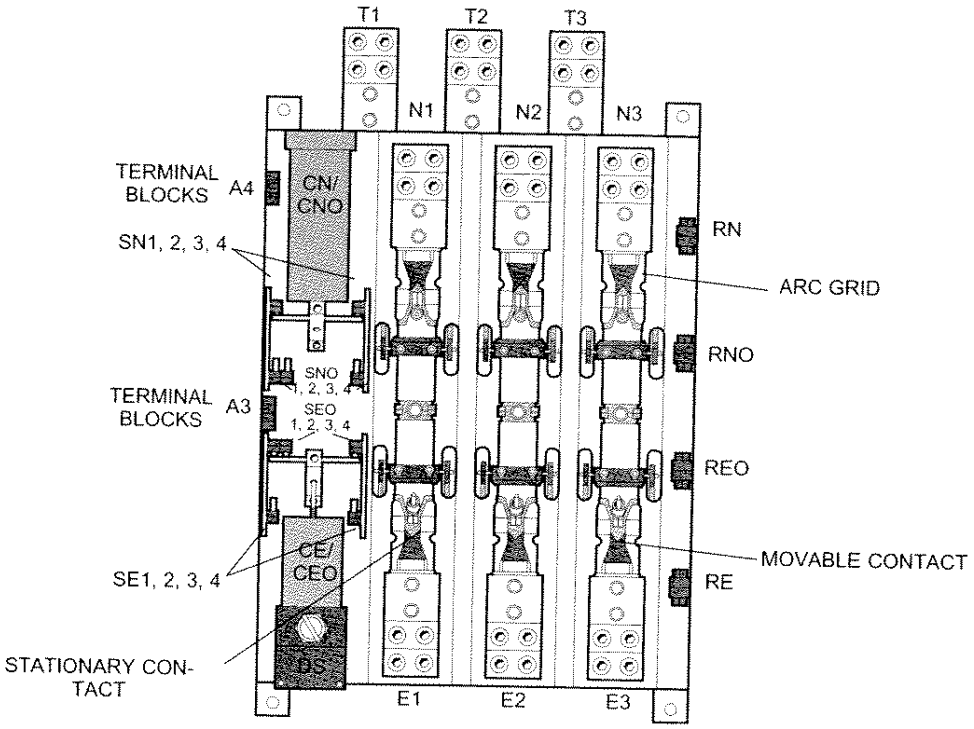
1. POWER PANEL — 100-400 AMPS



Power Panel Replacement Parts List — 100-400 Amps							
Tag	Description			100A	150A	225A	260A	400A
NL 1,2,3 EL 1,2,3 T 1,2,3 NLN, ELN, TN	Cable Connection Lug, CU Wire			PS-4418	PS-4418	PS-4418	S-1422	S-1422
NL 1,2,3	Movable & Stationary Contact Assembly (For 3P Units)			46P1100A	46P1100B	46P1100C	46P1100D	46P1100E
NLN				46P1101A	46P1101B	46P1101C	46P1101D	46P1101E
EL 1,2,3				46P1102A	46P1102B	46P1102C	46P1102D	46P1102E
ELN				46P1103A	46P1103B	46P1103C	46P1103D	46P1103E
	Arc Grid Assembly Kit			46P-1099				
RTN/RTE	Coil Rectifier			PS-5076				
SCN/SCNO	Sol Limit Switch			L-3079				
SCE/SCE	Sol Limit Switch			L-3079				
SN/SNO	Emergency Position Contact			46P-1133				
SE/SEO	Normal Position Contact			46P-1133				
DS	Disconnect Switch			Operator: L4018; Contact Block: L-1029				
CNO CEO	Main Operator Solenoids			**See Chart Below**				
Volts	**Ph**	**Wire**	**Coil VDC**	**Pole**	**Solenoid Part Number VDC**			
240	3	3	240	3	K-2189			
120/208	3	4	208	3,4	K-2177			
480	3	3	480	3	K-2176			
277/480	3	4	480	3,4	K-2176			
240/416	3	4	416	3	CONSULT FACTORY			

APPENDIX B - REPLACEMENT PARTS (Continued)

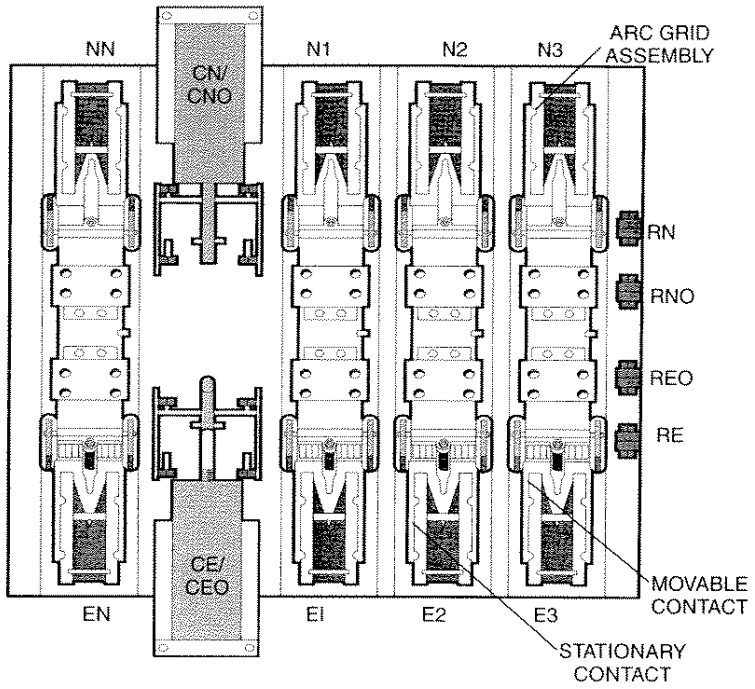
2. POWER PANEL — 600-1200 AMPS



Power Panel Replacement Parts List — 600-1200 Amps						
Tag	Description	Part Numbers				
NL 1,2,3 EL 1,2,3 T 1,2,3 NN, EN, TN	CABLE CONNECTION LUG, CU WIRE	600A S-1393F (2)600MCM-2			800-1200A 2-1392F (4)600MCM-2	
	Stationary Contact Assemby Kit	23P-1471			26P-1336	
	Arc Grid Assembly Kit	23P-1366			23P-1366	
	Movable Contact Assembly Kit	23P-1469			26P-1334	
	Movable Contact	23P-1470			26P-1335	
RN/RNO RE/REO	Coil Rectifier	23P-1473 (UP TO 240 VAC) 23P-1582 (UP TO 600 VAC)				
SN/SNO	Limit Switch	23P-1535(L), 23P-1533(R)				
SE/SEO	Limit Switch	23P-1536(L), 23P-1534(R)				
A3	Emergency Position Auxiliary Contact	23P-1536				
A4	Normal Position Auxiliary Contact	23P-1535				
DS	Disconnect Switch	Operator: L4009; Contact Block: L-1020				
CN/CNO CE/CEO	Main Operator Solenoids	**See Chart Below**				
	Voltage System			**Solenoid Part No.**		
Volts	**Ph**	**Wire**	**Coil VDC**	**Pole**	**600A**	**800-1200A**
240	3	3	240	3	K-2146	K-2147
120/208	3	4	208	3,4	K-2146	K-2147
480	3	3	480	3	K-2158	K-2157
277/480	3	4	480	3,4	K-2158	K-2157
240/416	3	4	416	3	CONSULT FACTORY	

APPENDIX B - REPLACEMENT PARTS (Continued)

3. POWER PANEL — 1600-3000 AMPS

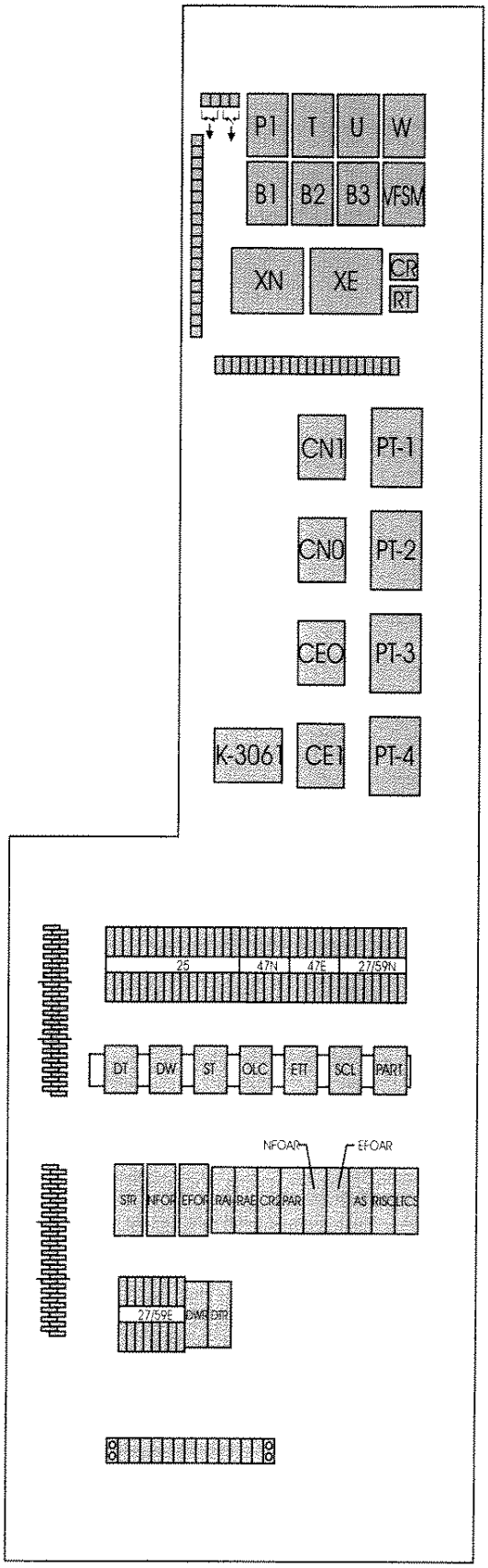


Power Panel Replacement Parts List — 1600-3000 AMPS							
Tag	Description				Stock Numbers By Amperage		
					1600	2000	3000
N1,2,3 E1,2,3 T1,2,3 NLN,ELN	Cable Connection Lug, CU Wire				23P-1594	S-1126F(2) Optional (8) 600MCM-2 23P-1594	23P-1619
	Stationary Contact Assemby Kit				23P-4134X	23P-4134Y	23P-4134Z
	Arc Grid Assembly Kit				23P-1171	23P-1171	23P-1171
	Movable Contact Assembly Kit				23P-1400	23P-1400	23P-1344
CN/CNO CE/CEO	Main Operator Solenoids				**See Chart Below**		
Voltage System					**Solenoid Part Number**		
Volts	**Ph**	**Wire**	**Coil VDC**	**Pole**			
120	1	2	120	2	S.P.O.	S.P.O.	S.P.O.
120/240	1	3	240	2,3	K-2151	K-2151	K-2151
240	3	3	240	3	K-2151	K-2151	K-2151
120/208	3	4	208	3,4	K-2151	K-2151	K-2151
480	3	3	480	3	K-2160	K-2160	K-2160
575	3	3	575/600	3	S.P.O.	S.P.O.	S.P.O.
277/480	3	4	480	3,4	K-2160	K-2160	K-2160
120/240	2	4	240	4	K-2151	K-2151	K-2151
240/416	3	4	416	3	CONSULT FACTORY		

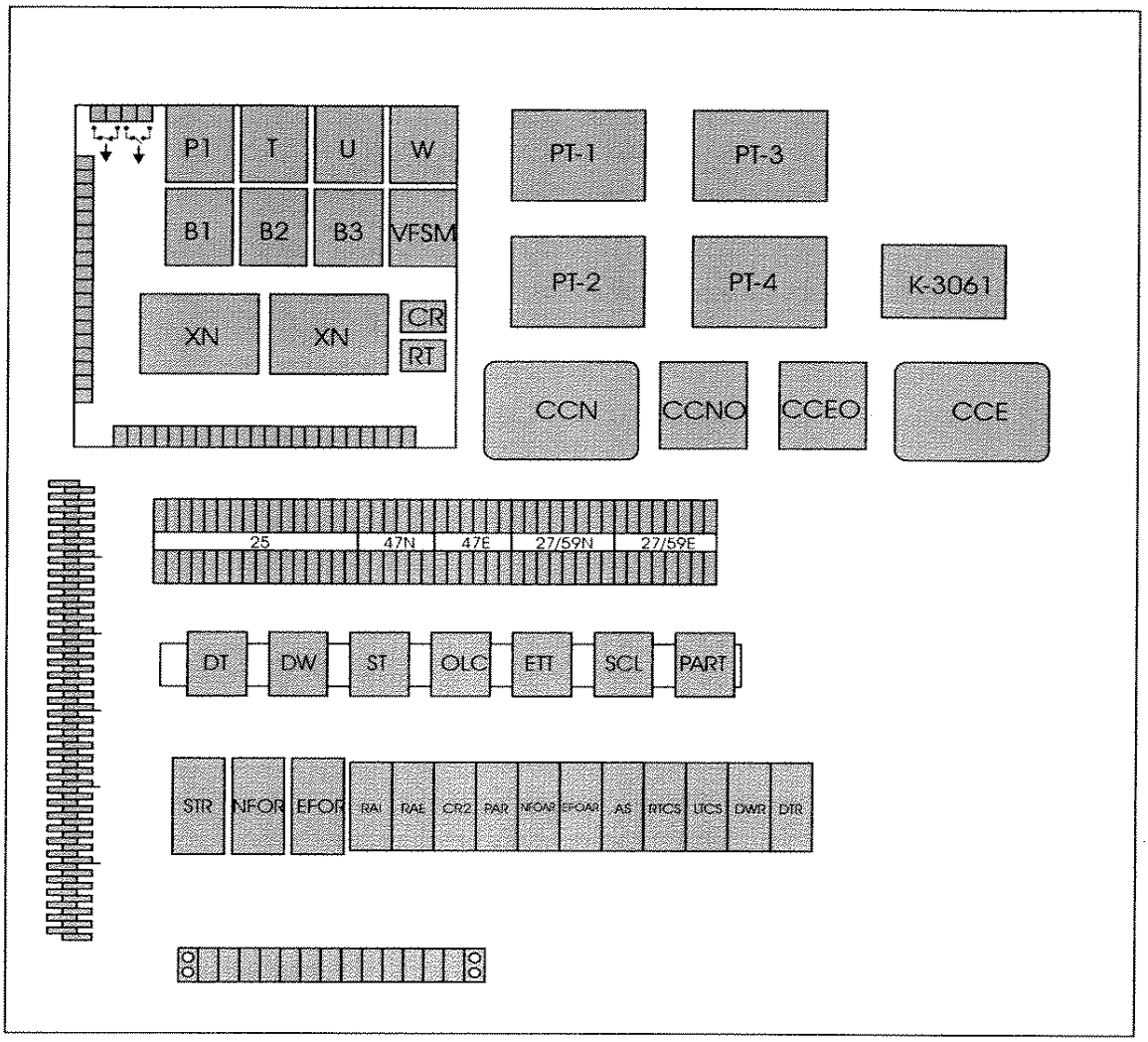
Operating Coil Hardware Kit				
SN/SNO-1,2	Switch Bracket Assembly	23P-1540	23P-1540	23P-1540
SE/SEO-1,2	Switch Bracket Assembly	23P-1541	23P-1541	23P-1541
SN/SNO-3,4	Switch Bracket Assembly	23P-1542	23P-1542	23P-1542
SE/SEO-3,4	Switch Bracket Assembly	23P-1543	23P-1543	23P-1543

APPENDIX B - REPLACEMENT PARTS (Continued)

4. CONTROL PANEL LAYOUT & PARTS LIST



APPENDIX B - REPLACEMENT PARTS (Continued)



APPENDIX B - REPLACEMENT PARTS (Continued)

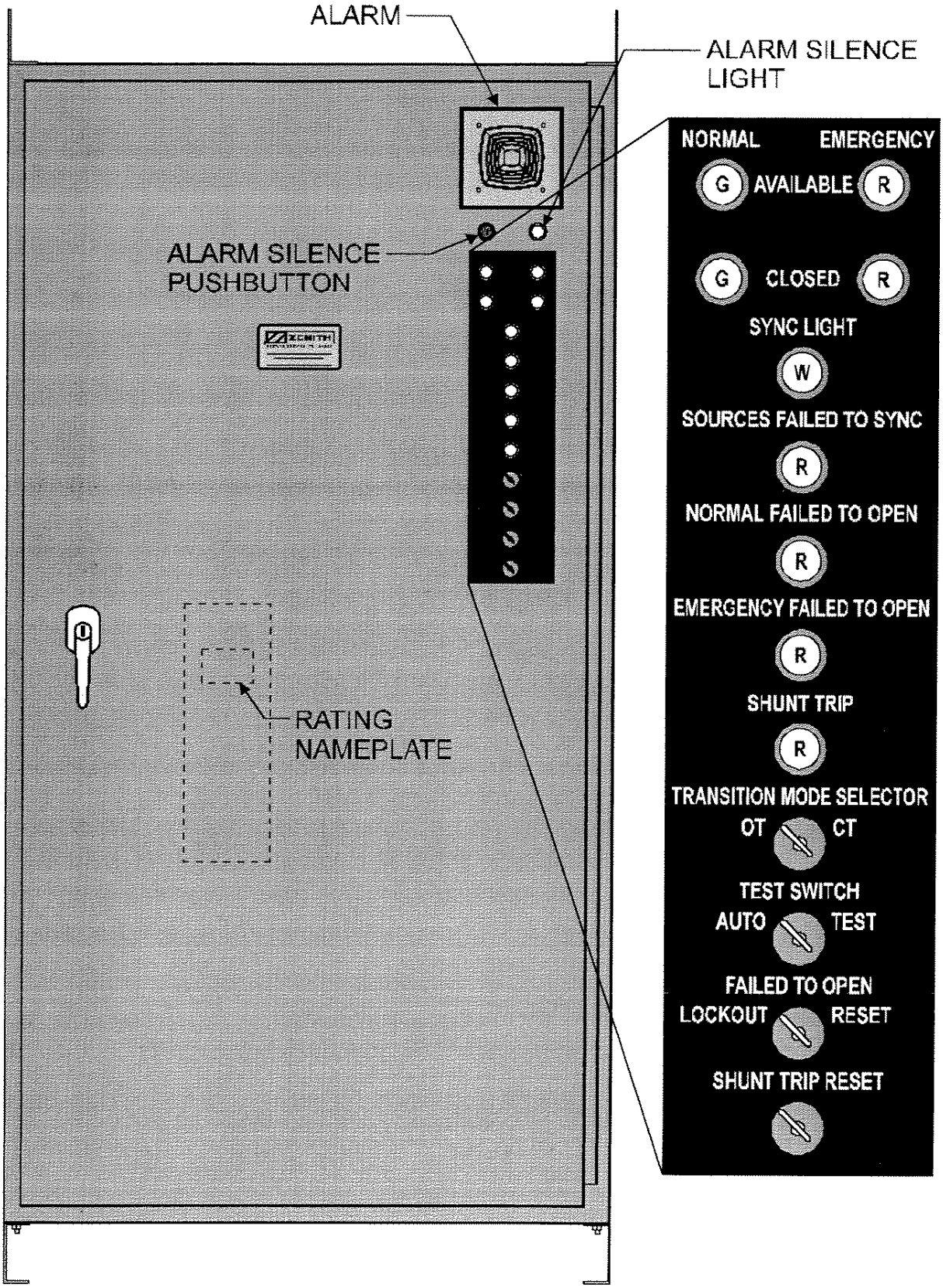
Closed Transition Transfer Switch Control Panel Parts List			
Tag	Description	Voltage	Part No.
CR2	Normal Control Relay	120 VAC	K1204
DT	Transfer Delay Timer Neutral to Normal	120 VAC	K1230
DTR	Normal Transfer Latch Relay	120 VAC	K1204
DW	Transfer Delay Timer Neutral to Emergency	120 VAC	K1230
DWR	Emergency Transfer Latch Relay	120 VAC	K1204
EFOAR	Relay, Emergency Fail to Open Alarm	24 VDC	K1242
EFOR	Emergency Fail to Open Latching Relay	120 VDC	K1240
ETT	Emergency Trip Timer	120 VAC	K1230
LTCS	Latch Test Cycle Start	120 VAC	K1204
NFOAR	Relay, Normal Fail to Open Alarm	24 VDC	K1242
NFOR	Normal Fail to Open Latching Relay	120 VDC	K1240
OLC	Open Last Close	120 VAC	K1230
PAR	Power Available Relay	120 VAC	K1204
PART	Power Available Timer	120 VAC	K1249
PT-1,2,3,4	Potential Transformers	120/480 VAC	K3094
		120/240 VAC	K3095
		120/208 VAC	K3096
RAI	Normal Available Relay	120 VAC	K1204
RAE	Emergency Available Relay	120 VAC	K1204
RTCS	Relay Test Cycle Start	240 VAC	K1256
SCL	Sync Check Latch Timer	120 VAC	K1249
ST	Sync Timer	120 VAC	K1230
STR	Shunt Trip Relay	120 VDC	K1240
XNE	Normal/Emergency Control Transformers	24/120 VAC	K3061

APPENDIX B - REPLACEMENT PARTS (Continued)

SSRCP Control Panel Standard Items Parts List			
Tag	Description	Voltage	Part No.
XN, XE	Control Transformer	208 VAC	K-3070
		240/480 VAC	K-3071
B1,2,3	Solid State Phase Relay	208/240 VAC	K-1186
		480 VAC	K-1188
VFSM	Voltage Frequency Sensor	120 VAC	K-1192
CR	Control Relay	120 VAC	K-1204
RT	Bypass T Relay	120 VAC	K-1204
J1-J11	Jumpers		PS-5067
T	Time Delay to Normal, Timer Solid State	120V .1 Sec. to 9990 Hrs. (Adj)	K-1230
U	Engine Cool Down, Timer Solid State	120V .1 Sec. to 9990 Hrs. (Adj)	K-1230
W	Time Delay to Emergency, Timer Solid State	120V .1 Sec. to 9990 Hrs. (Adj)	K-1230
P1	Time Delay Engine Start, Timer	120V .5 to 6 Sec. (Adj)	K-1201

Closed Transition Transfer Switch Control Panel (Standard Items)				
Tag	Description	Voltage	Part No.	
25	Sync Check Relay	120 VAC	K1234	
47N	Phase Sequencing, Normal	120 VAC	K1246	
47E	Phase Sequencing, Emergency	120 VAC	K1246	
27/59E	Over/Undervoltage, Emergency	120 VAC	K1269	
27/59N	Over/Undervoltage, Normal	120 VAC	K1269	
AS	Alarm Silence Relays	24 VDC	K1242	
CCE	Power Relay for CE Solenoid	120 VAC	K1120	400-1200A
		120 VAC	K1257	1600-3000A
CCEO	Power Relay for CEO Solenoid	120 VAC	K1120	
CCN	Power Relay for CN Solenoid	120 VAC	K1120	400-1200A
		120 VAC	K1257	1600-3000A
CCNO	Power Relay for CNO Solenoid	120 VAC	K1120	

5. CABINET DOOR PILOT DEVICES



APPENDIX B - REPLACEMENT PARTS (Continued)

Controls and Indicating Lights Parts List				
Indicating Lights		Part Numbers		
Description	Color	Socket	Bulb	Lens
Normal Available	Green	PS-5046	PS-5105	PS-5048
Emergency Available	Red	PS-5046	PS-5105	PS-5047
Normal Closed	Green	PS-5046	PS-5105	PS-5048
Emergency Closed	Red	PS-5054	PS-5105	PS-5047
Sync Light	White	PS-5046	Y500005	PS-5051
Fail To Sync Light	Red	PS-5046	PS-5105	PS-5047
Normal Failed To Open	Red	PS-5046	Y500005	PS-5047
Emergency Failed to Open	Red	PS-5046	Y500005	PS-5047
Shunt Trip Light	Red	PS-5046	PS-1272	PS-5047
Alarm Silence	Red	PS-5046	Y500005	PS-5047
Controls		Part Numbers		
Description		Operator	Switch	Mtg. Base
Transition Mode Selector		L-3081	L-1028 (4) L-1029 (2)	PS-3473
Test Switch		L-3081	L-1029	PS-3473
Failed to Open Lock Out Reset		L-4020	L-1028	PS-3473
Shunt Trip Reset		L-4020	L-1028	PS-3473
Alarm Silence Push Button		L-1025	L-1028 L-1029	PS-3473
Alarm		Y780001		



830 West 40th Street
Chicago, IL 60609
USA

Phone: 312 247-6400
FAX: 312 247-7805

© 1996 Zenith Controls, Inc.

ZTSCTH SERIES
AUTOMATIC TRANSFER SWITCHES
100 TO 400 AMP

FOR USE ON EMERGENCY OR STANDBY SYSTEMS – RATED FOR TOTAL SYSTEM & MOTOR LOAD

A. LEGEND

N1,2,3,(N).....Normal Line_____
E1,2,3,(N).....Emergency Line_____
T1,2,3,(N).....Load Connections
B1,2,3.....Solid State Phase Relay(s)
Dropout____ %
Pickup____ %
AS.....Alarm Silence Relay
CE/O.....Main Transfer Operator, Emergency
CN/O.....Main Transfer Operator, Normal
CE1..... Control Relay, Emergency Closing
CEO..... Control Relay, Emergency Opening
CN1..... Control Relay, Normal Closing
CNO..... Control Relay, Normal Opening
CR ,CR2.....Normal Control Relay
DS.....Disconnect Switch
DT.....Timer, Delay Open To Normal
DTR.....Normal Transfer Latch Relay
DW.....Timer, Delay Open To Emergency
DWR.....Emergency Transfer Latch Relay
D1.....Diode #1
D2.....Diode #2
E.....Engine Start Contact
EFOAR.....Emergency Fail to open Alarm Relay
EFOR.....Emergency Fail to open Relay
ETT.....Emergency Trip Timer
GND.....Ground
LTCS.....Latch Test Cycle Start
NB.....Neutral Bar (if required)
NFOAR.....Normal Fail to open Alarm Relay
NFOR.....Normal Fail to open Relay
OLC.....Open Last Close Timer
PAR.....Power Available Relay
PART.....Power Available Timer
PT–1,2..... Potential Transformers Normal
PT–3,4.....Potential Transformers Emergency
RAE.....Emergency Available Relay
RAI.....Normal Available Relay
RTE.....Bridge Rectifier, CE/O
RTN.....Bridge Rectifier, CN/O
RNE.....Bridge Rectifier, XNE
RT.....Emergency Control Relay
RTCS.....Relay Test Cycle Start
SCN, SCNO.....Limit Switches, CN/O
SCE, SCEO.....Limit Switches, CE/O
SCL.....SYNC Check Latch
SE,SEO.....Cutout Switch, Emergency
SN,SNO.....Cutout Switch, Normal
ST.....SYNC Timer
STR.....Shunt Trip Relay
VFSM.....Emergency Volt–Freq. Relay
Pickup {90% of rated Voltage, and 95% of rated Frequency
XE.....Control Transformer, Emergency
XN.....Control Transformer, Normal
XNE.....Control Transformer – Norm./Emerg.
25(ANSI).....Sync Check Relay
47N,E(ANSI).....Phase sequencing – Norm./Emerg.
27/59N,E(ANSI)..Over/Undervoltage – Norm./Emerg.

B. OPERATION (OPEN TRANSITION)

(See note #4)

When the Normal Line (NL) falls to the preset drop–out point or if any normal phase fails, the phase relay(s) will dropout disconnecting the CR relay.

When the Emergency Line (EL) voltage & frequency reach at least 90% of rated value, the VFSM relay energizes. Emergency transfer timer W energizes. After the set time delay, RT relay energizes to operate the CNO relay thru the SE cutout switch causing the CN/O transfer operator to operate thru the SCNO limit switch. The load is now trans–ferred to the Open position. The SNO and SCNO limit switches operate to disconnect the CNO relay and CN/O transfer operator. The transfer switch is now locked mechanically open. SNO is now activated This energizes the DW timer. After a set time delay, DW will energize CE1 which will then energize CE/O transfer operator thru the SCE and CE1. The load is now transferred to the emergency line supply. The SE and SCE limit switches operate to disconnect the CE1 relay and CE/O transfer operator. The transfer switch is now locked mechanically. into Emergency.

When the Normal Line voltage restores to the preset value, the phase relay(s), (B1, B2, B3) operate to energize the Normal restoration timer T. After a set time delay, CR relay energizes. The CEO relay is now energized thru the SN and SEO limit switches causing the CE/O transfer operator to operate thru the SCEO limit switch. The load is now transferred to the Open position. The SEO and SCEO limit switches operate to disconnect the CEO relay and CE/O transfer operator. The transfer switch is now locked mechanically open. SEO is now activated, energizing DT timer. After a set time delay, DT will energize CN1 which will then energize CN/O transfer operator thru the CN1 and SCN. The load is now transferred to the Normal line supply. The SN and SCN limit switches operate to disconnect the CN1 relay and CN/O transfer operator. The transfer switch is now mechanically locked into Normal.

DS – Disconnect Switch
When the Disconnect Switch is placed in the INHIBIT position the control circuits are opened and transfer cannot take place.

TS – Test Switch
The Test Switch simulates a normal line failure when activated.
To test, activate the Test Switch allowing the transfer switch to transfer to the EMERGENCY position. De–activate the Test Switch. The transfer switch will reset to the NORMAL position. Testing at least once a month is recommended. For hospital emergency systems, test once a week.

C. ACCESSORIES

The ZTSCTH series transfer switch is wired so that accessories can be easily added to the switch. The following is a description of the accessories which are supplied on this unit.

- ☐ A1 Auxiliary contact, S.P.D.T., operates on normal line failure.
- ☐ A1E Auxiliary contact, S.P.D.T., operates on emergency line failure.
- ☐ A3 Auxiliary contact closes when the transfer switch is in the Emergency position.
- ☐ A4 Auxiliary contact closes when the transfer switch is in Normal position.
- ☐ A6 Motor Disconnect. To de–energize external motor control circuit 5 seconds (adjustable) prior to transfer in either direction.
- ☐ C Plant Exercisor. Automatically starts generator for selected time intervals.
- ☐ C/D Plant Exercisor. Automatically starts generator to run unloaded or simulate a power failure and starts generator to run under load.
- ☐ E Engine Start Contact: 1 Normally Open 1 Normally Closed.
- ☐ F Auxiliary Fan Contact, S.P.N.O. Closes when generator is running.
- ☐ H Time delay to engine start, non–adjustable. Factory set 1 or 3 seconds. When the Normal line fails the relay de–energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.
- ☐ J1 Adjustable under frequency sensor.
- ☐ J2 Adjustable over/under frequency sensor.
- ☐ K Frequency meter to indicate load frequency.
- ☐ L1 Pilot Light. Switch in Emergency Position.
- ☐ L2 Pilot Light. Switch in Normal Position.
- ☐ L3 Pilot Light. Normal source available.
- ☐ L4 Pilot Light. Emergency source available.
- ☐ M1 Ammeter; Single phase.
- ☐ M2 Ammeter; Three phase
- ☐ M3 Voltmeter; Single phase.
- ☐ M4 Voltmeter; Three phase.
- ☐ P1 Time Delay to Engine Start (solid state). Adjustable over time range .5 to 6 seconds. When the Normal line fails the relay de–energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in Normal position, the relay energizes and the engine start contacts open to shut down the engine.
- ☐ P2 Time Delay to Engine Start (Pneumatic). Adjustable over time range 1/6 to 300 seconds. When the Normal line fails, the relay de–energizes. After the set time delay its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.
- ☐ Q2 Connections for remote peak shave or area protection relays. Includes bypass for automatic return to Normal if Emergency line fails and Normal is present.
- ☐ R1 Solid State Adjustable Overvoltage Relay(s). Set at 110% of pickup, 105% of dropout of nominal Line rate, unless otherwise specified.
- ☐ R4 In–Phase monitor. Prevents transfer until two sources are in–phase. For use of isochronous governors.
- ☐ R43 In–phase monitor. Prevents transfer until two sources are in–phase. For use with mechanical. governors.
- ☐ S1 Four–position Engine Control Selector Switch. "STOP", "HAND CRANK", "TEST", "AUTOMATIC".
- ☐ T Time delay, re–transfer to Normal. When the Normal line restores and the phase relays operate, the T timer is energized. After the set time delay, its contacts close the circuit to the CR relay which operates to restore the load to the Normal line. RT relay is supplied to bypass T contacts if Emergency is de–energized during timing. CAUTION–DO NOT SET TIMER AT THE "0" POINT.
- ☐ T3 W3 Presignal auxiliary Contact, S.P.D.T: Operates 0–30 seconds (adjustable) prior to transfer in either direction.
- ☐ U Time delay, engine cool–down. When the transfer switch is restored to the Normal position and the engine is signaled to shut down, the U timer operates to maintain the engine start circuit closed. At the end of the set time, the engine contacts open to shut down the engine. CAUTION–DO NOT SET TIMER AT THE "0" POINT.
- ☐ W Time delay, transfer to Emergency. When the Normal line fails and the engine has started, the VFSM relay energizes. The W timer energizes. After the set time delay, its contacts close to energize the RT relay. CAUTION–DO NOT SET TIMER AT THE "0" POINT.
- ☐ YE Pushbutton Transfer to Emergency. Provides manual control of transfer to emergency source. If time delay accessory W is supplied pushbutton bypasses time delay for immediate transfer; otherwise, transfer to emergency will be automatic after time delay. If time delay accessory W is not supplied, transfer will be non–automatic (by pushbutton only).
- ☐ YN Pushbutton to Retransfer to Normal. Provides manual control of retransfer to normal source. If time delay accessory T is supplied, pushbutton bypasses time delay for immediate retransfer; otherwise, retransfer to normal will be automatic after time delay. If time delay accessory T is not supplied, retransfer will be non–automatic (by pushbutton only).

Other: _____
_____
_____

NOTES:

1. ⚠ CAUTION:In using a 3 phase, 4 wire delta or open delta power supply (usually 120/240 volts, sometimes listed as 120/208 volts) with one leg having a grounded center tap, one line will be 160 to 208 volts to ground. When such a system is used it is necessary to connect the high leg to N2.DO NOT CONNECT 120 VOLT LOAD CIRCUIT TO THE HIGH LEG.
2. GROUNDING TERMINAL: A grounding terminal (GND) is provided. When installing open type switches connect this to the metal enclosure or conduit.
3. ⚠ WARNING – TO ENSURE AGAINST SHOCK OR ACCIDENT HAZARD, DISCONNECT ALL SOURCES OF SUPPLY BEFORE SERVICING.
4. OPEN TRANSITION OPERATION CAN BE SELECTED WITH BOTH SOURCES AVAILABLE. OPEN TRANSITION OCCURS BY DEFAULT WHEN THE LOAD–CONNECTED SOURCE FAILS.
5. ON SINGLE PHASE UNITS WHERE THE EMERGENCY SOURCE IS A UTILITY LINE, CONNECT EMERGENCY LINE SO THAT MINIMUM VOLTAGE IS MEASURED FROM N1 TO E1.
6. ON SINGLE PHASE (2 POLE) UNITS, CENTER POLE AND PHASE RELAYS (B2,B3) ARE NOT SUPPLIED ALSO 47N & 47E ARE ELIMINATED.

3Ø 27/59N & E ARE REPLACED BY 1Ø 27/59N & E.

REVISIONS				
REV	ECN NO.	DATE	DFT	ENG
A	–	ESTABLISH DWG.		
D	S–6358	03/11/96	RMC	SB
E	S–6619	11/22/96	SG	SB
F	S–7179	7/1/99	DF	SB

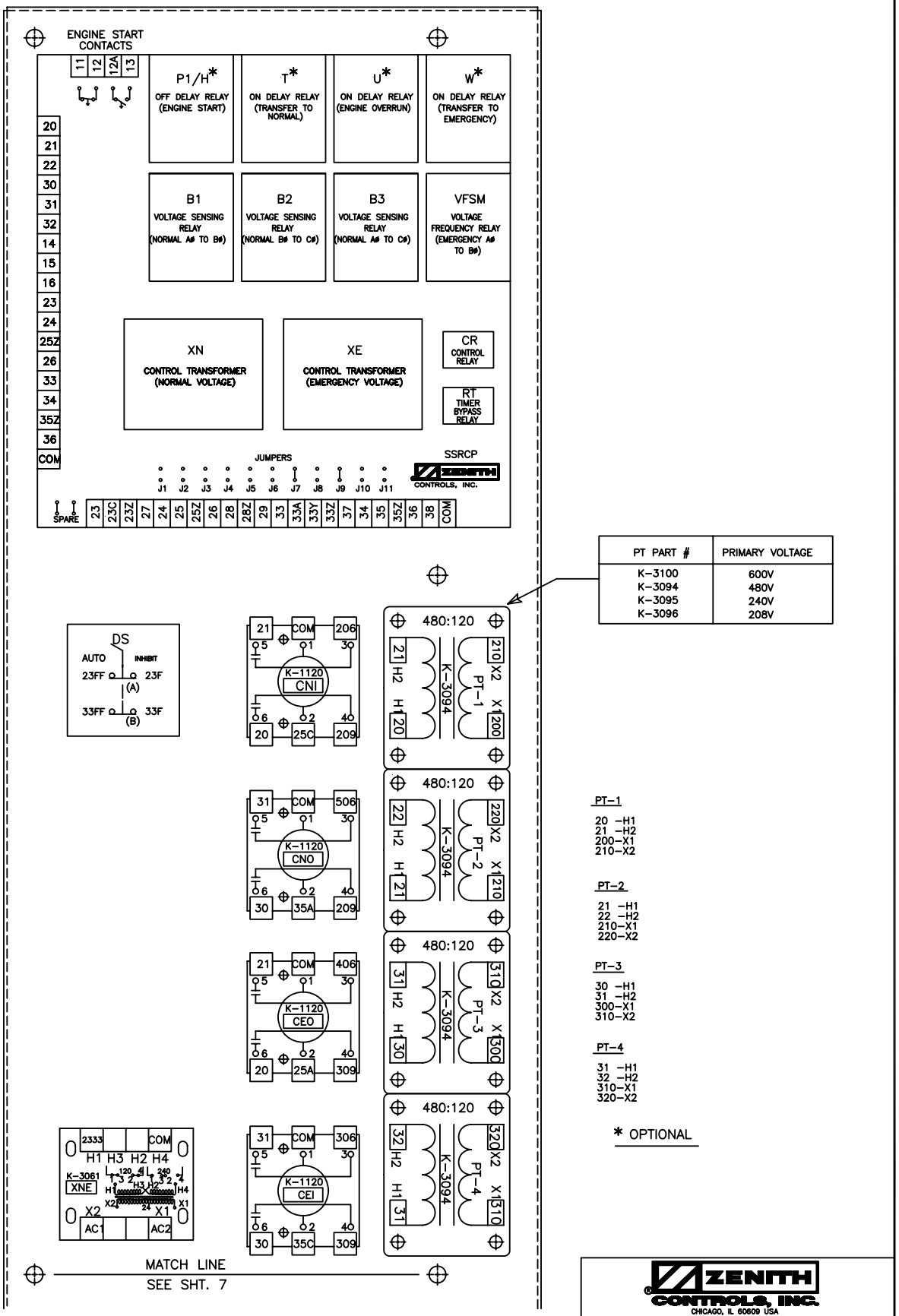
ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: LEGEND AND ACCESSORIES
JOB/MODEL: ZTSCTH10/40 (100 – 400 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	47A–7000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
IRAY	SB	01/27/94	N/A	1 OF 7	F



PT PART #	PRIMARY VOLTAGE
K-3100	600V
K-3094	480V
K-3095	240V
K-3096	208V

PT-1

20 -H1
21 -H2
200-X1
210-X2

PT-2

21 -H1
22 -H2
210-X1
220-X2

PT-3

30 -H1
31 -H2
300-X1
310-X2

PT-4

31 -H1
32 -H2
310-X1
320-X2

* OPTIONAL

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

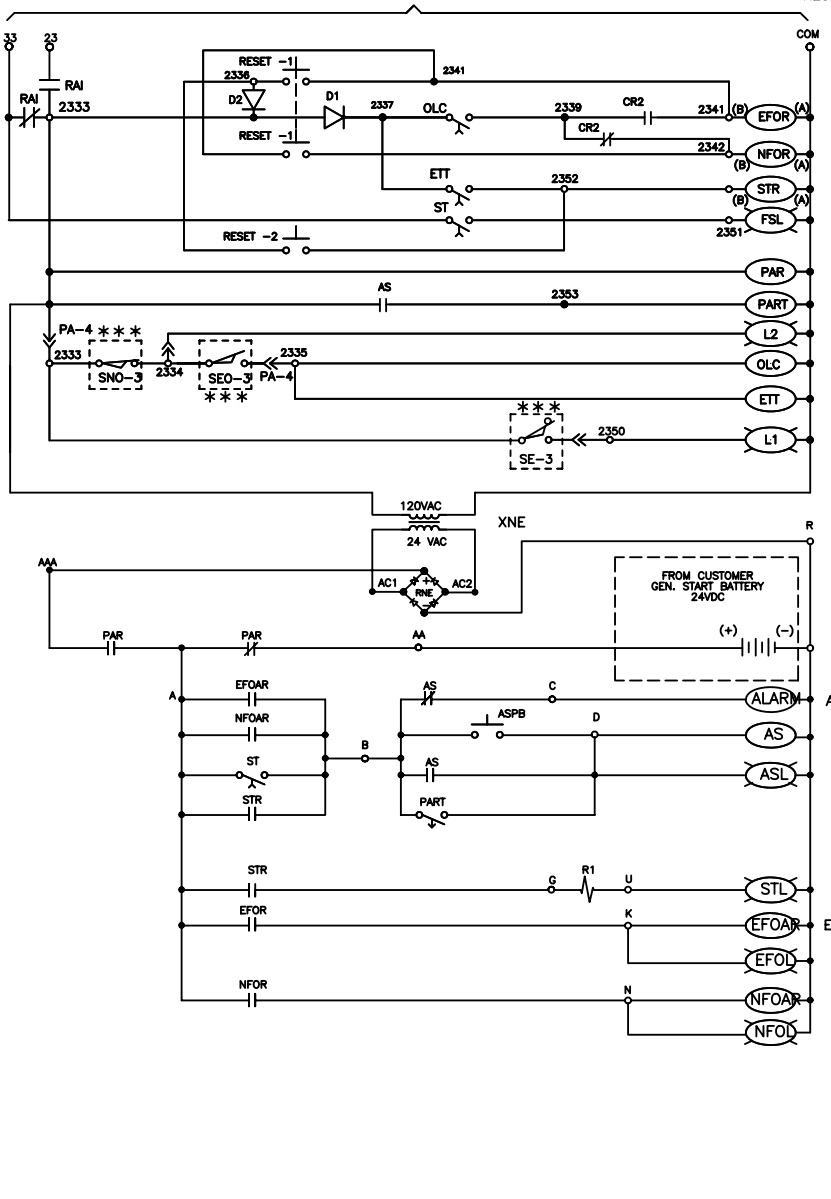
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

REVISIONS				
REV	ECN NO.	DATE	DFT	ENG
		ESTABLISH DWG.		
D	S-6358	03/11/96	RMC	SB
E	S-6619	11/22/96	SG	SB
F	S-7179	7/1/99	DF	SB

DWG TITLE: CONTROL PANEL LAYOUT
JOB/MODEL: ZTSCTH10/40 (100-400 AMP)
CHKD: APPD: CADD: ACAD ORDER NUMBER: - DRAWING NUMBER: 47A-7000
DRWN: IRAY ENGR: SB DATE: 01/27/94 SCALE: 1:2 SHEET: 6 OF 7 REV: F

ALARM CIRCUIT SCHEMATIC

TO CONTROL CIRCUIT SCHEMATIC, SHEET 4



RESET–1 – FAIL TO OPEN LOCKOUT RESET

RESET–2 – SHUNT TRIP RESET

EFOR – EMERGENCY FAIL TO OPEN RELAY (LATCH RELAY), 74, 104, 108, 157

D1 – DIODE #1

D2 – DIODE #2

NFOR – NORMAL FAIL TO OPEN, RELAY (LATCH RELAY), 66 78, 109, 160

STR – SHUNT TRIP RELAY, 152 , 155, 174

FSL – FAIL TO SYNC LIGHT

PAR – POWER AVAILABLE RELAY , 145

PART – POWER AVAILABLE TIMER , 152

L2 – NORMAL POSITION LIGHT

OLC – OPEN LAST CLOSE TIMER, 122

ETT – EMERGENCY TRIP TIMER , 125

L1 – EMERGENCY POSITION LIGHT

XNE – NORMAL/EMERGENCY CONTROL TRANSFORMER

RNE – BRIDGE RECTIFIER, XNE

ASPB – ALARM SILENCE PUSHBUTTON, 90, 149

AS – ALARM SILENCE,130,147,150

ASL – ALARM SILENCE LIGHT

STL – SHUNT TRIP LIGHT

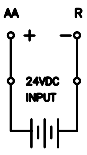
EFOAR – EMERGENCY FAIL TO OPEN ALARM RELAY,147

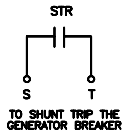
EFOL– EMERGENCY FAIL TO OPEN LIGHT.

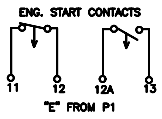
NFOAR– NORMAL FAIL TO OPEN ALARM RELAY,148

NFOL – NORMAL FAIL TO OPEN LIGHT

CUSTOMER CONNECTIONS







A3, A4

SEE POWER CIRCUIT SCHEMATIC AND LAYOUT

CONTACT RATING		
RELAY	CONTACT	RATING
P1	E	10 AMPS @ 32 VDC.
	A3,A4	20 AMPS,125,250 VAC.

LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —○— WIRE ON MAIN TERMINAL BLOCK —≫— WIRE IN DISCONNECT PLUG *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL		ZTSCTH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	–	ESTABLISH DWG.		
D	S–6358	03/11/96	RMC	SB
E	S–6619	11/22/96	SG	SB
F	S–7179	7/1/99	DF	SB

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: ALARM CIRCUIT SCHEMATIC & CUSTOMER CONNECTIONS

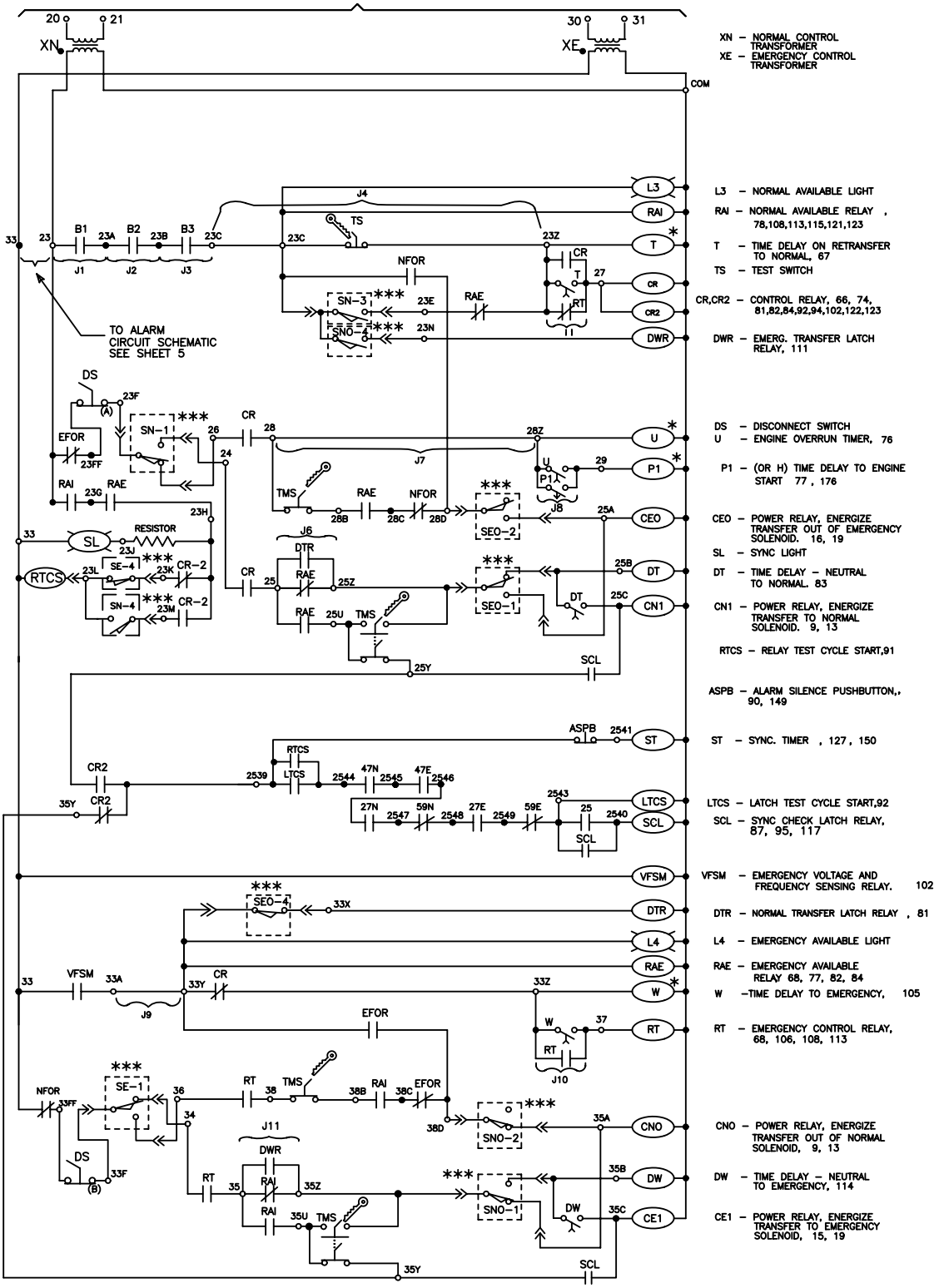
JOB/MODEL: ZTSCTH10/40 (100–400 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	47A–7000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
IRAY	SB	1/27/94	N/A	5 OF 7	F

CONTROL CIRCUIT SCHEMATIC

TO POWER CIRCUIT SCHEMATIC, SHEET 3



L3 – NORMAL AVAILABLE LIGHT
RAI – NORMAL AVAILABLE RELAY , 78,108,113,115,121,123
T – TIME DELAY ON RETRANSFER TO NORMAL, 67
TS – TEST SWITCH
CR,CR2 – CONTROL RELAY, 66, 74, 81,82,84,92,94,102,122,123
DWR – EMERG. TRANSFER LATCH RELAY, 111
DS – DISCONNECT SWITCH
U – ENGINE OVERRUN TIMER, 76
P1 – (OR H) TIME DELAY TO ENGINE START 77 , 176
CEO – POWER RELAY, ENERGIZE TRANSFER OUT OF EMERGENCY SOLENOID. 16, 19
SL – SYNC LIGHT
DT – TIME DELAY – NEUTRAL TO NORMAL. 83
CN1 – POWER RELAY, ENERGIZE TRANSFER TO NORMAL SOLENOID. 9, 13
RTCS – RELAY TEST CYCLE START,91
ASPB – ALARM SILENCE PUSHBUTTON,. 90, 149
ST – SYNC. TIMER , 127 , 150
LTCS – LATCH TEST CYCLE START,92
SCL – SYNC CHECK LATCH RELAY, 87, 95, 117
VFSM – EMERGENCY VOLTAGE AND FREQUENCY SENSING RELAY. 102
DTR – NORMAL TRANSFER LATCH RELAY , 81
L4 – EMERGENCY AVAILABLE LIGHT
RAE – EMERGENCY AVAILABLE RELAY 68, 77, 82, 84
W –TIME DELAY TO EMERGENCY, 105
RT – EMERGENCY CONTROL RELAY, 68, 106, 108, 113
CNO – POWER RELAY, ENERGIZE TRANSFER OUT OF NORMAL SOLENOID, 9, 13
DW – TIME DELAY – NEUTRAL TO EMERGENCY, 114
CE1 – POWER RELAY, ENERGIZE TRANSFER TO EMERGENCY SOLENOID, 15, 19

JUMPER	CONNECT POINTS	REMOVE JUMPER WHEN ACCESSORIES USED
J1	23,23A	B1
J2	23A,23B	B2
J3	23B,23C	B3
J4	23C,23Z	TS
J5	23Z,27	T
J6	25,25Z	DTR, RAE
J7	28,28Z	
J8	28Z,29	U
J9	33A,33Y	
J10	33Z,37	W
J11	35,35Z	DWR, RAI

NOTE

ZTSCTH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

LEGEND

- WIRE CONNECTION
- WIRE ON MAIN TERMINAL BLOCK
- WIRE IN DISCONNECT PLUG
- * OPTIONAL
- *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL

LIMIT SWITCH STATE (X = ACTIVATED)

ATS POSITION	SN	SNO	SEO	SE
NORMAL			X	X
PARALLED				
EMERGENCY	X	X		
OPEN	X	X	X	X

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	S-6351	ESTABLISH DWG.		
D	S-6358	03/11/96	RMC	SB
E	S-6619	11/22/96	SG	SB
F	S-7179	7/1/99	DF	SB

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

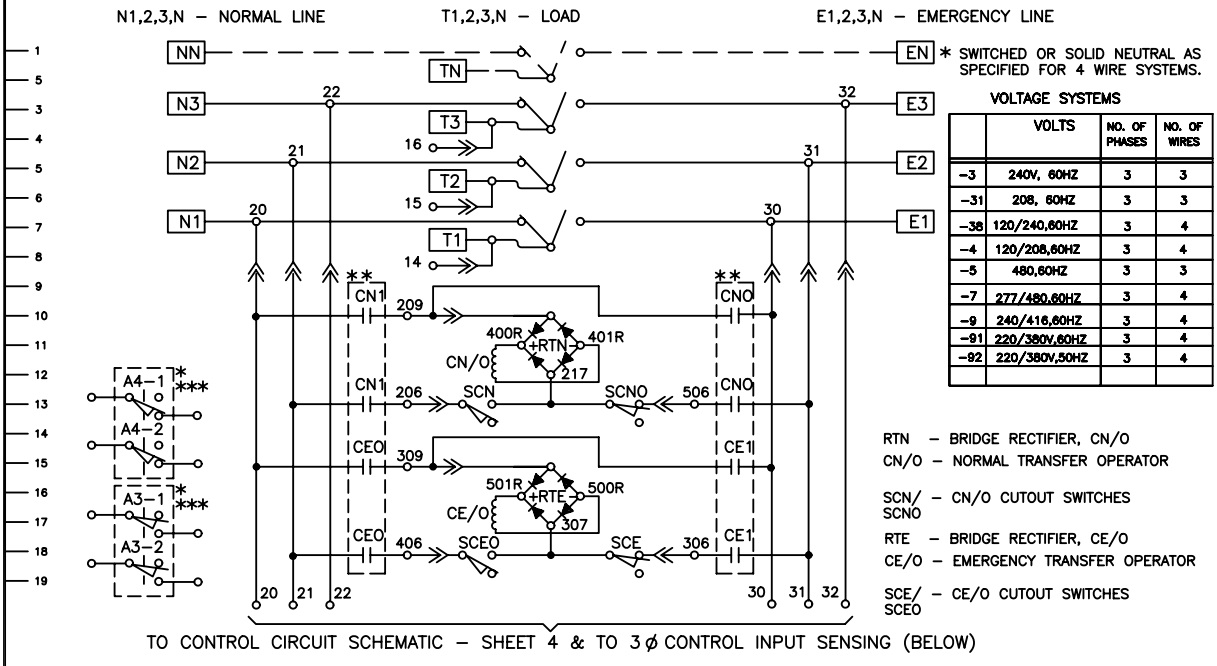
THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: CNTRL CIRCUIT SCHEMATIC
JOB/MODEL: ZTSCTH10/40 (100–400 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	47A–7000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
IRAY	SB	1/27/94	N/A	4 OF 7	F

POWER CIRCUIT SCHEMATIC

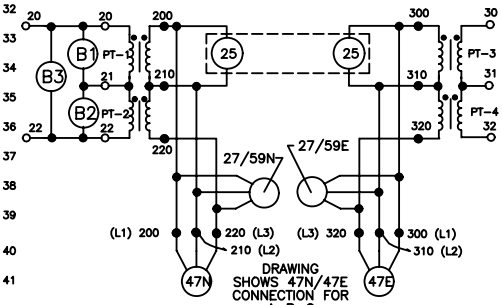


VOLTAGE SYSTEMS

	VOLTS	NO. OF PHASES	NO. OF WIRES
-3	240V, 60HZ	3	3
-31	208, 60HZ	3	3
-38	120/240,60HZ	3	4
-4	120/208,60HZ	3	4
-5	480,60HZ	3	3
-7	277/480,60HZ	3	4
-9	240/416,60HZ	3	4
-91	220/380V,60HZ	3	4
-92	220/380V,50HZ	3	4

RTN – BRIDGE RECTIFIER, CN/O
CN/O – NORMAL TRANSFER OPERATOR
SCN/ SCNO – CN/O CUTOUT SWITCHES
RTE – BRIDGE RECTIFIER, CE/O
CE/O – EMERGENCY TRANSFER OPERATOR
SCE/ SCEO – CE/O CUTOUT SWITCHES

3Ø CONTROL SENSING

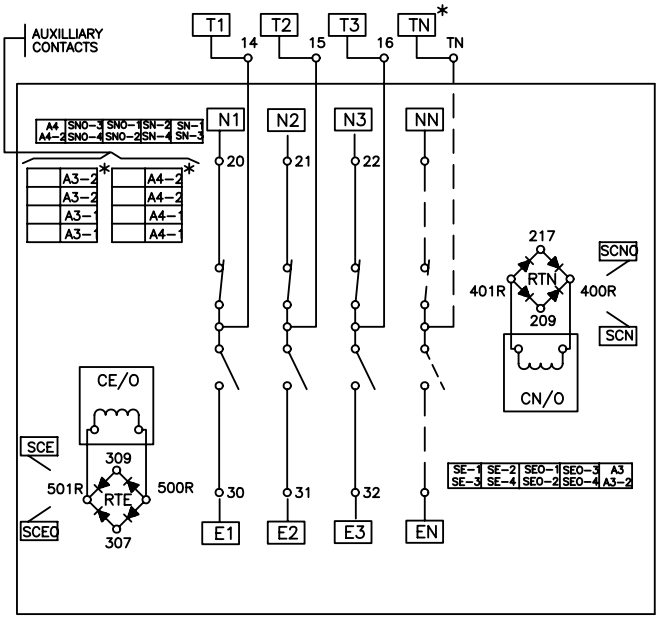


IF PHASE ROTATION SEQUENCE IS A-C-B SWAP L2 & L3 TERMINAL INPUTS ON EACH 47 RELAY.

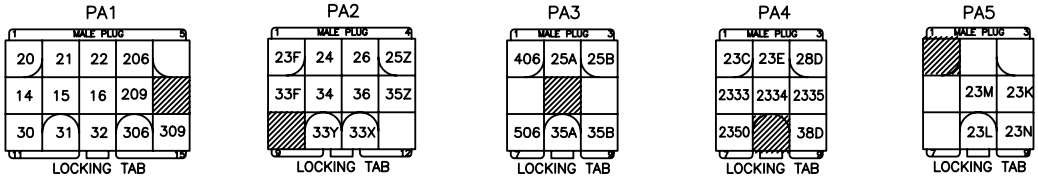
LEGEND:

PT- 1,2 – NORMAL POTENTIAL TRANSFORMERS
PT- 3,4 – EMERGENCY POTENTIAL TRANSFORMERS
B1,2,3 – UNDER VOLTAGE RELAYS , 64
27/59N – NORMAL UNDER/OVER VOLTAGE RELAY, 92
27/59E – EMERGENCY UNDER/OVER VOLTAGE RELAY, 92
47N – PHASE SEQUENCING NORMAL , 92
47E – PHASE SEQUENCING EMERGENCY , 92
25 – SYNC CHECK RELAY, 93

POWER PANEL LAYOUT



INTERCONNECT PLUGS



LEGEND	REFERENCE	NOTES
WIRE CONNECTION WIRE ON MAIN TERMINAL BLOCK WIRE IN DISCONNECT PLUG * OPTIONAL ** LOCATED ON CONTROL PANEL *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL		ZTSCTH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS				
REV	ECN NO.	DATE	DFT	ENG
A	–	ESTABLISH DWG.		
D	S-6358	03/11/96	RMC	SB
E	S-6619	11/22/96	SG	SB
F	S-7179	7/1/99	DF	SB

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: POWER CIRCUIT & 3Ø CONTROL SENSING
JOB/MODEL: ZTSCTH10/40 (100-400 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	47A-7000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
IRAY	SB	1/27/94	N/A	3 OF 7	F

D. LEGEND (PILOT DEVICES)

ASL.....Alarm Silence Light
ASPB.....Alarm Silence Pushbutton
EFOL.....Emergency Fail to open light
FSL.....Fail to SYNC Light
L1.....Emergency Position Light
L2.....Normal Position Light
L3.....Normal Available Light
L4.....Emergency Available Light
NFOL.....Normal Fail to open Light
RESET–1.....Fail to Open Lockout Reset
RESET–2.....Shunt Trip Reset
SL.....SYNC Light (Dark SYNC)
STL.....Shunt Trip Light
TMS.....Transition Mode Selector
TS.....Test Switch maintained, keyed

E. OPERATION – CLOSED TRANSITION

Zenith Closed Transition Transfer Switches are designed to Transfer load between two available sources, without interrupting power to the load (make before break). Paralleling of the two sources occurs within a predefined window of synchronization and lasts less the 100ms. The initial source is then disconnected.

To test the ATS, turning the Test Switch (TS) to Test initiates transfer by dropping out the Engine Start Relay. Turning the "TS" disables the circuit which transfers to Normal and enables the circuit which transfers to Emergency. The ATS closes into Emergency only after the Sync Check Relay ensures the proper phase relationship of both sources.
After the ATS closes into Emergency the SE limit switch becomes de–activated to de–energize the CE1 relay and energize the CNO relay which opens the ATS out of Normal. When the ATS has opened out of Normal, the SNO–2 limit switch activates to de–energize the CNO relay.
The ATS has now closed into Emergency Power without interrupting the load.

Turning the "TS" to "AUTO" initiates transfer to Normal.
Turning the "TS" disables the circuit which transfers to Emergency and enables the circuit which transfers to Normal. The ATS closes into Normal only after the Sync Check Relay ensures proper phase relationship of both sources.
After the ATS closes into Normal the SN limit switch becomes de–activated to de–energize the CN1 relay and energize the CEO relay, which opens the ATS out of Emergency. When the ATS has opened out of Emergency, the SEO–2 limit switch activates to de–energize the CEO relay. The ATS has now closed back into Normal Power without interrupting the load.

The ATS defaults to an open transition transfer when the Normal source fails. This signals the generator to start. After the generator voltage and frequency are at the proper level, the ATS transfers to Emergency.
Closed transition transfer is not possible with one source available.
One can select an Open Transition transfer via the Transition Mode Selector (TMS) for testing also.

If while in Closed Transition Mode, the ATS fails to open the source it is attemping to "transfer out of", the source that the ATS just closed into will be opened leaving the ATS in its initial source while disabling all ather transfer operations until the problem is corrected and the "reset" has been turned.

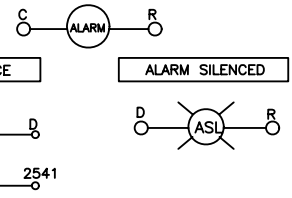
Also a dry contact to shunt trip the generator circuit breaker is available to remove the generator from the bus if neither operator opened.

A 24 VDC control circuit is supplied to control the Alarm and Warning indicators. To insure continuous power to this circuit, the customer supplies the 24 VDC.

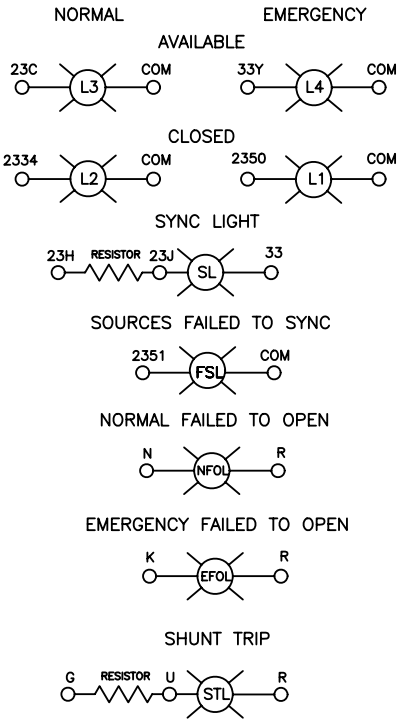
F. PARALLELING REQUIREMENTS

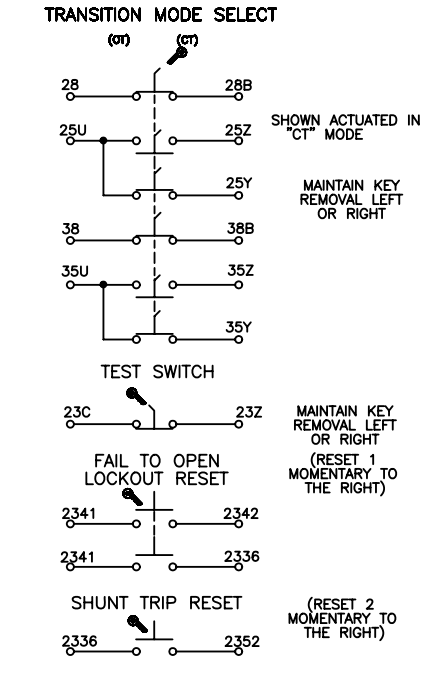
A. The unit is Factory set to accomplish transfer within 5 electrical degrees (at 0.1 Hz Δ F).
B. Requires an Isochronous Governor with an operating frequency of 60 ±0.2 Hz.
C. Requires a shunt trip breaker on the Generator set with a response time not exceeding 50 ms.

CABINET FRONT



CABINET FRONT





LEGEND	REFERENCE	NOTES

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	–	ESTABLISH DWG.		
D	S–6358	03/11/96	RMC	SB
E	S–6619	11/22/96	SG	SB
F	S–7179	07/01/99	DF	SB

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION. DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: CT OPERATION & CABINET FRONT
JOB/MODEL: ZTSCTH10/40 (100–400 AMP)

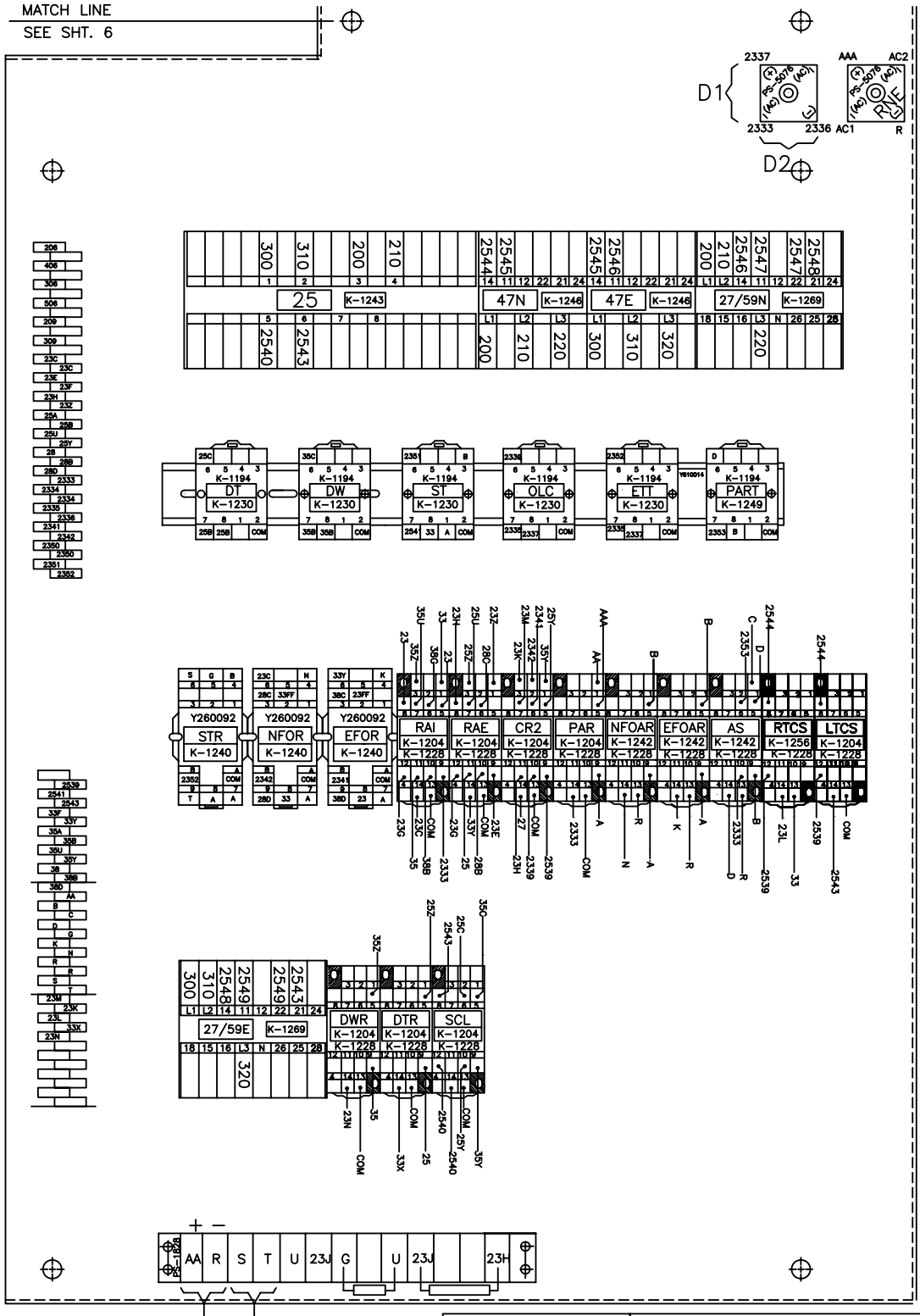
CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	47A–7000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
IRAY	SB	1/27/94	N/A	2 OF 7	F

27/59N	47N	25 BUS	27/59E	47E	25 GEN.
200–L1 210–L2 220–L3	200–L1 210–L2 220–L3	200–3 210–4	300–L1 310–L2 320–L3	300–L1 310–L2 320–L3	300–1 310–2

CTTS–Frequency, Phase Angle & Voltage window relays

PART # ON DEVICE	SETTINGS
K–1243	0.2 Hz ΔF @ NOMINAL V (≈20%)
K–1269	95% UNDERVOLTAGE PICK–UP & 105% OVERVOLTAGE PICK–UP DIFFERENTIAL SETTINGS AT MINIMUM



24VDC CUSTOMER INPUT

TO SHUNT TRIP THE GENERATOR BREAKER

WIRE NUMBER TO TERMINAL NUMBER CONNECTIONS ON 47N, 47E FOR A–B–C PHASE SEQUENCE. SWAP TERMINAL L2 & L3 INPUTS FOR A–B–C PHASE SEQUENCE.

LEGEND	REFERENCE	NOTES

REVISIONS

REV	ECN NO.	DATE	DFT	ENG
A	–	ESTABLISH DWG.		
D	S–6358	03/11/96	RMC	SB
E	S–6619	11/22/96	SG	SB
F	S–7179	7/1/99	DF	SB

ZENITH CONTROLS, INC.
CHICAGO, IL 60609 USA

THIS DRAWING CONTAINS PROPRIETARY AND CONFIDENTIAL INFORMATION.
DUPLICATION, REPRODUCTION OR USE OF THIS DOCUMENT OR ITS CONTENTS IN ANY FORM OTHER THAN AS EXPRESSLY PERMITTED BY ZENITH CONTROLS, INC. IS STRICTLY PROHIBITED.

DWG TITLE: CONTROL PANEL LAYOUT

JOB/MODEL: ZTSCTH10/40 (100–400 AMP)

CHKD:	APPD:	CADD:	ORDER NUMBER:	DRAWING NUMBER:
		ACAD	–	47A–7000

DRWN:	ENGR:	DATE:	SCALE:	SHEET:	REV:
IRAY	SB	1/27/94	1:1	7 OF 7	F

ZTSCTH SERIES
AUTOMATIC TRANSFER SWITCHES
600 TO 1200 AMP

FOR USE ON EMERGENCY OR STANDBY SYSTEMS - RATED FOR TOTAL SYSTEM & MOTOR LOAD

A. LEGEND

N1,2,3,(N).....Normal Line_____
E1,2,3,(N).....Emergency Line_____
T1,2,3,(N).....Load Connections
B1,2,3.....Solid State Phase Relay(s)
Dropout____ %
Pickup____ %
AS.....Alarm Silence Relay
CE.....Main Transfer Operator, Close into Emergency
CEO.....Main Transfer Operator, Open from Emergency
CN.....Main Transfer Operator, Close into Normal
CNO.....Main Transfer Operator, Open from Normal
CCE.....CE Control Relay, Emergency Closing
CCEO.....CEO Control Relay, Emergency Opening
CCN.....CN Control Relay, Normal Closing
CCNO.....CNO Control Relay, Normal Opening
CR ,CR2.....Normal Control Relay
DS.....Disconnect Switch
DT.....Timer, Delay Open To Normal
DTR.....Normal Transfer Latch Relay
DW.....Timer, Delay Open To Emergency
DWR.....Emergency Transfer Latch Relay
D1.....Diode #1
D2.....Diode #2
E.....Engine Start Contact
EFOAR.....Emergency Fail to open Alarm Relay
EFOR.....Emergency Fail to open Relay
ETT.....Emergency Trip Timer
GND.....Ground
LTCS.....Latch Test Cycle Start
NB.....Neutral Bar (if required)
NFOAR.....Normal Fail to open Alarm Relay
NFOR.....Normal Fail to open Relay
OLC.....Open Last Close Timer
PAR.....Power Available Relay
PART.....Power Available Timer
PT-1,2..... Potential Transformers Normal
PT-3,4.....Potential Transformers Emergency
RAE.....Emergency Available Relay
RAI.....Normal Available Relay
RE.....Bridge Rectifier, CE
REO.....Bridge Rectifier, CEO
RN.....Bridge Rectifier, CN
RNE.....Bridge Rectifier, XNE
RNO.....Bridge Rectifier, CNO
RT.....Emergency Control Relay
RTCS.....Relay Test Cycle Start
SCL.....SYNC Check Latch
SE,SEO.....Cutout Switch, Emergency
SN,SNO.....Cutout Switch, Normal
ST.....SYNC Timer
STR.....Shunt Trip Relay
VFSM.....Emergency Volt-Freq. Relay
Pickup {90% of rated Voltage, and {95% of rated Frequency
XE.....Control Transformer, Emergency
XN.....Control Transformer, Normal
XNE.....Control Transformer - Norm./Emerg.
25(ANSI).....Sync Check Relay
47N,E(ANSI).....Phase sequencing - Norm./Emerg.
27/59N,E(ANSI)..Over/Undervoltage - Norm./Emerg.

B. OPERATION (OPEN TRANSITION)

(See note #4)

When the Normal Line falls to the preset dropout point, the phase relays will dropout disconnecting the CR relay.

When the Emergency Line voltage & frequency reach the preset pickup point, the VFSM relay picks up. RT relay picks up to operate the CCNO relay through the SE & SNO cutout switches causing the emergency main transfer operator CNO to operate. The load is now transferred to the Open position. The SNO limit switch operates to disconnect the CCNO relay and CNO main transfer operator. The transfer switch is now mechanically locked open. Limit switch SNO is now activated, picking up the DW timer. After a set time delay, DW will pick up the CCE relay which will then pick up CE main transfer operator. The load is now transferred to the Emergency line. The SE limit switch operates to disconnect the CCE relay and CE main transfer operator. The transfer switch is now mechanically locked in Emergency.

When the Normal Line voltage exceeds the preset pick up point, the phase relays B1, B2, & B3 pick up. CR relay picks up to operate the CCEO relay through the SN & SEO cutout switches, causing the main transfer operator CEO to operate. The load is now transferred to the Open position. The SEO limit switch operates to disconnect the CCEO relay and CEO main transfer operator. The transfer switch is now mechanically locked Open. Limit switch SEO is now activated, picking up the DT timer. After a set time delay, DT will pick up the CCN relay which will then pick up the CN main transfer operator. The load is now re-transferred back to the Normal line. The SN limit switch operates to disconnect the CCN relay and CN main transfer operator. The transfer switch is now mechanically locked in Normal.

DS - Disconnect Switch
When the Disconnect Switch is placed in the INHIBIT position the circuit to the main transfer operators CN/CNO and CE/CEO is opened and transfer cannot take place.

TS - Test Switch
The Test Switch simulates a normal line failure when activated.
To test, activate the Test Switch allowing the transfer switch to transfer to the EMERGENCY position. De-activate the Test Switch. The transfer switch will reset to the NORMAL position. Testing at least once a month is recommended. For hospital emergency systems, test once a week.

C. ACCESSORIES

The ZTSCTH series transfer switch is wired so that accessories can be easily added to the switch. The following is a description of the accessories which are supplied on this unit.

- ☐ A1 Auxiliary contact, S.P.D.T., operates on normal line failure.
- ☐ A1E Auxiliary contact, S.P.D.T., operates on emergency line failure.
- ☐ A3 Auxiliary contact closes when the transfer switch is in the Emergency position.
- ☐ A4 Auxiliary contact closes when the transfer switch is in Normal position.
- ☐ A6 Motor Disconnect. To de-energize external motor control circuit 5 seconds (adjustable) prior to transfer in either direction.
- ☐ C Plant Exercisor. Automatically starts generator for selected time intervals.
- ☐ C/D Plant Exercisor. Automatically starts generator to run unloaded or simulate a power failure and starts generator to run under load.
- ☐ E Engine Start Contact: 1 Normally Open 1 Normally Closed.
- ☐ F Auxiliary Fan Contact, S.P.N.O. Closes when generator is running.
- ☐ H Time delay to engine start, non-adjustable. Factory set 1 or 3 seconds. When the Normal line fails the relay de-energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.
- ☐ J1 Adjustable under frequency sensor.
- ☐ J2 Adjustable over/under frequency sensor.
- ☐ K Frequency meter to indicate load frequency.
- ☐ L1 Pilot Light. Switch in Emergency Position.
- ☐ L2 Pilot Light. Switch in Normal Position.
- ☐ L3 Pilot Light. Normal source available.
- ☐ L4 Pilot Light. Emergency source available.
- ☐ M1 Ammeter; Single phase.
- ☐ M2 Ammeter; Three phase
- ☐ M3 Voltmeter; Single phase.
- ☐ M4 Voltmeter; Three phase.
- ☐ P1 Time Delay to Engine Start (solid state). Adjustable over time range .5 to 6 seconds. When the Normal line fails the relay de-energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in Normal position, the relay energizes and the engine start contacts open to shut down the engine.
- ☐ P2 Time Delay to Engine Start (Pneumatic). Adjustable over time range 1/6 to 300 seconds. When the Normal line fails, the relay de-energizes. After the set time delay its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.
- ☐ Q2 Connections for remote peak shave or area protection relays. Includes bypass for automatic return to Normal if Emergency line fails and Normal is present.
- ☐ R1 Solid State Adjustable Overvoltage Relay(s). Set at 110% of pickup, 105% of dropout of nominal Line rate, unless otherwise specified.
- ☐ R4 In-Phase monitor. Prevents transfer until two sources are in-phase. For use of isochronous governors.
- ☐ R43 In-phase monitor. Prevents transfer until two sources are in-phase. For use with mechanical. governors.
- ☐ S1 Four-position Engine Control Selector Switch. "STOP", "HAND CRANK", "TEST", "AUTOMATIC".
- ☐ T Time delay, re-transfer to Normal. When the Normal line restores and the phase relays operate, the T timer is energized. After the set time delay, its contacts close the circuit to the CR relay which operates to restore the load to the Normal line. RT relay is supplied to bypass T contacts if Emergency is de-energized during timing. CAUTION-DO NOT SET TIMER AT THE "0" POINT.
- ☐ T3 W3 Presignal auxiliary Contact, S.P.D.T: Operates 0-30 seconds (adjustable) prior to transfer in either direction.
- ☐ U Time delay, engine cool-down. When the transfer switch is restored to the Normal position and the engine is signaled to shut down, the U timer operates to maintain the engine start circuit closed. At the end of the set time, the engine contacts open to shut down the engine. CAUTION-DO NOT SET TIMER AT THE "0" POINT.
- ☐ W Time delay, transfer to Emergency. When the Normal line fails and the engine has started, the VFSM relay energizes. The W timer energizes. After the set time delay, its contacts close to energize the RT relay. CAUTION-DO NOT SET TIMER AT THE "0" POINT.
- ☐ YE Pushbutton Transfer to Emergency. Provides manual control of transfer to emergency source. If time delay accessory W is supplied pushbutton bypasses time delay for immediate transfer; otherwise, transfer to emergency will be automatic after time delay. If time delay accessory W is not supplied, transfer will be non-automatic (by pushbutton only).
- ☐ YN Pushbutton to Retransfer to Normal. Provides manual control of retransfer to normal source. If time delay accessory T is supplied, pushbutton bypasses time delay for immediate retransfer; otherwise, retransfer to normal will be automatic after time delay. If time delay accessory T is not supplied, retransfer will be non-automatic (by pushbutton only).

Other: _____
_____
_____

NOTES:

1. ⚠ CAUTION:In using a 3 phase, 4 wire delta or open delta power supply (usually 120/240 volts, sometimes listed as 120/208 volts) with one leg having a grounded center tap, one line will be 160 to 208 volts to ground. When such a system is used it is necessary to connect the high leg to N2.DO NOT CONNECT 120 VOLT LOAD CIRCUIT TO THE HIGH LEG.
2. GROUNDING TERMINAL: A grounding terminal (GND) is provided. When installing open type switches connect this to the metal enclosure or conduit.
3. ⚠ WARNING - TO ENSURE AGAINST SHOCK OR ACCIDENT HAZARD, DISCONNECT ALL SOURCES OF SUPPLY BEFORE SERVICING.
4. OPEN TRANSITION OPERATION CAN BE SELECTED WITH BOTH SOURSES AVAILABLE. OPEN TRANSITION OCCURS BY DEFAULT WHEN THE LOAD-CONNECTED SOURCE FAILS.
5. ON SINGLE PHASE UNITS WHERE THE EMERGENCY SOURCE IS A UTILITY LINE, CONNECT EMERGENCY LINE SO THAT MINIMUM VOLTAGE IS MEASURED FROM N1 TO E1.
6. ON SINGLE PHASE (2 POLE) UNITS, CENTER POLE AND PHASE RELAYS (B2,B3) ARE NOT SUPPLIED ALSO 47N & 47E ARE ELIMINATED.

3Ø 27/59N & E ARE REPLACED BY 1Ø 27/59N & E.

ACCESSORY LIST:

NOTES:

ZENITH CONTROLS, INC.

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
G	S-6358	3/11/96	RMC	SB
H	S-6619	11/13/96	AMG	SB

TITLE: LEGEND AND ACCESSORIES
MODEL: ZTSCTH60/120 (600-1200 AMP)

DRFT: IRAY	DATE: 1/27/94	SCALE: N/A	CHK:	APPD:
ENGR: JC				

DWG NO.: 43A-7000 REV: H
CADD: S5K SHT. 1 OF7

ORIGINAL

D. LEGEND (PILOT DEVICES)

ASL.....Alarm Silence Light
ASPB.....Alarm Silence Pushbutton
EFOL.....Emergency Fail to open light
FSL.....Fail to SYNC Light
L1.....Emergency Position Light
L2.....Normal Position Light
L3.....Normal Available Light
L4.....Emergency Available Light
NFOL.....Normal Fail to open Light
RESET-1.....Fail to Open Lockout Reset
RESET-2.....Shunt Trip Reset
SL.....SYNC Light (Dark SYNC)
STL.....Shunt Trip Light
TMS.....Transition Mode Selector
TS.....Test Switch maintained, keyed

E. OPERATION - CLOSED TRANSITION

Zenith Closed Transition Transfer Switches are designed to Transfer load between two available sources, without interrupting power to the load (make before break). Paralleling of the two sources occurs within a predefined window of synchronization and lasts less the 100ms. The initial source is then disconnected.

To test the ATS, turning the Test Switch (TS) to Test initiates transfer by dropping out the Engine Start Relay. Turning the "TS" disables the circuit which transfers to Normal and enables the circuit which transfers to Emergency. The ATS closes into Emergency only after the SYNC Check Relay ensures the proper phase relationship of both sources. After the ATS closes into Emergency the SE limit switch becomes activated to de-energize the CCE relay and energize the CCNO relay, which opens the ATS out of Normal. When the ATS has opened out of Normal, the SNO-2 limit switch activates to de-energize the CCNO relay. The ATS has now closed into Emergency Power without interrupting the load.

Turning the "TS" to "AUTO" intiates transfer to Normal. Turning the "TS" disables the circuit which transfers to Emergency and enables the circuit which transfers to Normal. The ATS closes into Normal only after the SYNC Check Relay ensures proper phase relationship of both sources. After the ATS closes into Normal the SN limit switch becomes activated to de-energize the CCN relay and energize the CCEO relay, which opens the ATS out of Emergency. When the ATS has opened out of Emergency, the SEO-2 limit switch activates to de-energize the CCEO relay. The ATS has now closed back into Normal Power without interrupting the load.

The ATS defaults to an open transition transfer when the Normal source fails. This signals the generator to start. After the generator voltage and frequency are at the proper level, the ATS transfers to Emergency. Closed transition transfer is not possible with one source available. One can select an Open Transition transfer via the Transition Mode Selector (TMS) for testing also.

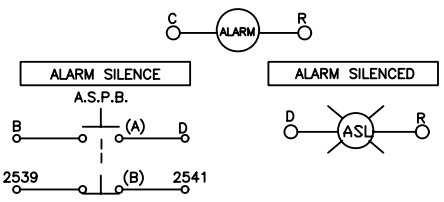
If while in Closed Transition Mode, the ATS fails to open the source it is attempting to "transfer out of", the source that the ATS just closed into will be opened leaving the ATS in its initial source while disabling all other transfer operations until the problem is corrected and the "reset" has been turned. Also a dry contact to shunt trip the generator circuit breaker is available to remove the generator from the bus if neither operator opened.

A 24 VDC control circuit is supplied to control the Alarm and Warning indicators. To insure continuous power to this circuit, the customer supplies the 24 VDC.

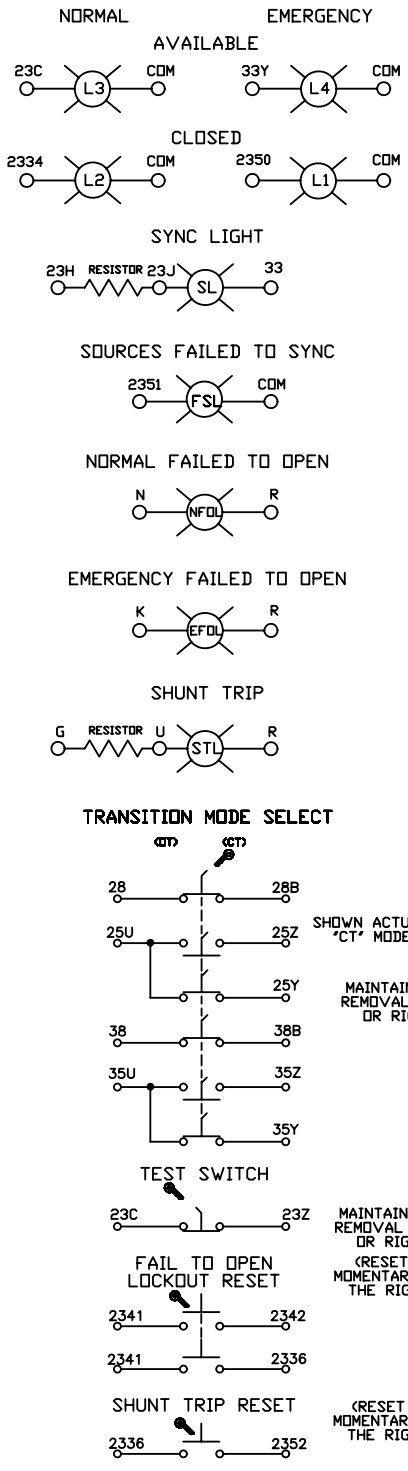
F. PARALLELING REQUIREMENTS

A. The unit is Factory set to accomplish transfer within 5 electrical degrees (at 0.1 Hz Δ F).
B. Requires an Isochronous Governor with an operating frequency of 60 ±0.2 Hz.
C. Requires a shunt trip breaker on the Generator set with a response time not exceeding 50 ms.

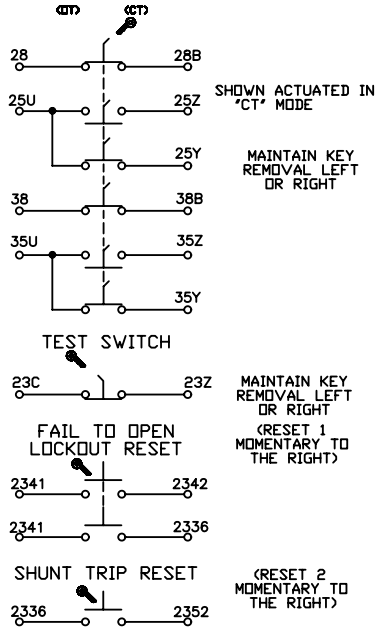
CABINET FRONT



CABINET FRONT



TRANSITION MODE SELECT



LEGEND	REFERENCE	NOTES

REVISIONS

RV	ECN NO.	DATE	DRF	ENG
G	S-6358	3/11/96	RMC	SB
H	S-6619	11/13/96	AMG	SB

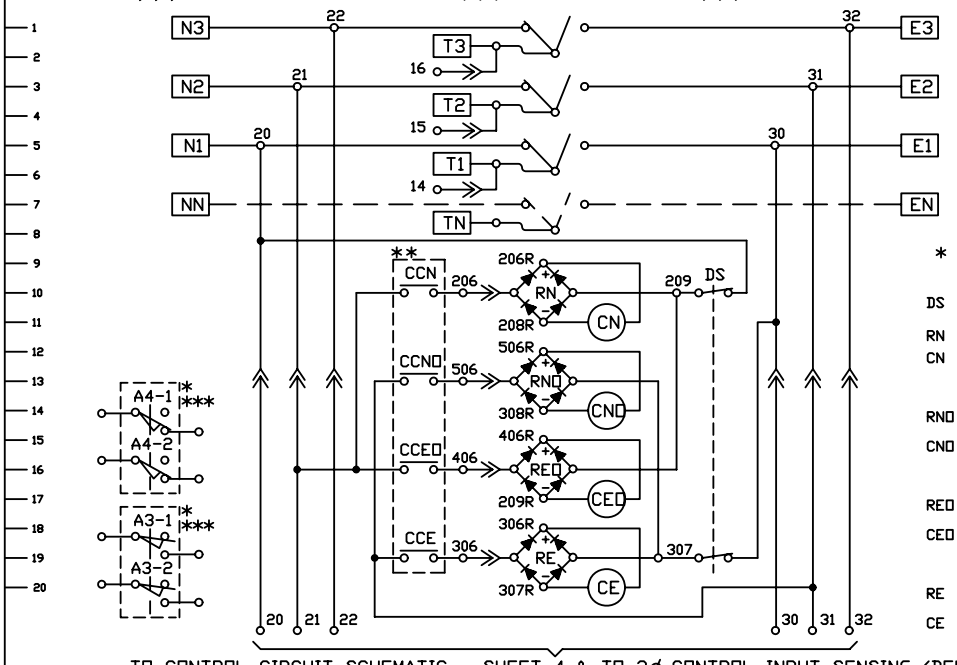
ZENITH CONTROLS, INC.

TITLE: CT OPERATION & CABINET FRONT
MODEL: ZTSCTH60/120 (600-1200 AMP)

DRFT: IRAY	DATE: 1/27/94	SCALE: N/A	CHK:	APPD:
ENGR: JC				

DWG NO.: 43A-7000 H
CADD: S5K SHT. 2 OF7 REV

POWER CIRCUIT SCHEMATIC



TO CONTROL CIRCUIT SCHEMATIC - SHEET 4 & TO 3Ø CONTROL INPUT SENSING (BELOW)

VOLTAGE SYSTEMS

	VOLTS	NO. OF PHASES	NO. OF WIRES
-3	240V, 60HZ	3	3
-31	208, 60HZ	3	3
-38	120/240,60HZ	3	4
-4	120/208,60HZ	3	4
-5	480,60HZ	3	3
-7	277/480,60HZ	3	4
-9	240/416,60HZ	3	4
-91	220/380V,60HZ	3	4
-92	220/380V,50HZ	3	4

* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEM

DS - DISCONNECT SWITCH FOR SERVICING

RN - BRIDGE RECTIFIER, CN

CN - TRANSFER OPERATOR, CLOSE INTO NORMAL

RNO - BRIDGE RECTIFIER, CNO

CNO - TRANSFER OPERATOR, OPEN FROM NORMAL

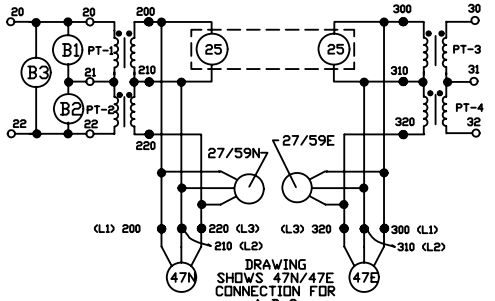
REO - BRIDGE RECTIFIER, CEO

CEO - TRANSFER OPERATOR, OPEN FROM EMERGENCY

RE - BRIDGE RECTIFIER, CE

CE - TRANSFER OPERATOR, CLOSE INTO EMERGENCY

3Ø CONTROL SENSING



DRAWING SHOWS 47N/47E CONNECTION FOR A-B-C PHASE ROTATION SEQUENCE. (PARENTHESIS=DEVICE TERMINAL #'s)

IF PHASE ROTATION SEQUENCE IS A-C-B SWAP L2 & L3 TERMINAL INPUTS ON EACH 47 RELAY.

LEGEND:

PT- 1,2 - NORMAL POTENTIAL TRANSFORMERS

PT- 3,4 - EMERGENCY POTENTIAL TRANSFORMERS

B1,2,3 - UNDER VOTAGE RELAYS , 64

27/59N - NORMAL UNDER/OVER VOLTAGE RELAY, 92

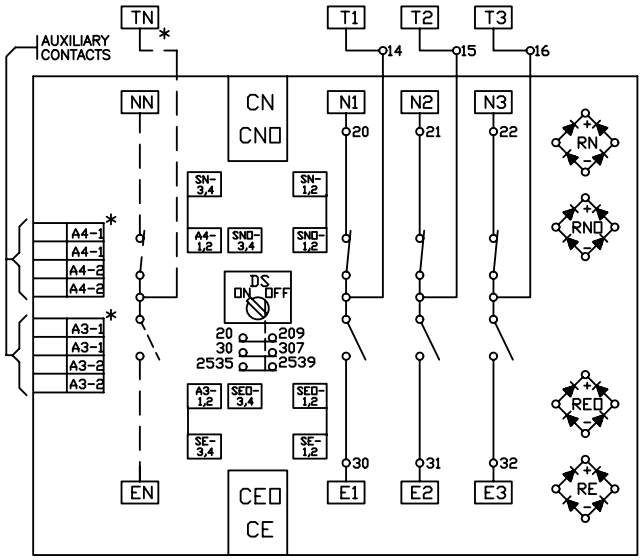
27/59E - EMERGENCY UNDER/OVER VOLTAGE RELAY, 92

47N - PHASE SEQUENCING NORMAL , 92

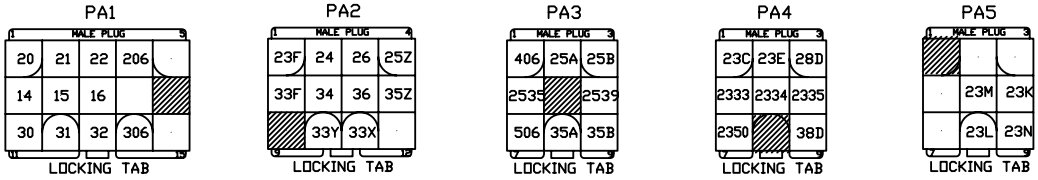
47E - PHASE SEQUENCING EMERG. , 92

25 - SYNC CHECK RELAY, 93

POWER PANEL LAYOUT



INTERCONNECT PLUGS



LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —○— WIRE ON MAIN TERMINAL BLOCK —≫— WIRE IN DISCONNECT PLUG * OPTIONAL ** LOCATED ON CONTROL PANEL *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL		ZTSCTH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
G	S-6358	3/11/96	RMC	SB
H	S-6619	11/13/96	AMG	SB

ZENITH CONTROLS, INC.

TITLE: POWER CIRCUIT & 3 Ø CONTROL SENSING

MODEL: ZTSCTH60/120 (600-1200 AMP)

DRFT: IRAY	DATE: 1/27/94	SCALE: N/A	CHK:	APPD:
ENGR: JC				

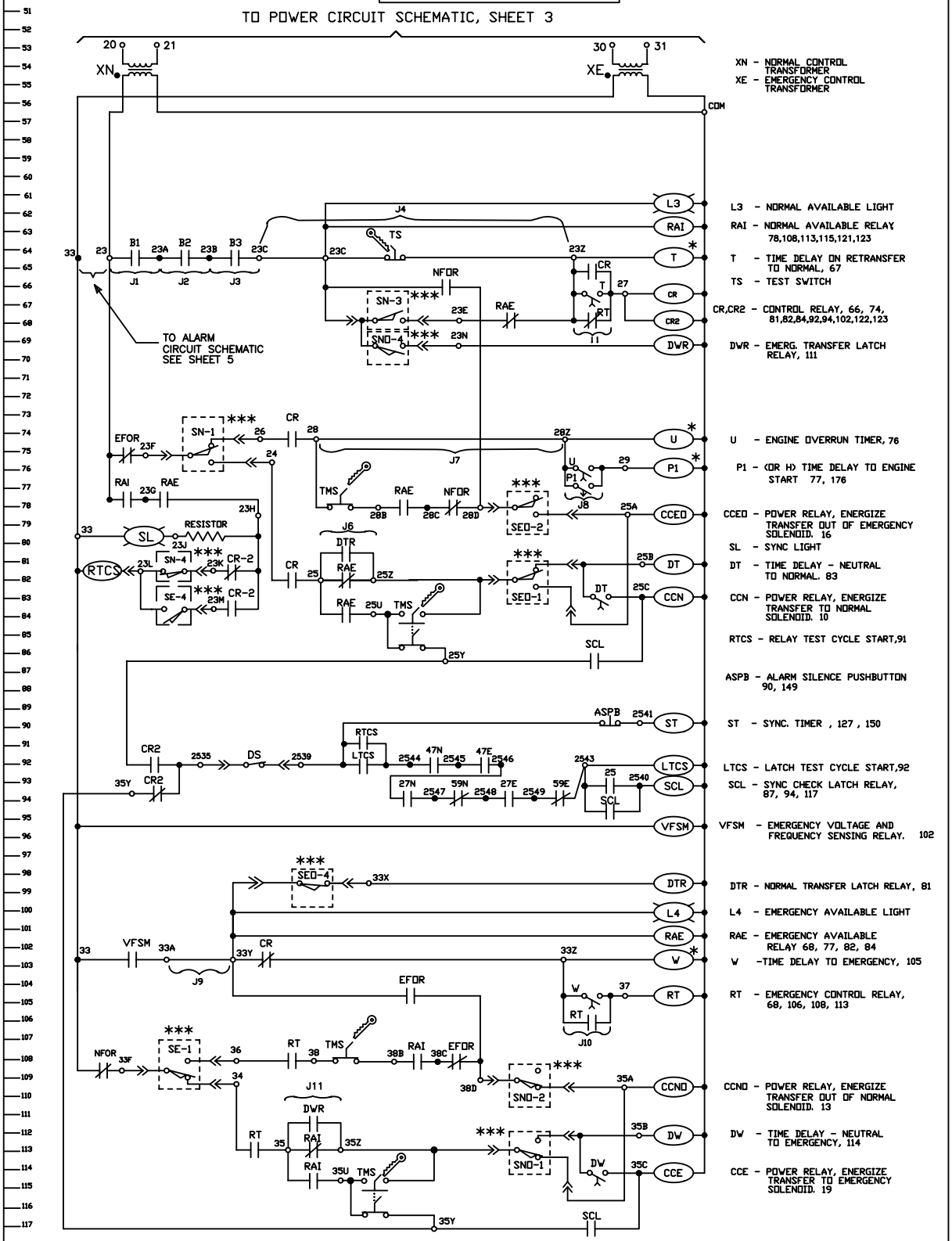
DWG NO.: 43A-7000 REV: H

CADD: S5K SHT. 3 OF 7

ORIGINAL

CONTROL CIRCUIT SCHEMATIC

TO POWER CIRCUIT SCHEMATIC, SHEET 3



JUMPER	CONNECT POINT	STANDARD CTTS COMPONENTS
J1	23,23A	B1
J2	23A,23B	B2
J3	23B,23C	B3
J4	23C,23Z	TS
J5	23Z,27	T
J6	25,25Z	DTR, RAE
J7	28,28Z	
J8	28Z,29	U
J9	33A,33Y	
J10	33Z,37	W
J11	35,35Z	DWR, RAI

NOTE:
ZTSCTH shown in Normal position with no power available

LEGEND
- WIRE CONNECTION
- WIRE ON MAIN TERMINAL BLOCK
- WIRE IN DISCONNECT PLUG
- * OPTIONAL
- *** MECHANICALLY ACTUATED LOCATED ON POWER PANEL

LIMIT SWITCH STATE (X = ACTIVATED)

ATS POSITION	SN	SNO	SEO	SE
NORMAL	X		X	
PARALLED	X			X
EMERGENCY		X		X
OPEN		X	X	

REVISIONS

RV	ECN NO.	DATE	DRF	ENG
G	S-6358	3/11/96	RMC	SB
H	S-6619	11/13/96	AMG	SB

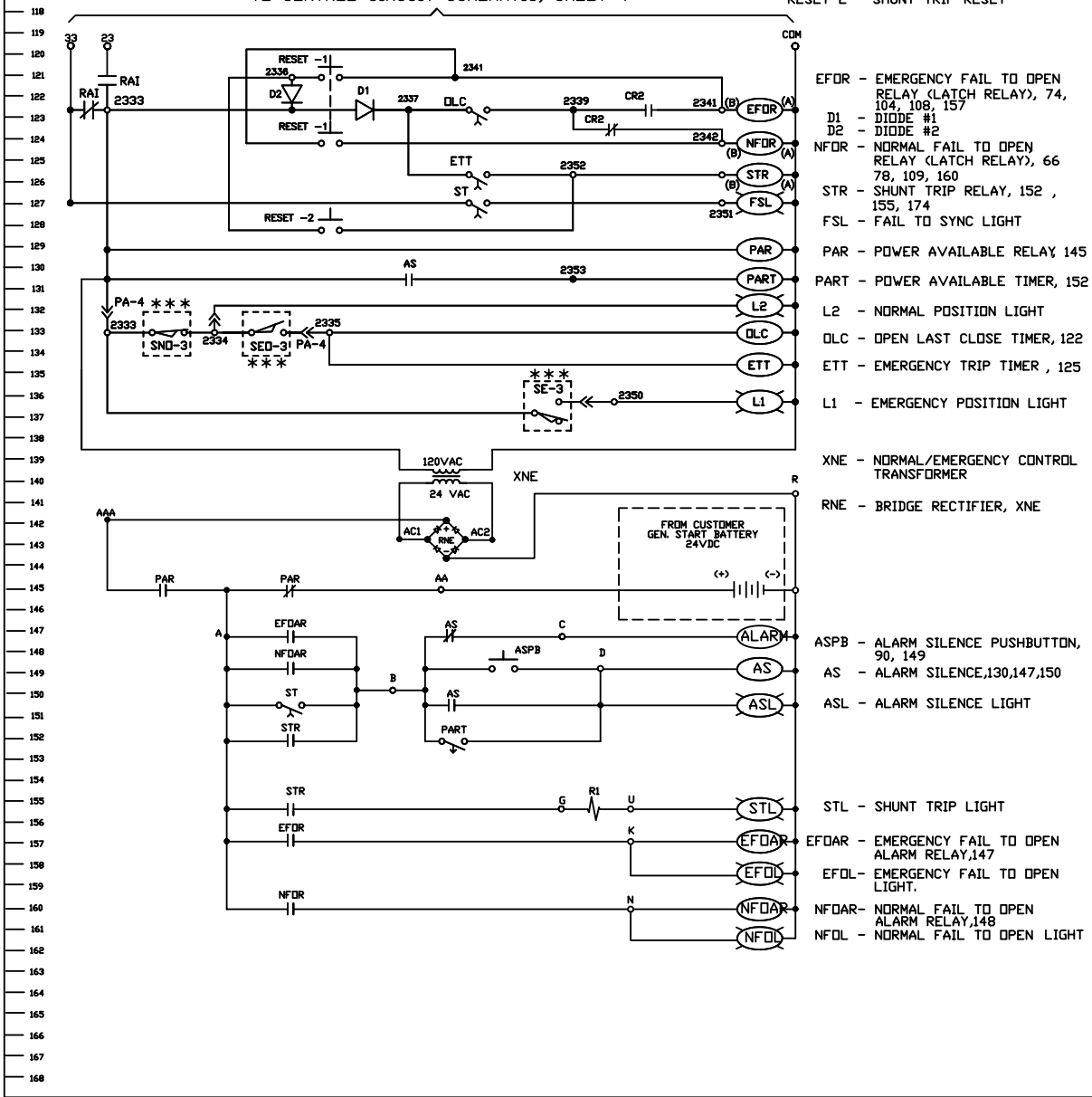
ZENITH CONTROLS, INC.

TITLE: CONTROL CIRCUIT SCHEMATIC
MODEL: ZTSCTH60/120 (600-1200 AMP)

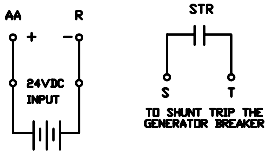
DRFT: IRAY	DATE:	SCALE:	CHK:	APPD:
ENGR: JC	1/27/94	N/A		

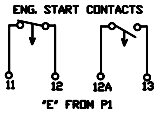
DWG NO.: 43A-7000 SHT. 4 OF 7 REV H
CADD: S5K

ALARM CIRCUIT SCHEMATIC



CUSTOMER CONNECTIONS





A3, A4
SEE POWER CIRCUIT SCHEMATIC AND LAYOUT

CONTACT RATING		
RELAY	CONTACT	RATING
P1		10 AMPS @ 32 VDC.
	A3,A4	20 AMPS,125,250 VAC.

LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —○— WIRE ON MAIN TERMINAL BLOCK ≫ WIRE IN DISCONNECT PLUG *** MECHANICALLY ACTUATED LOCATED ON POWER PANEL		ZTSCTH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
G	S-6358	3/11/96	RMC	SB
H	S-6619	11/13/96	AMG	SB

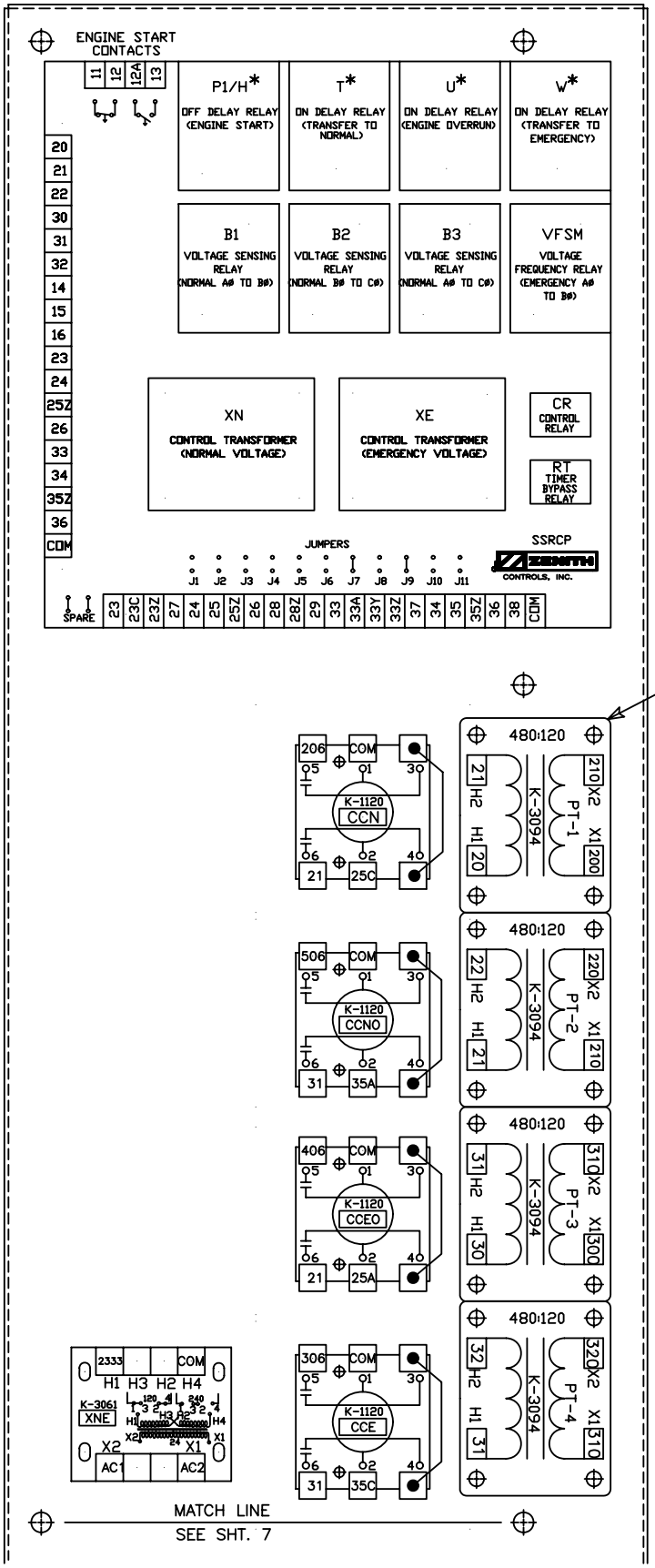
ZENITH CONTROLS, INC.

TITLE: ALARM CIRCUIT SCHEMATIC & CUSTOMER CONNECTIONS
MODEL: ZTSCTH60/120 (600-1200 AMP)

DRFT: IRAY	DATE: 1/27/94	SCALE: N/A	CHK:	APPD:
ENGR: JC				

DWG NO.: 43A-7000 H
CADD: S5K SHT. 5 OF7 REV

ORIGINAL



PT PART #	PRIMARY VOLTAGE
K-3100	600V
K-3094	480V
K-3095	240V
K-3096	208V

PT-1

20 -H1
21 -H2
200-X1
210-X2

PT-2

21 -H1
22 -H2
210-X1
220-X2

PT-3

30 -H1
31 -H2
300-X1
310-X2

PT-4

31 -H1
32 -H2
310-X1
320-X2

* OPTIONAL

ZENITH CONTROLS, INC.

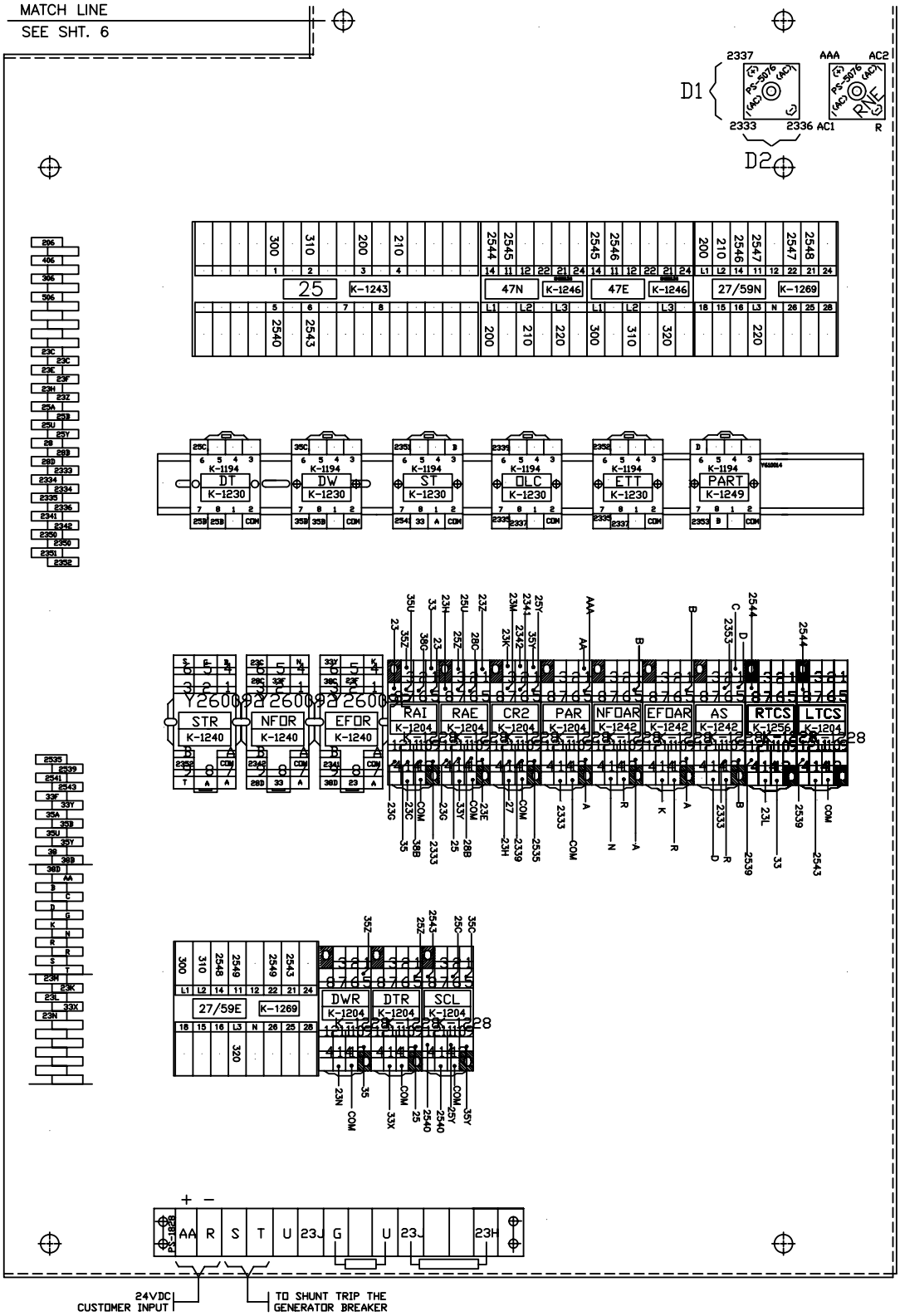
REVISIONS					TITLE: CONTROL PANEL LAYOUT				
RV	ECN NO.	DATE	DRF	ENG	MODEL: ZTSCTH60/120 (600-1200AMP)				
G	S-6358	03/11/96	RMC	SB	DRFT: IRAY	DATE:	SCALE:	CHK:	APPD:
H	S-6619	11/13/96	AMG	SB	ENGR: JC	01/27/94	1 : 2		
					DWG NO.: 43A-7000				H
					CADD: S5K		SHT. 6 OF 7		RCV

ORIGINAL

27/59N	47N	25 BUS	27/59E	47E	25 GEN.
200-L1	200-L1	200-3	300-L1	300-L1	300-1
210-L2	210-L2	210-4	310-L2	310-L2	310-2
220-L3	220-L3		320-L3	320-L3	

CTTS-Frequency, Phase Angle & Voltage window relays

PART # ON DEVICE	SETTINGS
K-1243	0.2 Hz ΔF @ NOMINAL V (≈20%)
K-1269	95% UNDERVOLTAGE PICK-UP & 105% OVERVOLTAGE PICK-UP DIFFERENTIAL SETTINGS AT MINIMUM



SEQUENCE. SWAP TERMINAL L2 & L3 INPUTS FOR A-B-C PHASE SEQUENCE. WIRE NUMBER TO TERMINAL NUMBER CONNECTIONS ON 47N, 47E FOR A-B-C PHASE

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
G	S-6358	3/11/96	RMC	SB
H	S-6619	11/13/96	AMG	SB

ZENITH CONTROLS, INC.

LEGEND	REFERENCE	NOTES

TITLE: CONTROL PANEL LAYOUT
MODEL: ZTSCTH60/120 (600-1200AMP)

DRFT: IRAY	DATE: 1/27/94	SCALE: 1:2	CHK:	APPD:
ENGR: SB				

DWG NO.: 43A-7000 SHT. 7 OF7 REV H
CADD: S5K

ZTSCTH SERIES
AUTOMATIC TRANSFER SWITCHES
1600 TO 3000 AMP

FOR USE ON EMERGENCY OR STANDBY SYSTEMS - RATED FOR TOTAL SYSTEM & MOTOR LOAD

A. LEGEND

N1,2,3,(N).....Normal Line_____
E1,2,3,(N).....Emergency Line_____
T1,2,3,(N).....Load Connections
B1,2,3.....Solid State Phase Relay(s)
Dropout____ %
Pickup____ %
AS.....Alarm Silence Relay
CE.....Main Transfer Operator, Close into Emergency
CEO.....Main Transfer Operator, Open from Emergency
CN.....Main Transfer Operator, Close into Normal
CNO.....Main Transfer Operator, Open from Normal
CCE.....CE Control Relay, Emergency Closing
CCEO.....CEO Control Relay, Emergency Opening
CCN.....CN Control Relay, Normal Closing
CCNO.....CNO Control Relay, Normal Opening
CR ,CR2.....Normal Control Relay
DS.....Disconnect Switch
DT.....Timer, Delay Open To Normal
DTR.....Normal Transfer Latch Relay
DW.....Timer, Delay Open To Emergency
DWR.....Emergency Transfer Latch Relay
D1.....Diode #1
D2.....Diode #2
E.....Engine Start Contact
EFOAR.....Emergency Fail to open Alarm Relay
EFOR.....Emergency Fail to open Relay
ETT.....Emergency Trip Timer
GND.....Ground
LTCS.....Latch Test Cycle Start
NB.....Neutral Bar (if required)
NFOAR.....Normal Fail to open Alarm Relay
NFOR.....Normal Fail to open Relay
OLC.....Open Last Close Timer
PAR.....Power Available Relay
PART.....Power Available Timer
PT-1,2..... Potential Transformers Normal
PT-3,4.....Potential Transformers Emergency
RAE.....Emergency Available Relay
RAI.....Normal Available Relay
RE.....Bridge Rectifier, CE
REO.....Bridge Rectifier, CEO
RN.....Bridge Rectifier, CN
RNE.....Bridge Rectifier, XNE
RNO.....Bridge Rectifier, CNO
RT.....Emergency Control Relay
RTCS.....Relay Test Cycle Start
SCL.....SYNC Check Latch
SE,SEO.....Cutout Switch, Emergency
SN,SNO.....Cutout Switch, Normal
ST.....SYNC Timer
STR.....Shunt Trip Relay
VFSM.....Emergency Volt-Freq. Relay
Pickup {90% of rated Voltage, and {95% of rated Frequency
XE.....Control Transformer, Emergency
XN.....Control Transformer, Normal
XNE.....Control Transformer - Norm./Emerg.
25(ANSI).....Sync Check Relay
47N,E(ANSI).....Phase sequencing - Norm./Emerg.
27/59N,E(ANSI)..Over/Undervoltage - Norm./Emerg.

B. OPERATION (OPEN TRANSITION)

(See note #4)

When the Normal Line falls to the preset dropout point, the phase relays will dropout disconnecting the CR relay.

When the Emergency Line voltage & frequency reach the preset pickup point, the VFSM relay picks up. RT relay picks up to operate the CCNO relay through the SE & SNO cutout switches causing the emergency main transfer operator CNO to operate. The load is now transferred to the Open position. The SNO limit switch operates to disconnect the CCNO relay and CNO main transfer operator. The transfer switch is now mechanically locked open. Limit switch SNO is now activated, picking up the DW timer. After a set time delay, DW will pick up the CCE relay which will then pick up CE main transfer operator. The load is now transferred to the Emergency line. The SE limit switch operates to disconnect the CCE relay and CE main transfer operator. The transfer switch is now mechanically locked in Emergency.

When the Normal Line voltage exceeds the preset pick up point, the phase relays B1, B2, & B3 pick up. CR relay picks up to operate the CCEO relay through the SN & SEO cutout switches, causing the main transfer operator CEO to operate. The load is now transferred to the Open position. The SEO limit switch operates to disconnect the CCEO relay and CEO main transfer operator. The transfer switch is now mechanically locked Open. Limit switch SEO is now activated, picking up the DT timer. After a set time delay, DT will pick up the CCN relay which will then pick up the CN main transfer operator. The load is now re-transferred back to the Normal line. The SN limit switch operates to disconnect the CCN relay and CN main transfer operator. The transfer switch is now mechanically locked in Normal.

DS - Disconnect Switch
When the Disconnect Switch is placed in the INHIBIT position the circuit to the main transfer operators CN/CNO and CE/CEO is opened and transfer cannot take place.

TS - Test Switch
The Test Switch simulates a normal line failure when activated.
To test, activate the Test Switch allowing the transfer switch to transfer to the EMERGENCY position. De-activate the Test Switch. The transfer switch will reset to the NORMAL position. Testing at least once a month is recommended. For hospital emergency systems, test once a week.

C. ACCESSORIES

The ZTSCTH series transfer switch is wired so that accessories can be easily added to the switch. The following is a description of the accessories which are supplied on this unit.

- ☐ A1 Auxiliary contact, S.P.D.T., operates on normal line failure.
- ☐ A1E Auxiliary contact, S.P.D.T., operates on emergency line failure.
- ☐ A3 Auxiliary contact closes when the transfer switch is in the Emergency position.
- ☐ A4 Auxiliary contact closes when the transfer switch is in Normal position.
- ☐ A6 Motor Disconnect. To de-energize external motor control circuit 5 seconds (adjustable) prior to transfer in either direction.
- ☐ C Plant Exercisor. Automatically starts generator for selected time intervals.
- ☐ C/D Plant Exercisor. Automatically starts generator to run unloaded or simulate a power failure and starts generator to run under load.
- ☐ E Engine Start Contact: 1 Normally Open 1 Normally Closed.
- ☐ F Auxiliary Fan Contact, S.P.N.O. Closes when generator is running.
- ☐ H Time delay to engine start, non-adjustable. Factory set 1 or 3 seconds. When the Normal line fails the relay de-energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.
- ☐ J1 Adjustable under frequency sensor.
- ☐ J2 Adjustable over/under frequency sensor.
- ☐ K Frequency meter to indicate load frequency.
- ☐ L1 Pilot Light. Switch in Emergency Position.
- ☐ L2 Pilot Light. Switch in Normal Position.
- ☐ L3 Pilot Light. Normal source available.
- ☐ L4 Pilot Light. Emergency source available.
- ☐ M1 Ammeter; Single phase.
- ☐ M2 Ammeter; Three phase
- ☐ M3 Voltmeter; Single phase.
- ☐ M4 Voltmeter; Three phase.
- ☐ P1 Time Delay to Engine Start (solid state). Adjustable over time range .5 to 6 seconds. When the Normal line fails the relay de-energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in Normal position, the relay energizes and the engine start contacts open to shut down the engine.
- ☐ P2 Time Delay to Engine Start (Pneumatic). Adjustable over time range 1/6 to 300 seconds. When the Normal line fails, the relay de-energizes. After the set time delay its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.
- ☐ Q2 Connections for remote peak shave or area protection relays. Includes bypass for automatic return to Normal if Emergency line fails and Normal is present.
- ☐ R1 Solid State Adjustable Overvoltage Relay(s). Set at 110% of pickup, 105% of dropout of nominal Line rate, unless otherwise specified.
- ☐ R4 In-Phase monitor. Prevents transfer until two sources are in-phase. For use of isochronous governors.
- ☐ R43 In-phase monitor. Prevents transfer until two sources are in-phase. For use with mechanical. governors.
- ☐ S1 Four-position Engine Control Selector Switch. "STOP", "HAND CRANK", "TEST", "AUTOMATIC".
- ☐ T Time delay, re-transfer to Normal. When the Normal line restores and the phase relays operate, the T timer is energized. After the set time delay, its contacts close the circuit to the CR relay which operates to restore the load to the Normal line. RT relay is supplied to bypass T contacts if Emergency is de-energized during timing. CAUTION-DO NOT SET TIMER AT THE "0" POINT.
- ☐ T3 W3 Presignal auxiliary Contact, S.P.D.T: Operates 0-30 seconds (adjustable) prior to transfer in either direction.
- ☐ U Time delay, engine cool-down. When the transfer switch is restored to the Normal position and the engine is signaled to shut down, the U timer operates to maintain the engine start circuit closed. At the end of the set time, the engine contacts open to shut down the engine. CAUTION-DO NOT SET TIMER AT THE "0" POINT.
- ☐ W Time delay, transfer to Emergency. When the Normal line fails and the engine has started, the VFSM relay energizes. The W timer energizes. After the set time delay, its contacts close to energize the RT relay. CAUTION-DO NOT SET TIMER AT THE "0" POINT.
- ☐ YE Pushbutton Transfer to Emergency. Provides manual control of transfer to emergency source. If time delay accessory W is supplied pushbutton bypasses time delay for immediate transfer; otherwise, transfer to emergency will be automatic after time delay. If time delay accessory W is not supplied, transfer will be non-automatic (by pushbutton only).
- ☐ YN Pushbutton to Retransfer to Normal. Provides manual control of retransfer to normal source. If time delay accessory T is supplied, pushbutton bypasses time delay for immediate retransfer; otherwise, retransfer to normal will be automatic after time delay. If time delay accessory T is not supplied, retransfer will be non-automatic (by pushbutton only).

Other: _____
_____
_____

NOTES:

1. ⚠ CAUTION:In using a 3 phase, 4 wire delta or open delta power supply (usually 120/240 volts, sometimes listed as 120/208 volts) with one leg having a grounded center tap, one line will be 160 to 208 volts to ground. When such a system is used it is necessary to connect the high leg to N2.DO NOT CONNECT 120 VOLT LOAD CIRCUIT TO THE HIGH LEG.
2. GROUNDING TERMINAL: A grounding terminal (GND) is provided. When installing open type switches connect this to the metal enclosure or conduit.
3. ⚠ WARNING - TO ENSURE AGAINST SHOCK OR ACCIDENT HAZARD, DISCONNECT ALL SOURCES OF SUPPLY BEFORE SERVICING.
4. OPEN TRANSITION OPERATION CAN BE SELECTED WITH BOTH SOURCES AVAILABLE. OPEN TRANSITION OCCURS BY DEFAULT WHEN THE LOAD-CONNECTED SOURCE FAILS.
5. ON SINGLE PHASE UNITS WHERE THE EMERGENCY SOURCE IS A UTILITY LINE, CONNECT EMERGENCY LINE SO THAT MINIMUM VOLTAGE IS MEASURED FROM N1 TO E1.
6. ON SINGLE PHASE (2 POLE) UNITS, CENTER POLE AND PHASE RELAYS (B2,B3) ARE NOT SUPPLIED ALSO 47N & 47E ARE ELIMINATED.

3Ø 27/59N & E ARE REPLACED BY 1Ø 27/59N & E.

ACCESSORY LIST:

NOTES:

ZENITH CONTROLS, INC.

REVISIONS					
RV	ECN NO.	DATE	DRF	ENG	
E	S-6358	03/11/96	RMC	SB	
F	S-6619	11/21/96	SG	SB	

TITLE: LEGEND AND ACCESSORIES
MODEL: ZTSCTH160/300 (1600-3000 AMP)

DRFT: IRAY	DATE:	SCALE:	CHK:	APPD:
ENGR: JC	1/27/94	N/A		

DWG NO.: 43A-7001 REV: F
CADD: S5K SHT. 1 OF7

ORIGINAL

D. LEGEND (PILOT DEVICES)

ASL.....Alarm Silence Light
ASPB.....Alarm Silence Pushbutton
EFOL.....Emergency Fail to open light
FSL.....Fail to SYNC Light
L1.....Emergency Position Light
L2.....Normal Position Light
L3.....Normal Available Light
L4.....Emergency Available Light
NFOL.....Normal Fail to open Light
RESET-1.....Fail to Open Lockout Reset
RESET-2.....Shunt Trip Reset
SL.....SYNC Light (Dark SYNC)
STL.....Shunt Trip Light
TMS.....Transition Mode Selector
TS.....Test Switch maintained, keyed

E. OPERATION - CLOSED TRANSITION

Zenith Closed Transition Transfer Switches are designed to Transfer load between two available sources, without interrupting power to the load (make before break). Paralleling of the two sources occurs within a predefined window of synchronization and lasts less the 100ms. The initial source is then disconnected.

To test the ATS, turning the Test Switch (TS) to Test initiates transfer by dropping out the Engine Start Relay. Turning the "TS" disables the circuit which transfers to Normal and enables the circuit which transfers to Emergency. The ATS closes into Emergency only after the SYNC Check Relay ensures the proper phase relationship of both sources. After the ATS closes into Emergency the SE limit switch becomes activated to de-energize the CCE relay and energize the CCNO relay, which opens the ATS out of Normal. When the ATS has opened out of Normal, the SNO-2 limit switch activates to de-energize the CCNO relay. The ATS has now closed into Emergency Power without interrupting the load.

Turning the "TS" to "AUTO" intiates transfer to Normal. Turning the "TS" disables the circuit which transfers to Emergency and enables the circuit which transfers to Normal. The ATS closes into Normal only after the SYNC Check Relay ensures proper phase relationship of both sources. After the ATS closes into Normal the SN limit switch becomes activated to de-energize the CCN relay and energize the CCEO relay, which opens the ATS out of Emergency. When the ATS has opened out of Emergency, the SEO-2 limit switch activates to de-energize the CCEO relay. The ATS has now closed back into Normal Power without interrupting the load.

The ATS defaults to an open transition transfer when the Normal source fails. This signals the generator to start. After the generator voltage and frequency are at the proper level, the ATS transfers to Emergency. Closed transition transfer is not possible with one source available. One can select an Open Transition transfer via the Transition Mode Selector (TMS) for testing also.

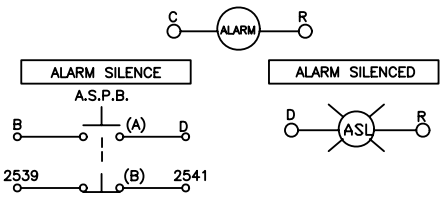
If while in Closed Transition Mode, the ATS fails to open the source it is attempting to "transfer out of", the source that the ATS just closed into will be opened leaving the ATS in its initial source while disabling all other transfer operations until the problem is corrected and the "reset" has been turned. Also a dry contact to shunt trip the generator circuit breaker is available to remove the generator from the bus if neither operator opened.

A 24 VDC control circuit is supplied to control the Alarm and Warning indicators. To insure continuous power to this circuit, the customer supplies the 24 VDC.

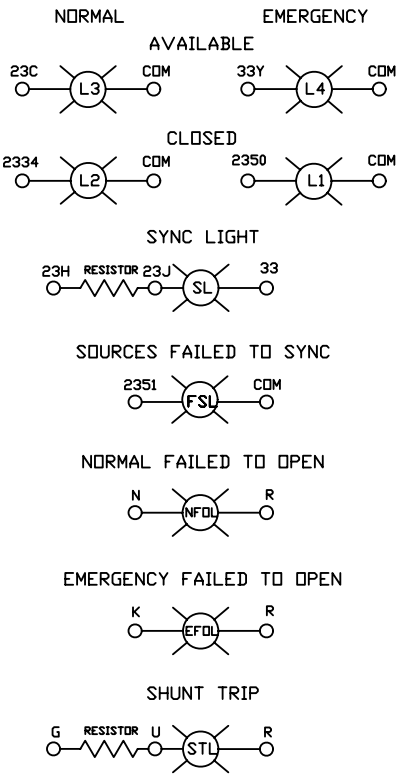
F. PARALLELING REQUREMENTS

A. The unit is Factory set to accomplish transfer within 5 electrical degrees (at 0.1 Hz Δ F).
B. Requires an Isochronous Governor with an operating frequency of 60 ±0.2 Hz.
C. Requires a shunt trip breaker on the Generator set with a response time not exceeding 50 ms.

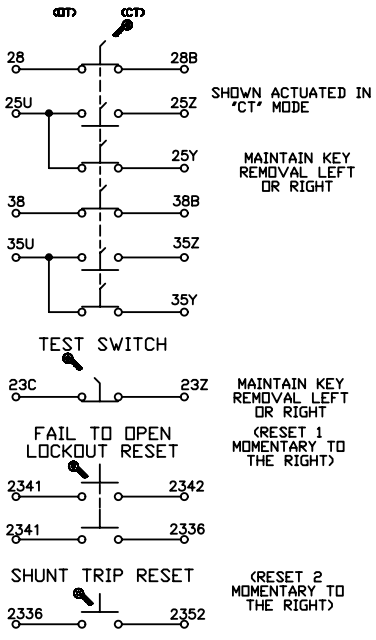
CABINET FRONT



CABINET FRONT



TRANSITION MODE SELECT



LEGEND	REFERENCE	NOTES

REVISIONS

RV	ECN NO.	DATE	DRF	ENG
E	S-6358	03/11/96	RMC	SB
F	S-6619	11/21/96	SG	SB

ZENITH CONTROLS, INC.

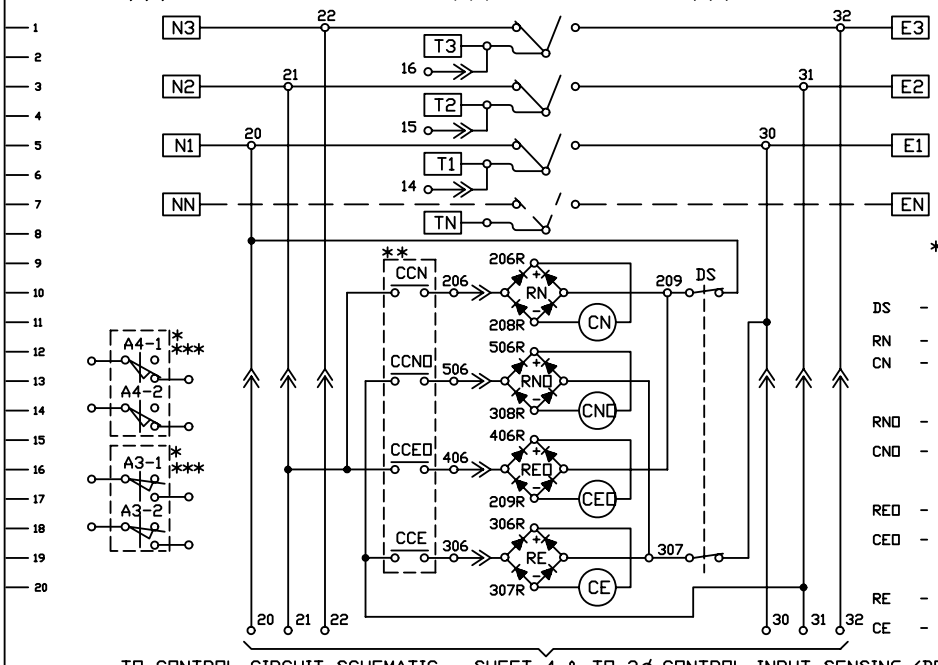
TITLE: CT OPERATION & CABINET FRONT
MODEL: ZTSCTH160/300 (1600-3000 AMP)

DRFT: IRAY	DATE:	SCALE:	CHK:	APPD:
ENGR: JC	1/27/94	N/A		

DWG NO.: 43A-7001 REV: F
CADD: S5K SHT. 2 OF 7

ORIGINAL

POWER CIRCUIT SCHEMATIC

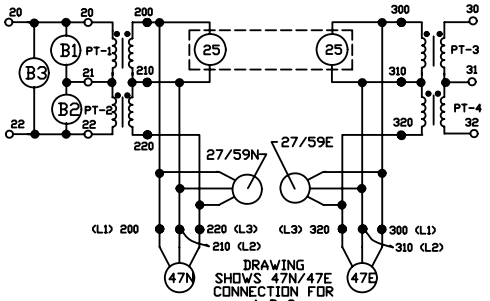


VOLTAGE SYSTEMS			
	VOLTS	NO. OF PHASES	NO. OF WIRES
-3	240V, 60HZ	3	3
-31	208, 60HZ	3	3
-38	120/240,60HZ	3	4
-4	120/208,60HZ	3	4
-5	480,60HZ	3	3
-7	277/480,60HZ	3	4
-9	240/416,60HZ	3	4
-91	220/380V,60HZ	3	4
-92	220/380V,50HZ	3	4

* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEM

DS - DISCONNECT SWITCH FOR SERVICING
RN - BRIDGE RECTIFIER, CN
CN - TRANSFER OPERATOR, CLOSE INTO NORMAL
RNO - BRIDGE RECTIFIER, CNO
CNO - TRANSFER OPERATOR, OPEN FROM NORMAL
REO - BRIDGE RECTIFIER, CEO
CEO - TRANSFER OPERATOR, OPEN FROM EMERGENCY
RE - BRIDGE RECTIFIER, CE
CE - TRANSFER OPERATOR, CLOSE INTO EMERGENCY

3Ø CONTROL SENSING



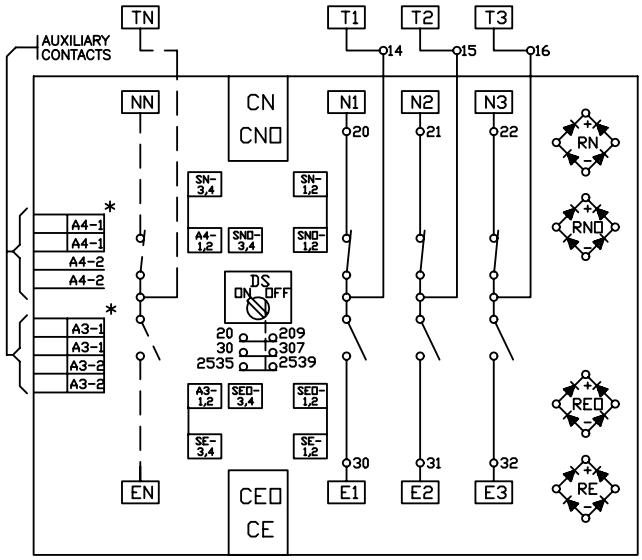
DRAWING SHOWS 47N/47E CONNECTION FOR A-B-C

PHASE ROTATION SEQUENCE. (PARENTHESIS=DEVICE TERMINAL #'s)
IF PHASE ROTATION SEQUENCE IS A-C-B
SWAP L2 & L3 TERMINAL INPUTS ON EACH 47 RELAY.

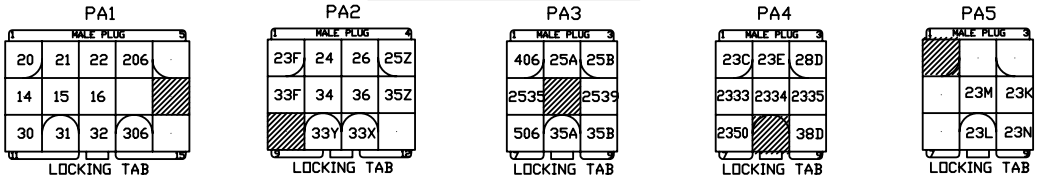
LEGEND:

PT- 1,2 - NORMAL POTENTIAL TRANSFORMERS
PT- 3,4 - EMERGENCY POTENTIAL TRANSFORMERS
B1,2,3 - UNDER VOTAGE RELAYS , 64
27/59N - NORMAL UNDER/OVER VOLTAGE RELAY, 92
27/59E - EMERGENCY UNDER/OVER VOLTAGE RELAY, 92
47N - PHASE SEQUENCING NORMAL , 92
47E - PHASE SEQUENCING EMERG. , 92
25 - SYNC CHECK RELAY, 93

POWER PANEL LAYOUT



INTERCONNECT PLUGS



LEGEND	REFERENCE	NOTES
WIRE CONNECTION WIRE ON MAIN TERMINAL BLOCK WIRE IN DISCONNECT PLUG ** LOCATED ON CONTROL PANEL *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL		ZTSCTH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
E	S-6358	03/11/96	RMC	SB
F	S-6619	11/21/96	SG	SB

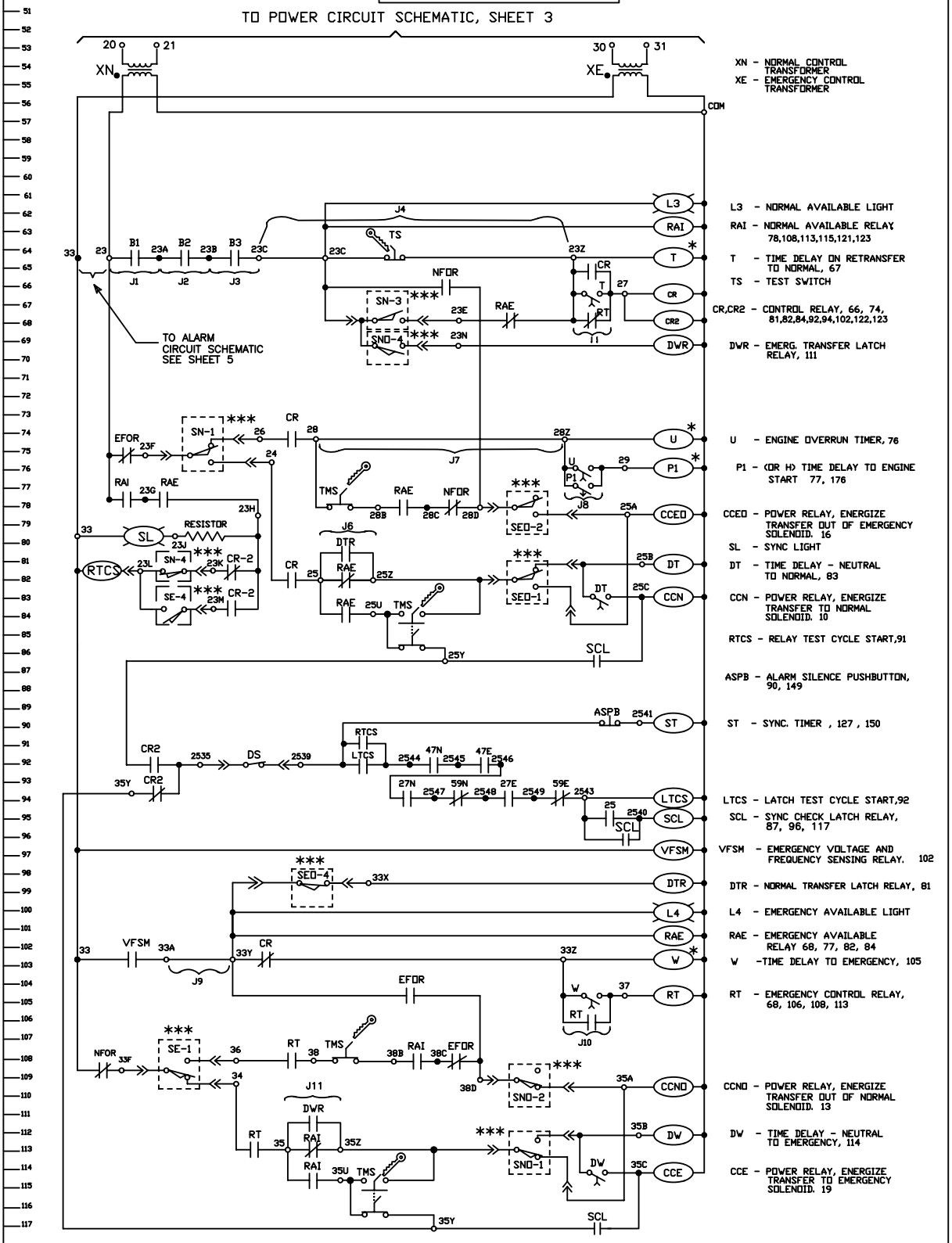
ZENITH CONTROLS, INC.

TITLE: POWER CIRCUIT & 3Ø CONTROL SENSING
MODEL: ZTSCTH160/300 (1600-3000 AMP)
DRFT: IRAY | DATE: | SCALE: | CHK: | APPD:
ENGR: JC | 1/27/94 | N/A
DWG NO.: 43A-7001 | REV: F
CADD: S5K | SHEET 3 OF 7

ORIGINAL

CONTROL CIRCUIT SCHEMATIC

TO POWER CIRCUIT SCHEMATIC, SHEET 3



JUMPER	CONNECT POINT	STANDARD CTTS COMPONENTS
J1	23,23A	B1
J2	23A,23B	B2
J3	23B,23C	B3
J4	23C,23Z	TS
J5	23Z,27	T
J6	25,25Z	DTR, RAE
J7	28,28Z	
J8	28Z,29	U
J9	33A,33Y	
J10	33Z,37	W
J11	35,35Z	DWR, RAI

NOTE:
ZTSCTH shown in Normal position with no power available

LEGEND
- WIRE CONNECTION
- WIRE ON MAIN TERMINAL BLOCK
- WIRE IN DISCONNECT PLUG
- * OPTIONAL
- ** LOCATED ON BYPASS OR BYPASS SUBPANEL
- *** MECHANICALLY ACTUATED LOCATED ON POWER PANEL

LIMIT SWITCH STATE (X = ACTIVATED)

ATS POSITION	SN	SNO	SEO	SE
NORMAL	X		X	
PARALLED	X			X
EMERGENCY		X		X
OPEN		X	X	

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
E	S-6358	03/11/96	RMC	SB
F	S-6619	11/21/96	SG	SB

ZENITH CONTROLS, INC.

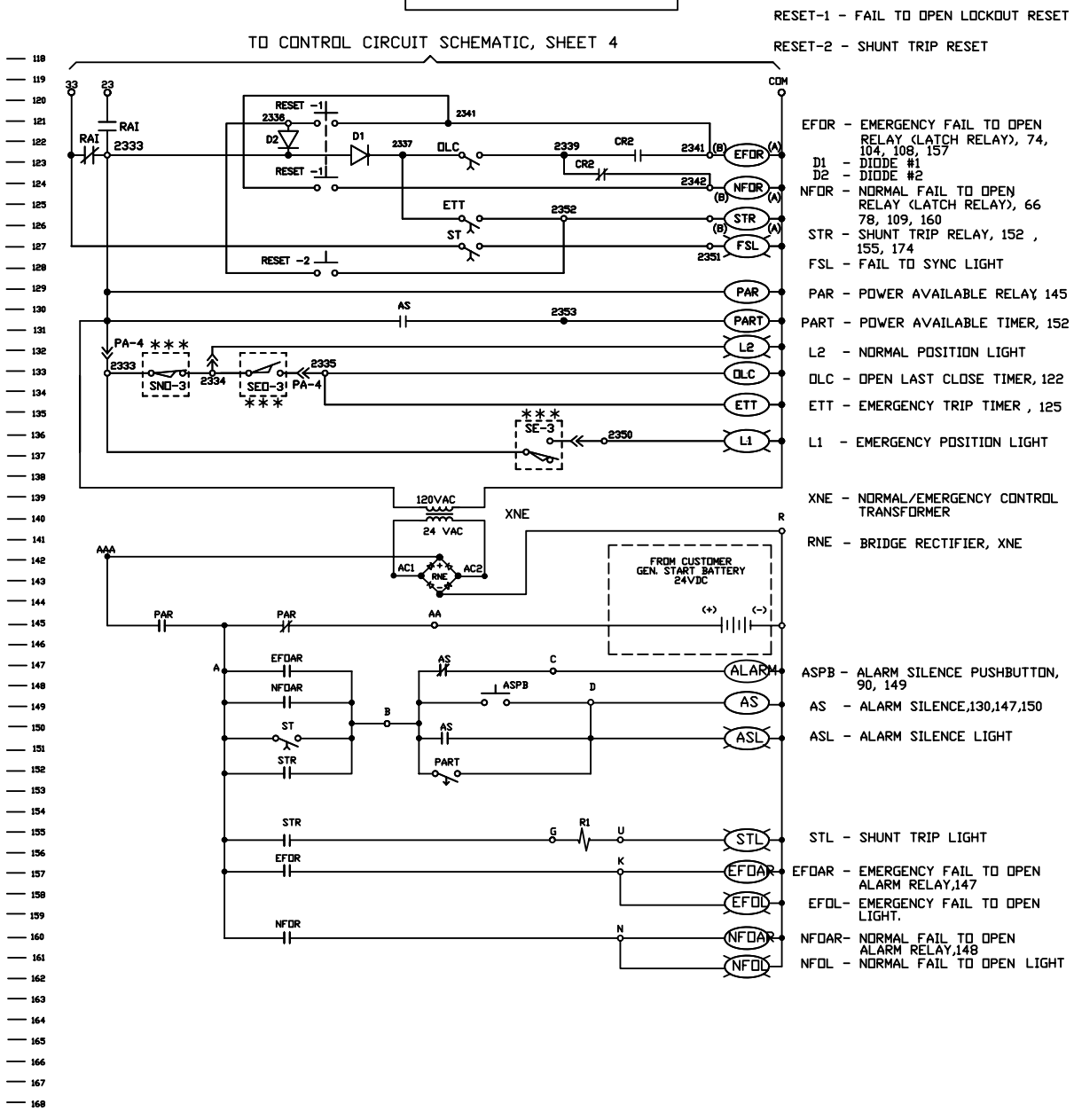
TITLE: CONTROL CIRCUIT SCHEMATIC
MODEL: ZTSCTH160-300 (1600-3000 AMP)

DRFT: IRAY	DATE:	SCALE:	CHK:	APPD:
ENGR: JC	1/27/94	N/A		

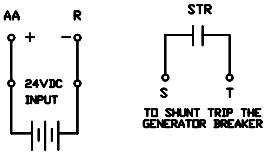
DWG NO.: 43A-7001 F
CADD: S5K SHT. 4 OF 7 REV

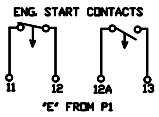
ORIGINAL
ORIGINAL

ALARM CIRCUIT SCHEMATIC



CUSTOMER CONNECTIONS





A3, A4
SEE POWER CIRCUIT SCHEMATIC AND LAYOUT

CONTACT RATING		
RELAY	CONTACT	RATING
P1	E	10 AMPS @ 32 VDC.
	A3,A4	20 AMPS,125,250 VAC.

LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —○— WIRE ON MAIN TERMINAL BLOCK ≫ WIRE IN DISCONNECT PLUG *** MECHANICALLY ACTUATED LOCATED ON POWER PANEL		ZTSCTH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
E	S-6358	03/11/96	RMC	SB
F	S-6619	11/21/96	SG	SB

ZENITH CONTROLS, INC.

TITLE: ALARM CIRCUIT SCHEMATIC & CUSTOMER CONNECTIONS

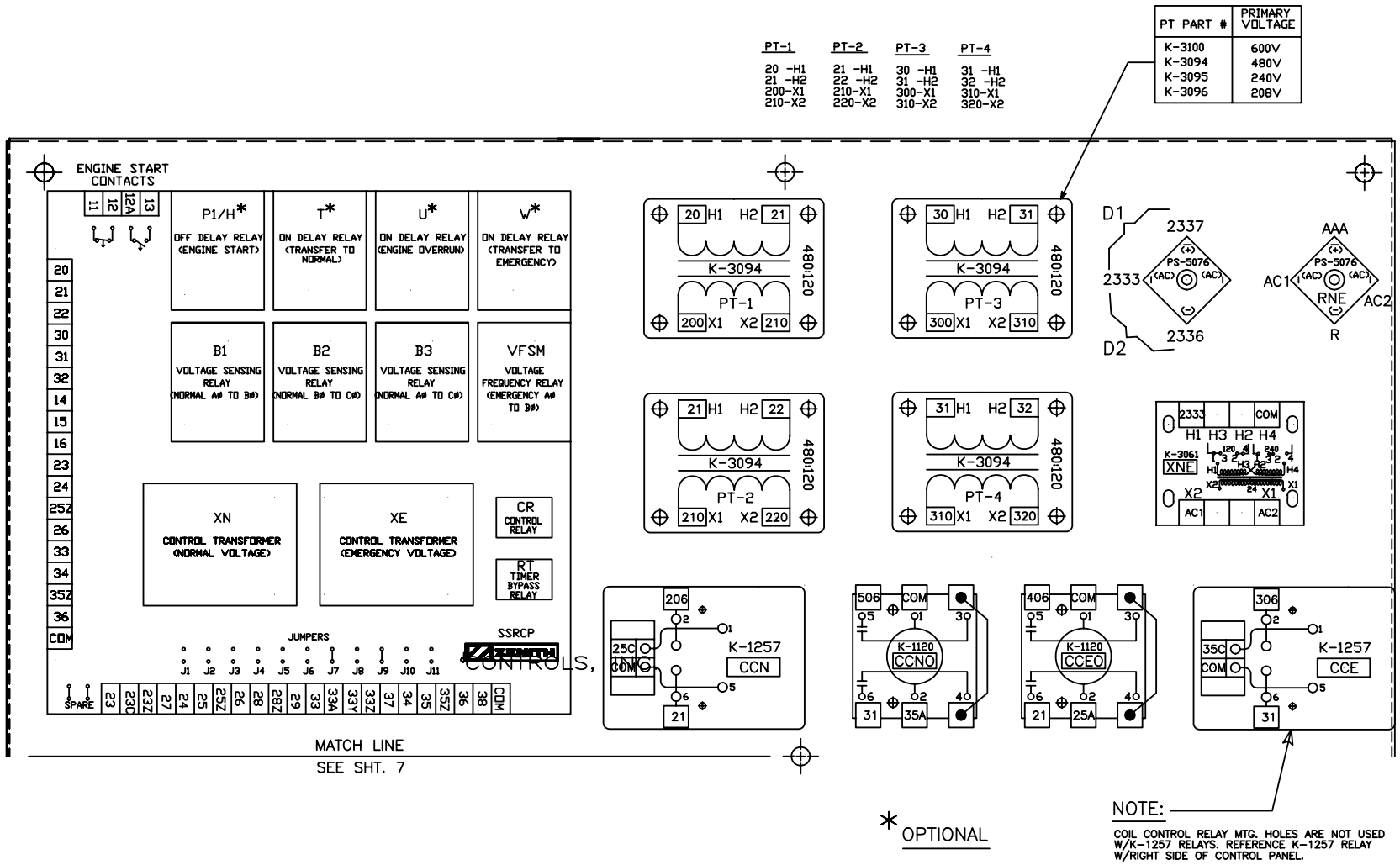
MODEL: ZTSCTH160/300 (1600-3000 AMP)

DRFT: IRAY	DATE: 1/27/94	SCALE: N/A	CHK:	APPD:
ENGR: JC				

DWG NO.: 43A-7001 REV F

CADD: S5K SHT. 5 OF7

ORIGINAL



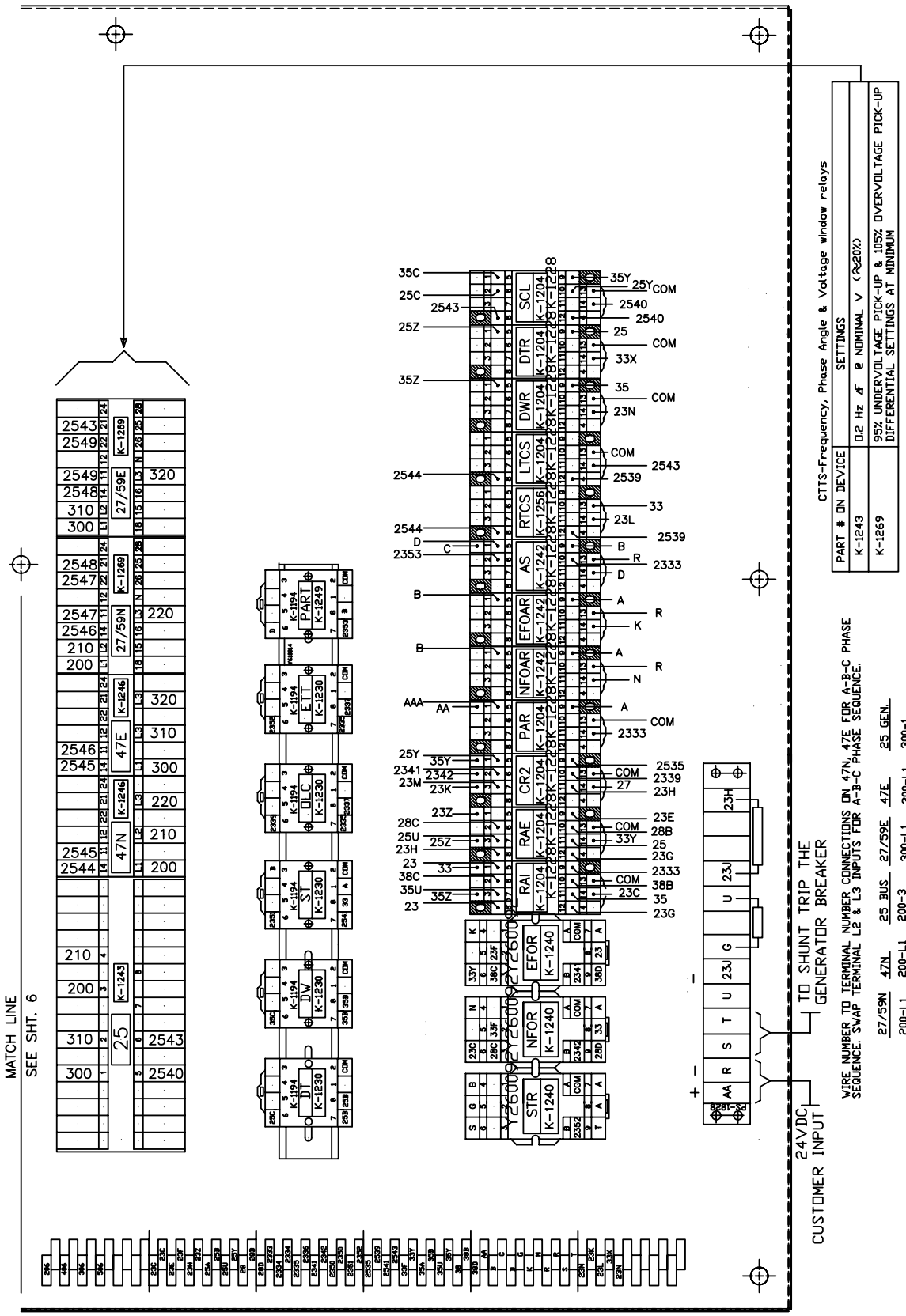
LEGEND | REFERENCE | NOTES

RV	ECN NO.	DATE	DRF	ENG
E	S-6358	03/11/98	RMC	SB
F	S-6619	11/21/96	SG	SB

REVISIONS

ZENITH CONTROLS, INC.

TITLE: CONTROL PANEL LAYOUT
MODEL: ZTSH160/300 (1600-3000 AMP)
DRFT: IRAY | DATE: 01/27/94 | SCALE: 1:2 | CHK: | APPD:
ENGR: JC
DWG NO.: 43A-7001 | REV F
CADD: S5K | SHT. 6 OF 7



LEGEND	REFERENCE	NOTES

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
E	S-6358	03/11/96	RMC	SB
F	S-6619	11/21/96	SG	SB

ZENITH CONTROLS, INC.

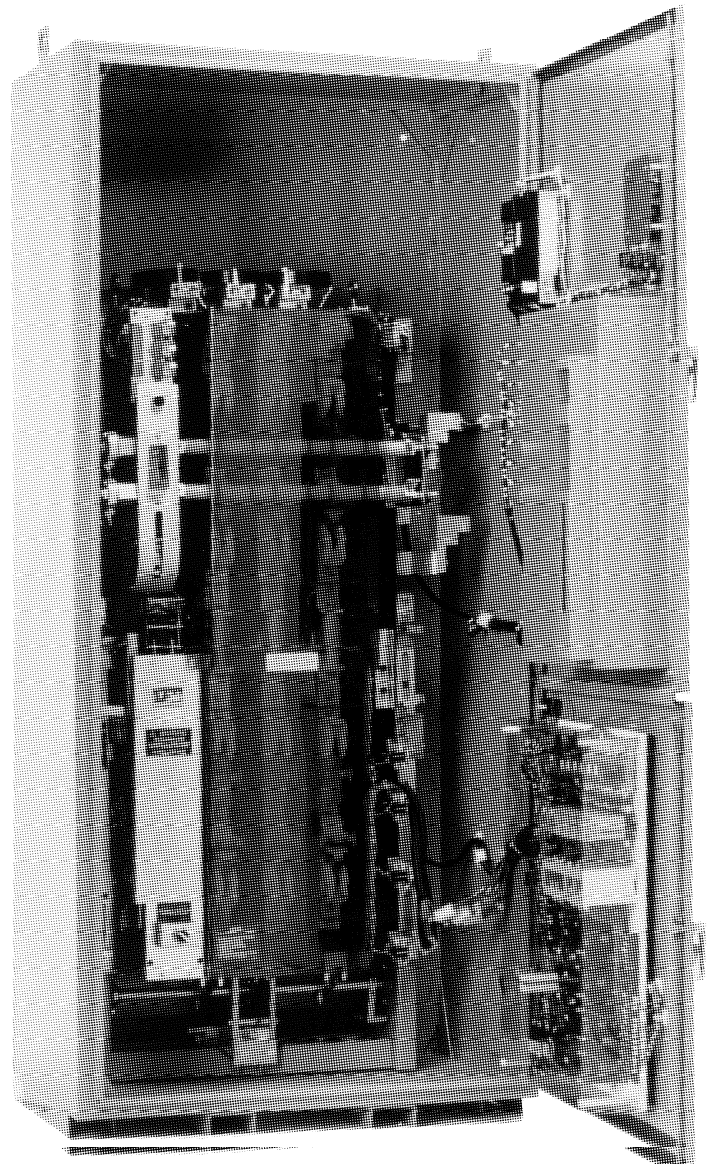
TITLE: CONTROL PANEL LAYOUT
MODEL: ZTSCTH160/300 (1600-3000 AMP)

DRFT: IRAY	DATE: 1/27/94	SCALE: 1:2	CHK:	APPD:
ENGR: JC				

DWG NO.: 43A-7001 REV: F
CADD: S5K SHT. 7 OF 7

ZENITH®
CONTROLS, INC.

OPERATION AND MAINTENANCE MANUAL
ZBTSCTH SERIES POWER PANEL
100 - 4000 AMPS



ISO 9001

46R-7000D
Rev 8/97

INTRODUCTION

Zenith Bypass-Isolation Closed Transition Transfer Switches provide Zenith's most comprehensive load power protection during standard operation, maintenance and testing procedures.

Closed Transition Transfer Switches parallel two available sources of power during test procedures to enable transfer without interrupting power to the load (make-before-break). Paralleling of the two sources occurs within a predefined window of synchronization and the initial source is then disconnected. If the primary source falls below preset voltage limits and the second source is available, the transfer switch defaults to open transition (break-before-make) mode. In this mode, the transfer switch uses the power from the available source to open the switch from the "dead source" first, before closing the switch into the second source. When in the Bypass-Isolation mode, the switch acts as a manual transfer switch, enabling testing, repair and even removal of the automatic transfer switch.

All Zenith transfer switches are designed for use on emergency or standby systems, and are rated for total system or motor loads. Transfer switches are UL Listed under Standard 1008 and CSA Certified under Standard C22.2 No. 178.

This manual provides information on the installation, operation, and maintenance of the switch. In addition, a complete information package is supplied with each transfer switch which details the features and accessories provided on that switch. The information package and the instruction manual should be kept in a readily accessible location to provide complete reference information on this critically important piece of equipment.

TABLE OF CONTENTS

Section I **INSTALLATION..... 2**
1. Requirements 2
2. Equipment Inspection and Storage 2
3. Mounting 2
4. Power Connections 3
5. Control Connections 4
6. Final Equipment Inspection 5
7. Functional Test 5

Section II **OPERATION AND FEATURES..... 6**
1. Sequence Of Operation 6
2. Bypass-Isolation Switch Operation 8
3. Zenith Standard Package 11
4. Zenith Optional Accessories 11

Section III **MAINTENANCE AND TESTING..... 12**
1. Inspection and Cleaning 12
2. Servicing 12
3. Testing 12
4. Troubleshooting 13
5. Emergency Service Procedure/Extended Parallel Time 14

Section IV **ADJUSTMENTS AND SETTINGS..... 16**
1. Paralleling Relay Settings 16
2. Solid State Timers 16
3. Voltage/Frequency Sensor (VFSM) 16
4. Solid State Phase Relay (ARSM) 17
5. Paralleling Window Under-Overvoltage Sensing Relay 17
6. Electronic Time Switch Z2000-2A 17

Appendix A **TYPICAL SCHEMATIC DIAGRAMS..... 19**
1. 100-400 Amps 19
2. 600-3000 Amps 20
3. Alarm Circuit Schematic 21
4. Three-Phase Control Sensing Schematic 21
5. Bypass Control Circuit 22

Appendix B **REPLACEMENT PARTS..... 23**
1. Power Panel — 100-400 Amps 23
2. Power Panel — 600-1200 Amps 23
3. Power Panel — 1600-3000 Amps 24
4. Bypass Subpanel 24
5. Control Panel Layout and Parts List 28
6. Cabinet Door Pilot Devices 31

SECTION I - INSTALLATION

⚠ DANGER

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or any of its components.

Each Zenith transfer switch is factory wired and tested. A complete information package is furnished with each switch which includes:

a. Sequence of operation.
b. Description and operation of all accessories supplied.
c. Power panel connection diagram and schematic.
d. Description and identification of all customer field connections.

Installation of Zenith transfer switches includes:

a. Mounting the transfer switch cabinet.
b. Connection of all Normal, Emergency, and Load cables or bus bars.
c. Connection of external control circuits as required.

1. REQUIREMENTS

⚠ DANGER

Closed transition transfer switches typically require momentary paralleling of utility and generator sources. The customer should obtain approval from their utility before using a closed transition transfer switch.

The following requirements must be met to use a closed transition transfer switch:

a. Isochronous governor with a frequency range of 60 ± 0.2 Hz.
b. Shunt trip breaker on the genset with a response time not exceeding 50 milliseconds.

2. EQUIPMENT INSPECTION AND STORAGE

Immediately inspect the transfer switch when received to detect any damage which may have occurred during transit. If damage is found or suspected, file claims as soon as possible with the carrier and notify the nearest Zenith representative.

Before installation, it is necessary to store the transfer switch in a clean dry place, protected from dirt and water. Provide ample air circulation and heat, if necessary, to prevent condensation.

Storage Temperature:
-30 C to + 65 C (-22 F to +149 F)

Operating Temperature (Ambient):
-20 C to +75 C (-4 F to +167 F) [40-260 Amps]
-20 C to +40 C (-4 F to +104 F) [400-3000 Amps]

Humidity:
5% to 95% (non-condensing)

3. MOUNTING

Adequate lifting means must be used to mount the transfer switch into place. The recommended method for moving the transfer switch using the lifting eyes and a spreader bar is illustrated in *Figure 1.* Enough room should be allowed to open the cabinet doors fully for inspection and servicing of the switch per NEC and local codes.

Before drilling conduit entry holes or any accessory mounting holes, cover and protect the switch and control panel to prevent dirt and metal fragments from entering the mechanical and electrical components. Failure to do so may result in damage and malfunction of the switch.

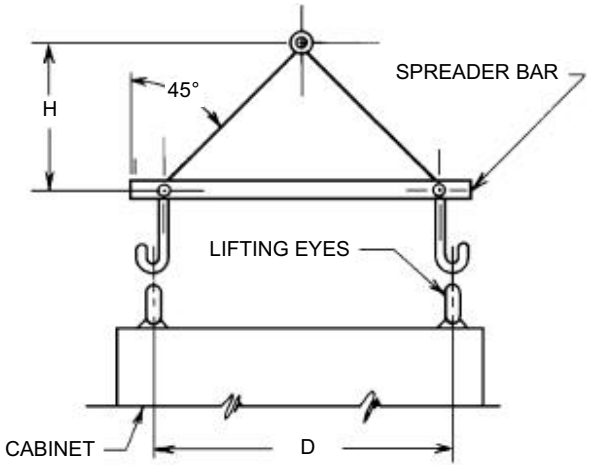


Figure 1

⚠ NOTICE

When lifting the switch using a spreader bar, height H must be equal to half of distance D.

4. POWER CONNECTIONS

Zenith transfer switches are supplied with UL listed solderless screw type terminals as standard for the Normal, Emergency, and Load power connections. *Table 1* lists the number and sizes of the cable lugs supplied as standard for each switch amp rating.

Connect the Normal, Emergency, and Load conductors to the clearly marked terminals on the transfer switch. Remove surface oxides from cables by cleaning with a wire brush. Verify that all connections are correct before tightening the lugs. All cable lug connections must be tightened to the proper torque values as shown in *Table 2*.

Do not run cables or wiring behind front-connected transfer switches.

In cases where the Normal, Emergency, and Load connections are made to a rear connected bus bar, a compression washer, flat washer, and a minimum grade 5 bolt must be used and torqued to the values in *Table 3*.

Screw Type Terminals for External Power Connections				
Switch Size (Amps)	Normal, Emergency & Load Terminals		Fully Rated Neutral Bar (When Required)	
	Cable Per Pole	Range of Wire Sizes	Number of Cables	Number of Cables
100	1	#14 to 1/0 AWG	3	#14 to 1/0 AWG
150	1	#8 to 3/0 AWG	3	#6 AWG to 300 MCM
225	1	#6 AWG to 250 MCM	3	#6 AWG to 300 MCM
260	1	#6 AWG to 350 MCM	3	#6 AWG to 300 MCM
400	1	#4 AWG to 600 MCM	4	#6 AWG to 300 MCM
600	2	#2 AWG to 600 MCM	8	#2 AWG to 600 MCM
800 1000 1200	4	#2 AWG to 600 MCM	12	#2 AWG to 600 MCM
1600 2000 3000 4000	Line and load terminals are located in rear and arranged for bus bar connection.		12	3/0 AWG to 750 MCM

Table 1

Tightening Torque for Lugs		
Socket Size Across Flats	Torque	
	Lb.-In.	Lb.-Ft.
1/8	45	4
5/32	100	8
3/16	120	10
7/32	150	12
1/4	200	17
5/16	275	23
3/8	375	31
1/2	500	42
9/16	600	50

Table 2

Tightening Torque for Bus Bars		
Bolt Size	Torque Bolt (Grade 5)	
	Lb.-In.	Lb.-Ft.
1/4-20	72	6
5/16-18	132	11
3/8-16	300	25
1/2-13	720	60

Table 3

5. CONTROL CONNECTIONS

A complete information package is furnished with each transfer switch including a complete connection diagram and schematic which details all necessary control circuit field connections.

The engine start control wires connect to the terminals specified in the upper right corner of the bypass cabinet. Terminals for field connections to the A3 Emergency auxiliary contacts and the A4 Normal auxiliary contacts are also provided. These terminals are clearly marked and appear on the left side of the ATS power panel. *Figure 2* below shows the location of these terminals.

Make all other necessary external control connections to the appropriate terminal blocks located on the control panel. Insure that all connections are tightened to the torque specified in *Table 4*.

Control Wire Connections	
Wire Size (AWG)	**Torque Lb.-In.**
18-16	19
14-8	19
6-4	36

Table 4

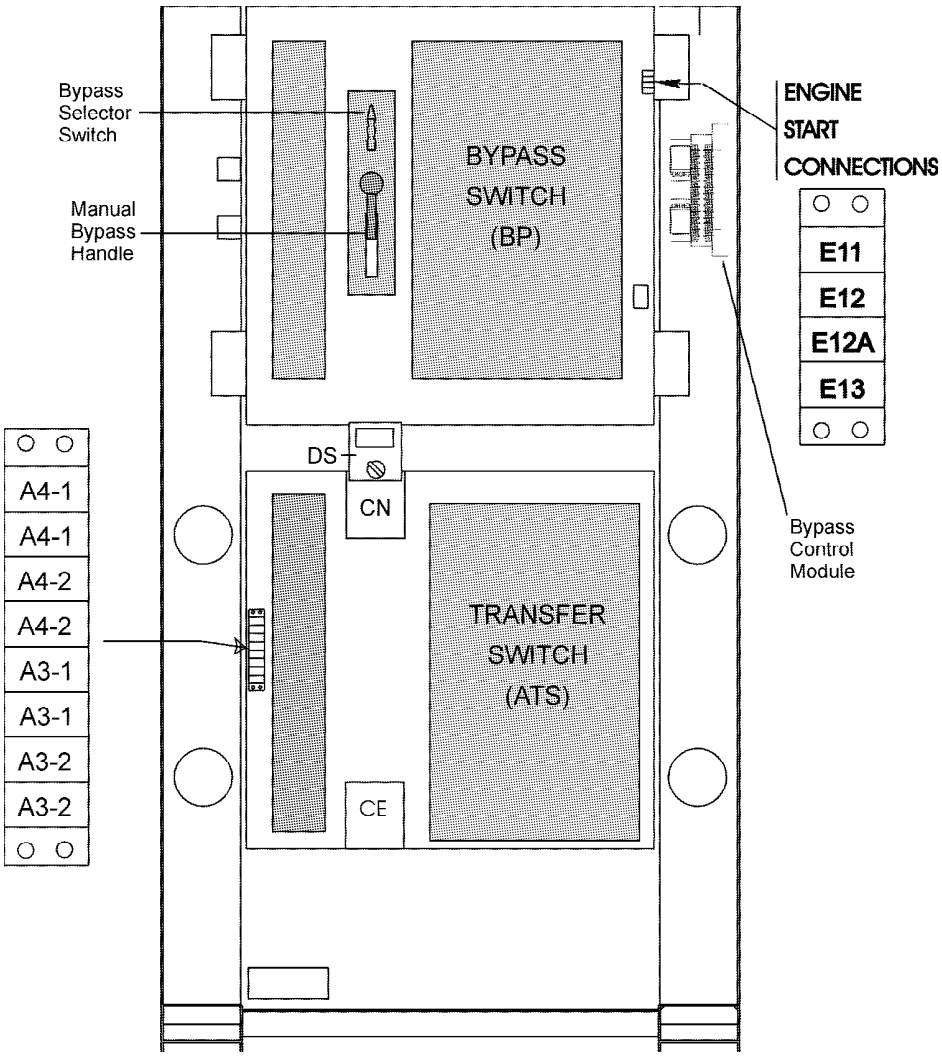


Figure 2

6. FINAL EQUIPMENT INSPECTION

Prior to energizing the transfer switch:

a. Remove any debris incurred due to shipment or installation. DO NOT use a blower since debris may become lodged in the electrical and mechanical components and cause damage. Use of a vacuum is recommended.
b. Verify that all cabled connections are correct and that phase rotation of both sources match.
c. Check engine start connections and verify the correct connection of all control wires.
d. Check settings of all timers and adjust as necessary. Also adjust any optional accessories as required. [See MX200 manual (50R-2000) for instructions on timer and option adjustments.]
e. Check the integrity of power connections by verifying actual lug torque values as specified in this manual.
f. Make sure that all covers and barriers are installed and properly fastened.

7. FUNCTIONAL TEST

The functional testing of the transfer switch consists of electrical tests described in this section. Before proceeding, refer to the information package supplied with the transfer switch. Read and understand all instructions and review the operation of all accessories provided.

Before starting the operation test, check the equipment rating nameplate on the transfer switch to verify the correct system voltage. An example of the equipment rating nameplate is shown in *Figure 3.*

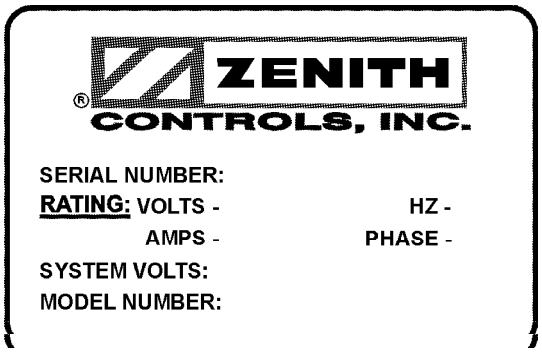


Figure 3

To begin the test, close the Normal source circuit breaker. Phase relays B1, B2, and B3 will pick up and the LED indicators will illuminate. Verify the phase to phase voltages at the Normal line terminals.

Next, close the Emergency source breaker and start the engine generator. The VFSM relay will pick up and the LED indicator will illuminate. Check the phase to phase voltages at the Emergency line terminals. Also, verify that the phase rotation of the Emergency source is the same as the phase rotation of the Normal source.

After the sources have been verified, shut down the engine generator, and put the starting control in the automatic position. Complete the visual inspection of the transfer switch, and close and lock the cabinet door.

Initiate the electrical transfer test by activating the test switch (TS). This de-energizes the engine start relay. The transfer switch closes into Emergency only after the sync-check relay ensures the proper phase relationship of both sources. After the transfer switch closes into Emergency, the SE limit switch becomes activated to de-energize the CCE relay and energize the CCNO relay. This opens the transfer switch out of Normal. When the transfer switch has opened out of Normal, the SNO-2 limit switch activates to de-energize the CCNO relay. The transfer switch has now closed into Emergency power without interrupting the load.

Turning the TS to AUTO initiates re-transfer to Normal. The transfer switch closes into Normal only after the sync-check relay ensures the proper phase relationship of both sources. After the transfer switch closes into Normal, the SN limit switch becomes activated (de-activated in 400 Amp units) to de-energize the CCN relay and energize the CCEO relay; the transfer switch opens out of Emergency. Then the SEO-2 limit switch activates to de-energize the CCEO relay. The transfer switch has now closed back into Normal power without interrupting the load.

The transfer switch defaults to an open transition transfer when the Normal source fails. Closed transition transfer is not possible with one source available. Open transition transfer for testing can be selected via the transition mode selector switch. (For a description of the Open Transition sequence of operation, refer to Section II - Operation and Features, page 6.)

A 24 VDC circuit is supplied to control the alarm and warning indicators. To ensure continuous power to this circuit, a constant 24 VDC can be supplied by the customer from the engine start battery.

⚠ NOTICE

A periodic test of the transfer switch under load conditions is recommended to insure proper operation.

SECTION II - OPERATION AND FEATURES

1. SEQUENCE OF OPERATION

Figure 4 is a typical schematic diagram of a Zenith closed transition transfer switch. The information supplied with the transfer switch includes a schematic diagram and description of operation of all accessories provided.

Transfer of the load to the Emergency source begins automatically when any phase of the Normal source falls below the preset dropout point and this undervoltage failure condition is detected by solid state phase relays B1, B2, B3.

The phase relays drop out, de-energizing the Normal control relays CR & CR2, and engine start timer P1 begins its timing cycle. The P1 time delay is provided to override momentary outages and to prevent nuisance starting of the engine generator. If the Normal source voltage returns above the phase relays' pickup setting, the P1 timing cycle is reset to zero by re-energizing the CR relay.

If the normal source voltage does not return before the P1 time delay is completed, the P1 timer drops out and sends a starting signal to the engine generator. An Emergency voltage and frequency sensing relay (VFSM) monitors the voltage and frequency of the Emergency source. When both the voltage and the frequency of the Emergency source reach the preset pickup points, the VFSM relay initiates transfer to the Emergency source and timer W begins it timing cycle. The W timer provides an adjustable transfer delay to the Emergency source as required.

When the W time is completed, the Emergency control relay RT energizes and picks up the CCNO relay. The CNO solenoid is then energized to open the transfer switch from normal position to neutral position. The switch remains in the neutral position for the duration of the DW time delay. After the DW time delay is completed, the CCE relay energizes the CE solenoid to close the transfer switch into the emergency source. The SE limit switch activates to de-energize the CCE relay.

The sequence for retransfer to the Normal source begins automatically when the voltage on all phases of the Normal source reach the preset pickup point and this condition is detected by the solid state phase relays, B1, B2, B3.

When the Normal source restores and if the transition mode selector switch is in CT (Closed Transition), the transfer switch will return to the Normal source in a make-before-break sequence (this is described in the Testing section of this manual).

If the transition mode selector switch is in OT (Open Transition), the transfer switch will return to the normal source in a break-before-make sequence. When the Normal source restores, the solid state phase relays, B1, B2, B3 pick up and switching to the Normal source is initiated by energizing timer T, beginning its timer cycle. The T timer provides an adjustable delay to insure that the Normal source has stabilized before reconnection to the load. If the Normal source fails before the T time delay completes, the phase relays drop out and the T timing cycle is reset to zero.

When the T time delay is completed, the Normal control relay CR energizes and picks up the power relay CCEO. This energizes the CEO solenoid opening the transfer switch out of the emergency source. The SEO-1 limit switch activates to energize the DT time delay and de-energize the CCEO relay. After the DT time delay is completed, the CCN relay energizes the CN solenoid to retransfer the switch into the normal source. The SN limit switch activates to de-energize the CCN relay. The SN limit switch also energizes the engine over-run timer U and begins its timing cycle. This timer provides a period of time for the engine generator to run without load and cool down before shutdown. After the U time delay is completed, the P1 timer is energized and the engine generator is shutdown.

NOTES:

1. The transition mode selector switch on the front door enables the user to operate the unit in Open Transition mode, if so desired.
2. When in Closed Transition mode, if the transfer switch does not open the first source within 100 milliseconds, an alarm will sound, the transfer switch will open the last source it closed in to and will lock out the control circuit from any transfer operation. After the condition has been corrected the control circuit should be reset by turning the Failed to Open Lockout Reset switch to the right.
3. The controls will provide a signal to shunt trip the generator breaker if the transfer switch remains closed into both sources for more than 325 ms. The load will then be fed by the utility source. The maximum time that the two sources would be parallel, under these conditions, is less than 0.5 sec. Before operating the closed transition transfer switch the condition must be corrected and the shunt trip reset. Refer to the procedure for servicing the switch after shunt tripping occurs. The shunt trip reset switch is provided on the front door. Alarm and lights on the front door provide indication of failure conditions.

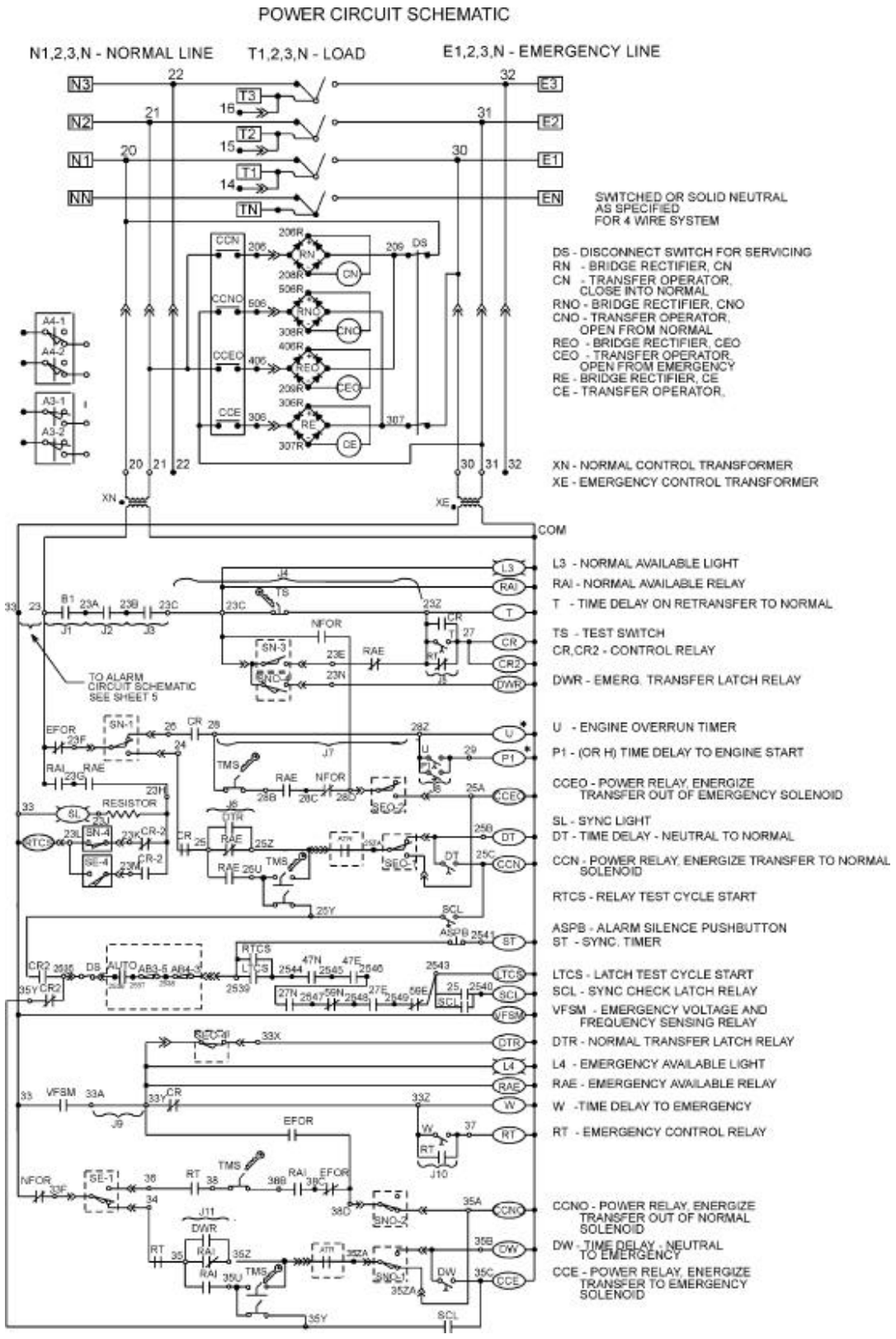

POWER CIRCUIT SCHEMATIC
N1,2,3,N - NORMAL LINE
T1,2,3,N - LOAD
E1,2,3,N - EMERGENCY LINE
SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEM
DS - DISCONNECT SWITCH FOR SERVICING
RN - BRIDGE RECTIFIER, CN
CN - TRANSFER OPERATOR, CLOSE INTO NORMAL
RNO - BRIDGE RECTIFIER, CNO
CNO - TRANSFER OPERATOR, OPEN FROM NORMAL
REO - BRIDGE RECTIFIER, CEO
CEO - TRANSFER OPERATOR, OPEN FROM EMERGENCY
RE - BRIDGE RECTIFIER, CE
CE - TRANSFER OPERATOR.
XN - NORMAL CONTROL TRANSFORMER
XE - EMERGENCY CONTROL TRANSFORMER
COM
L3 - NORMAL AVAILABLE LIGHT
RAI - NORMAL AVAILABLE RELAY
T - TIME DELAY ON RETRANSFER TO NORMAL
TS - TEST SWITCH
CR,CR2 - CONTROL RELAY
DWR - EMERG. TRANSFER LATCH RELAY
U - ENGINE OVERRUN TIMER
P1 - (OR H) TIME DELAY TO ENGINE START
CCEO - POWER RELAY, ENERGIZE TRANSFER OUT OF EMERGENCY SOLENOID
SL - SYNC LIGHT
DT - TIME DELAY - NEUTRAL TO NORMAL
CCN - POWER RELAY, ENERGIZE TRANSFER TO NORMAL SOLENOID
RTCS - RELAY TEST CYCLE START
ASPB - ALARM SILENCE PUSHBUTTON
ST - SYNC. TIMER
LTCS - LATCH TEST CYCLE START
SCL - SYNC CHECK LATCH RELAY
VFSM - EMERGENCY VOLTAGE AND FREQUENCY SENSING RELAY
DTR - NORMAL TRANSFER LATCH RELAY
L4 - EMERGENCY AVAILABLE LIGHT
RAE - EMERGENCY AVAILABLE RELAY
W -TIME DELAY TO EMERGENCY
RT - EMERGENCY CONTROL RELAY
CCNO - POWER RELAY, ENERGIZE TRANSFER OUT OF NORMAL SOLENOID
DW - TIME DELAY - NEUTRAL TO EMERGENCY
CCE - POWER RELAY, ENERGIZE TRANSFER TO EMERGENCY SOLENOID
TO ALARM CIRCUIT SCHEMATIC SEE SHEET 5
RESISTOR

Figure 4

2. BYPASS-ISOLATION OPERATION - 100-400 AMP

a. Automatic
1) Manually operated bypass switch contacts (BN/BE) are open and ATS is supplying load.
2) Disconnect Switch (DS) is in Auto.

b. To Bypass ATS
1) Open bottom cabinet door and turn DS to Inhibit.
2) Position Manual Bypass Handle (MBH) to same power source as ATS.

c. To Test ATS
1) Bypass per above instructions.
2) Move ATS Location Handle (ALH) to Test location.
3) Turn DS to Auto.
4) Test Switch (TS) on bottom cabinet door will allow electrical operation of ATS.

d. To Isolate ATS
1) Bypass per above instructions.
2) Move ALH to Isolate location.

e. To Remove ATS
1) Bypass and isolate per above instructions.
2) Move ALH to Release location.
3) Disconnect multipin plugs.
4) Lift ATS out of drawer.

f. To Reconnect ATS
1) Place ATS into drawer slots (front rollers first).
2) Turn DS to Inhibit.
3) Manually position ATS into same source as bypass switch.
4) Reconnect multipin plugs and external connections to ATS.
5) Push ATS inward to engage carriage.
6) Move ALH to Test location (as indicated by light).
7) Turn DS to Auto and use TS to electrically operate ATS.
8) Turn DS to Inhibit.
9) Move ALH to Auto location.
10) Turn DS to Auto and open bypass with MBH.
11) ATS is now fully automatic.

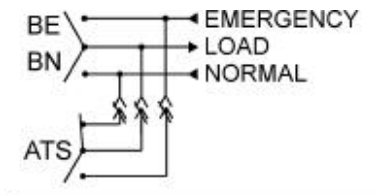


FIG. 1 BP IS OPEN WITH ATS IN NORMAL

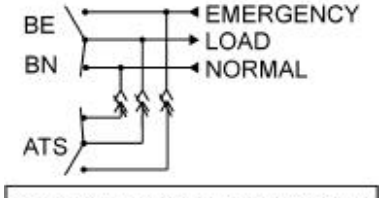


FIG. 2 BP IN NORMAL WITH ATS IN NORMAL

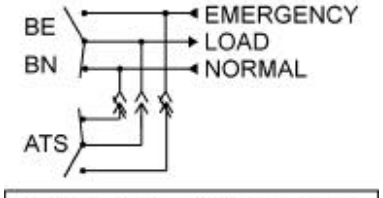


FIG. 3 BP IN NORMAL WITH ATS IN TEST (LOAD CONNECTIONS ARE OPEN)

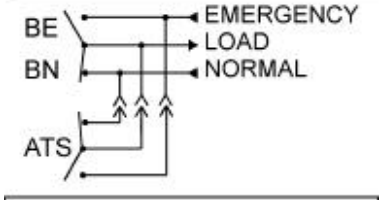


FIG. 4 BP IN NORMAL WITH ATS ISOLATED

Notes:

1. DS in Inhibit will prevent ATS electrical operation.
2. Do not use excessive force on mechanical handles.
3. Figures depict Bypass Normal. Sequence is the same for Bypass Emergency.
4. When ATS is in Test or Isolate, bypass switch is manual; transfer switch to either available source (indicated on light panel).
5. To operate bypass switch when ATS is in Test or Isolate, position MBH to available power source.

Legend:

1. BP - bypass switch (indicated by contacts BN/BE) is a three position switch.
2. ATS - Automatic Transfer Switch.

3. BYPASS-ISOLATION OPERATION - 600-1200 AMP

a. Automatic
1) Manually operated bypass switch contacts (BN/BE) are open and ATS is supplying load.
2) Disconnect Switch (DS) is in Auto.

b. To Bypass ATS
1) Open bottom cabinet door and turn DS to Inhibit.
2) Turn Bypass Selector Switch (BSS) to same power source as ATS.
3) Move the Manual Bypass Handle (MBH) upward.

c. To Test ATS
1) Bypass per above instructions.
2) Rotate crank mechanism counterclockwise until ATS Test light is illuminated.
3) Turn DS to Auto.
4) Test Switch (TS) on bottom cabinet door will allow electrical operation of ATS.

d. To Isolate ATS
1) Bypass per above instructions.
2) Rotate crank mechanism counterclockwise until ATS Isolated light is illuminated.

e. To Remove ATS
1) Bypass and isolate per above instructions.
2) Disconnect multipin plugs and external connections to ATS.
3) Rotate four power panel latches to vertical position, slide ATS forward and lock mechanism in place.
4) ATS can now be removed from cabinet.

f. To Reconnect ATS
1) Place ATS in slide mechanism.
2) Unlock slide mechanism. Slide ATS over power panel latches and rotate latches to horizontal position.
3) Turn DS to Inhibit.
4) Manually position ATS into same source as bypass switch.
5) Reconnect multipin plugs and external connections to ATS.
6) Rotate crank mechanism clockwise until ATS Test light is illuminated.
7) Turn DS to Auto and use TS to electrically operate ATS.
8) Turn DS to Inhibit.
9) Move ALH to Auto location.
10) Turn DS to Auto and open bypass with MBH.
11) ATS is now fully automatic.

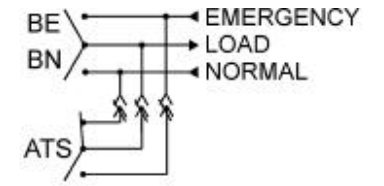


FIG. 1 BP IS OPEN WITH ATS IN NORMAL

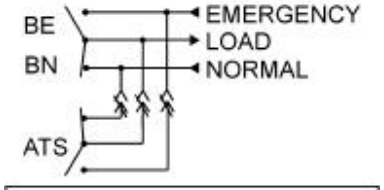


FIG. 2 BP IN NORMAL WITH ATS IN NORMAL

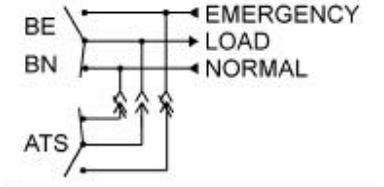


FIG. 3 BP IN NORMAL WITH ATS IN TEST (LOAD CONNECTIONS ARE OPEN)

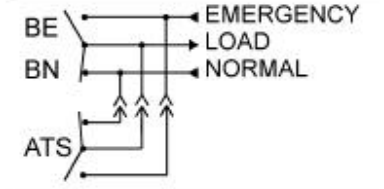


FIG. 4 BP IN NORMAL WITH ATS ISOLATED

Notes:
1. DS in Inhibit will prevent ATS electrical operation.
2. Do not use excessive force on mechanical handles.
3. Figures depict Bypass Normal. Sequence is the same for Bypass Emergency.
4. When ATS is in Test or Isolate, bypass switch is manual transfer switch to either available source (indicated on light panel).
5. To operate bypass switch when ATS is in Test or Isolate:
   a) Move MBH downward (to open open Bypass Contacts BN/BE).
   b) Turn BSS to opposite power source.
   c) Move MBH upward to close into selected power source.

Legend:
1. BP - Bypass Switch (indicated by contacts BN/BE) is a three posi tion switch.
2. ATS - Automatic Transfer Switch.

4. BYPASS-ISOLATION OPERATION - 1600-4000 AMP

a. Automatic
1) Manually operated bypass switch contacts (BN/BE) are open and ATS is supplying load.
2) Disconnect Switch (DS) is in Auto.

b. To Bypass ATS
1) Open bottom cabinet door and turn DS to Inhibit.
2) Turn Bypass Selector Switch (BSS) to same power source as ATS.
3) Move the Manual Bypass Handle (MBH) upward.

c. To Test ATS
1) Bypass per above instructions.
2) Rotate crank mechanism counterclockwise until ATS Test light is illuminated.
3) Turn DS to Auto.
4) Test Switch (TS) on bottom cabinet door will allow electrical operation of ATS.

d. To Isolate ATS
1) Bypass per above instructions.
2) Rotate crank mechanism counterclockwise until ATS Isolated light is illuminated.

e. To Remove ATS
1) Bypass and isolate per above instructions.
2) Disconnect multipin plugs and external connections to ATS.
3) Slide four corner latches of ATS to innermost position.
4) ATS can now be removed from cabinet.

f. To Reconnect ATS
1) Roll cart back into cabinet.
2) Slide four corner latches of ATS to outermost position.
3) Turn DS to Inhibit.
4) Manually position ATS into same source as bypass switch.
5) Reconnect multipin plugs and external connections to ATS.
6) Rotate crank mechanism clockwise until ATS Test light is illuminated.
7) Turn DS to Auto and use TS to electrically operate ATS.
8) Turn DS to Inhibit.
9) Rotate crank mechanism clockwise until ATS location pointer is aligned with Auto mark on location indicator (ATS must be in same source as bypass).
10) Turn DS to Auto and open bypass with MBH.
11) ATS is now fully automatic.

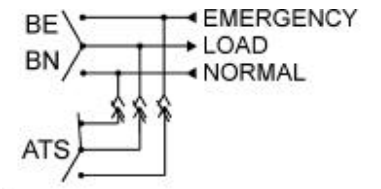


FIG. 1 BP IS OPEN WITH ATS IN NORMAL

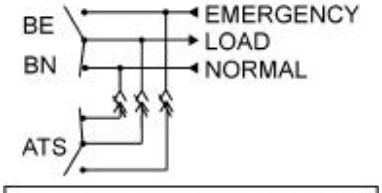


FIG. 2 BP IN NORMAL WITH ATS IN NORMAL

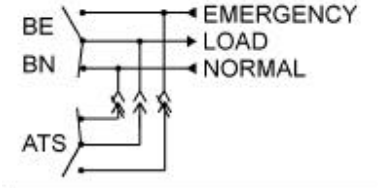


FIG. 3 BP IN NORMAL WITH ATS IN TEST (LOAD CONNECTIONS ARE OPEN)

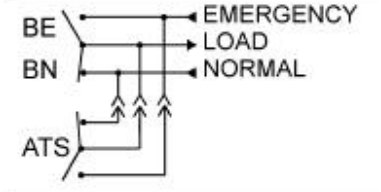


FIG. 4 BP IN NORMAL WITH ATS ISOLATED

Notes:
1. DS in Inhibit will prevent ATS electrical operation.
2. DO NOT use excessive force on mechanical handles.
3. Figures depict Bypass Normal. Sequence is the same for Bypass Emergency.
4. When ATS is in Test or Isolate, bypass switch is a manual transfer switch to either available source (indicated on light panel).
5. To operate bypass switch when ATS is in Test or Isolate:
   a) Move MBH downward (to open Bypass Contacts BN/BE)
   b) Turn BSS to opposite power source.
   c) Move MBH upward to close into selected power source.

Legend:
1. BP - Bypass Switch (indicated by contacts BN/BE) is a three position switch.
2. ATS - Automatic Transfer Switch.

5. ZENITH STANDARD PACKAGE

The Zenith Closed Transition Switch comes with the following standard features:

A3 Auxiliary contact closes when the switch is in the Emergency position.

A4 Auxiliary contact closes when the switch is in the Normal position.

DT Adjustable time delay before closing into Normal source from open position (Open Transition Mode only).

DW Adjustable time delay before closing into Emergency source from open position (Open Transition Mode only).

E Engine start contact closes to start the engine generator when the Normal source fails. 1 N.O., 1 N.C. contact.

P1 Solid state adjustable timer with range from 0.5 to 6.0 seconds. The contact closes to start the engine generator.

T Adjustable time delay to transfer out of Emergency source and into open position after Normal source is restored.

U Adjustable time delay for engine cool down after engine generator is signaled to shut down.

W Adjustable time delay to transfer out of Normal source and into open position after Normal source failure.

6. ZENITH OPTIONAL ACCESSORIES

Many control accessories are available to meet specific and special requirements. **Your drawings indicate which accessories were ordered with your switch.**

SECTION III - MAINTENANCE AND TESTING

A preventive maintenance program will insure high reliability and long life for the transfer switch. The preventive maintenance program for the transfer switch should include the following items:

1. INSPECTION AND CLEANING

⚠ DANGER

HAZARDOUS VOLTAGE
(Can Cause Severe Injury or Death)

Turn OFF all power before installation, adjustment, or removal of transfer switch or

Before doing any work on the transfer switch, de-energize all sources of power. The switch should be inspected for any accumulation of dust, dirt, or moisture, and should be cleaned by vacuuming or wiping with a dry cloth or soft brush. DO NOT use a blower since debris may become lodged in the electrical and mechanical components and cause damage.

Remove the transfer switch barriers and check the condition of the contacts. Any surface deposits must be removed with a clean cloth (DO NOT USE EMERY CLOTH OR A FILE). If the contacts are pitted or worn excessively, they should be replaced. A general inspection of mechanical integrity should be made to include loose, broken or badly worn parts.

2. SERVICING

All worn or inoperative parts must be replaced using Zenith recommended replacement parts. Appendix B at the back of this manual includes replacement part information for typical power and control panel configurations. When ordering parts provide the model number or serial number from the transfer switch rating nameplate.

The operating mechanism of the transfer switch is lubricated with Lubriplate 105. The lubricant applied at the factory provides adequate lubrication for the lifetime of the switch. Should debris contaminate the mechanism, clean and apply additional Lubriplate.

3. TESTING

After completing the inspection, cleaning and servicing of the transfer switch, reinstall the switch cover, and close and lock the cabinet door. Reclose the circuit breakers feeding the utility and generator sources to the switch.

Initiate the electrical transfer test by activating the TS test switch. This de-energizes the engine start relay. The transfer switch closes into Emergency only after the sync-check relay ensures the proper phase relationship of both sources. After the transfer switch closes into Emergency, the SE limit switch becomes activated to de-energize the CCE relay and energize the CCNO relay. This opens the transfer switch out of Normal. When the transfer switch has opened out of Normal, the SNO-2 limit switch activates to de-energize the CCNO relay. The transfer switch has now closed into emergency power without interrupting the load.

Turning the TS to AUTO initiates re-transfer to Normal. The transfer switch closes into Normal, only after the sync-check relay ensures the proper phase relationship of both sources. After the transfer switch closes into Normal, the SN limit switch becomes activated to de-energize the CCN relay and energize the CCEO relay; the transfer switch opens out of Emergency. Then the SEO-2 limit switch activates to de-energize the CCEO relay. The transfer switch has now closed back into normal power without interrupting the load.

The transfer switch defaults to an open transition transfer when the Normal source fails. Closed transition transfer is not possible with one source available. Open transition transfer for testing can be selected via the transition mode selector switch.

A 24 VDC circuit is supplied to control the alarm and warning indicators. To insure continuous power to this circuit, a constant 24 VDC can be supplied by the customer from the engine start battery.

⚠ NOTICE

A periodic test of the transfer switch under load conditions is recommended to insure proper operation.

4. TROUBLESHOOTING

Before beginning any troubleshooting activity, refer to the information package supplied with the transfer switch and review the description and operation of all accessories supplied. Also refer to Section II of this manual, Operation and Features.

CONDITION	ITEMS TO BE CHECKED
a. Engine-Generator Does Not Start when Normal source fails or Test Switch (TS) is activated.	1) Verify the setting of the time delay P1. 2) Make sure timer P1 drops out and the engine-start contact closes after time delay is completed. 3) Make sure the starting battery is charged and connected to the engine-generator. 4) Generator controls in Automatic mode. 5) Verify wiring of the engine-start contact If the generator does not start, contact the generator dealer.
b. Does Not Transfer To Emergency after generator starts.	1) If in Closed Transition Mode: a) Verify that the phase angle difference between Normal and Emergency is < 5° (@ 0.1 Hz f). b) Verify that the frequency difference between Normal and Emergency is < 0.2 Hz (0.1 Hz is recommended). Also verify that the frequency difference is not 0 Hz. c) Verify that the voltage difference between Normal and Emergency is < ±5% of nominal. d) Verify that the phase sequence is the same for Normal and Emergency. 2) Emergency source breaker should be closed. 3) Emergency source voltage and frequency should meet the preset pickup values of the VFSM relay. 4) Make sure Emergency control relay RT picks up after time delay W.
c. Does Not Retransfer To Normal when Normal source restores or Test Switch (TS) is deactivated.	1) If in Closed Transition Mode: a) Verify that the phase angle difference between Normal and Emergency is < 5° (@ 0.1 Hz f). b) Verify that the frequency difference between Normal and Emergency is < 0.2 Hz (0.1 Hz is recommended). Also verify that the frequency difference is not 0 Hz. c) Verify that the voltage difference between Normal and Emergency is < ±5% of Nominal. d) Verify that the phase sequence is the same for Normal and Emergency. 2) Normal source voltage should meet the preset pickup value of the phase relays. 3) Make sure Normal control relay CR picks up after time delay T. 4) Verify the circuit connections from the power relay, CN1 or CCN, to the Normal switch operating circuit. 5) Verify the circuit connections from the power relay, CE1 or CCE, to the Emergency switch operating circuit.
d. Engine-Generator Does Not Shutdown after retransfer to Normal.	1) Verify the setting of engine overrun time delay U. 2) Make sure timer P1 picks up and the engine-start contact has opened. 3) Generator controls in Automatic mode. 4) Verify wiring of the engine-start contact.

5. EMERGENCY SERVICE PROCEDURE FOR EXTENDED PARALLEL TIME

a. Auto Location:

Removal of closed transition transfer switch after Emergency breaker shunt trip.

1) Disconnect all power sources from bypass-isolation transfer switch.
2) Open the bottom cabinet door and turn the Disconnect Switch (DS) to the OFF position.
3) Remove the service access cover on the left hand side of the transfer switch.
4) The manual operator and the manual handle will now be exposed. Insert the handle into the Emergency side manual operator. Open the Emergency side contacts.
5) Close bottom cabinet door.
6) Energize Normal power.
7) Close the bypass contacts (BN) as described in Section II of this manual.
8) Isolate the transfer switch as described in Section II.
9) Remove the transfer switch from the bypass-isolation transfer switch as indicated on the bypass instruction label to inspect and repair.
10) Re-install the transfer switch after maintenance with contacts closed to the same source as the bypass switch. Re-install the manual handle in its holder and the service access cover on the left side of the transfer switch.
11) Re-connect the transfer switch to AUTO, as described in Section II.

b. Auto Location:

Removal of the closed transition transfer switch if Normal and Emergency contacts remain open.

1) Turn the BSS to an available source. Close the bypass switch into the available source as described in Section II of this manual.
2) Turn the DS to INHIBIT. Remove the transfer switch service access cover. Close the transfer switch into the same source as the bypass switch. (Incorrect sequencing is prevented by the interlocks while the transfer switch is in AUTO only.)
3) Remove the transfer switch from the bypass-isolation transfer switch as indicated in Section II to inspect and repair.

c. Test Location:

Removal of the closed transition transfer switch if both Normal and Emergency contacts remain open.

1) Close the bypass switch contacts (BN) as indicated on the bypass instruction label on the cabinet door.
2) Disconnect all power sources from bypass-isolation closed transition transfer switch.
3) Open bottom cabinet door. Turn the Disconnect Switch (DS) to the OFF position.
4) Remove the service access cover on the left side of the transfer switch.
5) The manual operator and the manual handle will not be exposed. Insert the handle into the Normal side and close the Normal contacts.
6) Close the bottom cabinet door.
7) Energize Normal power.
8) Remove the automatic transfer switch from the bypass-isolation transfer switch as indicated in Section II.
9) Re-install the transfer switch after maintenance with contacts closed to the same source as the bypass switch. Re-install the manual handle in its holder and the service ccess cover on the left side of the transfer switch.
10) Re-connect the transfer switch to AUTO, as indicated in Section II.

SECTION III - MAINTENANCE AND TESTING (Continued)

FIELD NOTES

Model Number _____

Serial Number _____

Date Shipped _____

Start-Up Date _____

Drawings Supplied _____

Test And Maintenance Notes			
Date	**Tested**	**Observations**	**Notes**

SECTION IV - ADJUSTMENTS AND SETTINGS (Continued)

1. PARALLELING RELAY SETTINGS

25, 27/59N & 27/59E are factory set to allow paralleling of the sources only when these conditions have been met:

a. Phase Angle Differences < 5° (@ 0.1 Hz f)
b. Frequency Difference < 0.2 Hz
c. Voltage Difference < ±5% Nominal

NOTES:

1. This system requires an isochronous governor with an operating frequency of 60 ± 0.2 Hz.
2. Requires a shunt trip breaker on generator set with a response time not exceeding 50 ms.

2. SOLID STATE TIMERS

Solid state timers are adjustable from 0.1 second to 100 hours. The red timing indicator in the upper left corner flashes as the timer progresses through the timing cycle. When the timing cycle is completed, the indicator remains illuminated. A flathead screwdriver is required to change the setting, as shown in *Figure 5* below.

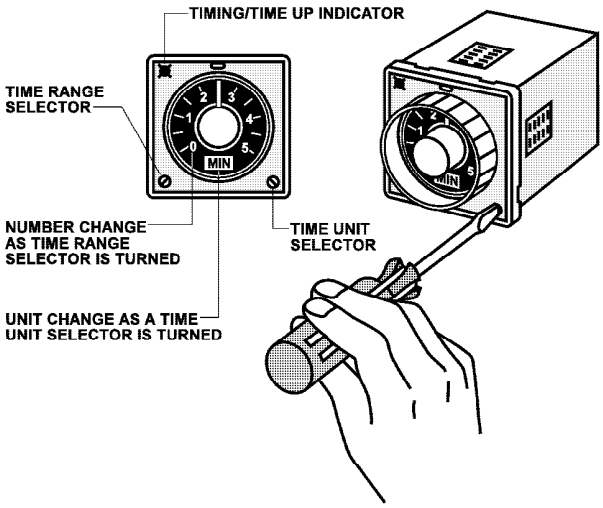


Figure 5

The time unit is selected by turning the rotary switch at the lower right of the timer. Four selections are available: “Seconds”, “Minutes”, “Hours”, “10 Hours”. The time unit selected is displayed in the window below the time setting dial.

The time range is selected by turning the rotary switch at the lower left of the timer. Four ranges are available: “0-0.5”, “0-1.0”, “0-5.0”, “0-10.0”. The dial digits appear in the windows around the time setting knob.

⚠ CAUTION

Do NOT change the setting while the timer is energized. Timer malfunction or damage may

The factory setting of the solid state timers used in the Zenith standard package are shown in Table 5 below.

Timer	Factory Setting
T	30 minutes
U	5 minutes
W	1 second
DT	5 seconds
DW	5 seconds
ST	1 second
PART	0.002 sec,
OLC	0.275 sec.
ETT	0.420 sec.

Table 5

3. VOLTAGE/FREQUENCY SENSOR (VFSM)

The pickup point may be adjusted by rotating the adjustment screw as shown in *Figure 6* below. Counter-clockwise rotation increases the pickup voltage.

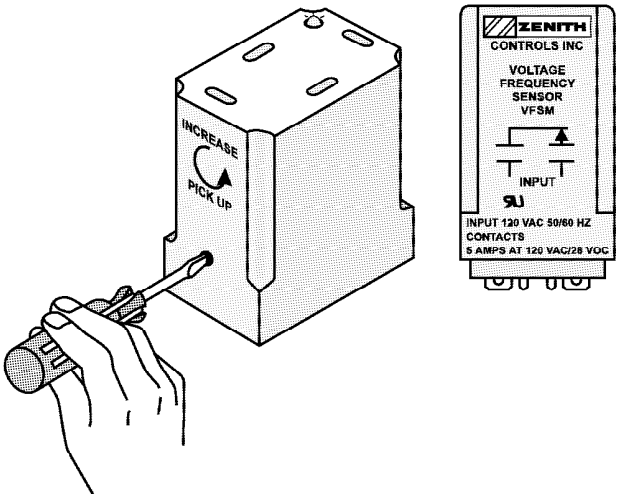


Figure 6

Pickup Voltage (at 100% Frequency)
Adjustable: 80% to 95%
Factory Set: 90%
Pickup Frequency
Adjustable: 80% to 100%
Factory Set: 95%

4. SOLID STATE PHASE RELAY (ARSM)

The pickup and dropout points may be adjusted by using the following procedure. Use of a variable voltage supply (Variac) is required. The relay is illustrated in *Figure 7* below.

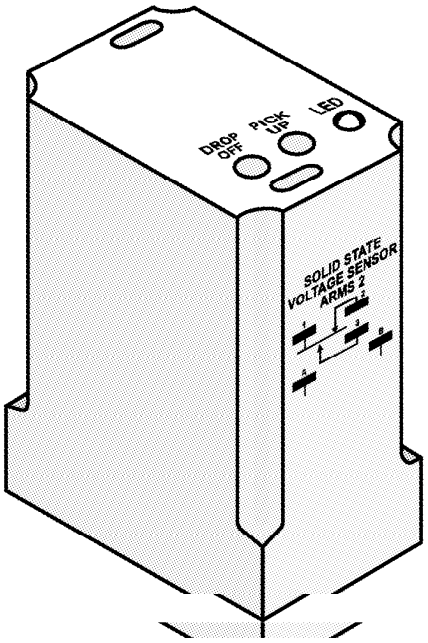


Figure 7

a. Turn the pickup adjustment fully clockwise.
b. Turn the dropout adjustment fully counter-clockwise.
c. Set Variac to the desired pickup voltage.
d. Rotate the pickup adjustment counterclock-wise very slowly until the relay picks up. The LED will illuminate.
e. Set Variac to the desired dropout voltage.
f. Rotate the dropout adjustment clockwise very slowly until the relay drops out. The LED will go out.
g. Verify the setting by raising the voltage until the relay picks up and lowering the voltage until the relay drops out.

Pickup Voltage:	75% to 115% of Nominal
Factory Set:	90% of Nominal
Dropout Voltage:	55% to 105% of Nominal
Factory Set:	80% of Nominal

5. PARALLELING WINDOW UNDER-OVERVOLTAGE SENSING RELAY

The pickup and dropout points may be adjusted by using the following procedure. Use of a variable voltage supply (Variac) is required. The relay is illustrated in *Figure 8.*

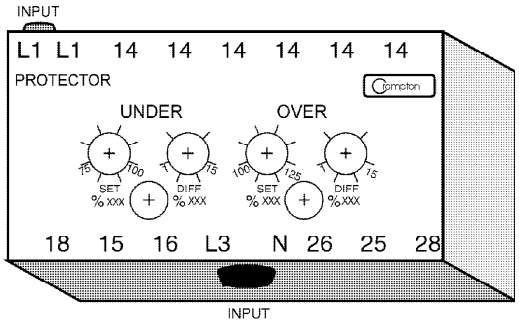


Figure 8

a. Turn both DIFF adjustments fully counter-clockwise.
b. Undervoltage sensing - Use lowest phase to phase relationship on Variac to set the relay. Set Variac voltage to desired undervoltage setting. Turn undervoltage SET adjustment fully clockwise, then slowly counterclockwise until the LED illuminates.
c. Overvoltage sensing - Use the highest phase to phase voltage relationship on Variac to set the relay. Set Variac voltage to desired overvoltage. Turn overvoltage SET adjustment fully clockwise, then counterclockwise until LED illuminates.

Undervoltage:	75-100% of 120V
Factory Set:	95%
Overvoltage:	100-125% of 120V
Factory Set:	105%

6. ELECTRONIC TIME SWITCH Z2000-2A

This time switch is used for the C/D option. Time switch Z2000-1A is used for the C option.

a. Setting Time and Day:

Press and hold " 🕘 " button during the Following adjustments:

1) Press "d" to set day pointer to correct day: 1 = Monday...7 = Sunday
2) Press "h" to set the hour. The time of day is expressed in 24-hour military time: 04:00 = 4 a.m.....20:00 = 8 p.m.
3) Press "m" to set minutes
4) Release " 🕘 " button. Clock is running

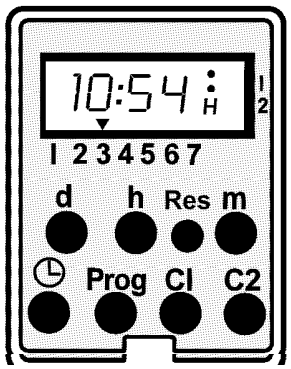


Figure 9

b. Programming:

Twenty-four total ON or OFF settings are available on one, several, or all days of the week.

1) Press Prog button. The blank program entry field will appear with two flashing points: "__:__"
2) Press either C1 or C2 depending on which channel you wish to program.
3) Next, select either On or Off by pressing C1 or C2 which toggles the On/Off mode.
4) You will now see the pointer flashing above 1 for Monday. To lock in Monday, press Prog. If you want to enter further days, press d then Prog to lock them in. Solid pointers must be displayed over each day that the switching command is required.
5) Once the days are selected, press h button to enter the desired hour and press m to enter the desired minutes. To enter the program into the time switch, press Prog. When the programming is complete, press " ◴ " to return the clock run mode. If the " ◴ " button is not depressed, it will switch to the clock run mode after 60 seconds.

c. Program Review and Change:

Press Prog button to recall and review the C1 and"C2 On/Off times. An E is displayed if all 24 positions are used or if the next available position is not filled. To change or clear a program, press Prog button to find the program to be changed or cleared. Change by pressing d, h or m buttons as required. Clear the entire program by simultaneously pressing "h" and "m". Press " ◴ " to return to the clock run mode.

d. Program Override:

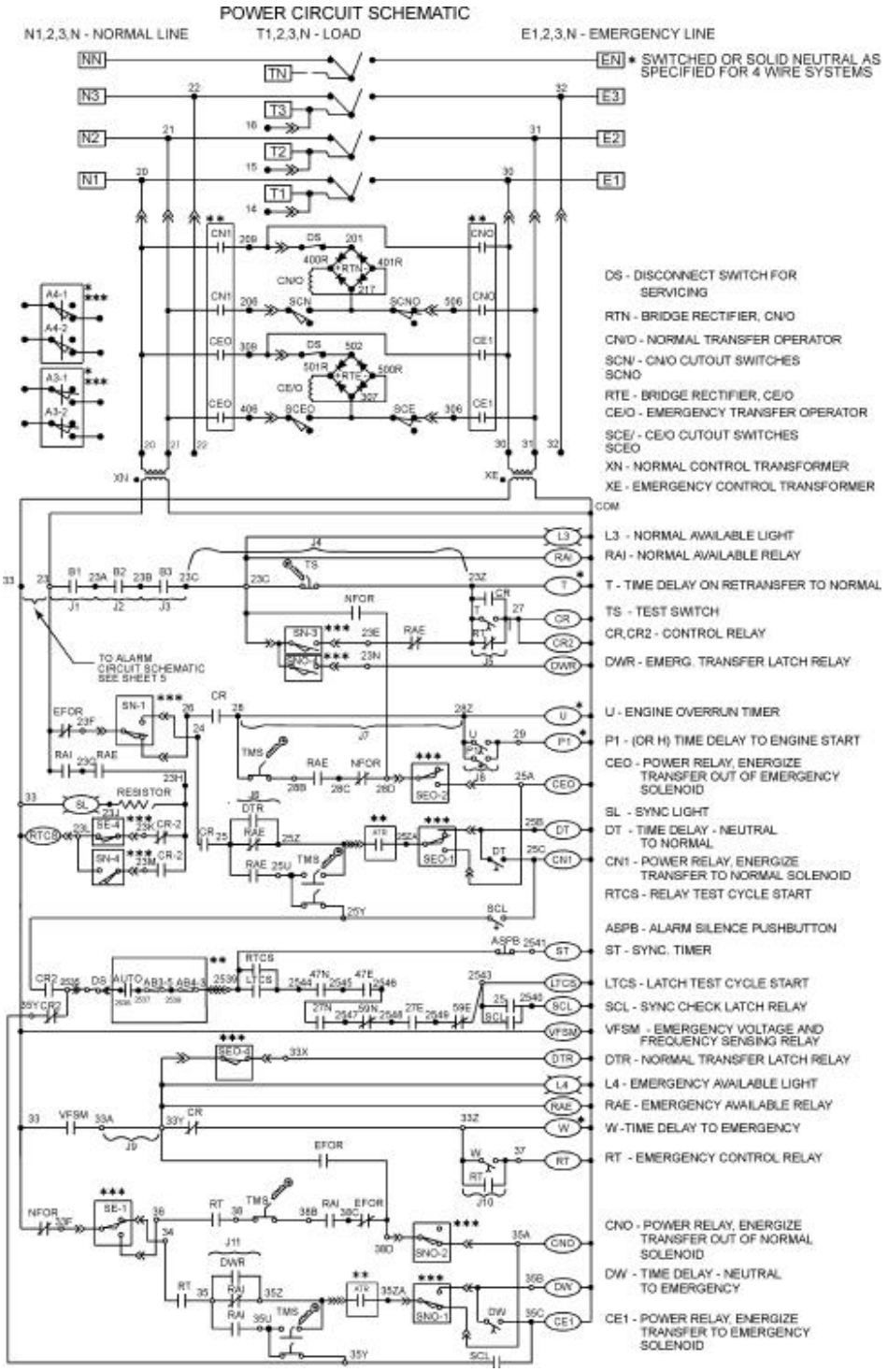
Each On/Off state can be manually changed by pressing C1 or C2. The next counteracting program cancels the manual override and resumes previous programming.

To continuously override automatic programming, press m and C1 or C2. The continuous override On/Off stat is preceded by a black dot on the display. To cancel, press m and C1 or C2 until the dot disappears.

The automatic program can be continuously overridden up to 47 days by pressing and holding h while pressing C1 or C2 until the display shows the number of days desired. Starting the following day at "0:00", the display will show a "0:00", both C1 and C2 off, and an H in the lower right hand corner.

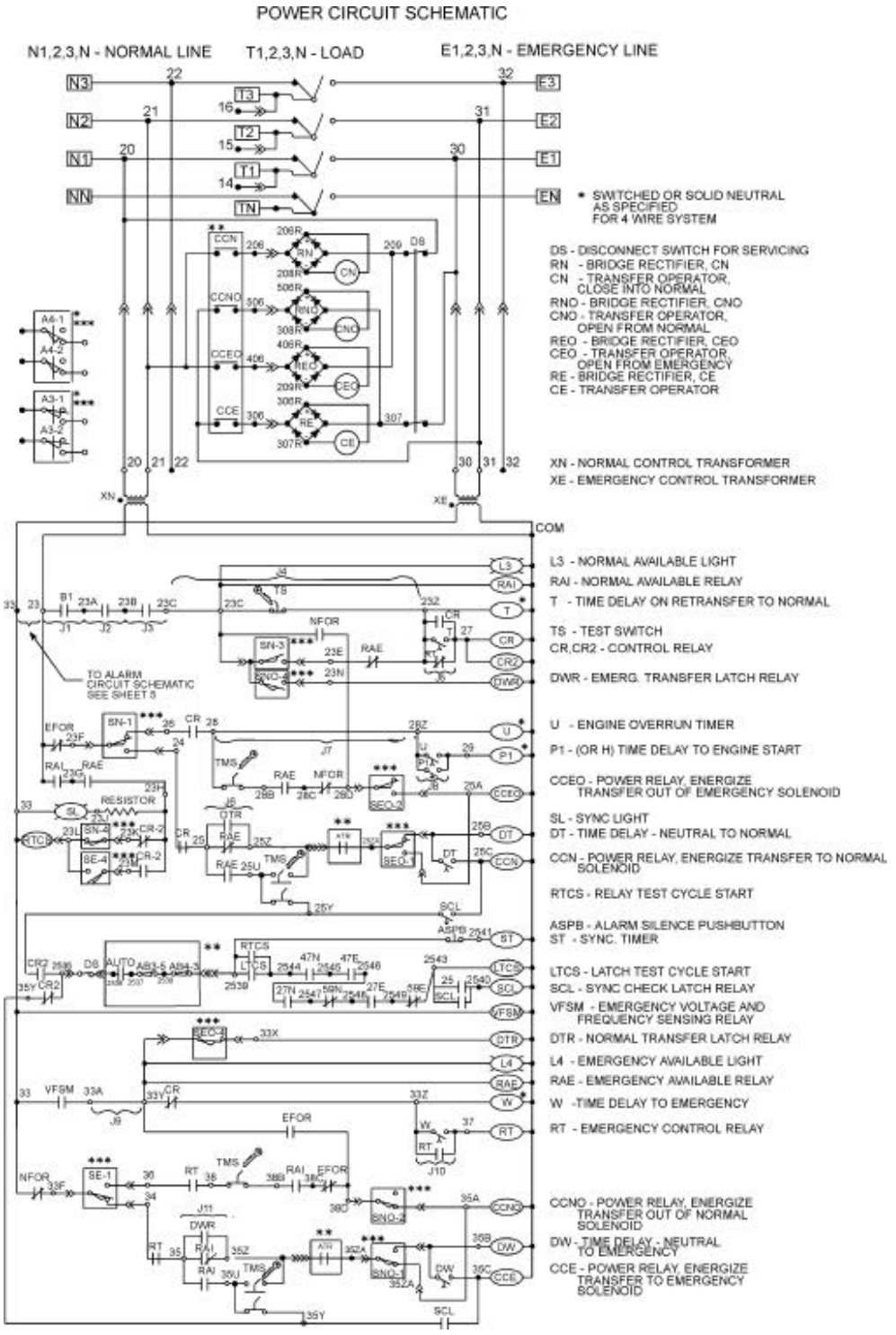
APPENDIX A - TYPICAL SCHEMATIC DIAGRAMS

1. 100-400 AMPS



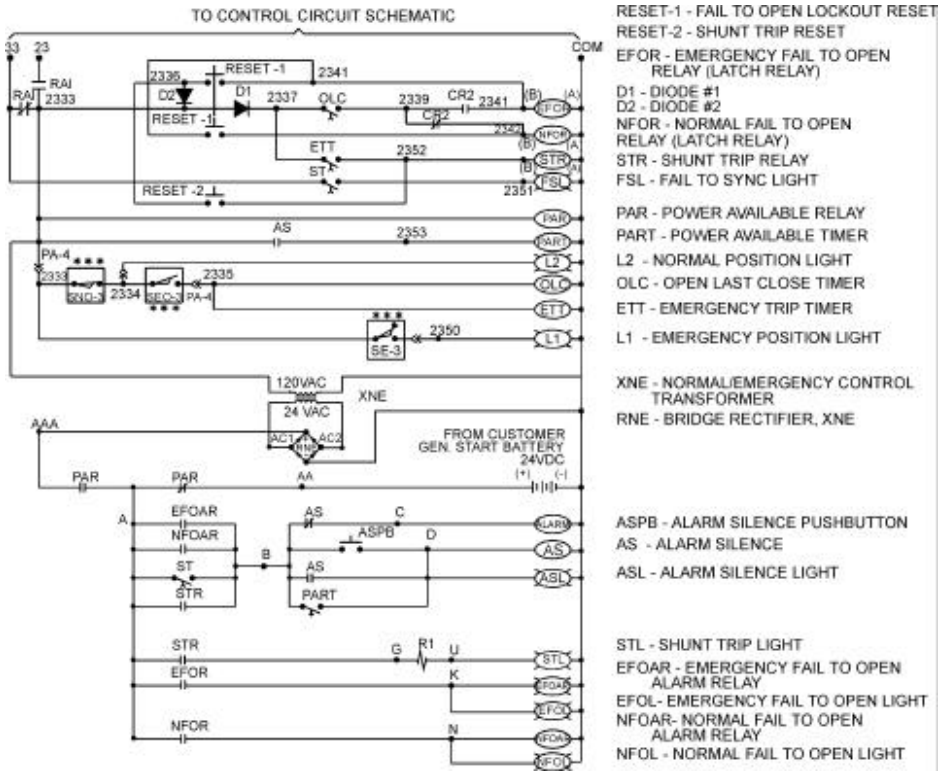
APPENDIX A - TYPICAL SCHEMATIC DIAGRAMS (Continued)

2. 600-3000 AMPS

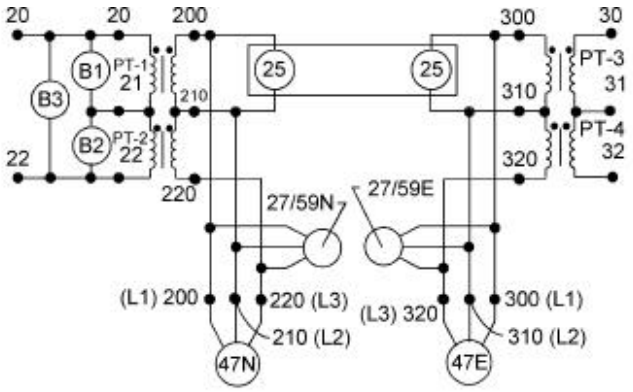


APPENDIX A - TYPICAL SCHEMATIC DIAGRAMS (Continued)

3. ALARM CIRCUIT SCHEMATIC



4. 3ϕ CONTROL SENSING SCHEMATIC



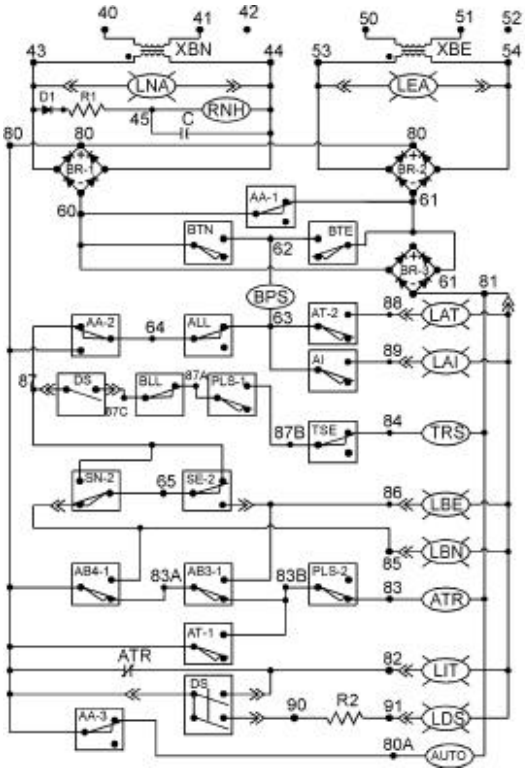
DRAWING SHOWS 47N/47E CONNECTION FOR A-B-C PHASE ROTATION SEQUENCE. (PARENTHESIS = DEVICE TERMINAL #'s) IF PHASE ROTATION SEQUENCE IS A-B-C SWAP L2 & L3 TERMINAL INPUTS ON EACH 47 RELAY.

LEGEND: PT- 1,2 - NORMAL POTENTIAL TRANSFORMERS
PT- 3,4 - EMERGENCY POTENTIAL TRANSFORMERS
B1,2,3 - UNDER VOLTAGE RELAYS
27/59N - NORMAL UNDER/OVER VOLTAGE RELAY
27/59E - EMERGENCY UNDER/OVER VOLTAGE RELAY
47N - PHASE SEQUENCING NORMAL
47E - PHASE SEQUENCING EMERGENCY
25 - SYNC CHECK RELAY

APPENDIX A - TYPICAL SCHEMATIC DIAGRAMS (Continued)

5. BYPASS CONTROL CIRCUIT

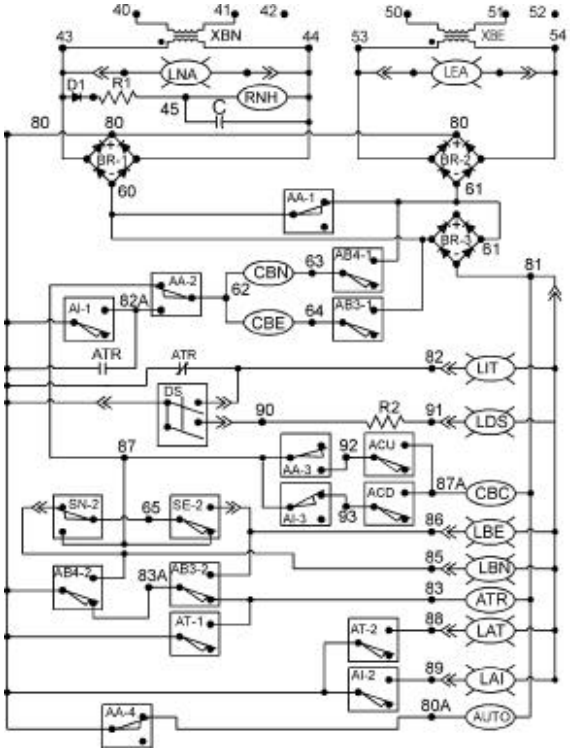
a. 100-400 Amp



LNA - NORMAL AVAILABLE LIGHT
LEA - EMERGENCY AVAILABLE LIGHT
RNH - NORMAL VOLTAGE RELAY
D1 - DIODE
R1 - RESISTOR, RNH
C - CAPACITOR, RNH
BR-1,2,3 - BRIDGE RECTIFIER

AA-1 - LIMIT SWITCH, ATS AUTO LOCATION
BTN - LIMIT SWITCH, BYPASS TRANSFER NORMAL
BTE - LIMIT SWITCH, BYPASS TRANSFER EMERGENCY
BPS - BYPASS SOLENOID
AA-2 - LIMIT SWITCH, ATS IN AUTO
ALL - LIMIT SWITCH, ATS LOCK LOCATION
AT-2 - LIMIT SWITCH, ATS IN TEST
LAT - ATS TEST LOCATION
AI - LIMIT SWITCH, ATS IN ISOLATE
LAI - ATS ISOLATE LIGHT
BLL - LIMIT SWITCH, BYPASS LOCK LOCATION
PLS-1 - PERMISSIVE LIMIT SWITCH
TSE - LIMIT SWITCH, TRANSFER SWITCH ENGAGED
TRS - SOLENOID, TRANSFER RELEASE
NA-4 - LIMIT SWITCH, ATS IN NORMAL
EA-3 - LIMIT SWITCH, ATS IN EMERGENCY
LBE - BYPASS EMERGENCY
LBN - BYPASS NORMAL LIGHT
AB4 - LIMIT SWITCH, BYPASS NORMAL
AB3-1 - LIMIT SWITCH, BYPASS EMERGENCY
PLS-2 - PERMISSIVE LIMIT SWITCH
AT-1 - LIMIT SWITCH
ATR - AUTO/TEST RELAY
LIT - ATS INHIBIT LIGHT
DS - ATS DISCONNECT SWITCH
R2 - RESISTOR, LDS
LDS - LIGHT, DISCONNECT SWITCH INHIBIT POSITION

b. 600-3000 Amp



LNA - NORMAL AVAILABLE LIGHT
LEA - EMERGENCY AVAILABLE LIGHT
RNH - NORMAL VOLTAGE RELAY
D1 - DIODE
R1 - RESISTOR, RNH
C - CAPACITOR, RNH
BR-1,2,3 - BRIDGE RECTIFIER

AA-1 - LIMIT SWITCH

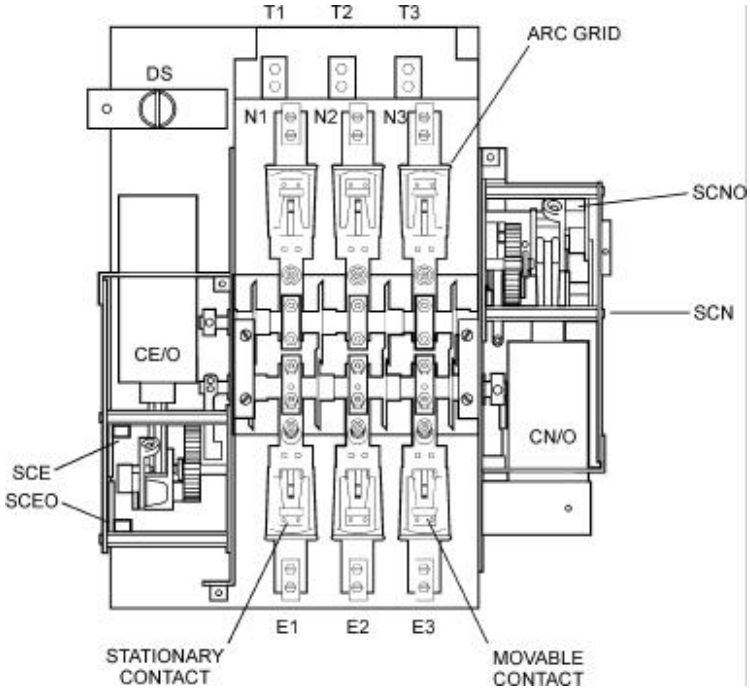
AB4-1- LIMIT SWITCH, BYPASS NORMAL
CBN - NORMAL TRANSFER OPERATOR
AA-2 - LIMIT SWITCH, ATS IN AUTO
AB3-1- LIMIT SWITCH, BYPASS EMERGENCY
CBE - EMERGENCY TRANSFER OPERATOR
LIT - ATS INHIBIT LIGHT
AI-1 - LIMIT SWITCH, ATS IN ISOLATE
LDS - DISCONNECT SWITCH
DS - ATS DISCONNECT SWITCH
R2 - RESISTOR, LDS
ACU - LIMIT SWITCH, CRANK HANDLE ENGAGED
CBC - CRANK SOLENOID
AA-3 - LIMIT SWITCH, ATS IN AUTO
ACD - LIMIT SWITCH, CRANK HANDLE ENGAGED
AI-3 - LIMIT SWITCH, ATS IN ISOLATE
LBE - BYPASS EMERGENCY
LBN - BYPASS NORMAL LIGHT
AB4-2- LIMIT SWITCH, BYPASS NORMAL
AB3-2- LIMIT SWITCH, BYPASS EMERGENCY
AT-1 - LIMIT SWITCH
ATR - AUTO/TEST RELAY
LAT - ATS TEST LOCATION
AT-2 - LIMIT SWITCH, ATS IN TEST
LAI - ATS ISOLATE LIGHT
AI-2 - LIMIT SWITCH, ATS IN ISOLATE
AA-4 - LIMIT SWITCH, ATS AUTO LOCATION

APPENDIX B - REPLACEMENT PARTS

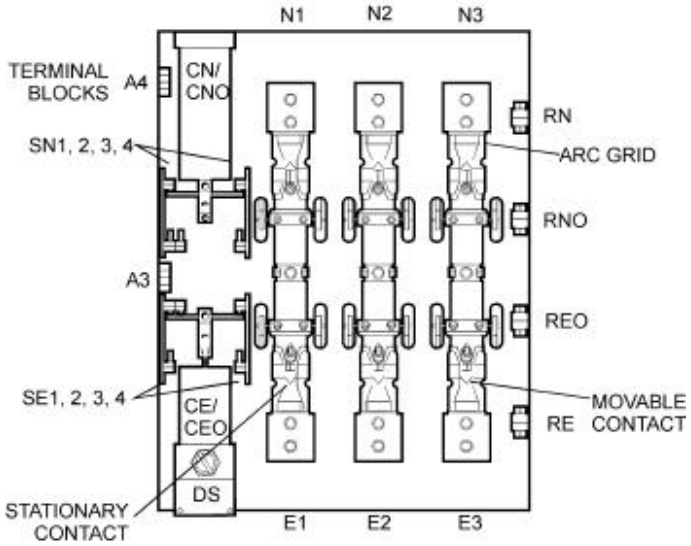
⚠ NOTICE

Model number and serial number of switch must be included with all orders for replacement parts. Specify line voltages, drawing numbers and date of installation. When ordering parts not shown on the parts list, refer to this part by its legend description in the wiring diagrams.

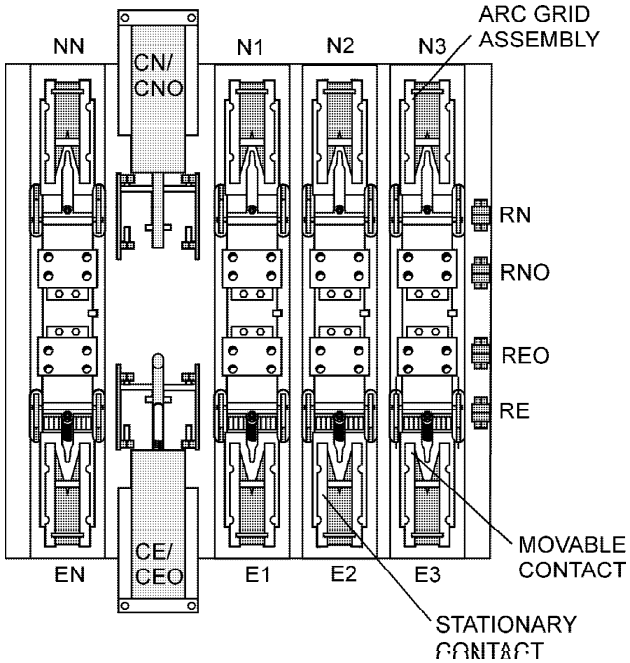
1. POWER PANEL 100-400 AMPS



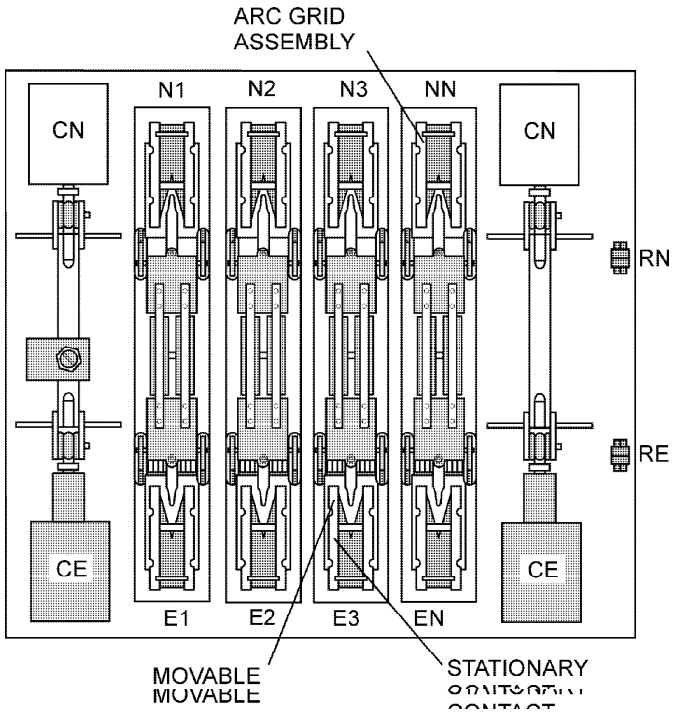
2. POWER PANEL 600-1200 AMPS



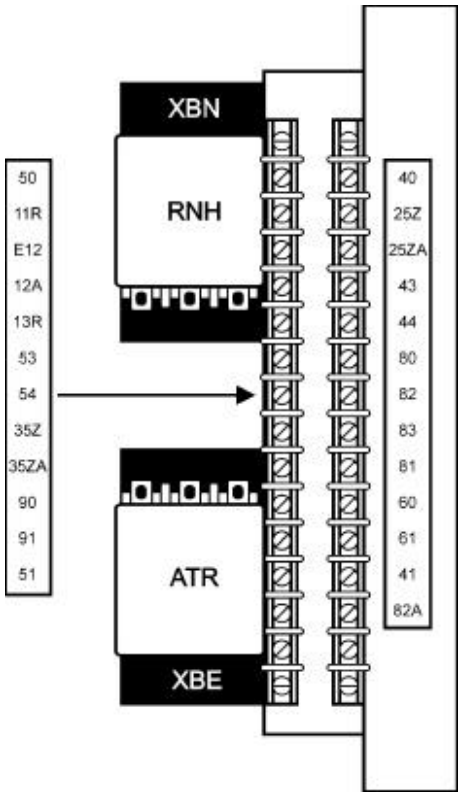
3. POWER PANEL 1600-3000 AMPS



4. POWER PANEL 4000 AMPS



5. BYPASS SUBPANEL



APPENDIX B - REPLACEMENT PARTS (Continued)

Power Panel Replacement Parts List 100-400 Amps										
Tag	Description						100A	150A	225A	260A	400A
NL1,2,3 EL1,2,3 T1,2,3 NLN, ELN, TN	Cable Connection Lug, CU Wire						PS-4418	PS-4418	PS-4418	S-1422	S-1422
Bypass Contact Assembly (Movable and Stationary)											
N1,2,3	Normal						46P-1104A	46P-1104B	46P-1104C	46P-1104D	46P-1104E
N	(Sw. Neutral Normal)						46P-1105A	46P-1105B	46P-1105C	46P-1105D	46P-1105E
E1,2,3	Emergency						46P-1106A	46P-1106B	46P-1106C	46P-1106D	46P-1106E
E	(Sw. Neutral Emergency)						46P-1107A	46P-1107B	46P-1107C	46P-1107D	46P-1107E
ATS Contact Assembly (Movable and Stationary)											
NL1,2,3	Normal						46P-1100A	46P-1100B	46P-1100C	46P-1100D	46P-1100E
N	(Sw. Neutral Normal)						46P-1101A	46P-1101B	46P-1101C	46P-1101D	46P-1101E
EL1,2,3	Emergency						46P-1102A	46P-1102B	46P-1102C	46P-1102D	46P-1102E
N	(Sw. Neutral Emergency)						46P-1103A	46P-1103B	46P-1103C	46P-1103D	46P-1103E
Arc Grid Assy.							46P-1099				
XBN, XBE	Bypass Step-Down Transformer Secondary 24V				**Voltage**		**Part No.**				
					120/240		K-3061				
					208/416		K-3063				
					220/440		K-3064				
					240/480		K-3062				
					380		K-3067				
					575		K-3065				
					600		K-3066				
Main ATS Operating Coils											
CN/O & CE/O	No.	Volts	Ph	Wire	Coil Volts	Poles	Part No.				
	-1	120	1	2	120	2	K-2178				
	-2	120/240	1	3	240	2, 3	K-2189				
	-3	240	3	3	240	3					
	-38	120/240	3	4	240	3, 4					
	-4	120/208	3	4	208	3, 4	K-2177				
	-5	480	3	3	480	3	K-2176				
	-6	575/600	3	3	575/600	3	SPO				
	-7	277/480	3	4	480	3, 4	K-2176				
	-9	240/416	3	4	416	3, 4	SPO				
	-91	220/380	3	4	380	3, 4	K-2188				
SN/SEO SE/SEO A3 A4	Normal Position Limit Switch Emergency Position Limit Switch ATS Emergency Position Switch ATS Normal Position Switch						L-3002				
SCN/O & SCE/O	CN/O & CE/O Limit Switches						L-3079				
AA AE1,2 PLS1,2	ATS Auto Location Switch ATS Isolate/Remove Location Switch Position Lever Switch						L-3071				
AI AT1,2	ATS Isolate Location Switch ATS Test Location Switch						L-3070				
AB3/ABE AB4/ABN NA4 EA3	Bypass Emergency Position Switch Bypass Normal Position Switch Normal TRS Limit Switch Emergency TRS Limit Switch						L-5021				
BTE BTN TSE BLL ALL	Bypass Emergency Position Switch Bypass Normal Position Switch ATS Engaged Switch Bypass Lock Location Switch ATS Lock Location Switch						L-3054				
DS	ATS Solenoid Disconnect Switch: Operator 2-Position Maintain						L-4018				
	Contact Block N.C. (3)						L-1029				
	Contact Block N.O. (2)						L-1028				
	Contact Block Mounting Plate						PS-3473				
BPS TRS	Bypass Interlock Solenoid Transfer Release Solenoid						K-2180				

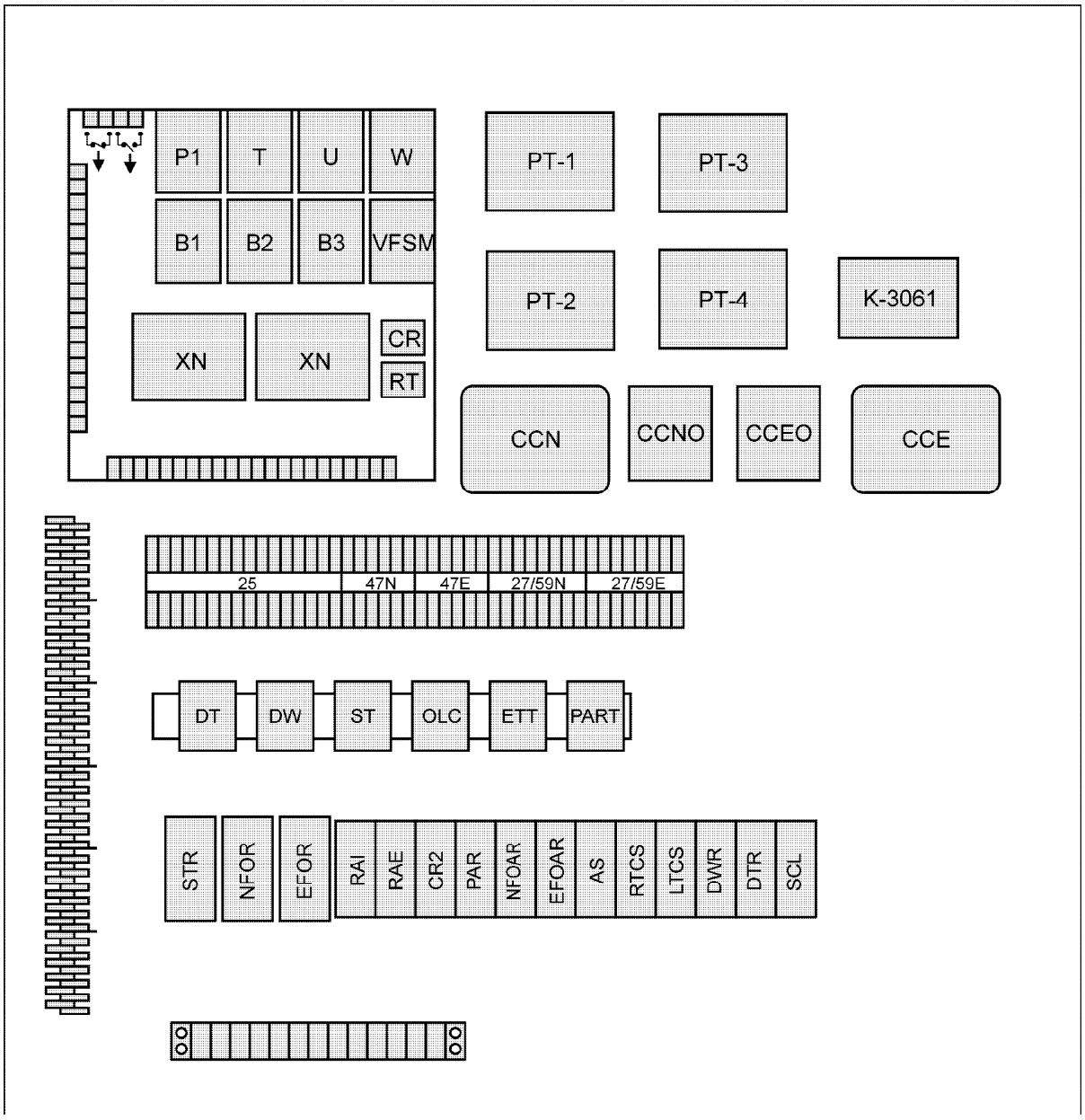
APPENDIX B - REPLACEMENT PARTS (Continued)

Power Panel Replacement Parts List 600-1200 Amps								
Tag	Description					600A	800A	1000A	1200A
N 1,2,3,N	Normal Connections CU/AL Cable Lugs					S-2119 (2) 600MCM-2	S-2131 (3) 600MCM-2	S-2132 (4) 600MCM-2	S-2132 (4) 600MCM-2
E 1,2,3,N	Emergency Connections CU/AL Cable Lugs					S-1393F (2) 600MCM-2	S-1391F (3) 600MCM-2	S-1392F (4) 600MCM-2	S-1392F (4) 600MCM-2
T 1,2,3,N	Load Connections CU/AL Cable Lugs					S-1393F (2) 600MCM-2	S-1391F (3) 600MCM-2	S-1392F (4) 600MCM-2	S-1392F (4) 600MCM-2
STAT (BP)	Stationary Contact Assembly Bypass					26P-1144	26P-1126	26P-1126	26P-1126
STAT (ATS)	Stationary Contact Assembly ATS					26P-1144	26P-1126	26P-1126	26P-1126
ARC	Arc Grid Assembly Kit					23P-1366			
MOV	Movable Contact Assembly					23P-1157	23P-1125	26P-1125	26P-1125
	Movable Contact (Switched Neutral)					23P-1157	26P-1231	26P-1231	26P-1231
XBN, XBE	Bypass Step-Down Transformer 25VA, Secondary 24V					**Voltage**	**Part No.**		
						120/240	K-3061		
						208/416	K-3063		
						220/440	K-3064		
						240/480	K-3062		
						380	K-3067		
						575	K-3065		
						600	K-3066		
Main ATS Operating Coils									
	Voltage Systems								
	No.	Volts	Ph	Wire	Coil Volts	Poles	Part No.		
CN/CNO CE/CEO	-1	120	1	2	120	2	SPO		
	-2	120/240	1	3	240	2	SPO		
						3	K-2146	K-2147	
	-3	240	3	3	240	3			
	-4	120/208	3	4	208	3, 4			
	-5	480	3	3	480	3	K-2158	K-2157	
	-7	277/480	3	4	480	3, 4			
	-9	240/416	3	4	416	3, 4	SPO		
SN/SNO-1,2	ATS Normal Position Coil					23P-1533			
SN/SNO-3,4	Cutout Switch DPDT					23P-1535			
SE/SEO-1,2	ATS Emergency Position Coil					23P-1534			
SE/SEO-3,4	Cutout Switch DPDT					23P-1536			
A3	ATS Emergency Position Switch					L-5021			
A4	ATS Normal Position Switch								
	Limit Switch, DPDT Roller Actuator								
AA	ATS Auto Location Switch					L-3052			
AT	ATS Test Location Switch					L-3054, L-3052			
ACU/ACD	Crank Limit Switches					L-3054			
AI	ATS Isolate Location					L-3052			
AE	Engine Start Transfer					L-3052			
	Limit Switch, DPDT Lever Actuator								
AB3	Bypass Emergency Position Switch								
AB4	Bypass Normal Position Switch					L-5021			
ASE	BSS Emergency Position Switch								
ASN	BSS Normal Position Switch								
DS	**ATS Solenoid Disconnect Switch**								
	Operator 2-Position Maintain					L-4009			
	Contact Block N.C. (3)					L-1020			
	Contact Block N.O. (2)					L-1024			
CBE	Emergency Interlock Solenoid					K-2192			
CBN	Normal Interlock Solenoid								
CBC	Crank Mechanism Solenoid					K-2159			
RN/RNO RE/REO	Coil Rectifiers					23P-1473			

APPENDIX B - REPLACEMENT PARTS (Continued)

Power Panel Replacement Parts List 1600-4000 Amps									
Tag	Description						1600/2000A	3000A	4000A
NL1,2,3 EL1,2,3	Cable Connection at Rear						S-1302F(2) Optional T1,2,3 (8) 600MCM-2		
	Stationary Contact Assembly Bypass and ATS						S-2308	S-2343	23P-1655
	Arc Grid Assembly Kit						23P-1171		
	Movable Contact Assembly						23P-1400	23P-1344	23P-1640
	Movable Contact						23P-1399	23P-1338	SPO
XBN, XBE	Bypass Step-Down Transformer 25VA, Secondary 24V						**Voltage**	**Part No.**	
							120/240	K-3061	
							208/416	K-3063	
							220/440	K-3064	
							240/480	K-3062	
							380	K-3067	
							575	K-3065	
							600	K-3066	
Main ATS Operating Coils									
CN/O & CE/O	Voltage Systems								
	No.	Volts	Ph	Wire	Coil Volts	Poles	Part No.		
	-1	120	1	2	120	2	SPO		
	-2	120/240	1	3	240	2, 3	K-2151		K-2219
	-3	240	3	3	240	3			
	-4	120/208	3	4	208	3, 4			
	-5	480	3	3	480	3	K-2160		K-2218
	-6	575	3	3	600	3	SPO		
	-7	277/480	3	4	480	3, 4	K-2160		K-2218
	-8	120/240	2	4	240	4	K-2151		K-2219
	-9	240/416	3	4	416	3, 4	Consult Zenith Factory		K-2220
SN/SNO	Limit Switch						23P-1540		
SE/SEO	Limit Switch						23P-1541		
A3	ATS Emergency Position Switch						23P-1543		
A4	ATS Normal Position Switch						23P-1542		
AA AT AI	ATS Auto Location Switch ATS Test Location Switch ATS Isolate Location Switch						L-3071		
AE	**Limit Switch DPDT, Roller Actuator** Engine Start Transfer						L-3052		
AB3 AB4	**Limit Switch DPDT, Lever Actuator** Bypass Emergency Position Switch Bypass Normal Position Switch						L-5021		
DS	ATS Solenoid Disconnect Switch: Operator 2-Position Maintain						L-4018		
	Contact Block N.C. (1) Contact Block N.O. (2)						L-1020 L-1024		
CBE CBN	Emergency Interlock Solenoid Normal Interlock Solenoid						K-2192		
CBC	Crank Enable Solenoid						K-2159R		
CH	Crank Handle Limit Switch						L-3052		
RN/RNO RE/REO	Coil Rectifiers						23P-1473 23P-1582 (480VAC)		

5. CONTROL PANEL LAYOUT AND PARTS LIST



APPENDIX B - REPLACEMENT PARTS (Continued)

Closed Transition Transfer Switch Control Panel Parts List			
Tag	Description	Voltage	Part No.
CR2	Normal Control Relay	120 VAC	K-1204
DT	Transfer Delay Timer Neutral to Normal	120 VAC	K-1230
DTR	Normal Transfer Latch Relay	120 VAC	K-1204
DW	Transfer Delay Timer Neutral to Emergency	120 VAC	K-1230
DWR	Emergency Transfer Latch Relay	120 VAC	K-1204
EFOAR	Relay, Emergency Fail to Open Alarm	24 VDC	K-1242
EFOR	Emergency Fail to Open Latching Relay	120 VDC	K-1240
ETT	Emergency Trip Timer	120 VAC	K-1230
LTCS	Latch Test Cycle Start	120 VAC	K-1204
NFOAR	Relay, Normal Fail to Open Alarm	24 VDC	K-1242
NFOR	Normal Fail to Open Latching Relay	120 VDC	K-1240
OLC	Open Last Close	120 VAC	K-1230
PAR	Power Available Relay	120 VAC	K-1204
PART	Power Available Timer	120 VAC	K-1249
PT1,2,3,4	Potential Transformers	120 /480 VAC	K-3094
		120/240 VAC	K-3095
		120/208 VAC	K-3096
RAI	Normal Available Relay	120 VAC	K-1204
RAE	Emergency Available Relay	120 VAC	K-1204
RTCS	Relay Test Cycle Start	240 VAC	K-1256
SCL	Sync Check Latch Relay	120 VAC	K-1204
ST	Sync Timer	120 VAC	K-1230
STR	Shunt Trip Relay	120 VDC	K-1240
XNE	Normal/Emergency Control Transformers	24/120 VAC	K-3061

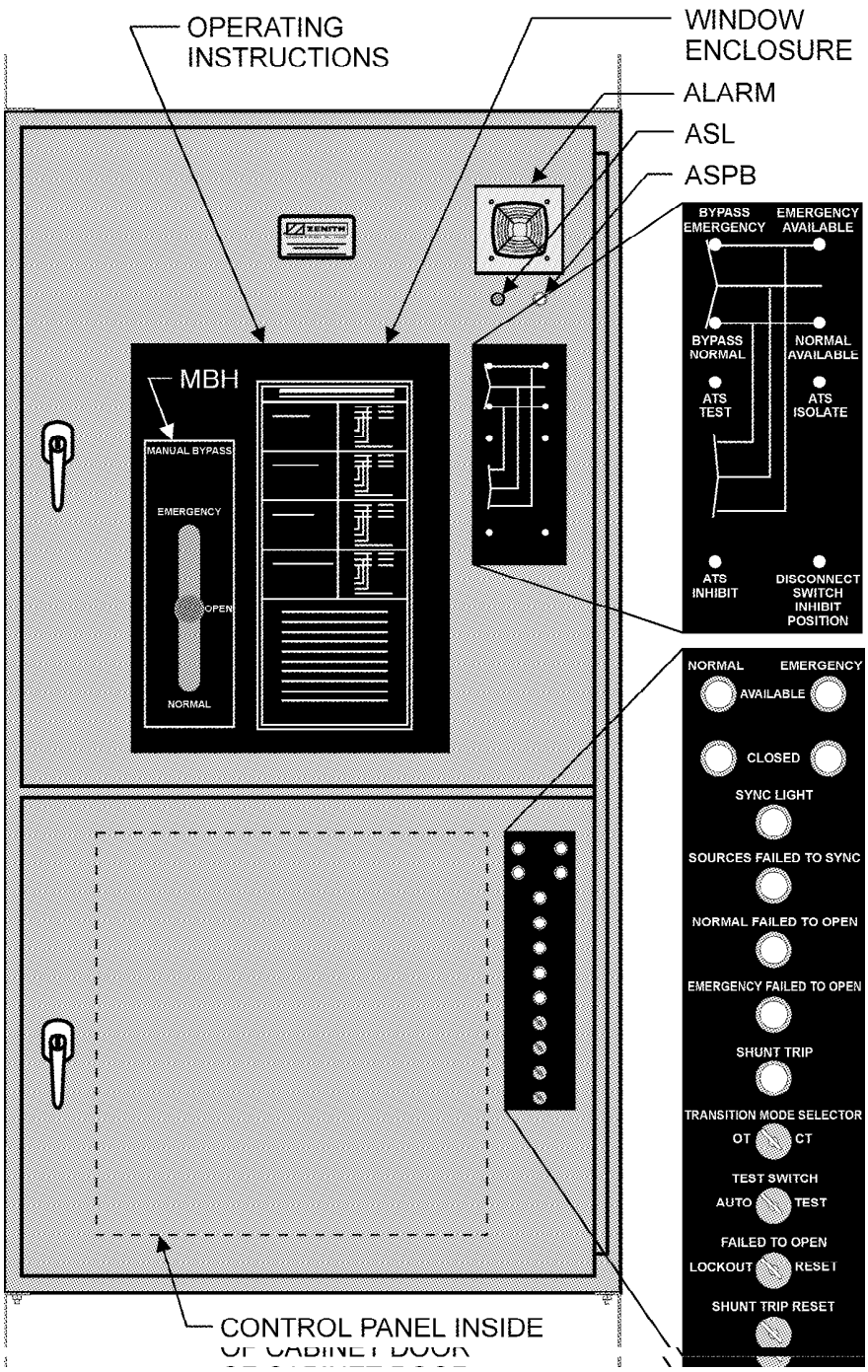
SSRCP Control Panel Standard Items Parts List			
Tag	Description	Voltage	Part No.
XN, XE	Control Transformer	208 VAC	K-3070
		240/480 VAC	K-3071
B1,2,3	Solid State Phase Relay	208/240 VAC	K-1186
		480 VAC	K-1188
VFSM	Voltage Frequency Sensor	120 VAC	K-1192
CR	Control Relay	120 VAC	K-1204
RT	Bypass T Relay	120 VAC	K-1204
J1-J11	Jumpers	-	PS-5067
T	Time Delay to Normal, Timer Solid State	120 VAC (Adjustable .1 second to 9990 hours)	K-1230
U	Engine Cool Down, Timer Solid State	120 VAC (Adjustable .1 second to 9990 hours)	K-1230
W	Time Delay to Emergency, Timer Solid State	120 VAC (Adjustable .1 second to 9990 hours)	K-1230
P1	Time Delay Engine Start, Timer	120 VAC (Adjustable .5 to 6 seconds)	K-1201

APPENDIX B - REPLACEMENT PARTS (Continued)

Closed Transition Transfer Switch Control Panel (Standard Items)				
Tag	Description	Voltage	Part No.	
25	Sync Check Relay	120 VAC	K-1234	
47N	Phase Sequencing, Normal	120 VAC	K-1246	
47E	Phase Sequencing, Emergency	120 VAC	K-1246	
27/59E	Over/Undervoltage, Emergency	120 VAC	K-1269	
27/59N	Over/Undervoltage, Normal	120 VAC	K-1269	
AS	Alarm Silence Relays	24 VDC	K-1242	
CCN	Power Relay for CN Solenoid	120 VAC	K-1120	400-1200A
			K-1257	1600-3000A
CCNO	Power Relay for CNO Solenoid	120 VAC	K-1120	
CCE	Power Relay for CE Solenoid	120 VAC	K-1120	400-1200A
			K-1257	1600-3000A
CCEO	Power Relay for CEO Solenoid	120 VAC	K-1120	

Bypass Control Panel Parts List		
Tag	Description	Part No.
BR-1,2,3	Bridge Rectifier	PS-5076
RNH	Normal Voltage Relay	K-1218
R1	Resistor, RNH, 30 ohm	PS-4056
R2	Resistor, LDS, 120 ohm	PS-4057
D1	Diode	PS-4812
C	Capacitor RNH	PS-4058
ATR	Auxiliary Test Relay	K-1218

6. CABINET DOOR PILOT DEVICES



BYPASS-ISOLATION CLOSED TRANSITION TRANSFER SWITCH CONTROLS

APPENDIX B - REPLACEMENT PARTS (Continued)

Controls and Indicating Lights Parts List				
Controls		**Part No.**		
Description		**Operator**	**Switch**	**Mounting Base**
Transition Mode Selector		L-3081	L-1028 (4) L-1029 (2)	PS-3473
Test Switch		L-3081	L-1029	
Failed to Open Lock Out Reset		L-4020	L-1028	
Shunt Trip Reset		L-4020	L-1028	
Alarm Silence Push Button (ASPB)		L-1025	L-1028 L-1029	
Alarm		Y780001		
Indicating Lights (Upper Door)		**Part No.**		
Description	**Color**	**Socket**	**Bulb**	**Lens**
Normal Available	Green	PS-5046	Y500005	PS-5048
Emergency Available	Red			PS-5047
Bypass Normal Location	Green			PS-5048
Bypass Emergency Location	Red			PS-5047
ATS Test Position	Amber			PS-5049
ATS Isolate Position	Amber			PS-5049
ATS Inhibit	Red			PS-5047
ATS Disconnect Switch “Off”	Red			PS-5047
Indicating Lights (Lower Door)		**Part Numbers**		
Description	**Color**	**Socket**	**Bulb**	**Lens**
Normal Available	Green	PS-5046	PS-5105	PS-5048
Emergency Available	Red			PS-5047
Normal Closed	Green			PS-5048
Emergency Closed	Red	PS-5054		PS-5047
Sync Light	White	PS-5046	Y500005	PS-5051
Fail To Sync Light	Red		PS-5105	PS-5047
Normal Failed To Open	Red		Y500005	
Emergency Failed To Open	Red		Y500005	
Shunt Trip Light	Red		PS-1272	
Alarm Silence (ASL)	Red		Y500005	



830 West 40th Street
Chicago, IL 60609 USA

Phone: 773 247-6400
Fax: 773 247-7805
E-Mail: zenith@zenithcontrols.com
www.zenithcontrols.com

© 1997 Zenith Controls, Inc.

ZBTSCTH SERIES
BYPASS/ISOLATION/CLOSED TRANSITION TRANSFER SWITCH OPERATION
100-400 AMP
OPERATION: BYPASS/ISOLATION SWITCH

AUTOMATIC

1. Manually operated Bypass Switch contacts (BN/BE) are open and ATS is supplying load
2. Disconnect Switch (DS) is in "AUTO".

TO BYPASS ATS

1. Open bottom cabinet door & turn DS to "INHIBIT".
2. Position manual bypass handle (MBH) to same power source as ATS.

TO TEST ATS

1. Bypass per above insturctions.
2. Move ATS location handle (ALH) to "TEST" location.
3. Turn DS to "AUTO".
4. Test Switch (TS) on bottom cabinet door will allow electrical operation of ATS.

TO ISOLATE ATS

1. Bypass per above instructions.
2. Move ALH to "ISOLATE" location.

TO REMOVE ATS

1. Bypass and Isolate per above instructions.
2. Move ALH to "RELEASE" location.
3. Disconnect multipin plugs.
4. Lift ATS out of drawer.

TO RECONNECT ATS

1. Place ATS into drawer slots (front rollers first).
2. Turn DS to "INHIBIT".
3. Manually position ATS into same source as Bypass Switch.
4. Reconnect multipin plugs and external connections to ATS.
5. Push ATS inward to engage carriage.
6. Move ALH to "TEST" location (as indicated by light)
7. Turn DS to "AUTO" and use TS to electrically operate ATS.
8. Turn DS to "INHIBIT".
9. Move ALH to "AUTO" location.
10. Turn DS to "AUTO" & open Bypass with MBH.
11. ATS is now fully automatic (Fig.1).

NOTES:

1. DS in "INHIBIT" will prevent ATS electrical operation.
2. Do not use excessive force on mechanical handles.
3. Above Figures depict Bypass NORMAL. Sequence is same for Bypass EMERGENCY.
4. When ATS is in TEST or ISOLATE, Bypass Switch is manual transfer switch to either available source (indicated on light panel).
5. To operate Bypass Switch when ATS is in TEST or ISOLATE, position MBH to available power source.

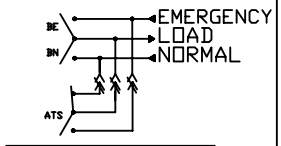


FIG. 1 BP IS OPEN WITH ATS IN NORMAL

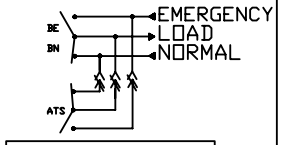


FIG. 2 BP IN NORMAL WITH ATS IN NORMAL

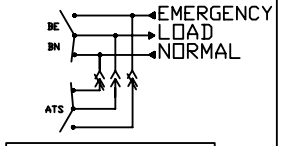


FIG. 3 BP IN NORMAL WITH ATS IN TEST (LOAD CONNECTIONS ARE OPEN)

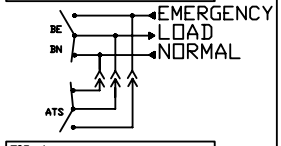


FIG. 4 BP IN NORMAL WITH ATS ISOLATED

NOTES:
1. BP-Bypass switch (indicated by contacts BN/BE) is a 3 position switch.
2. ATS-Automatic Transfer Switch

LEGEND: BYPASS/ISOLATION SWITCH (BP)

I. (BP) BYPASS/ISOLATION SWITCH: MECHANICAL COMPONENTS

N1,2,3(N).....	Normal Line connections_____
E1,2,3(N).....	Emergency Line connections_____
T1,2,3(N).....	Load Line connections_____
BE.....	Bypass Emergency contacts
BN.....	Bypass Normal contacts
MBH.....	Manual Bypass Handle
ALH.....	ATS Location Handle

II. (BP) BYPASS/ISOLATION: ELECTRICAL COMPONENTS

AA-1,2,3.....	Limit switch held actuated in Auto location of ATS, Non-actuated Test and Isolated locations.
AB3-1,2,3,4,5.....	Limit switch, actuated in Bypass Emergency position
AB4-1,2,3.....	Limit switch, actuated in Bypass Normal position
ABE.....	Auxiliary Bypass contact (Emergency)
ABN.....	Auxiliary Bypass contact (Normal)
AE-1,2.....	Limit switch, switches Engine Start from ATS control to bypass control during ATS Isolate
AI.....	Limit switch, actuated in Isolate location
ALL.....	Limit switch, ATS lock location
AT-1,2.....	Limit switch, actuated in Test location
ATR.....	Auto/Test Relay. Energized in AUTO and TEST locations
AUTO.....	Auto Location Relay. Energized in AUTO location
BLL.....	Limit switch, Bypass lock location
BPS.....	Bypass Solenoid
BR-1,2,3.....	Bridge Rectifier
BTE.....	Limit switch, Bypass Transfer Emergency (actuates during MBH movement to Emergency)
BTN.....	Limit switch, Bypass Transfer Normal (actuates during MBH movement to Normal)
C.....	Capacitor: RNH
D1.....	Diode
PLS-1,2.....	Permissive limit switches
R1.....	Resistor: RNH
R2.....	Resistor: LDS
RNH.....	Relay normally held, 24 VDC coil, 3PDT
SE-2.....	Limit switch, ATS in Emergency
SN-2.....	Limit switch, ATS in Normal
TRS.....	Transfer Release Solenoid
TSE.....	Limit switch. Transfer switch engaged non-activated in remove position
XBE.....	Emergency line control transformer
XBN.....	Normal line control transformer

III. (BP) BYPASS/ISOLATION SWITCH: INDICATOR LIGHTS

LNA.....	Normal available
LEA.....	Emergency available
LBN(NOTE 1).....	Bypass Normal (BN closed)
LBE(NOTE 1).....	Bypass Emergency (BE closed)
LAT(NOTE 1).....	ATS in Test location
LAI(NOTE 1).....	ATS in Isolate location
LIT(NOTE 1).....	ATS Inhibit
LDS(NOTE 1).....	ATS DS switch in INHIBIT position

NOTES:
1. Indicator off during automatic operation of ATS.
2. Four pole includes neutral lugs.

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
E	S-6358	03/14/96	RMC	SB
F	S-6619	11/21/96	SG	SB

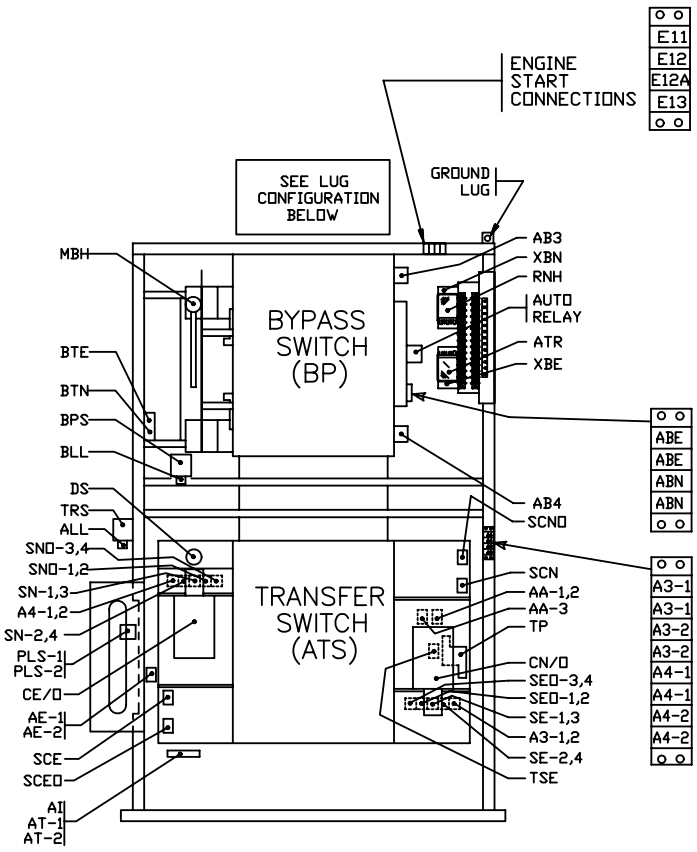
ZENITH CONTROLS, INC.

TITLE: BP/ISOLATION SW: LEGEND & OPERATION
MODEL: ZBTSCTH10/40 (100-400 AMPS)

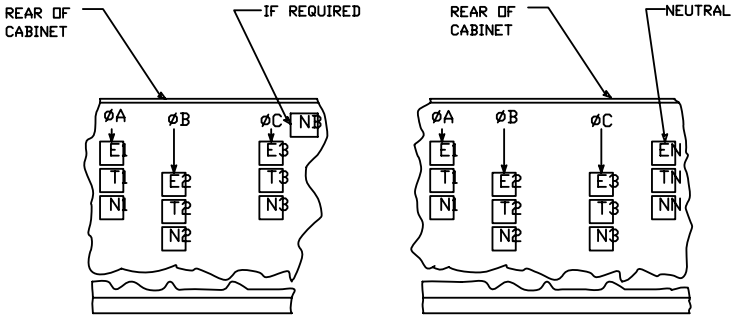
DRFT: IRAY	DATE:	SCALE:	CHK:	APPD:
ENGR: JC	01/27/94	N/A		

DWG NO.: 46A-7000 REV F
CADD: S5K SHT. 1 OF 10

ORIGINAL



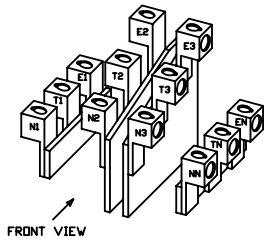
DEVICE TAG	TERMINAL MARKINGS WIRE NUMBER						COMMENTS
TRANSFORMERS	X1	X2	H1	H2	H3	H4	
XBE	53	54	50			51	G CASE
XBN	43	44	40			41	G CASE
SOLENOIDS	NO MARKINGS						
BPS	63		62				G CASE
TRS	84		81				
CN/O	400R		401R				
CE/O	500R		501R				
SWITCHES	NO		NC		NC		NO
DS	80	82	209	201	2535	2536	87 87C
	80	90	309	502			
LIMIT SWITCHES	C	NC	NO	C	NC	NO	
A3	A3-1	A3-1		A3-2	A3-2		
A4	A4-1	A4-1		A4-2	A4-2		
AA-1,2	60		61	64	80	87	
AA-3	80		80A				
AB3-1,4	83A	83B	86	ABE		ABE	
AB3-2,3	E12		E11	E12A	12A		
AB3-5	2537	2538					
AB4-1,2	80	83A	85	ABN		ABN	
AB4-3	2538	2539					
PLS-1,2	87A		87B	83B	83		
ALL	64		63				
BLL	87C		87A				
TSE	87B		84				
BTN	60		62				
BTE	61		62				
AE-1,2	E11	11	11R	E13	13	13R	
AI				63		89	
AT-1,2	80		83B	63		88	
SE-1,3	33F	36	34	2333	2350		
SN-1,3	23F	26	24	23C		23E	
SE-2,4	65	86	87	23K		23L	
SN-2,4	65	85	87	23M		23L	
SEO-1,2,3,4	25ZA	25A	25B	28D	25A		
	2334	2335		33Y		33X	
SNO-1,2,3,4	35ZA	35A	35B	38D	35A		
	2333	2334		23C		23N	
RECTIFIERS	AC	AC	+	-			
BR-1	43	44	80	60			
BR-2	53	54	80	61			
BR-3	60	61		81			
RTN	201	217	400R	401R			
RTE	502	307	501R	500R			



SECTION "B-B" (3-POLE)

SECTION "B-B" (4-POLE)

LUG CONFIGURATION



ISOMETRIC VIEW
LUG CONFIGURATION
(4-POLE)

LEGEND	NOTES

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
E	S-6358	03/11/96	RMC	SB
F	S-6619	11/21/96	SG	SB

ZENITH CONTROLS, INC.

TITLE: BP & ATS COMPONENT LOCATIONS

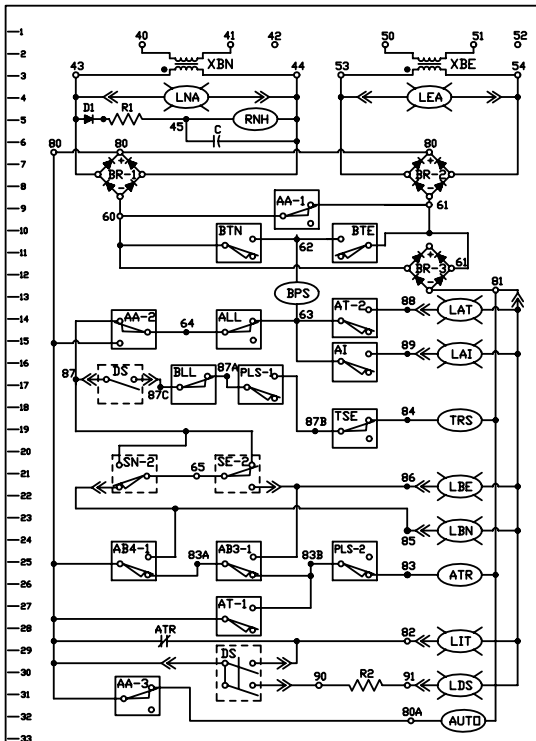
MODEL: ZBTSCTH10/40 (100-400 AMPS)

DRFT: IRAY	DATE:	SCALE:	CHK:	APPD:
ENGR: JC	01/27/94	N/A		

DWG NO.: 46A-7000 F

CADD: S5K SHT. 2 OF 10 REV

ORIGINAL



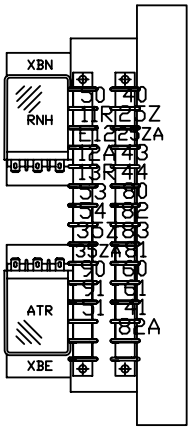
LNA - NORMAL AVAILABLE LIGHT
LEA - EMERGENCY AVAILABLE LIGHT
RNH - NORMALLY HELD RELAY
D1 - DIODE
R1 - RESISTOR, RNH
C - CAPACITOR, RNH
BR-1,2,3 - BRIDGE RECTIFIER

AA-1 - LIMIT SWITCH, ATS AUTO LOCATION
BTN - LIMIT SWITCH, BYPASS TRANSFER NORMAL (MBH MOVEMENT TO NORMAL)
BTE - LIMIT SWITCH, BYPASS TRANSFER EMERG. (MBH MOVEMENT TO EMERGENCY)
BPS - BYPASS SOLENOID
AA-2 - LIMIT SWITCH, ATS AUTO LOCATION
ALL - LIMIT SWITCH, ATS LOCK LOCATION
AT-2 - LIMIT SWITCH, ATS TEST LOCATION
LAT - LIGHT, ATS TEST LOCATION
AI - LIMIT SWITCH, ATS ISOLATE LOCATION
LAI - LIGHT, ATS ISOLATE LOCATION
BLL - LIMIT SWITCH, BYPASS LOCK LOCATION
PLS-1- PERMISSIVE LIMIT SWITCH
TSE - LIMIT SWITCH, TRANSFER SWITCH ENGAGED
TRS - SOLENOID, TRANSFER RELEASE
SN-2 - LIMIT SWITCH, ATS IN NORMAL
SE-2 - LIMIT SWITCH, ATS IN EMERGENCY
LBE - LIGHT, BYPASS EMERGENCY

LBN - LIGHT, BYPASS NORMAL
AB4-1 - LIMIT SWITCH, BYPASS NORMAL
AB3-1- LIMIT SWITCH, BYPASS EMERGENCY
PLS-2- PERMISSIVE LIMIT SWITCH
ATR - AUTO/TEST RELAY
AT-1 - LIMIT SWITCH, ATS TEST LOCATION

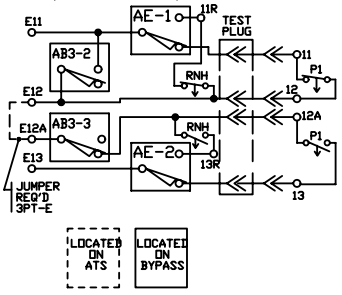
LIT - LIGHT, ATS INHIBIT
DS - ATS DISCONNECT SWITCH
R2 - RESISTOR, LDS
LDS - LIGHT, DISCONNECT SWITCH INHIBIT POSITION
ALH - ATS LOCATION HANDLE
AA-3 - LIMIT SWITCH ATS AUTO LOCATION
AUTO - AUTO LOCATION RELAY

BYPASS SUBPANEL

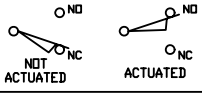


ENGINE START CIRCUIT

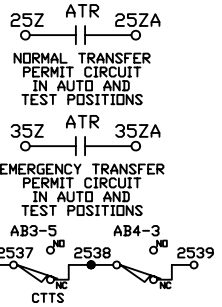
AE-1,2 - LIMIT SWITCH, ENGINE START TRANSFER
AB3-2,3- LIMIT SWITCH, BYPASS EMERGENCY



LIMIT SWITCHES



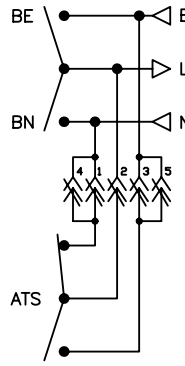
PERMIT CIRCUITS

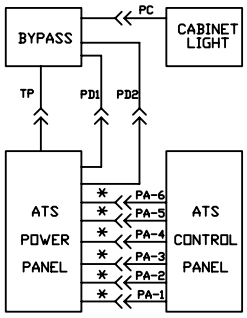


CLOSED TRANSITION PERMIT CIRCUIT (IN AUTO LOCATION ONLY)

LIMIT SWITCH CHART

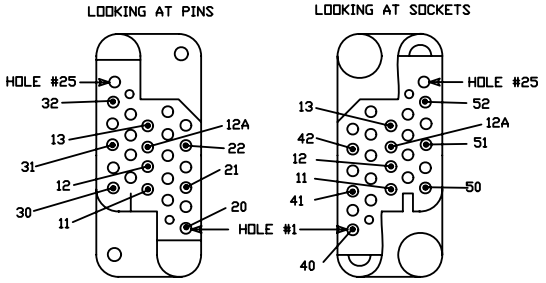
X = ACTUATED	ATS LOCATION				ATS MODE		BYPASS MODE		
	AUTO	TEST	ISO	REMOVE	NORM	EMERG.	NORM	EMERG.	OPEN
AA	X								
AT		X							
AI			X	X					
ALL	X	X	X	X					
TSE	X	X	X						
AE			X	X					
NA					X				
EA						X			
AB4							X		
AB3								X	
BLL								X	X
PLS	ACTIVATED WHEN ALH IS OPERATED								

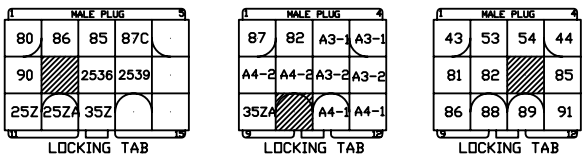




* SEE INTERCONNECT PLUGS ON SCHEMATIC SHEET

ATS TEST PLUG (TP)





ATS LOCATION	LOAD CARRYING CONTACTS			ATS TEST PLUG (TP)	
	1	2	3	4	5
AUTO	X	X	X	X	X
TEST	O	O	O	X	X
ISOLATE	O	O	O	O	O

X = CLOSED
O = OPEN

NOTES

ATS SHOWN IN NORMAL POSITION, BYPASS OPEN WITH NO POWER AVAILABLE.

REVISIONS

RV	ECN NO.	DATE	DRF	ENG
E	S-6358	03/11/96	RMC	SB
F	S-6619	11/21/96	SG	SB

ZENITH CONTROLS, INC.

TITLE: BYPASS CONTROL CIRCUIT SCHEMATIC
MODEL: ZBTSCTH10/40 (100-400 AMPS)

DRFT: IRAY	DATE:	SCALE:	CHK:	APPD:
ENGR: JC	01/27/94	N/A		

DWG NO.: 46A-7000 F
CADD: S5K SHT. 3 OF 10 REV

ORIGINAL

LEGEND & OPERATION
AUTOMATIC TRANSFER SWITCH
(ATS)

FOR USE ON EMERGENCY OR STANDBY SYSTEMS - RATED FOR TOTAL SYSTEM & MOTOR LOAD

A. LEGEND

N1,2,3,(N).....Normal Line_____
E1,2,3,(N).....Emergency Line_____
T1,2,3,(N).....Load Connections
B1,2,3.....Solid State Phase Relay(s)
Dropout____ %
Pickup____ %
AS.....Alarm Silence Relay
CE/O.....Main Transfer Operator, Emergency
CN/O.....Main Transfer Operator, Normal
CE1..... Control Relay, Emergency Closing
CEO..... Control Relay, Emergency Opening
CN1..... Control Relay, Normal Closing
CNO..... Control Relay, Normal Opening
CR ,CR2.....Normal Control Relay
DS.....Disconnect Switch
DT.....Timer, Delay Open To Normal
DTR.....Normal Transfer Latch Relay
DW.....Timer, Delay Open To Emergency
DWR.....Emergency Transfer Latch Relay
D1.....Diode #1
D2.....Diode #2
E.....Engine Start Contact
EFOAR.....Emergency Fail to open Alarm Relay
EFOR.....Emergency Fail to open Relay
ETT.....Emergency Trip Timer
GND.....Ground
LTCS.....Latch Test Cycle Start
NB.....Neutral Bar (if required)
NFOAR.....Normal Fail to open Alarm Relay
NFOR.....Normal Fail to open Relay
OLC.....Open Last Close Timer
PAR.....Power Available Relay
PART.....Power Available Timer
PT-1,2..... Potential Transformers Normal
PT-3,4.....Potential Transformers Emergency
RAE.....Emergency Available Relay
RAI.....Normal Available Relay
RTE.....Bridge Rectifier, CE/O
RTN.....Bridge Rectifier, CN/O
RNE.....Bridge Rectifier, XNE
RT.....Emergency Control Relay
RTCS.....Relay Test Cycle Start
SCN, SCNO.....Limit Switches, CN/O
SCE, SCEO.....Limit Switches, CE/O
SCL.....SYNC Check Latch
SE,SEO.....Cutout Switch, Emergency
SN,SNO.....Cutout Switch, Normal
ST.....SYNC Timer
STR.....Shunt Trip Relay
VFSM.....Emergency Volt-Freq. Relay
Pickup {90% of rated Voltage, and 95% of rated Frequency
XE.....Control Transformer, Emergency
XN.....Control Transformer, Normal
XNE.....Control Transformer - Norm./Emerg.
25(ANSI).....Sync Check Relay
47N,E(ANSI).....Phase sequencing - Norm./Emerg.
27/59N,E(ANSI)..Over/Undervoltage - Norm./Emerg.

B. OPERATION (OPEN TRANSITION)

(See note #4)

When the Normal Line falls to the preset drop-out point or if any normal phase fails, the phase relay(s) will dropout disconnecting the CR relay.

When the Emergency Line voltage & frequency reach at least 90% of rated value, the VFSM relay energizes. Emergency transfer timer W energizes. After the set time delay, RT relay energizes to operate the CNO relay thru the SE cutout switch causing the CN/O transfer operator to operate thru the SCNO limit switch. The load is now trans--ferred to the Open position. The SNO and SCNO limit switches operate to disconnect the CNO relay and CN/O transfer operator. The transfer switch is now locked mechanically open. SNO is now activated This energizes the DW timer. After a set time delay, DW will energize CE1 which will then energize CE/O transfer operator thru the SCE and CE1. The load is now transferred to the emergency line supply. The SE and SCE limit switches operate to disconnect the CE1 relay and CE/O transfer operator. The transfer switch is now locked mechanically. into Emergency.

When the Normal Line voltage restores to the preset value, the phase relay(s), (B1, B2, B3) operate to energize the Normal restoration timer T. After a set time delay, CR relay energizes. The CEO relay is now energized thru the SN and SEO limit switches causing the CE/O transfer operator to operate thru the SCEO limit switch. The load is now transferred to the Open position. The SEO and SCEO limit switches operate to disconnect the CEO relay and CE/O transfer operator. The transfer switch is now locked mechanically open. SEO is now activated, energizing DT timer. After a set time delay, DT will energize CN1 which will then energize CN/O transfer operator thru the CN1 and SCN. The load is now transferred to the Normal line supply. The SN and SCN limit switches operate to disconnect the CN1 relay and CN/O transfer operator. The transfer switch is now mechanically locked into Normal.

DS - Disconnect Switch
When the Disconnect Switch is placed in the INHIBIT position the circuit to the main transfer operators CN/O and CE/O is opened and transfer cannot take place.

TS - Test Switch
The Test Switch simulates a normal line failure when activated.
To test, activate the Test Switch allowing the transfer switch to transfer to the EMERGENCY position. De-activate the Test Switch. The transfer switch will reset to the NORMAL position. Testing at least once a month is recommended. For hospital emergency systems, test once a week.

C. ACCESSORIES

The ZTSCTH series transfer switch is wired so that accessories can be easily added to the switch. The following is a description of the accessories which are supplied on this unit.

- ☐ A1 Auxiliary contact, S.P.D.T., operates on normal line failure.
- ☐ A1E Auxiliary contact, S.P.D.T., operates on emergency line failure.
- ☐ A3 Auxiliary contact closes when the transfer switch is in the Emergency position.
- ☐ A4 Auxiliary contact closes when the transfer switch is in Normal position.
- ☐ A6 Motor Disconnect. To de-energize external motor control circuit 5 seconds (adjustable) prior to transfer in either direction.
- ☐ C Plant Exercisor. Automatically starts generator for selected time intervals.
- ☐ C/D Plant Exercisor. Automatically starts generator to run unloaded or simulate a power failure and starts generator to run under load.
- ☐ E Engine Start Contact: 1 Normally Open 1 Normally Closed.
- ☐ F Auxiliary Fan Contact, S.P.N.O. Closes when generator is running.
- ☐ H Time delay to engine start, non-adjustable. Factory set 1 or 3 seconds. When the Normal line fails the relay de-energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.
- ☐ J1 Adjustable under frequency sensor.
- ☐ J2 Adjustable over/under frequency sensor.
- ☐ K Frequency meter to indicate load frequency.
- ☐ L1 Pilot Light. Switch in Emergency Position.
- ☐ L2 Pilot Light. Switch in Normal Position.
- ☐ L3 Pilot Light. Normal source available.
- ☐ L4 Pilot Light. Emergency source available.
- ☐ M1 Ammeter; Single phase.
- ☐ M2 Ammeter; Three phase
- ☐ M3 Voltmeter; Single phase.
- ☐ M4 Voltmeter; Three phase.
- ☐ P1 Time Delay to Engine Start (solid state). Adjustable over time range .5 to 6 seconds. When the Normal line fails the relay de-energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in Normal position, the relay energizes and the engine start contacts open to shut down the engine.
- ☐ P2 Time Delay to Engine Start (Pneumatic). Adjustable over time range 1/6 to 300 seconds. When the Normal line fails, the relay de-energizes. After the set time delay its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.
- ☐ Q2 Connections for remote peak shave or area protection relays. Includes bypass for automatic return to Normal if Emergency line fails and Normal is present.
- ☐ R1 Solid State Adjustable Overvoltage Relay(s). Set at 110% of pickup, 105% of dropout of nominal Line rate, unless otherwise specified.
- ☐ R4 In-Phase monitor. Prevents transfer until two sources are in-phase. For use of isochronous governors.
- ☐ R43 In-phase monitor. Prevents transfer until two sources are in-phase. For use with mechanical. governors.
- ☐ S1 Four-position Engine Control Selector Switch. "STOP", "HAND CRANK", "TEST", "AUTOMATIC".
- ☐ T Time delay, re-transfer to Normal. When the Normal line restores and the phase relays operate, the T timer is energized. After the set time delay, its contacts close the circuit to the CR relay which operates to restore the load to the Normal line. RT relay is supplied to bypass T contacts if Emergency is de-energized during timing. CAUTION-DO NOT SET TIMER AT THE "0" POINT.
- ☐ T3 W3 Presignal auxiliary Contact, S.P.D.T: Operates 0-30 seconds (adjustable) prior to transfer in either direction.
- ☐ U Time delay, engine cool-down. When the transfer switch is restored to the Normal position and the engine is signaled to shut down, the U timer operates to maintain the engine start circuit closed. At the end of the set time, the engine contacts open to shut down the engine. CAUTION-DO NOT SET TIMER AT THE "0" POINT.
- ☐ W Time delay, transfer to Emergency. When the Normal line fails and the engine has started, the VFSM relay energizes. The W timer energizes. After the set time delay, its contacts close to energize the RT relay. CAUTION-DO NOT SET TIMER AT THE "0" POINT.
- ☐ YE Pushbutton Transfer to Emergency. Provides manual control of transfer to emergency source. If time delay accessory W is supplied pushbutton bypasses time delay for immediate transfer; otherwise, transfer to emergency will be automatic after time delay. If time delay accessory W is not supplied, transfer will be non-automatic (by pushbutton only).
- ☐ YN Pushbutton to Retransfer to Normal. Provides manual control of retransfer to normal source. If time delay accessory T is supplied, pushbutton bypasses time delay for immediate retransfer; otherwise, retransfer to normal will be automatic after time delay. If time delay accessory T is not supplied, retransfer will be non-automatic (by pushbutton only).

Other: _____
_____
_____

NOTES:

1. ⚠ CAUTION:In using a 3 phase, 4 wire delta or open delta power supply (usually 120/240 volts, sometimes listed as 120/208 volts) with one leg having a grounded center tap, one line will be 160 to 208 volts to ground. When such a system is used it is necessary to connect the high leg to N2.DO NOT CONNECT 120 VOLT LOAD CIRCUIT TO THE HIGH LEG.
2. GROUNDING TERMINAL: A grounding terminal (GND) is provided. When installing open type switches connect this to the metal enclosure or conduit.
3. ⚠ WARNING - TO ENSURE AGAINST SHOCK OR ACCIDENT HAZARD, DISCONNECT ALL SOURCES OF SUPPLY BEFORE SERVICING.
4. OPEN TRANSITION OPERATION CAN BE SELECTED WITH BOTH SOURCES AVAILABLE. OPEN TRANSITION OCCURS BY DEFAULT WHEN THE LOAD-CONNECTED SOURCE FAILS.
5. ON SINGLE PHASE UNITS WHERE THE EMERGENCY SOURCE IS A UTILITY LINE, CONNECT EMERGENCY LINE SO THAT MINIMUM VOLTAGE IS MEASURED FROM N1 TO E1.
6. ON SINGLE PHASE (2 POLE) UNITS, CENTER POLE AND PHASE RELAYS (B2,B3) ARE NOT SUPPLIED ALSO 47N & 47E ARE ELIMINATED.

3Ø 27/59N & E ARE REPLACED BY 1Ø 27/59N & E.

ACCESSORY LIST:

NOTES:

ZENITH CONTROLS, INC.

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
E	S-6358	03/11/96	RMC	SB
F	S-6619	11/21/96	SG	SB

TITLE: LEGEND AND ACCESSORIES
MODEL: ZBTSCTH10/40 (100-400 AMPS)

DRFT: IRAY	DATE:	SCALE:	CHK:	APPD:
ENGR: JC	01/27/94	N/A		

DWG NO.: 46A-7000 REV: F
CADD: S5K SHT. 4 OF 10

ORIGINAL

D. LEGEND (PILOT DEVICES)

ASL.....Alarm Silence Light
ASPB.....Alarm Silence Pushbutton
EFOL.....Emergency Fail to open light
FSL.....Fail to SYNC Light
L1.....Emergency Position Light
L2.....Normal Position Light
L3.....Normal Available Light
L4.....Emergency Available Light
NFOL.....Normal Fail to open Light
RESET-1.....Fail to Open Lockout Reset
RESET-2.....Shunt Trip Reset
SL.....SYNC Light (Dark SYNC)
STL.....Shunt Trip Light
TMS.....Transition Mode Selector
TS.....Test Switch maintained, keyed

E. OPERATION - CLOSED TRANSITION

Zenith Closed Transition Transfer Switches are designed to Transfer load between two available sources, without interrupting power to the load (make before break). Paralleling of the two sources occurs within a predefined window of synchronization and lasts less the 100ms. The initial source is then disconnected.

To test the ATS, turning the Test Switch (TS) to Test initiates transfer by dropping out the Engine Start Relay. Turning the "TS" disables the circuit which transfers to Normal and enables the circuit which transfers to Emergency. The ATS closes into Emergency only after the Sync Check Relay ensures the proper phase relationship of both sources.
After the ATS closes into Emergency the SE limit switch becomes de-activated to de-energize the CE1 relay and energize the CNO relay which opens the ATS out of Normal. When the ATS has opened out of Normal, the SNO-2 limit switch activates to de-energize the CNO relay.
The ATS has now closed into Emergency Power without interrupting the load.

Turning the "TS" to "AUTO" initiates transfer to Normal.
Turning the "TS" disables the circuit which transfers to Emergency and enables the circuit which transfers to Normal. The ATS closes into Normal only after the Sync Check Relay ensures proper phase relationship of both sources.
After the ATS closes into Normal the SN limit switch becomes de-activated to de-energize the CN1 relay and energize the CEO relay, which opens the ATS out of Emergency. When the ATS has opened out of Emergency, the SEO-2 limit switch activates to de-energize the CEO relay. The ATS has now closed back into Normal Power without interrupting the load.

The ATS defaults to an open transition transfer when the Normal source fails. This signals the generator to start. After the generator voltage and frequency are at the proper level, the ATS transfers to Emergency.
Closed transition transfer is not possible with one source available.
One can select an Open Transition transfer via the Transition Mode Selector (TMS) for testing also.

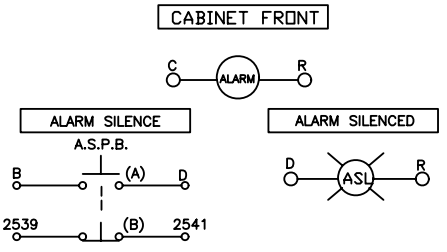
If while in Closed Transition Mode, the ATS fails to open the source it is attemping to "transfer out of", the source that the ATS just closed into will be opened leaving the ATS in its initial source while disabling all other transfer operations until the problem is corrected and the "reset" has been turned.

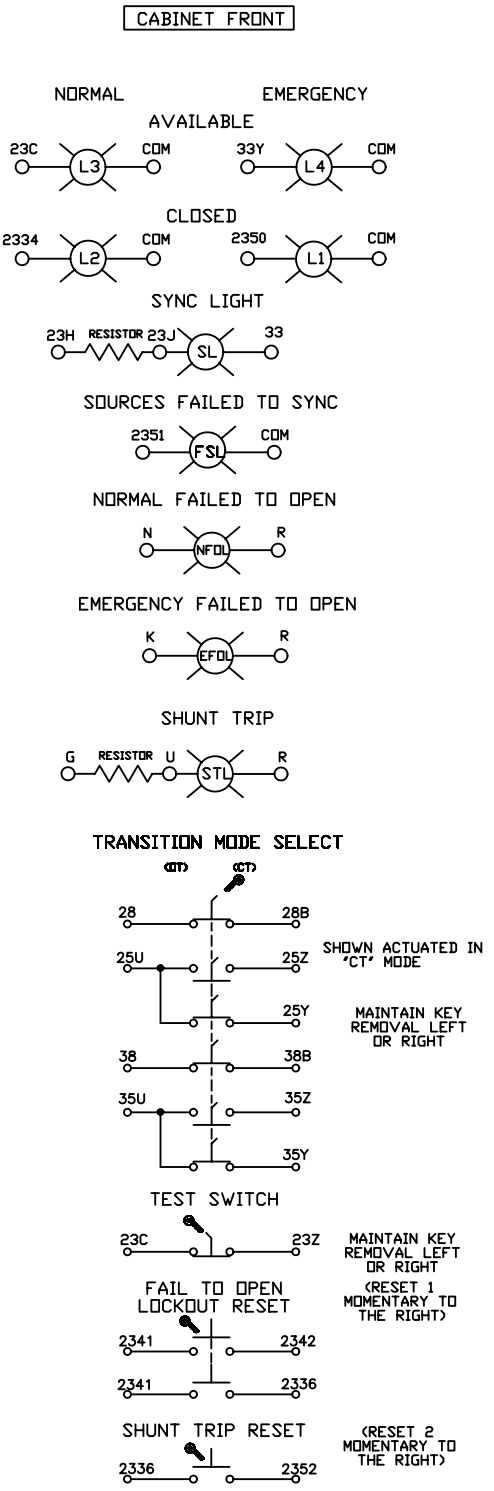
Also a dry contact to shunt trip the generator circuit breaker is available to remove the generator from the bus if neither operator opened.

A 24 VDC control circuit is supplied to control the Alarm and Warning indicators. To insure continuous power to this circuit, the customer supplies the 24 VDC.

F. PARALLELING REQUREMENTS

A. The unit is Factory set to accomplish transfer within 5 electrical degrees (at 0.1 Hz Δ F).
B. Requires an Isochronous Governor with an operating frequency of 60 ±0.2 Hz.
C. Requires a shunt trip breaker on the Generator set with a response time not exceeding 50 ms.





LEGEND	REFERENCE	NOTES

REVISIONS

RV	ECN NO.	DATE	DRF	ENG
E	S-6358	03/11/96	RMC	SB
F	S-6619	11/21/96	SG	SB

ZENITH CONTROLS, INC.

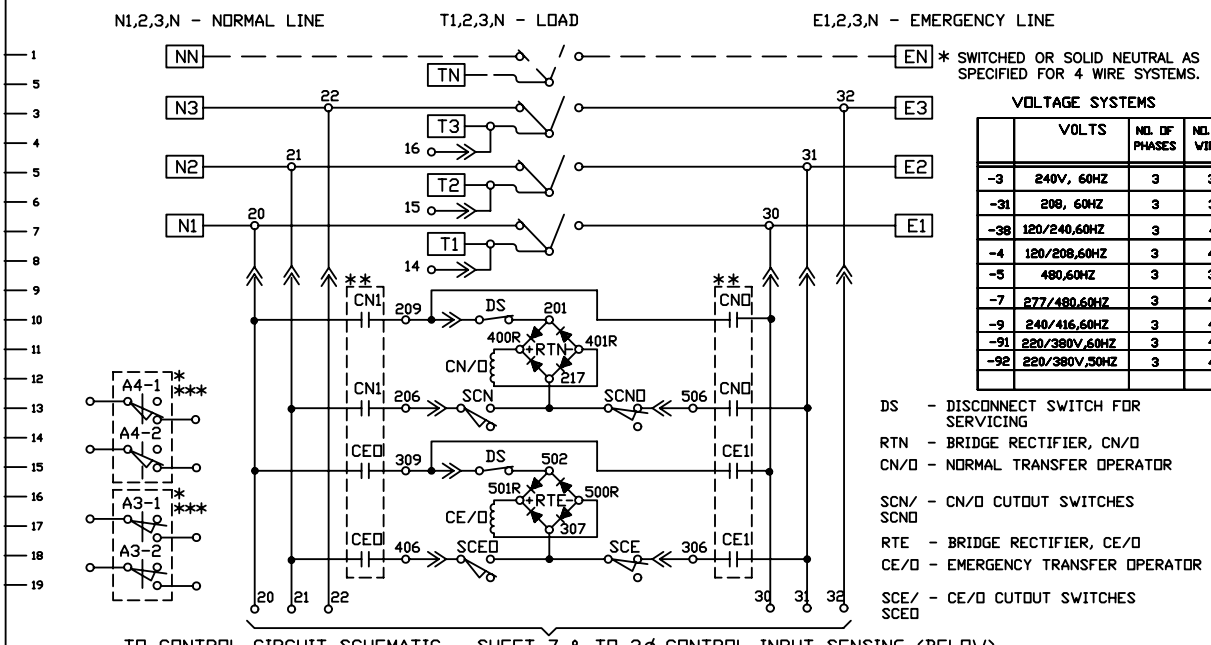
TITLE: CT OPERATION & CABINET FRONT
MODEL: ZBTSCTH10/40 (100-400 AMPS)

DRFT: IRAY	DATE:	SCALE:	CHK:	APPD:
ENGR: JC	01/27/94	N/A		

DWG NO.: 46A-7000 REV: F
CADD: S5K SHT. 5 OF 10

ORIGINAL

POWER CIRCUIT SCHEMATIC



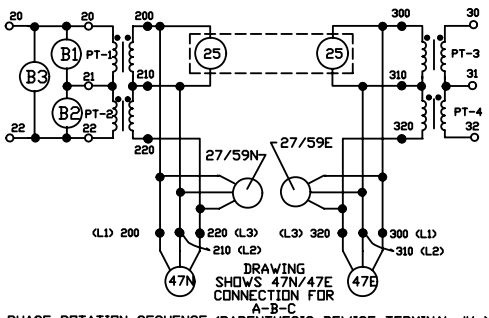
* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEMS.

VOLTAGE SYSTEMS

	VOLTS	NO. OF PHASES	NO. OF WIRES
-3	240V, 60HZ	3	3
-31	208, 60HZ	3	3
-38	120/240,60HZ	3	4
-4	120/208,60HZ	3	4
-5	480,60HZ	3	3
-7	277/480,60HZ	3	4
-9	240/416,60HZ	3	4
-91	220/380V,60HZ	3	4
-92	220/380V,50HZ	3	4

DS - DISCONNECT SWITCH FOR SERVICING
RTN - BRIDGE RECTIFIER, CN/□
CN/□ - NORMAL TRANSFER OPERATOR
SCN/ SCN□ - CN/□ CUTOUT SWITCHES
RTE - BRIDGE RECTIFIER, CE/□
CE/□ - EMERGENCY TRANSFER OPERATOR
SCE/ SCE□ - CE/□ CUTOUT SWITCHES

3Ø CONTROL SENSING

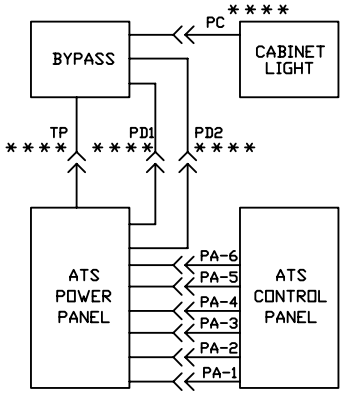


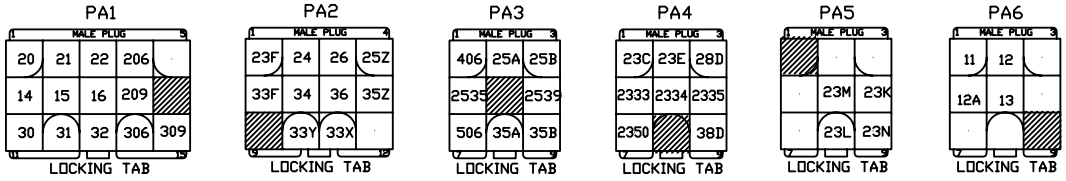
PHASE ROTATION SEQUENCE. (PARENTHESIS=DEVICE TERMINAL #'s)
IF PHASE ROTATION SEQUENCE IS A-C-B SWAP L2 & L3 TERMINAL INPUTS ON EACH 47 RELAY.

LEGEND:

PT- 1,2 - NORMAL POTENTIAL TRANSFORMERS
PT- 3,4 - EMERGENCY POTENTIAL TRANSFORMERS
B1,2,3 - UNDER VOLTAGE RELAYS , 64
27/59N - NORMAL UNDER/OVER VOLTAGE RELAY, 92
27/59E - EMERGENCY UNDER/OVER VOLTAGE RELAY, 92
47N - PHASE SEQUENCING NORMAL , 92
47E - PHASE SEQUENCING EMERGENCY, 92
25 - SYNC CHECK RELAY, 93

INTERCONNECT PLUGS





LEGEND	NOTES
●— WIRE CONNECTION —○— WIRE ON MAIN TERMINAL BLOCK —≫ WIRE IN DISCONNECT PLUG * OPTIONAL ** LOCATED ON CONTROL PANEL *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL **** SEE BYPASS CONTROL SUBPANEL AND PLUGS	ZBTSCTH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
E	S-6358	03/11/96	RMC	SB
F	S-6619	11/21/96	SG	SB

ZENITH CONTROLS, INC.

TITLE: POWER CIRCUIT & 3Ø CONTROL SENSING
MODEL: ZBTSCTH10/40 (100-400 AMPS)

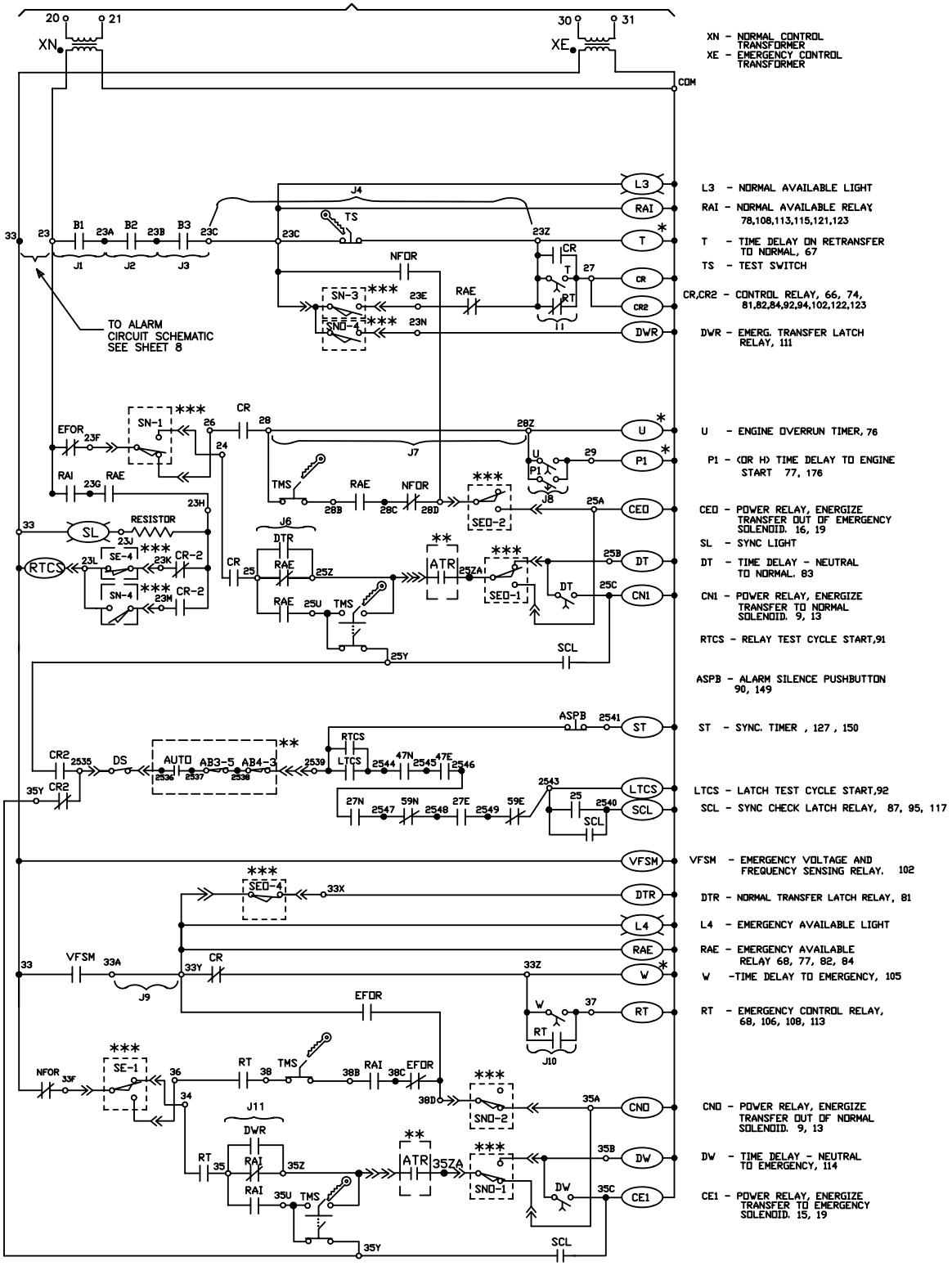
DRFT: IRAY	DATE:	SCALE:	CHK:	APPD:
ENGR: JC	01/27/94	N/A		

DWG NO.: 46A-7000 REV: F
CADD: S5K SHT. 6 OF 10

ORIGINAL

CONTROL CIRCUIT SCHEMATIC

TO POWER CIRCUIT SCHEMATIC, SHEET 6



JUMPER	CONNECT POINT	STANDARD CTTS COMPONENTS
J1	23,23A	B1
J2	23A,23B	B2
J3	23B,23C	B3
J4	23C,23Z	TS
J5	23Z,27	T
J6	25,25Z	DTR, RAE
J7	28,28Z	
J8	28Z,29	U
J9	33A,33Y	
J10	33Z,37	W
J11	35,35Z	DWR, RAI

LEGEND
- WIRE CONNECTION
- WIRE ON MAIN TERMINAL BLOCK
- WIRE IN DISCONNECT PLUG
- * OPTIONAL
- ** LOCATED ON BYPASS SUBPANEL
- *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL

LIMIT SWITCH STATE (X = ACTIVATED)

ATS POSITION	SN	SNO	SEO	SE
NORMAL			X	X
PARALLED				
EMERGENCY	X	X		
OPEN	X	X	X	X

NOTES:

ZBTSCTH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS

RV	ECN NO.	DATE	DRF	ENG
E	S-6358	03/11/96	RMC	SB
F	S-6619	11/21/96	SG	SB

ZENITH CONTROLS, INC.

TITLE: CONTROL CIRCUIT SCHEMATIC

MODEL: ZBTSCTH10/40 (100-400 AMPS)

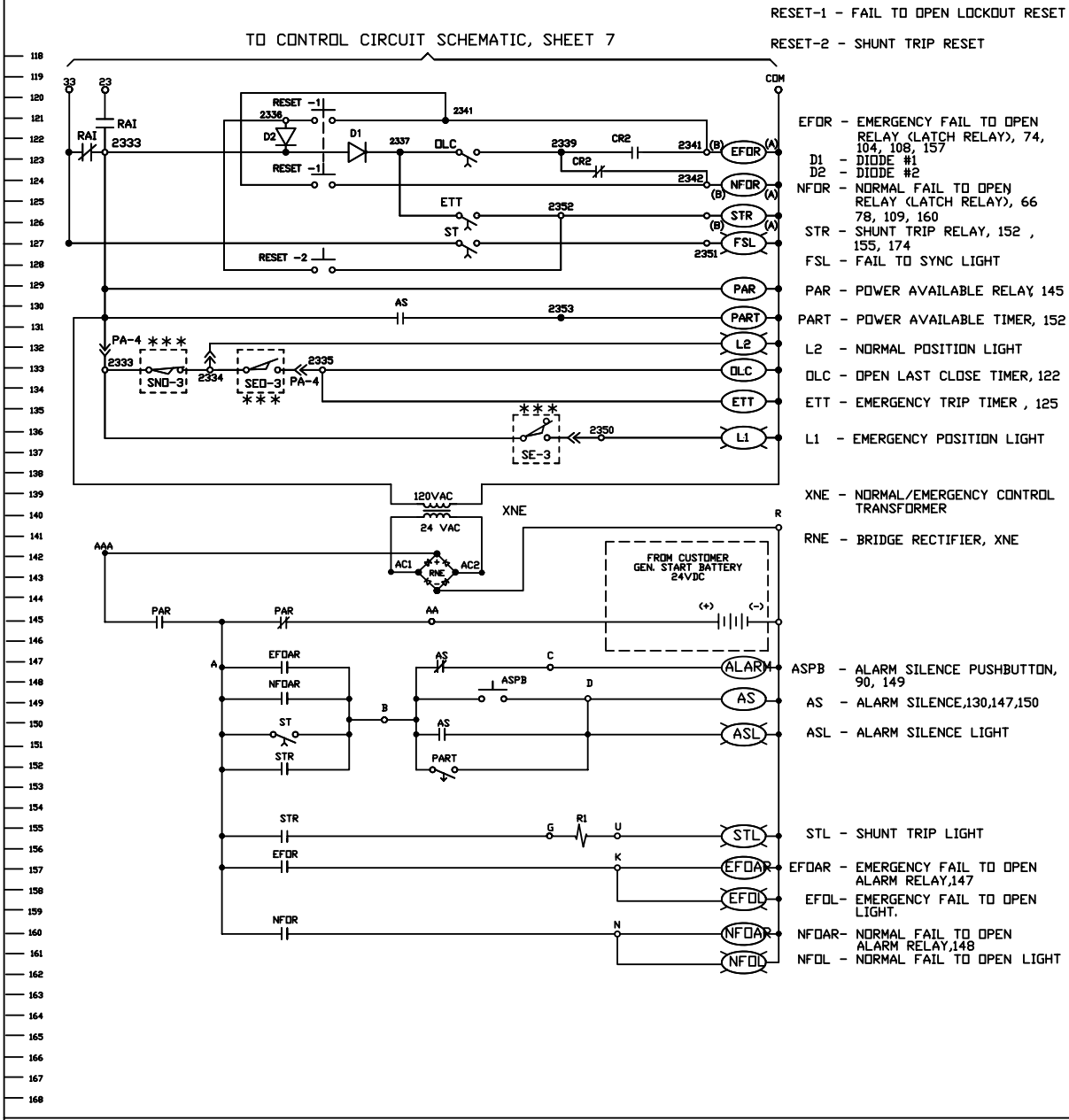
DRFT: IRAY	DATE:	SCALE:	CHK:	APPD:
ENGR: JC	01/27/94	N/A		

DWG NO.: 46A-7000 REV F

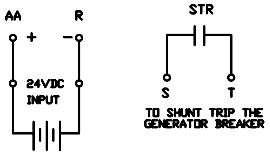
CADD: S5K SHT. 7 OF 10

ORIGINAL

ALARM CIRCUIT SCHEMATIC



CUSTOMER CONNECTIONS



A3, A4
SEE POWER CIRCUIT SCHEMATIC AND LAYOUT

ENGINE START
SEE BP CONTROL CIRCUIT SCHEMATIC & BP & ATS COMPONENT LOCATIONS

CONTACT RATING		
RELAY	CONTACT	RATING
P1		10AMP @ 32VDC
	A3, A4	20AMP, 125, 250 VAC

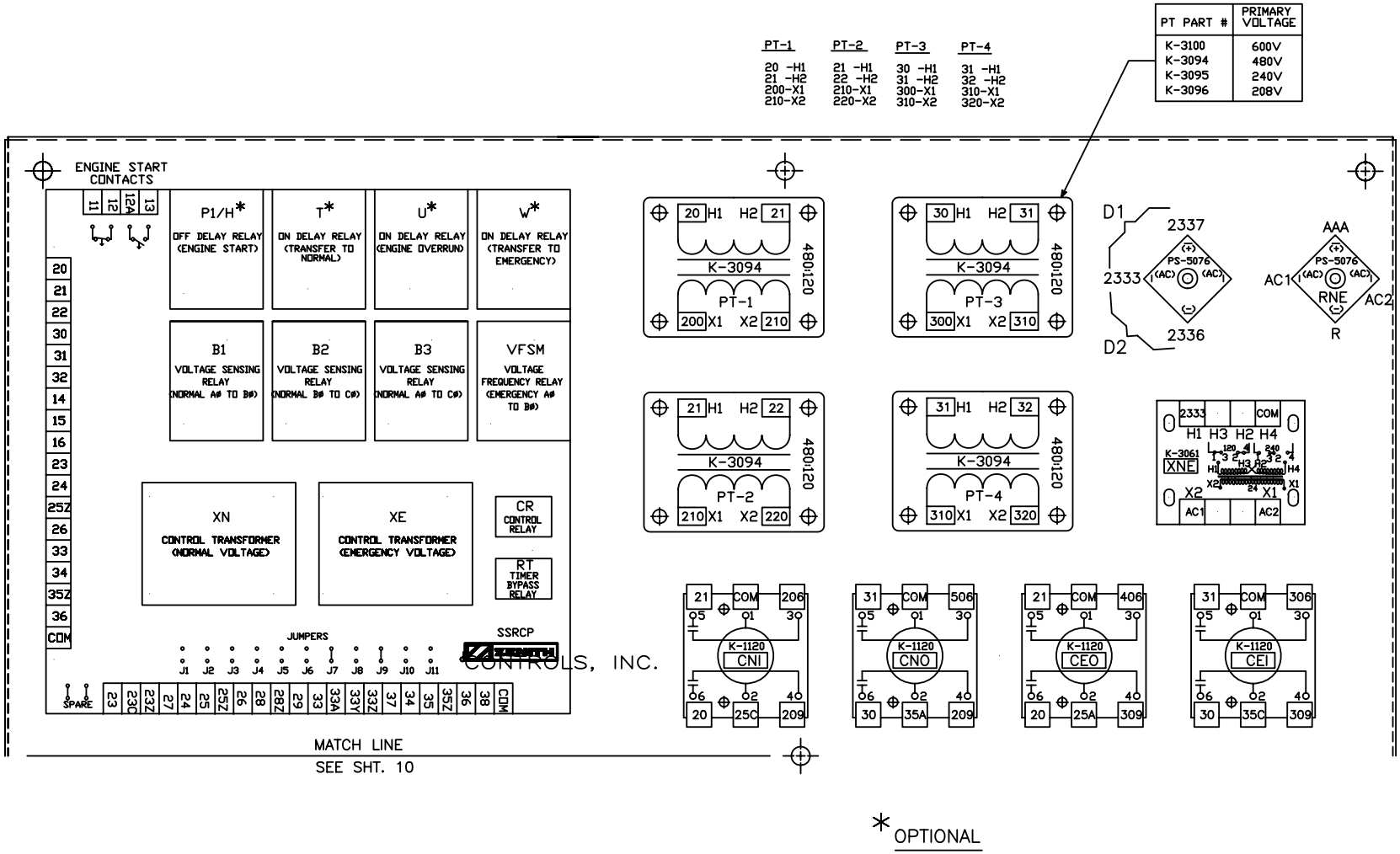
LEGEND	NOTES
WIRE CONNECTION WIRE ON MAIN TERMINAL BLOCK WIRE IN DISCONNECT PLUG *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL	ZBTSCTH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
E	S-6358	03/11/96	RMC	SB
F	S-6619	11/21/96	SG	SB

ZENITH CONTROLS, INC.

TITLE: ALARM CIRCUIT SCHEMATIC & CUST. CONN.				
MODEL: ZBTSCTH10/40 (100-400 AMPS)				
DRFT: IRAY	DATE:	SCALE:	CHK:	APPD:
ENGR: JC	01/27/94	N/A		
DWG NO.: 46A-7000				F
CADD: S5K			SHT. 8 OF 10	REV

ORIGINAL



REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
E	S-6358	03/11/96	RMC	SB
F	S-6619	11/21/96	SG	SB

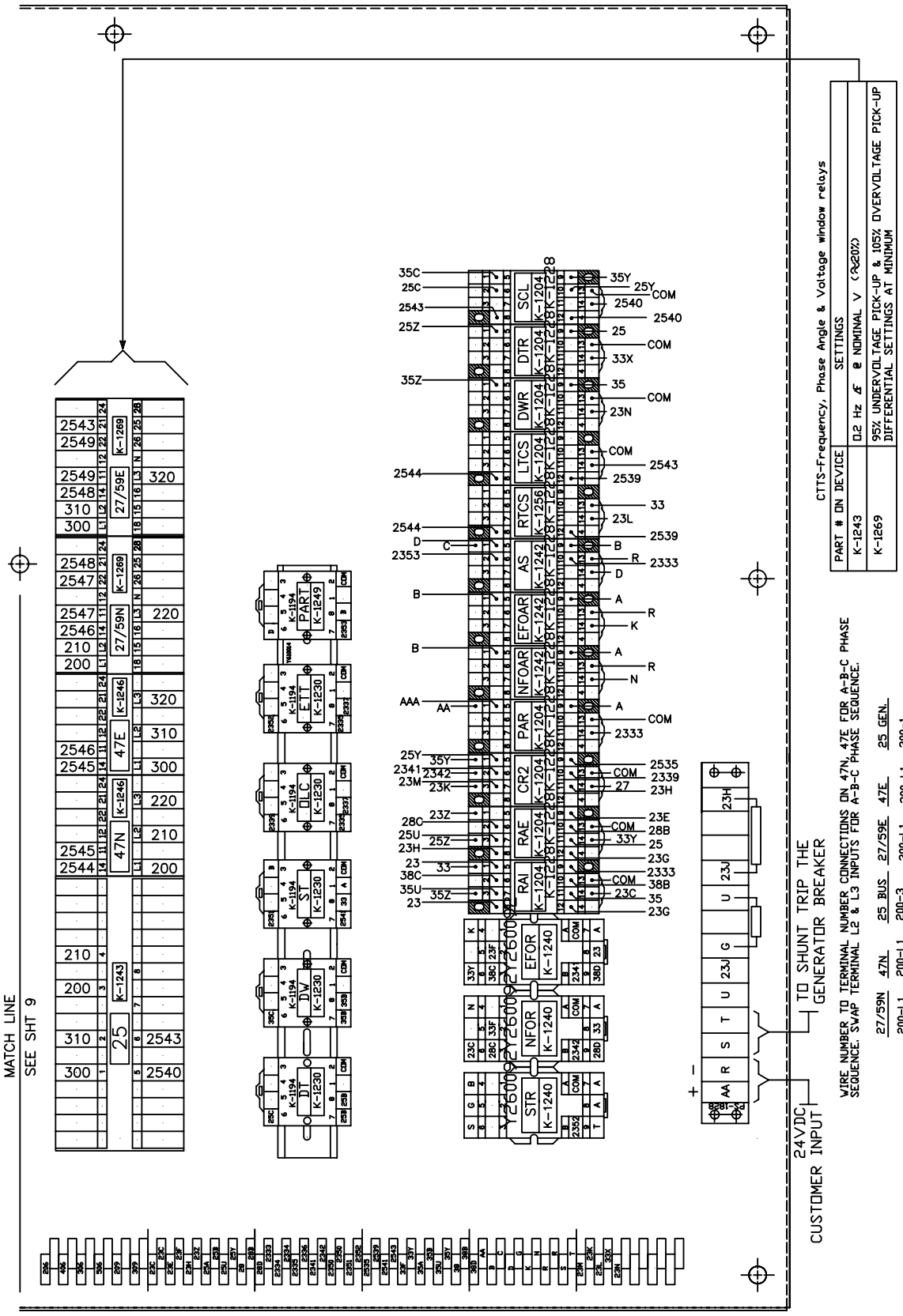
LEGEND | REFERENCE | NOTES

ZENITH CONTROLS, INC.

TITLE: CONTROL PANEL LAYOUT
MODEL: ZBTSCTH10/40 (100-400 AMPS)

DRFT: IRAY	DATE: 01/27/94	SCALE: 1 : 2	CHK:	APPD:
ENGR: JC				

DWG NO.: 46A-7000 REV F
CADD: S5K
SHT. 9 OF 10
ORIGINAL



LEGEND	REFERENCE	NOTES

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
E	S-6358	03/11/96	RMC	SB
F	S-6619	11/21/96	SG	SB

ZENITH CONTROLS, INC.

TITLE: CONTROL PANEL

MODEL: ZBTSCTH10/40 (100-400 AMPS)

DRFT: IRAY	DATE:	SCALE:	CHK:	APPD:
ENGR: JC	1/27/94	1:2		

DWG NO.: 46A-7000 F

CADD: S5K SHT. 10 OF 10 REV

ORIGINAL

ZBTSCTH SERIES
BYPASS/ISOLATION/CLOSED TRANSITION TRANSFER SWITCH OPERATION
600-1200 AMP

OPERATION: BYPASS/ISOLATION SWITCH

AUTOMATIC

1. Manaully operated Bypass Switch contacts (BN/BE) are open and ATS is supplying load.
2. Disconnect Switch (DS) is in "AUTO".

TO BYPASS ATS

1. Open bottom cabinet door and turn DS to "INHIBIT".
2. Turn Bypass Selector Switch (BSS) to same power source as ATS.
3. Move the Manual Bypass Handle (MBH) upward.

TO TEST ATS

1. Bypass per above instructions.
2. Rotate crank mechanism counterclockwise until ATS TEST light is illuminated.
3. Turn DS to "AUTO".
4. Test Switch (TS) on bottom cabinet door will allow electrical operation of ATS.

TO ISOLATE ATS

1. Bypass per above instructions.
2. Rotate crank mechanism counterclockwise until ATS ISOLATED light is illuminated.

TO REMOVE ATS

1. Bypass and Isolate per above instructions.
2. Disconnect multipin plugs and external connections to ATS.
3. Rotate four power panel latches to vertical position, slide ATS forward & lock mechanism in place.
4. ATS can now be removed from cabinet.

TO RECONNECT ATS

1. Place ATS in slide mechanism.
2. Unlock slide mechanism. Slide ATS over power panel latches and rotate latches to horizontal position.
3. Turn DS Switch to "INHIBIT".
4. Manually position ATS into same source as Bypass Switch.
5. Reconnect multipin plugs and external connections to ATS.
6. Rotate crank mechanism clockwise until ATS TEST light is illuminated.
7. Turn DS Switch to "AUTO" and use TS to electrically operate ATS.
8. Turn DS to "INHIBIT".
9. Rotate crank mechanism clockwise until ATS location pointer is aligned with "AUTO" mark on location indicator. (ATS must be in same source as Bypass).
10. Turn DS to "AUTO" and open Bypass with MBH.
11. ATS is now fully automatic (Figure 1).

NOTES:

1. DS in "INHIBIT" will prevent ATS electrical operation.
2. DO NOT use excessive force on mechanical handles.
3. Above Figures depict Bypass NORMAL. Sequence is same for Bypass EMERGENCY.
4. When ATS is in TEST or ISOLATE, Bypass Switch is a manual transfer switch to either available source. (Indicated on light panel).
5. To operate Bypass Switch when ATS is in TEST or ISOLATE:
   a) Move MBH downward (to open Bypass Contacts BN/BE).
   b) Turn BSS to opposite power source.
   c) Move MBH upward to close into selected power source.

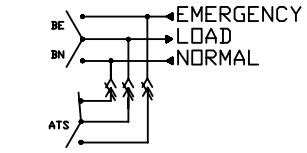


FIG. 1 BP IS OPEN WITH ATS IN NORMAL

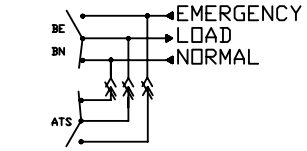


FIG. 2 BP IN NORMAL WITH ATS IN NORMAL

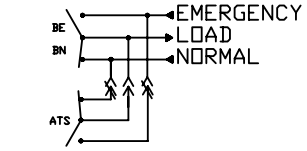


FIG. 3 BP IN NORMAL WITH ATS IN TEST (LOAD CONNECTIONS ARE OPEN)

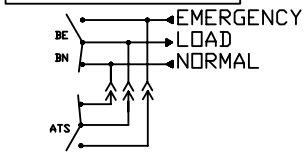


FIG. 4 BP IN NORMAL WITH ATS ISOLATED

NOTES:
1. BP-Bypass switch (indicated by contacts BN/BE) is a 3 position switch.
2. ATS-Automatic Transfer Switch

LEGEND: BYPASS/ISOLATION SWITCH (BP)

I. (BP) BYPASS/ISOLATION SWITCH: MECHANICAL COMPONENTS

N1,2,3,(N).....	Normal Line connections_____
E1,2,3,(N).....	Emergency Line connections_____
T1,2,3,(N).....	Load Line connections_____
BE.....	Bypass Emergency contacts
BN.....	Bypass Normal contacts
BSS.....	Bypass Selector Switch
MBH.....	Manual Bypass Handle

II. (BP) BYPASS/ISOLATION: ELECTRICAL COMPONENTS

AA-1,2,3,4.....	Limit switch held actuated in Auto location of ATS, Non-actuated Test and Isolated locations.
AB3-1,2,3,4,5.....	Limit switch, actuated in Bypass Emergency position
AB4-1,2,3.....	Limit switch, actuated in Bypass Normal position
ACU/ACD.....	Limit Switch, actuated when crankhandle is engaged
AE-1,2.....	Limit switch, switches Engine Start from ATS control to bypass control during ATS Isolate
AI-1,2,3.....	Limit switch, actuated in Isolate location
AT-1,2.....	Limit switch, actuated in Test location
ATR.....	Auto/Test Relay. Energized in AUTO and TEST locations
AUTO.....	Auto location relay. Energized in AUTO location.
BR-1,2,3.....	Bridge Rectifier
C.....	Capacitor: RNH
CBC.....	Crank Solenoid
CBE.....	Emergency Bypass Permissive Solenoid
CBN.....	Normal Bypass Permissive Solenoid
D1.....	Diode
RNH.....	Relay normally held, 24 VDC coil, 3PDT
R1.....	Resistor: RNH
R2.....	Resistor: LDS
XBE.....	Emergency line control transformer
XBN.....	Normal line control transformer

III. (BP) BYPASS/ISOLATION SWITCH: INDICATOR LIGHTS

LNA.....	Normal available
LEA.....	Emergency available
LBN(NOTE 1).....	Bypass Normal (BN closed)
LBE(NOTE 1).....	Bypass Emergency (BE closed)
LAT(NOTE 1).....	ATS in Test location
LAI(NOTE 1).....	ATS in Isolate location
LIT(NOTE 1).....	ATS Inhibit
LDS(NOTE 1).....	ATS DS switch in INHIBIT position

NOTES:
1. Indicator off during automatic operation of ATS.
2. Four pole includes neutral lugs.

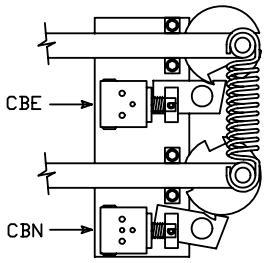
REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
E	S-6358	3/8/96	RMC	SB
F	S-6619	11/21/96	SG	SB

ZENITH CONTROLS, INC.

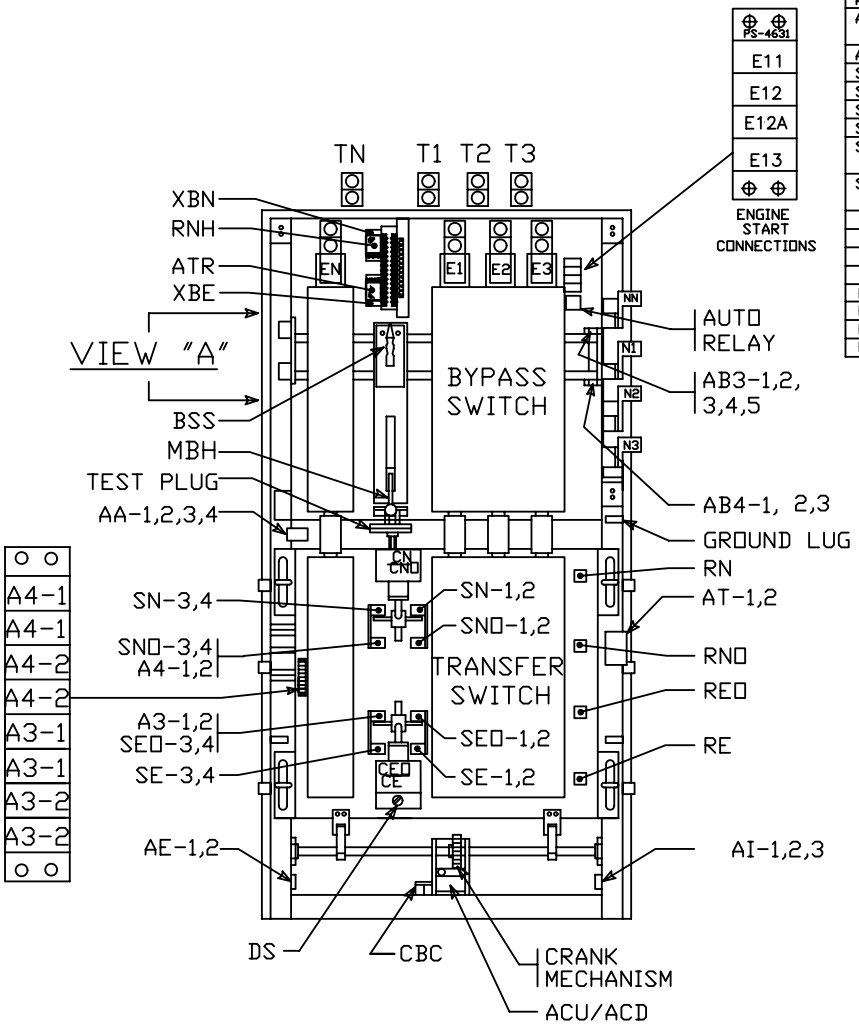
TITLE: BP/ISOLATION SW: LEGEND & OPERATION				
MODEL: ZBTSCTH60/120 (600-1200 AMP)				
DRFT: IRAY	DATE:	SCALE:	CHK:	APPD:
ENGR: JC	01/27/94	N/A		
DWG NO.: 46A-7001				F
CADD: S5K		SHT. 1 OF 1 0		REV

ORIGINAL

DEVICE TAG	TERMINAL MARKINGS WIRE NUMBER						COMMENTS
TRANSFORMERS	X1	X2	H1	H2	H3	H4	
XBE	53	54	50			51	G CASE
XBN	43	44	40			41	G CASE
SOLENOIDS	NO MARKINGS						
CBE	64		62				G CASE
CBN	63		62				G CASE
CBC	87A		81				
CN	206R		208R				
CE	306R		307R				
CNO	308R		506R				
CEO	209R		406R				
SWITCHES	NO		NC		NC		
DS	80	82	20	209	2535	2536	
	80	90	30	307			
LIMIT SWITCHES	C	NC	NO	C	NC	NO	
A3(SEO-5,6)	A3-1	A3-1		A3-2	A3-2		
A4(SNO-5,6)	A4-1	A4-1		A4-2	A4-2		
AA-1,2	60		61	62	82A	87	
AA-3,4	87	92		80		80A	
AB3-1,2	64		60	83A	83	86	
AB3-3,4	E12		E11	E12A	12A		
AB3-5	2537	2538					
AB4-1,2	63		61	80	83A	85	
AB4-3	2538	2539					
ACD	93		87A				
ACU	92		87A				
AE-1,2	E11	11	11R	E13	13	13R	
AI-1,2,3	80		82A	80		89	
	87	93					
AT-1,2	80		83	80		88	
SE-1,3	33F	34	36	2333		2350	
SN-1,3	23F	24	26	23C	23E		
SE-2, 4	65	87	86	23M		23L	
SN-2, 4	65	87	85	23K		23L	
SEO-1,2,3,4	25ZA	25A	25B	28D	25A		
	2334	2335		33Y		33X	
SNO-1,2,3,4	35ZA	35A	35B	38D	35A		
	2333	2334		23C		23N	
RECTIFIERS	AC	AC	+	-			
BR-1	43	44	80	60			
BR-2	53	54	80	61			
BR-3	60	61		81			
RN	206	209	206R	208R			
RNO	506	307	506R	308R			
REO	406	209	406R	209R			
RE	306	307	306R	307R			



VIEW "A"



LEGEND	REFERENCE	NOTES

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
E	S-6358	3/8/96	RMC	SB
F	S-6619	11/21/96	SG	SB

ZENITH CONTROLS, INC.

TITLE: BYPASS & ATS COMPONENT LOCATIONS

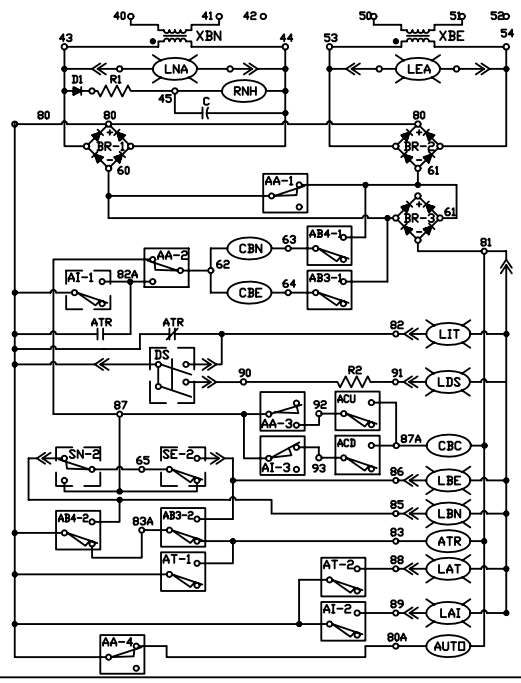
MODEL: ZBTSCTH60/120 (600-1200 AMPS)

DRFT: IRAY	DATE: 1/27/94	SCALE: N/A	CHK:	APPD:
ENGR: JC				

DWG NO.: 46A-7001 REV F

CADD: S5K SHT. 2 OF 10

ORIGINAL



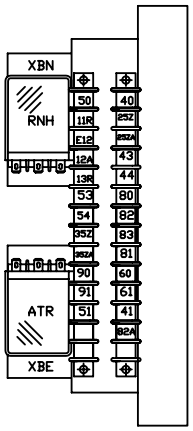
LNA - NORMAL AVAILABLE LIGHT
LEA - EMERGENCY AVAILABLE LIGHT
RNH - NORMAL VOLTAGE RELAY
D1 - DIODE
R1 - RESISTOR, RNH
C - CAPACITOR, RNH
BR-1,- BRIDGE RECTIFIER 2,3

AA-1 - LIMIT SWITCH

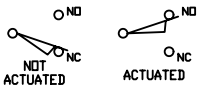
AB4-1- LIMIT SWITCH, BYPASS NORMAL
CBN - NORMAL TRANSFER OPERATOR
AA-2 - LIMIT SWITCH, ATS IN AUTO
AB3-1- LIMIT SWITCH, BYPASS EMERGENCY
CBE - EMERGENCY TRANSFER OPERATOR
LIT - ATS INHIBIT LIGHT
AI-1 - LIMIT SWITCH, ATS IN ISOLATE
LDS - DISCONNECT SWITCH
DS - ATS DISCONNECT SWITCH
R2 - RESISTOR, LDS
ACU - LIMIT SWITCH, CRANK HANDLE ENGAGED
CBC - CRANK SOLENOID
AA-3 - LIMIT SWITCH, ATS IN AUTO
ACD - LIMIT SWITCH, CRANK HANDLE ENGAGED
AI-3 - LIMIT SWITCH, ATS IN ISOLATE
LBE - BYPASS EMERGENCY
LBN - BYPASS NORMAL LIGHT
AB4-2- LIMIT SWITCH, BYPASS NORMAL
AB3-2- LIMIT SWITCH, BYPASS EMERGENCY
AT-1 - LIMIT SWITCH
ATR - AUTO/TEST RELAY
LAT - ATS TEST LOCATION
AT-2 - LIMIT SWITCH, ATS IN TEST
LAI - ATS ISOLATE LIGHT
AI-2 - LIMIT SWITCH, ATS IN ISOLATE

AA-4 - LIMIT SWITCH, ATS AUTO LOCATION.

BYPASS SUBPANEL

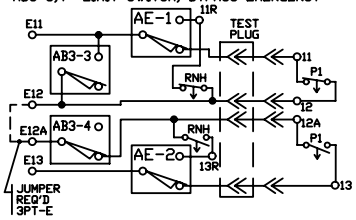


LIMIT SWITCHES

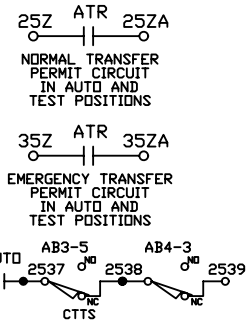


ENGINE START CIRCUIT

AE-1,2 - LIMIT SWITCH, ENGINE START TRANSFER
AB3-3,4- LIMIT SWITCH, BYPASS EMERGENCY



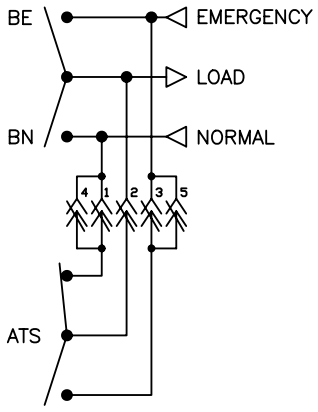
PERMIT CIRCUITS

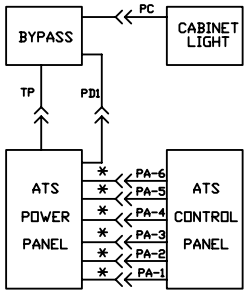


CLOSED TRANSITION PERMIT CIRCUIT (IN AUTO LOCATION ONLY)

LIMIT SWITCH CHART

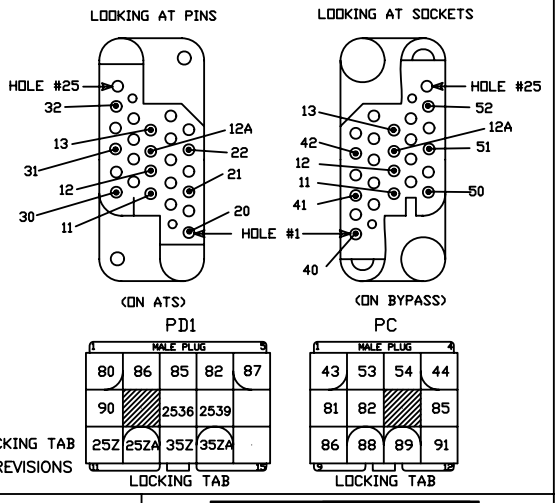
X = ACTUATED	ATS LOCATION				ATS MODE		BYPASS MODE	
	AUTO	TEST	ISO	REMOVE	NORM	EMERG.	NORM	EMERG.	OPEN
AA	X								
AT		X							
AI			X	X					
AE			X	X					
SN					X				
SE						X			
AB4							X		
AB3								X	





* SEE INTERCONNECT PLUGS ON SCHEMATIC SHEET

ATS TEST PLUG (TP)



ATS LOCATION	LOAD CARRYING CONTACTS			ATS TEST PLUG (TP)	
	1	2	3	4	5
AUTO	X	X	X	X	X
TEST	O	O	O	X	X
ISOLATE	O	O	O	O	O

X = CLOSED
O = OPEN

NOTES

ATS SHOWN IN NORMAL POSITION, BYPASS OPEN WITH NO POWER AVAILABLE.

RV	ECN NO.	DATE	DRF	ENG
E	S-6358	3/8/96	RMC	SB
F	S-6619	11/21/96	SG	SB

ZENITH CONTROLS, INC.

TITLE: BYPASS CONTROL CIRCUIT SCHEMATIC
MODEL: ZBTSCTH60/120 (600-1200 AMPS)
DRFT: IRAY | DATE: | SCALE: | CHK: | APPD:
ENGR: JC | 01/27/94 | N/A
DWG NO.: 46A-7001 | REV: F
CADD: S5K | SHT. 3 OF 10

ORIGINAL

LEGEND & OPERATION
AUTOMATIC TRANSFER SWITCH (ATS)

FOR USE ON EMERGENCY OR STANDBY SYSTEMS - RATED FOR TOTAL SYSTEM & MOTOR LOAD

A. LEGEND

N1,2,3,(N).....Normal Line_____
E1,2,3,(N).....Emergency Line_____
T1,2,3,(N).....Load Connections
B1,2,3.....Solid State Phase Relay(s)
Dropout____ %
Pickup____ %
AS.....Alarm Silence Relay
CE.....Main Transfer Operator, Close into Emergency
CEO.....Main Transfer Operator, Open from Emergency
CN.....Main Transfer Operator, Close into Normal
CNO.....Main Transfer Operator, Open from Normal
CCE.....CE Control Relay, Emergency Closing
CCEO.....CEO Control Relay, Emergency Opening
CCN.....CN Control Relay, Normal Closing
CCNO.....CNO Control Relay, Normal Opening
CR ,CR2.....Normal Control Relay
DS.....Disconnect Switch
DT.....Timer, Delay Open To Normal
DTR.....Normal Transfer Latch Relay
DW.....Timer, Delay Open To Emergency
DWR.....Emergency Transfer Latch Relay
D1.....Diode #1
D2.....Diode #2
E.....Engine Start Contact
EFOAR.....Emergency Fail to open Alarm Relay
EFOR.....Emergency Fail to open Relay
ETT.....Emergency Trip Timer
GND.....Ground
LTCS.....Latch Test Cycle Start
NB.....Neutral Bar (if required)
NFOAR.....Normal Fail to open Alarm Relay
NFOR.....Normal Fail to open Relay
OLC.....Open Last Close Timer
PAR.....Power Available Relay
PART.....Power Available Timer
PT-1,2..... Potential Transformers Normal
PT-3,4.....Potential Transformers Emergency
RAE.....Emergency Available Relay
RAI.....Normal Available Relay
RE.....Bridge Rectifier, CE
REO.....Bridge Rectifier, CEO
RN.....Bridge Rectifier, CN
RNE.....Bridge Rectifier, XNE
RNO.....Bridge Rectifier, CNO
RT.....Emergency Control Relay
RTCS.....Relay Test Cycle Start
SCL.....SYNC Check Latch
SE,SEO.....Cutout Switch, Emergency
SN,SNO.....Cutout Switch, Normal
ST.....SYNC Timer
STR.....Shunt Trip Relay
VFSM.....Emergency Volt-Freq. Relay
Pickup {90% of rated Voltage, and 95% of rated Frequency
XE.....Control Transformer, Emergency
XN.....Control Transformer, Normal
XNE.....Control Transformer - Norm./Emerg.
25(ANSI).....Sync Check Relay
47N,E(ANSI).....Phase sequencing - Norm./Emerg.
27/59N,E(ANSI)..Over/Undervoltage - Norm./Emerg.

B. OPERATION (OPEN TRANSITION)

(See note #4)

When the Normal Line falls to the preset dropout point, the phase relays will dropout disconnecting the CR relay.
When the Emergency Line voltage & frequency reach the preset pickup point, the VFSM relay picks up. RT relay picks up to operate the CCNO relay through the SE & SNO cutout switches causing the emergency main transfer operator CNO to operate. The load is now transferred to the Open position. The SNO limit switch operates to disconnect the CCNO relay and CNO main transfer operator. The transfer switch is now mechanically locked open. Limit switch SNO is now activated, picking up the DW timer. After a set time delay, DW will pick up the CCE relay which will then pick up CE main transfer operator. The load is now transferred to the Emergency line. The SE limit switch operates to disconnect the CCE relay and CE main transfer operator. The transfer switch is now mechanically locked in Emergency.

When the Normal Line voltage exceeds the preset pick up point, the phase relays B1, B2, & B3 pick up. CR relay picks up to operate the CCEO relay through the SN & SEO cutout switches, causing the main transfer operator CEO to operate. The load is now transferred to the Open position. The SEO limit switch operates to disconnect the CCEO relay and CEO main transfer operator. The transfer switch is now mechanically locked Open. Limit switch SEO is now activated, picking up the DT timer. After a set time delay, DT will pick up the CCN relay which will then pick up the CN main transfer operator. The load is now re-transferred back to the Normal line. The SN limit switch operates to disconnect the CCN relay and CN main transfer operator. The transfer switch is now mechanically locked in Normal.

DS - Disconnect Switch
When the Disconnect Switch is placed in the INHIBIT position the circuit to the main transfer operators CN/CNO and CE/CEO is opened and transfer cannot take place.

TS - Test Switch
The Test Switch simulates a normal line failure when activated.
To test, activate the Test Switch allowing the transfer switch to transfer to the EMERGENCY position. De-activate the Test Switch. The transfer switch will reset to the NORMAL position. Testing at least once a month is recommended. For hospital emergency systems, test once a week.

C. ACCESSORIES

The ZTSCTH series transfer switch is wired so that accessories can be easily added to the switch. The following is a description of the accessories which are supplied on this unit.

- ☐ A1 Auxiliary contact, S.P.D.T., operates on normal line failure.
- ☐ A1E Auxiliary contact, S.P.D.T., operates on emergency line failure.
- ☐ A3 Auxiliary contact closes when the transfer switch is in the Emergency position.
- ☐ A4 Auxiliary contact closes when the transfer switch is in Normal position.'
- ☐ A6 Motor Disconnect. To de-energize external motor control circuit 5 seconds (adjustable) prior to transfer in either direction.
- ☐ C Plant Exercisor. Automatically starts generator for selected time intervals.
- ☐ C/D Plant Exercisor. Automatically starts generator to run unloaded or simulate a power failure and starts generator to run under load.
- ☐ E Engine Start Contact: 1 Normally Open 1 Normally Closed.
- ☐ F Auxiliary Fan Contact, S.P.N.O. Closes when generator is running.
- ☐ H Time delay to engine start, non-adjustable. Factory set 1 or 3 seconds. When the Normal line fails the relay de-energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.
- ☐ J1 Adjustable under frequency sensor.
- ☐ J2 Adjustable over/under frequency sensor.
- ☐ K Frequency meter to indicate load frequency.
- ☐ L1 Pilot Light. Switch in Emergency Position.
- ☐ L2 Pilot Light. Switch in Normal Position.
- ☐ L3 Pilot Light. Normal source available.
- ☐ L4 Pilot Light. Emergency source available.
- ☐ M1 Ammeter; Single phase.
- ☐ M2 Ammeter; Three phase
- ☐ M3 Voltmeter; Single phase.
- ☐ M4 Voltmeter; Three phase.
- ☐ P1 Time Delay to Engine Start (solid state). Adjustable over time range .5 to 6 seconds. When the Normal line fails the relay de-energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in Normal position, the relay energizes and the engine start contacts open to shut down engine.
- ☐ P2 Time Delay to Engine Start (Pneumatic). Adjustable over time range 1/6 to 300 seconds. When the Normal line fails, the relay de-energizes. After the set time delay its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.
- ☐ Q2 Connections for remote peak shave or area protection relays. Includes bypass for automatic return to Normal if Emergency line fails and Normal is present.
- ☐ R1 Solid State Adjustable Overvoltage Relay(s). Set at 110% of pickup, 105% of dropout of nominal Line rate, unless otherwise specified.
- ☐ R4 In-Phase monitor. Prevents transfer until two sources are in-phase. For use of isochronous governors.
- ☐ R43 In-phase monitor. Prevents transfer until two sources are in-phase. For use with mechanical. governors.
- ☐ S1 Four-position Engine Control Selector Switch. "STOP", "HAND CRANK", "TEST", "AUTOMATIC".
- ☐ T Time delay, re-transfer to Normal. When the Normal line restores and the phase relays operate, the T timer is energized. After the set time delay, its contacts close the circuit to the CR relay which operates to restore the load to the Normal line. RT relay is supplied to bypass T contacts if Emergency is de-energized during timing. CAUTION-DO NOT SET TIMER AT THE "0" POINT.
- ☐ T3 W3 Presignal auxiliary Contact, S.P.D.T: Operates 0-30 seconds (adjustable) prior to transfer in either direction.
- ☐ U Time delay, engine cool-down. When the transfer switch is restored to the Normal position and the engine is signaled to shut down, the U timer operates to maintain the engine start circuit closed. At the end of the set time, the engine contacts open to shut down the engine. CAUTION-DO NOT SET TIMER AT THE "0" POINT.
- ☐ W Time delay, transfer to Emergency. When the Normal line fails and the engine has started, the VFSM relay energizes. The W timer energizes. After the set time delay, its contacts close to energize the RT relay. CAUTION-DO NOT SET TIMER AT THE "0" POINT.
- ☐ YE Pushbutton Transfer to Emergency. Provides manual control of transfer to emergency source. If time delay accessory W is supplied pushbutton bypasses time delay for immediate transfer; otherwise, transfer to emergency will be automatic after time delay. If time delay accessory W is not supplied, transfer will be non-automatic (by pushbutton only).
- ☐ YN Pushbutton to Retransfer to Normal. Provides manual control of retransfer to normal source. If time delay accessory T is supplied, pushbutton bypasses time delay for immediate retransfer; otherwise, retransfer to normal will be automatic after time delay. If time delay accessory T is not supplied, retransfer will be non-automatic (by pushbutton only).

Other: _____
_____
_____

NOTES:

1. ⚠ CAUTION:In using a 3 phase, 4 wire delta or open delta power supply (usually 120/240 volts, sometimes listed as 120/208 volts) with one leg having a grounded center tap, one line will be 160 to 208 volts to ground. When such a system is used it is necessary to connect the high leg to N2DO NOT CONNECT 120 VOLT LOAD CIRCUIT TO THE HIGH LEG.
2. GROUNDING TERMINAL: A grounding terminal (GND) is provided. When installing open type switches the connect this to the metal enclosure or conduit.
3. ⚠ WARNING - TO ENSURE AGAINST SHOCK OR ACCIDENT HAZARD, DISCONNECT ALL SOURCES OF SUPPLY BEFORE SERVICING.
4. OPEN TRANSITION OPERATION CAN BE SELECTED WITH BOTH SOURCES AVAILABLE. OPEN TRANSITION OCCURS BY DEFAULT WHEN THE LOAD-CONNECTED SOURCE FAILS.
5. ON SINGLE PHASE UNITS WHERE THE EMERGENCY SOURCE IS A UTILITY LINE, CONNECT EMERGENCY LINE SO THAT MINIMUM VOLTAGE IS MEASURED FROM N1 TO E1.
6. ON SINGLE PHASE (2 POLE) UNITS, CENTER POLE AND PHASE RELAYS (B2,B3) ARE NOT SUPPLIED ALSO 47N & 47E ARE ELIMINATED.

3Ø 27/59N & E ARE REPLACED BY 1Ø 27/59N & E.

ACCESSORY LIST:

NOTES:

ZENITH CONTROLS, INC.

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
E	S-6358	3/8/96	RMC	SB
F	S-6619	11/21/96	SG	SB

TITLE: LEGEND AND ACCESSORIES
MODEL: ZBTSCTH60/120 (600-1200 AMP)

DRFT: IRAY	DATE: 1/27/94	SCALE: N/A	CHK:	APPD:
ENGR: JC				

DWG NO.: 46A-7001 REV: F
CADD: S5K SHT. 4 OF 10

ORIGINAL

D. LEGEND (PILOT DEVICES)

ASL.....Alarm Silence Light
ASPB.....Alarm Silence Pushbutton
EFOL.....Emergency Fail to open light
FSL.....Fail to SYNC Light
L1.....Emergency Position Light
L2.....Normal Position Light
L3.....Normal Available Light
L4.....Emergency Available Light
NFOL.....Normal Fail to open Light
RESET-1.....Fail to Open Lockout Reset
RESET-2.....Shunt Trip Reset
SL.....SYNC Light (Dark SYNC)
STL.....Shunt Trip Light
TMS.....Transition Mode Selector
TS.....Test Switch maintained, keyed

E. OPERATION - CLOSED TRANSITION

Zenith Closed Transition Transfer Switches are designed to Transfer load between two available sources, without interrupting power to the load (make before break). Paralleling of the two sources occurs within a predefined window of synchronization and lasts less the 100ms. The initial source is then disconnected.

To test the ATS, turning the Test Switch (TS) to Test initiates transfer by dropping out the Engine Start Relay. Turning the "TS" disables the circuit which transfers to Normal and enables the circuit which transfers to Emergency. The ATS closes into Emergency only after the SYNC Check Relay ensures the proper phase relationship of both sources. After the ATS closes into Emergency the SE limit switch becomes activated to de-energize the CCE relay and energize the CCNO relay, which opens the ATS out of Normal. When the ATS has opened out of Normal, the SNO-2 limit switch activates to de-energize the CCNO relay. The ATS has now closed into Emergency Power without interrupting the load.

Turning the "TS" to "AUTO" intigtes transfer to Normal. Turning the "TS" disables the circuit which transfers to Emergency and enables the circuit which transfers to Normal. The ATS closes into Normal only after the SYNC Check Relay ensures proper phase relationship of both sources. After the ATS closes into Normal the SN limit switch becomes activated to de-energize the CCN relay and energize the CCEO relay, which opens the ATS out of Emergency. When the ATS has opened out of Emergency, the SEO-2 limit switch activates to de-energize the CCEO relay. The ATS has now closed back into Normal Power without interrupting the load.

The ATS defaults to an open transition transfer when the Normal source fails. This signals the generator to start. After the generator voltage and frequency are at the proper level, the ATS transfers to Emergency. Closed transition transfer is not possible with one source available. One can select an Open Transition transfer via the Transition Mode Selector (TMS) for testing also.

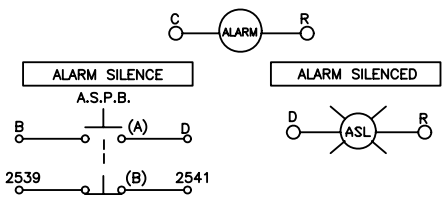
If while in Closed Transition Mode, the ATS fails to open the source it is attempting to "transfer out of", the source that the ATS just closed into will be opened leaving the ATS in its initial source while disabling all other transfer operations until the problem is corrected and the "reset" has been turned. Also a dry contact to shunt trip the generator circuit breaker is available to remove the generator from the bus if neither operator opened.

A 24 VDC control circuit is supplied to control the Alarm and Warning indicators. To insure continuous power to this circuit, the customer supplies the 24 VDC.

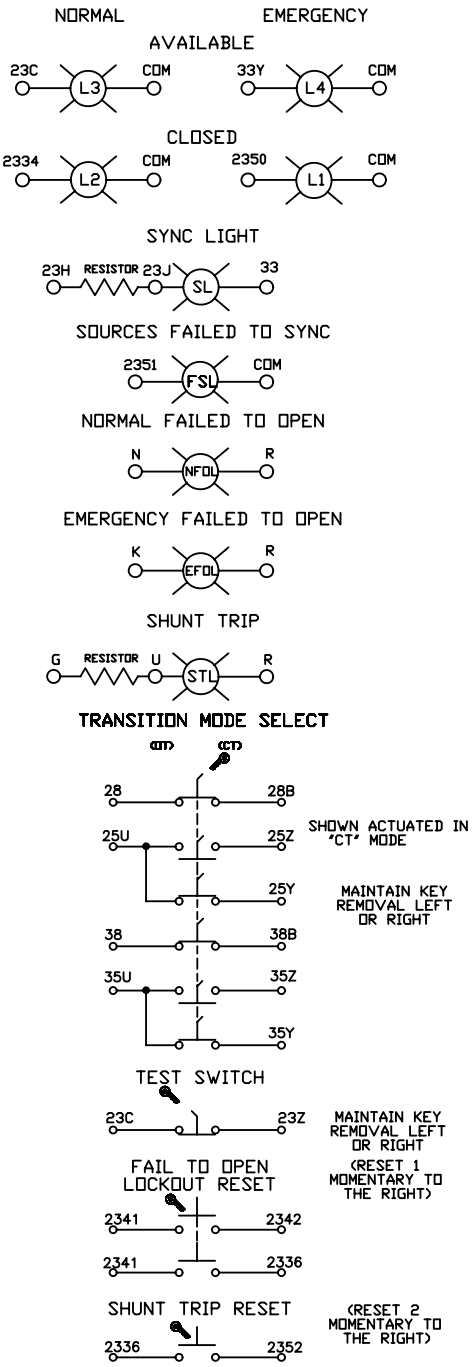
F. PARALLELING REQUREMENTS

A. The unit is Factory set to accomplish transfer within 5 electrical degrees (at 0.1 Hz Δ F).
B. Requires an Isochronous Governor with an operating frequency of 60 -+0.2 Hz.
C. Requires a shunt trip breaker on the Generator set with a response time not exceeding 50 ms.

CABINET FRONT



CABINET FRONT



LEGEND	REFERENCE	NOTES

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
E	S-6358	3/8/96	RMC	SB
F	S-6619	11/21/96	SG	SB

ZENITH CONTROLS, INC.

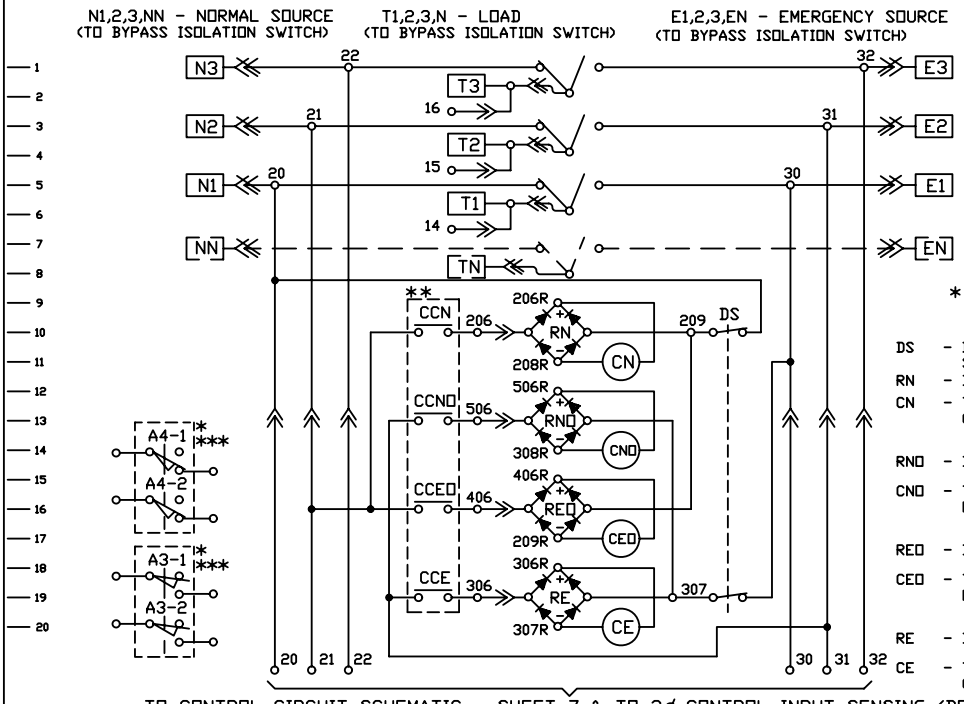
TITLE: CT OPERATION & CABINET FRONT
MODEL: ZBTSCTH60/120 (600-1200 AMP)

DRFT: IRAY	DATE:	SCALE:	CHK:	APPD:
ENGR: JC	1/27/94	N/A		

DWG NO.: 46A-7001 REV: F
CADD: S5K SHT. 5 OF 10

ORIGINAL

POWER CIRCUIT SCHEMATIC



VOLTAGE SYSTEMS

	VOLTS	NO. OF PHASES	NO. OF WIRES
-3	240V, 60HZ	3	3
-31	208, 60HZ	3	3
-38	120/240,60HZ	3	4
-4	120/208,60HZ	3	4
-5	480,60HZ	3	3
-7	277/480,60HZ	3	4
-9	240/416,60HZ	3	4
-91	220/380V,60HZ	3	4
-92	220/380V,50HZ	3	4

* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEM

DS - DISCONNECT SWITCH FOR SERVICING

RN - BRIDGE RECTIFIER, CN

CN - TRANSFER OPERATOR, CLOSE INTO NORMAL

RND - BRIDGE RECTIFIER, CND

CND - TRANSFER OPERATOR, OPEN FROM NORMAL

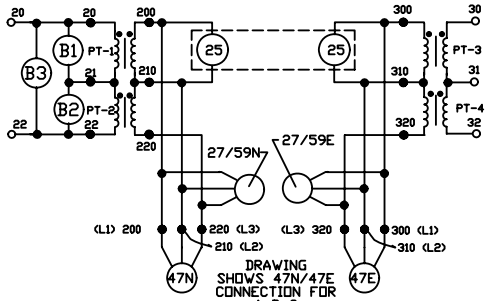
RED - BRIDGE RECTIFIER, CED

CED - TRANSFER OPERATOR, OPEN FROM EMERGENCY

RE - BRIDGE RECTIFIER, CE

CE - TRANSFER OPERATOR, CLOSE INTO EMERGENCY

3Ø CONTROL SENSING



PHASE ROTATION SEQUENCE. (PARENTHESIS=DEVICE TERMINAL #'s)
IF PHASE ROTATION SEQUENCE IS A-C-B
SWAP L2 & L3 TERMINAL INPUTS ON EACH 47 RELAY.

LEGEND:

PT- 1,2 - NORMAL POTENTIAL TRANSFORMERS

PT- 3,4 - EMERGENCY POTENTIAL TRANSFORMERS

B1,2,3 - UNDER VOLTAGE RELAYS , 64

27/59N - NORMAL UNDER/OVER VOLTAGE RELAY, 92

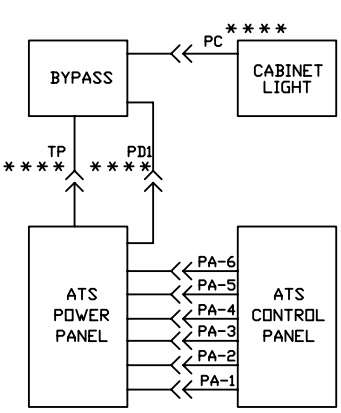
27/59E - EMERGENCY UNDER/OVER VOLTAGE RELAY, 92

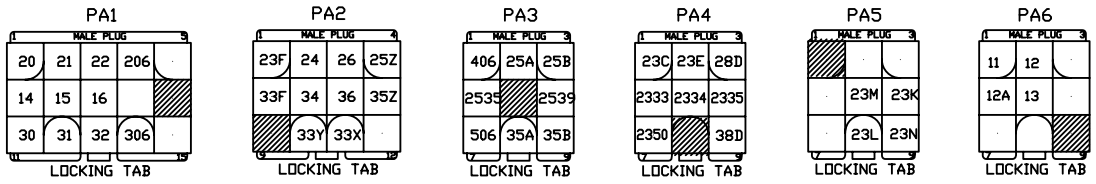
47N - PHASE SEQUENCING NORMAL , 92

47E - PHASE SEQUENCING EMERGENCY , 92

25 - SYNC CHECK RELAY, 93

INTERCONNECT PLUGS





LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —○— WIRE ON MAIN TERMINAL BLOCK —≫— WIRE IN DISCONNECT PLUG * OPTIONAL ** LOCATED ON CONTROL PANEL *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL **** SEE BYPASS CONTROL SUBPANEL AND PLUGS		ZBTSCTH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
E	S-6358	3/8/96	RMC	SB
F	S-6619	11/21/96	SG	SB

ZENITH CONTROLS, INC.

TITLE: POWER CIRCUIT & 3 ØCONTROL SENSING

MODEL: ZBTSCTH60/120 (600-1200 AMP)

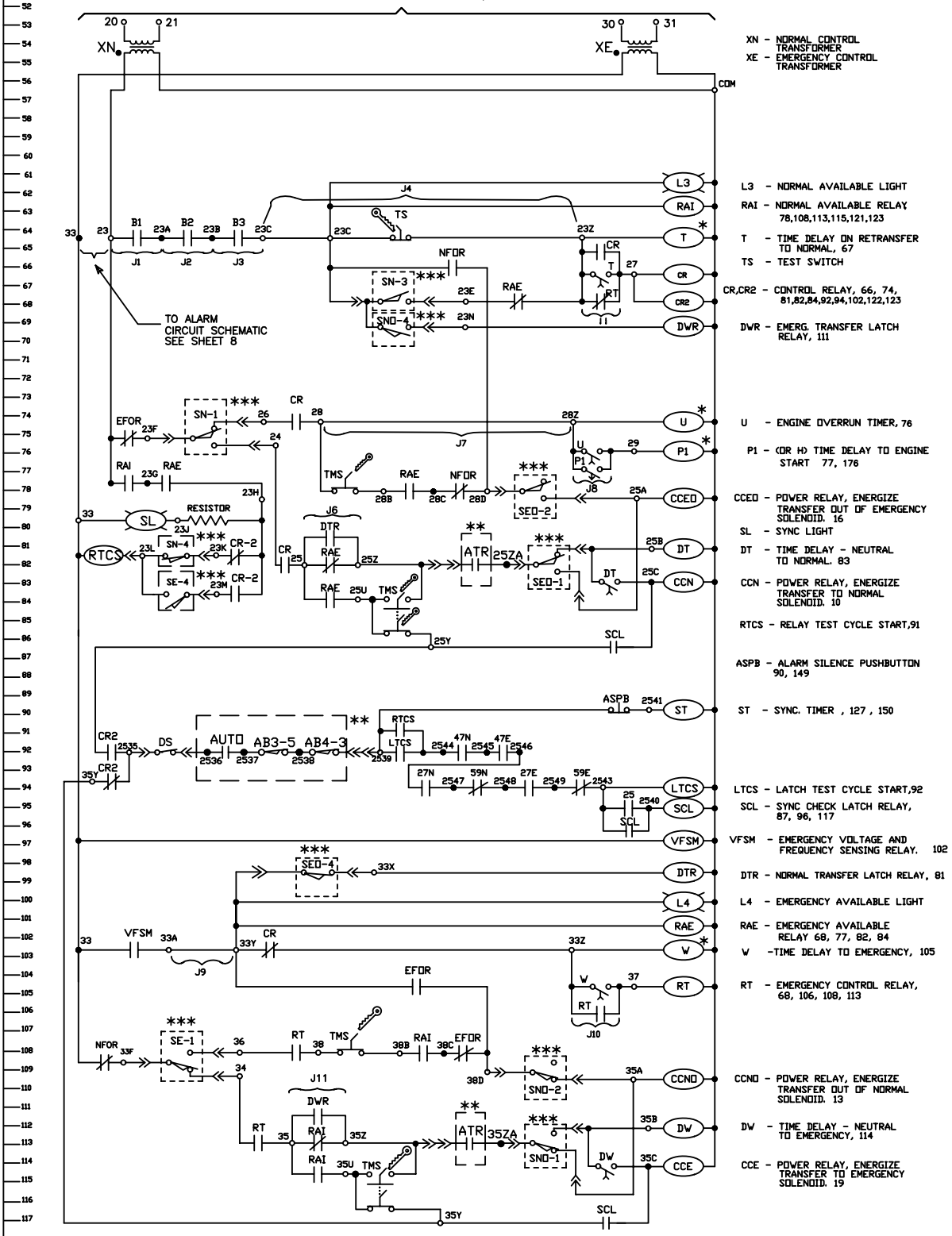
DRFT: IRAY	DATE:	SCALE:	CHK:	APPD:
ENGR: JC	1/27/94	N/A		

DWG NO.: 46A-7001 F

CADD: S5K SHT. 6 OF 10 REV

CONTROL CIRCUIT SCHEMATIC

TO POWER CIRCUIT SCHEMATIC, SHEET 6



XN - NORMAL CONTROL TRANSFORMER
XE - EMERGENCY CONTROL TRANSFORMER

L3 - NORMAL AVAILABLE LIGHT

RAI - NORMAL AVAILABLE RELAY 78,108,113,115,121,123

T - TIME DELAY ON RETRANSFER TO NORMAL, 67

TS - TEST SWITCH

CR,CR2 - CONTROL RELAY, 66, 74, 81,82,84,92,94,102,122,123

DWR - EMERG. TRANSFER LATCH RELAY, 111

U - ENGINE OVERRUN TIMER, 76

P1 - (OR H) TIME DELAY TO ENGINE START 77, 176

CCEO - POWER RELAY, ENERGIZE TRANSFER OUT OF EMERGENCY SOLENOID. 16

SL - SYNC LIGHT

DT - TIME DELAY - NEUTRAL TO NORMAL. 83

CCN - POWER RELAY, ENERGIZE TRANSFER TO NORMAL SOLENOID. 10

RTCS - RELAY TEST CYCLE START,91

ASPB - ALARM SILENCE PUSHBUTTON 90, 149

ST - SYNC. TIMER , 127 , 150

LTCS - LATCH TEST CYCLE START,92

SCL - SYNC CHECK LATCH RELAY, 87, 96, 117

VFSM - EMERGENCY VOLTAGE AND FREQUENCY SENSING RELAY. 102

DTR - NORMAL TRANSFER LATCH RELAY, 81

L4 - EMERGENCY AVAILABLE LIGHT

RAE - EMERGENCY AVAILABLE RELAY 68, 77, 82, 84

W -TIME DELAY TO EMERGENCY, 105

RT - EMERGENCY CONTROL RELAY, 68, 106, 108, 113

CCNO - POWER RELAY, ENERGIZE TRANSFER OUT OF NORMAL SOLENOID. 13

DW - TIME DELAY - NEUTRAL TO EMERGENCY, 114

CCE - POWER RELAY, ENERGIZE TRANSFER TO EMERGENCY SOLENOID. 19

JUMPER	CONNECT POINT	STANDARD CTTS COMPONENTS
J1	23,23A	B1
J2	23A,23B	B2
J3	23B,23C	B3
J4	23C,23Z	TS
J5	23Z,27	T
J6	25,25Z	DTR, RAE
J7	28,28Z	
J8	28Z,29	U
J9	33A,33Y	
J10	33Z,37	W
J11	35,35Z	DWR, RAI

NOTE:
ZBTSCTH shown in Normal position with no power available

LEGEND
- WIRE CONNECTION
- WIRE ON MAIN TERMINAL BLOCK
- WIRE IN DISCONNECT PLUG
- * OPTIONAL
- ** LOCATED ON BYPASS OR BYPASS SUBPANEL
- *** MECHANICALLY ACTUATED LOCATED ON POWER PANEL

LIMIT SWITCH STATE (X = ACTIVATED)

ATS POSITION	SN	SNO	SEO	SE
NORMAL	X		X	
PARALLED	X			X
EMERGENCY		X		X
OPEN		X	X	

REVISIONS

RV	ECN NO.	DATE	DRF	ENG
E	S-6358	03/11/96	RMC	SB
F	S-6619	11/21/96	SG	SB

ZENITH CONTROLS, INC.

TITLE: CONTROL CIRCUIT SCHEMATIC

MODEL: ZBTSCTH60/120 (600-1200 AMPS.)

DRFT: IRAY	DATE: 1/27/94	SCALE: N/A	CHK:	APPD:
ENGR: JC				

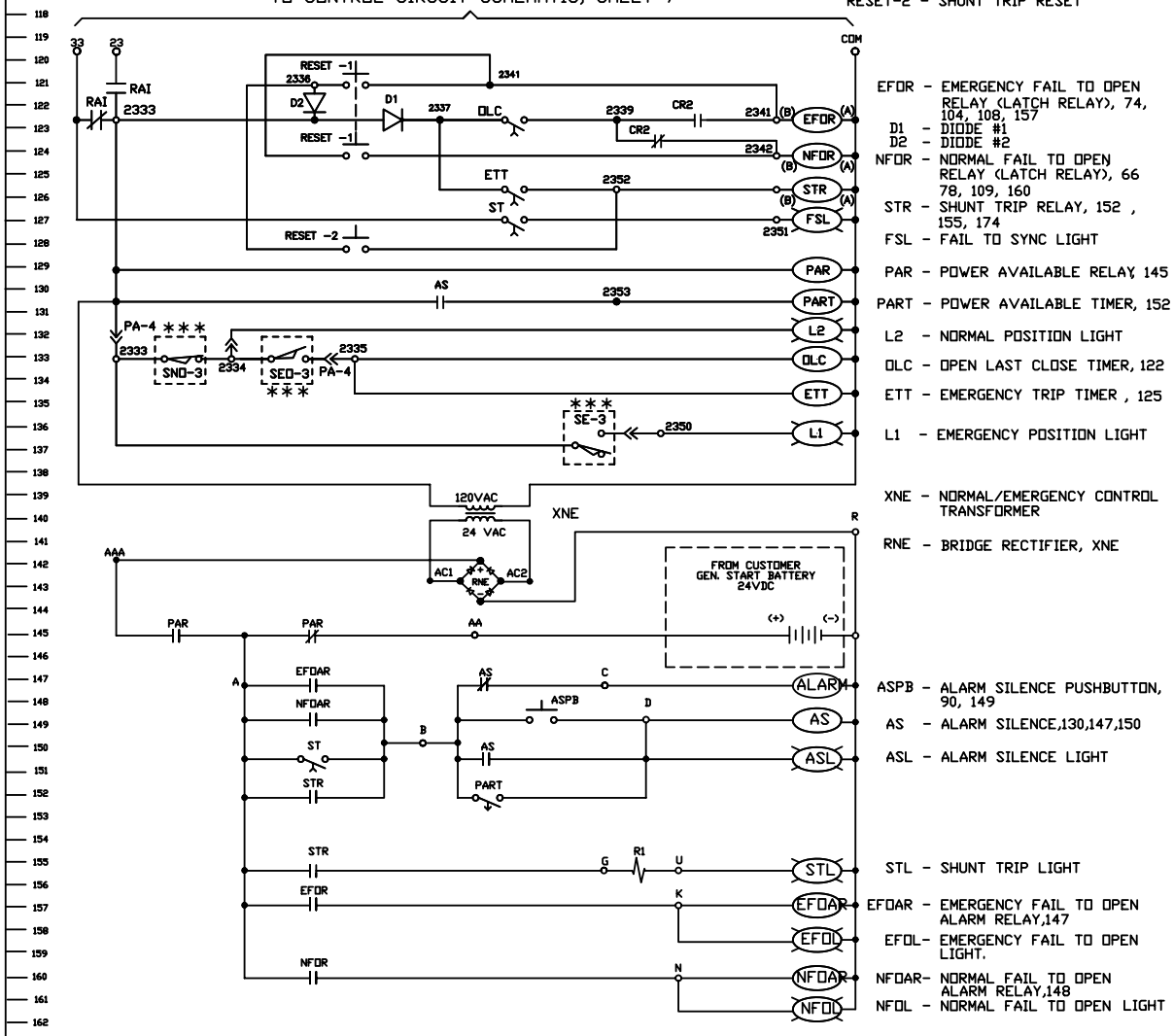
DWG NO.: 46A-7001 F

CADD: S5K SHT. 7 OF 10 REV

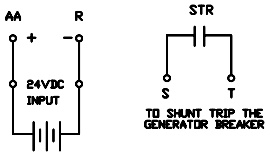
ORIGINAL

ORIGINAL

ALARM CIRCUIT SCHEMATIC



CUSTOMER CONNECTIONS



ENGINE START
SEE BP CONTROL CIRCUIT SCHEMATIC & BP & ATS COMPONENT LOCATIONS

A3, A4
SEE POWER CIRCUIT SCHEMATIC AND LAYOUT

CONTACT RATING		
RELAY	CONTACT	RATING
P1		10 AMPS @ 32 VDC.
	A3,A4	20 AMPS,125,250 VAC.

LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —○— WIRE ON MAIN TERMINAL BLOCK —≫— WIRE IN DISCONNECT PLUG *** MECHANICALLY ACTUATED, LOCATED ON POWER PANEL		ZBTSCTH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
E	S-6358	03/11/96	RMC	SB
F	S-6619	11/21/96	SG	SB

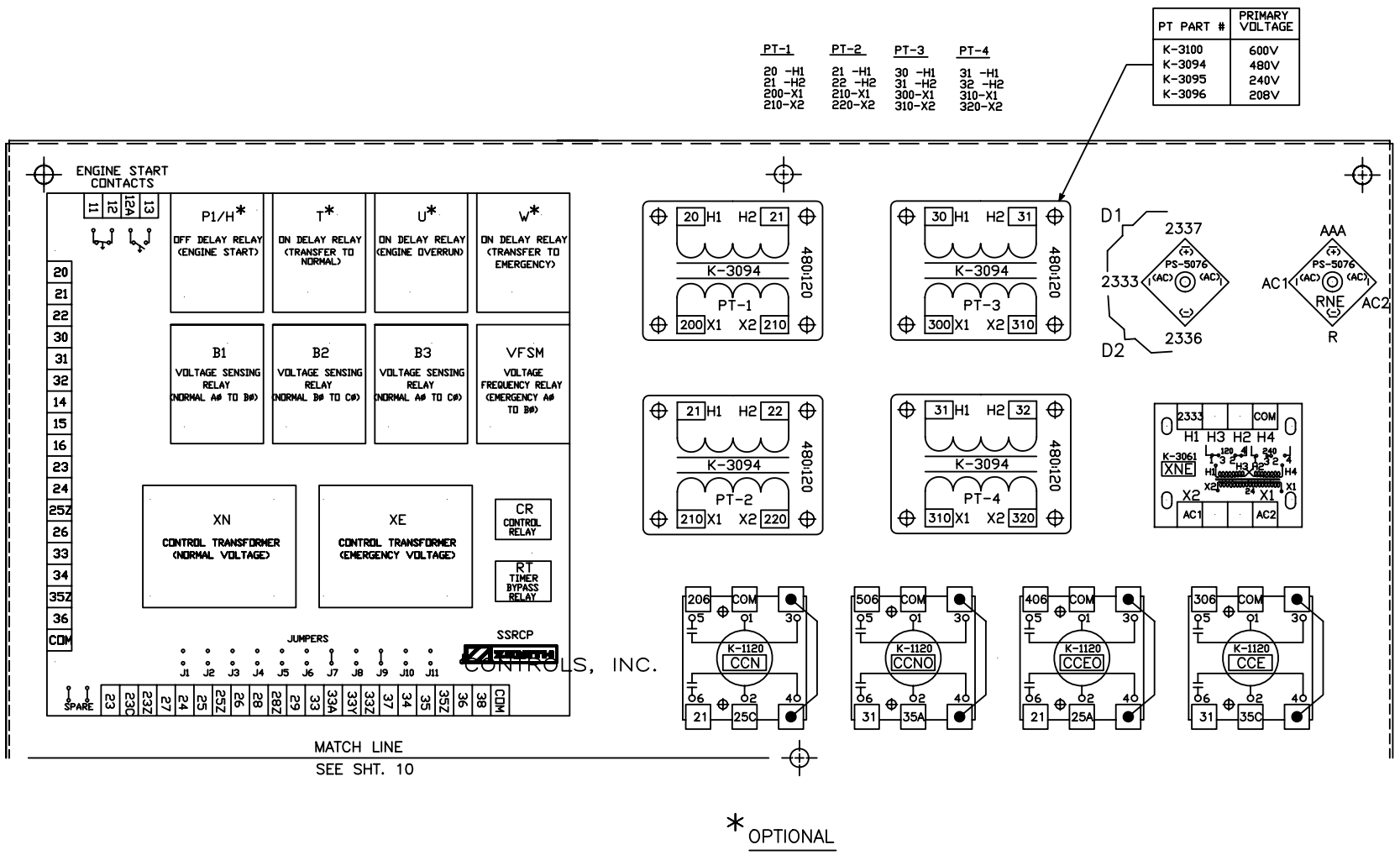
ZENITH CONTROLS, INC.

TITLE: ALARM CIRCUIT SCHEMATIC & CUSTOMER CONNECTIONS
MODEL: ZBTSCTH60/120 (600-1200 AMP)

DRFT: IRAY	DATE:	SCALE:	CHK:	APPD:
ENGR: JC	1/27/94	N/A		

DWG NO.: 46A-7001 REV F
CADD: S5K SHT. 8 OF 10

ORIGINAL

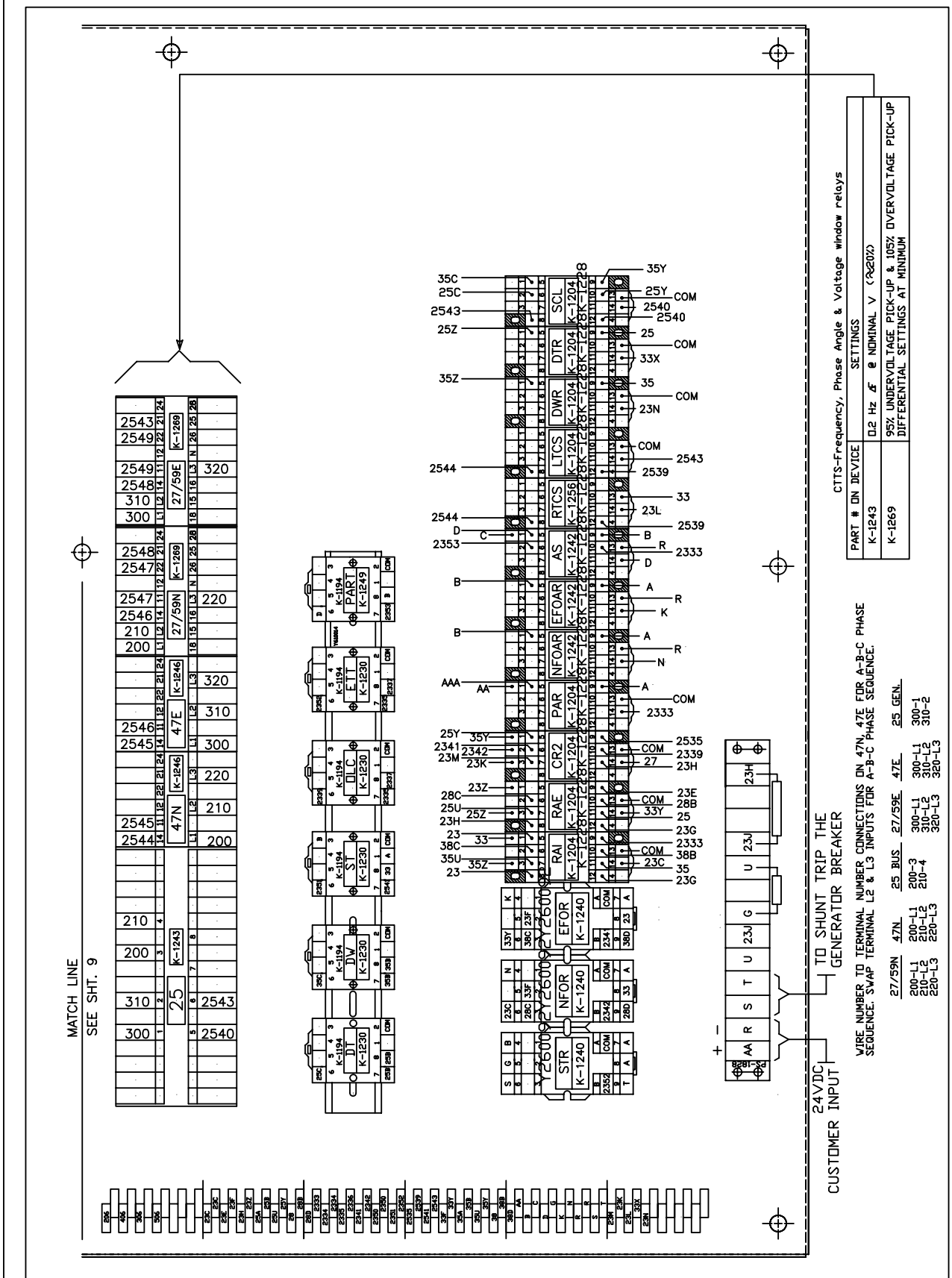


ZENITH CONTROLS, INC.

REV	ECN NO.	DATE	DRF	ENG
E	S-6358	03/11/96	RMC	SB
F	S-6619	11/21/96	SG	SB

TITLE: CONTROL PANEL LAYOUT
MODEL: ZBTSCTH60/120 (600-1200 AMP)
DRFT: IRAY DATE: 1/27/94 SCALE: 1:2 CHK: APPD:
ENGR: JC
DWG NO.: 46A-7001 REV F
CADD: SSK SHT. 9 OF 10
ORIGINAL

LEGEND | REFERENCE | NOTES | REVISIONS



LEGEND	REFERENCE	NOTES

REVISIONS

RV	ECN NO.	DATE	DRF	ENG
E	S-6358	03/11/96	RMC	SB
F	S-6619	11/21/96	SG	SB

ZENITH CONTROLS, INC.

TITLE: CONTROL PANEL LAYOUT
MODEL: ZBTSCTH60/120 (600-1200 AMP)
DRFT: IRAY | DATE: 1/27/94 | SCALE: 1:2 | CHK: | APPD:
ENGR: JC
DWG NO.: 46A-7001 | REV: F
CADD: S5K | SHT. 10 OF 10

ZBTSCTH SERIES
BYPASS/ISOLATION/CLOSED TRANSITION TRANSFER SWITCH OPERATION
1600-3000 AMP

OPERATION: BYPASS/ISOLATION SWITCH

AUTOMATIC

1. Manually operated Bypass Switch contacts (BN/BE) are open and ATS is supplying load.
2. Disconnect Switch (DS) is in "AUTO".

TO BYPASS ATS

1. Open bottom cabinet door and turn DS to "INHIBIT".
2. Turn Bypass Selector Switch (BSS) to same power source as ATS.
3. Move the Manual Bypass Handle (MBH) upward.

TO TEST ATS

1. Bypass per above instructions.
2. Rotate crank mechanism counterclockwise until ATS TEST light is illuminated.
3. Turn DS to "AUTO".
4. Test Switch (TS) on bottom cabinet door will allow electrical operation of ATS.

TO ISOLATE ATS

1. Bypass per above instructions.
2. Rotate crank mechanism counterclockwise until ATS ISOLATED light is illuminated.

TO REMOVE ATS

1. Bypass and Isolate per above instructions.
2. Disconnect multipin plugs and external connections to ATS.
3. Slide four corner latches of ATS to innermost position.
4. ATS can now be removed from cabinet.

TO RECONNECT ATS

1. Roll cart back into cabinet.
2. Slide four corner latches of ATS to outermost position.
3. Turn DS Switch to "INHIBIT".
4. Manually position ATS into same source as Bypass Switch.
5. Reconnect multipin plugs and external connections to ATS.
6. Rotate crank mechanism clockwise until ATS TEST light is illuminated.
7. Turn DS Switch to "AUTO" and use TS to electrically operate ATS.
8. Turn DS to "INHIBIT".
9. Rotate crank mechanism clockwise until ATS location pointer is aligned with "AUTO" mark on location indicator. (ATS must be in same source as Bypass).
10. Turn DS to "AUTO" and open Bypass with MBH.
11. ATS is now fully automatic (Figure 1).

NOTES:

1. DS in "INHIBIT" will prevent ATS electrical operation.
2. DO NOT use excessive force on mechanical handles.
3. Above Figures depict Bypass NORMAL. Sequence is same for Bypass EMERGENCY.
4. When ATS is in TEST or ISOLATE, Bypass Switch is a manual transfer switch to either available source. (Indicated on light panel).
5. To operate Bypass Switch when ATS is in TEST or ISOLATE:
   a) Move MBH downward (to open Bypass Contacts BN/BE).
   b) Turn BSS to opposite power source.
   c) Move MBH upward to close into selected power source.

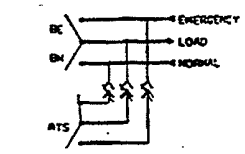


FIG. 1 BP IS OPEN WITH ATS IN NORMAL

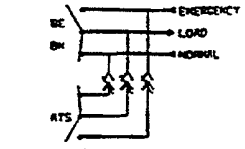


FIG. 2 BP IN NORMAL WITH ATS IN NORMAL

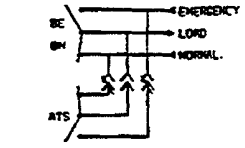


FIG. 3 BP IN NORMAL WITH ATS IN TEST (LOAD CONNECTIONS ARE OPEN)

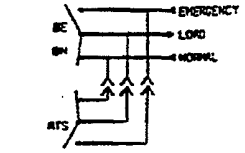


FIG. 4 BP IN NORMAL WITH ATS ISOLATED

NOTES:
1. BP-Bypass switch (indicated by contacts BN/BE) is a 3 position switch.
2. ATS-Automatic Transfer Switch

LEGEND: BYPASS/ISOLATION SWITCH (BP)

I. (BP) BYPASS/ISOLATION SWITCH: MECHANICAL COMPONENTS

N1,2,3,(N).....Normal Line connections
E1,2,3,(N).....Emergency Line connections
T1,2,3,(N).....Load Line connections
BE.....Bypass Emergency contacts
BN.....Bypass Normal contacts
BSS.....Bypass Selector Switch
MBH.....Manual Bypass Handle

II. (BP) BYPASS/ISOLATION: ELECTRICAL COMPONENTS

AR-1,2,3.....Limit switch held actuated in Auto location of ATS. Non-actuated Test and Isolated locations.
AB3-1,2,3,4,5.....Limit switch, actuated in Bypass Emergency position
AB4-1,2,3.....Limit switch, actuated in Bypass Normal position

AE-1,2.....Limit switch, switches Engine Start from ATS control to bypass control during ATS Isolate
AI-1,2.....Limit switch, actuated in Isolate location
AT-1,2.....Limit switch, actuated in Test location
ATR.....Auto/Test Relay. Energized in AUTO and TEST locations
AUTO..... Auto location relay. Energized in AUTO location.
BR-1,2,3.....Bridge Rectifier
C.....Capacitor: RNH
CBC.....Crank Solenoid
CBE.....Emergency Bypass Permissive Solenoid
CBN.....Normal Bypass Permissive Solenoid
CH-1.....Limit Switch, Deactivated when Crank Handle is Engaged
D1.....Diode
RNH.....Relay normally held, 24 VDC coil, 3PDT
R1.....Resistor: RNH
R2.....Resistor: LDS
XBE.....Emergency line control transformer
XBN.....Normal line control transformer

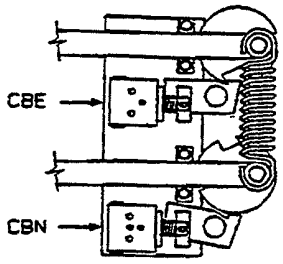
III. (BP) BYPASS/ISOLATION SWITCH: INDICATOR LIGHTS

LNA.....Normal available
LEA.....Emergency available
LBN(NOTE 1).....Bypass Normal (BN closed)
LBE(NOTE 1).....Bypass Emergency (BE closed)
LAT(NOTE 1).....ATS in Test location
LAI(NOTE 1).....ATS in Isolate location
LIT(NOTE 1).....ATS Inhibit
LDS(NOTE 1).....ATS DS switch in INHIBIT position

NOTES:
1. Indicator off during automatic operation of ATS.
2. Four pole includes neutral lugs.

ZENITH CONTROLS, INC.

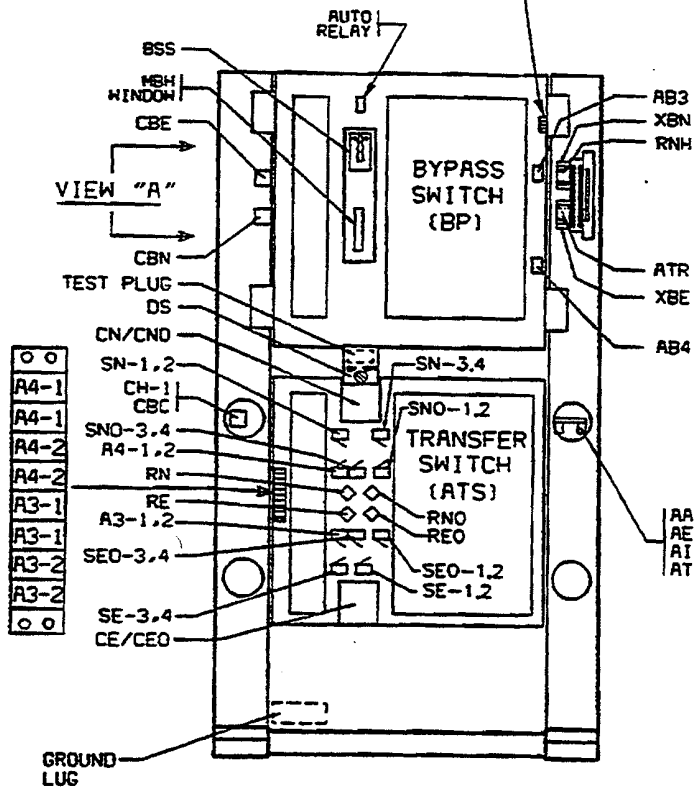
REVISIONS					TITLE: BP/ISOLATION SW: LEGEND & OPERATION				
RV	ECN NO.	DATE	DRF	ENG					
D	S-6358	03/11/96	RMC	SB	MODEL: ZBTSCTH160/3000 (1600-3000 AMP				
E	S-6616	11/22/96	SG	SB	DRFT: IRAY	DATE:	SCALE:	CHK:	APPD:
					ENGR: JC	01/27/94	N/A	JCH	SB
					DWG NO.: 46A-7002				E



VIEW "A"

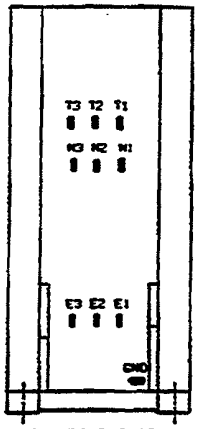
ENGINE START CONNECTIONS



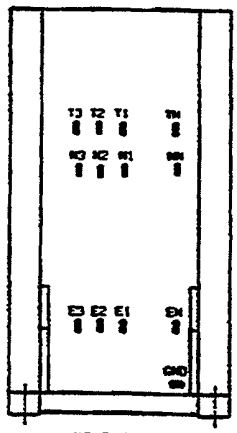


DEVICE TAG	TERMINAL MARKINGS WIRE NUMBER						COMMENTS
TRANSFORMERS	X1	X2	H1	H2	H3	H4	
XBE	53	54	50			51	G CASE
XBN	43	44	40			41	G CASE
SOLENOIDS	NO MARKINGS						
CBE	64	62					G
CBN	63	62					G
CBC	87A	81					
CN	206R	208R					
CE	306R	307R					
CNO	308R	506R					
CEO	209R	406R					
SWITCHES	NO		NC		NC		
DS	80	82	20	208	256	256	
	80	90	30	307			
LIMIT SWITCHES	C	NC	NO	C	NC	NO	
A3 (SEO-5,6)	A3-1	A3-1		A3-2	A3-2		
A4 (SNO-5,6)	A4-1	A4-1		A4-2	A4-2		
AA-1,2	60		61	62	82A	87	
AA-3	80		80A				
AB3-1,2	64		60	83R	83	86	
AB3-3,4	E12		E11	E12N	12A		
AB3-5	257	258					
AB4-1,2	63		61	80	83R	85	
AB4-3	258	258					
CH-1	C	NC					
	87	87A					
AE-1,2	E11	11	11R	E13	13	13R	
AI-1,2	80		82A	80		89	
AT-1,2	80		83	80		86	
SE-1,3	33F	34	36	233		235	
SN-1,3	23F	24	26	23C	23E		
SE-2, 4	65	87	85	23H		23L	
SN-2, 4	65	87	85	23K		23L	
SEO-1,2,3,4	25A	25A	25B	280	25A		
	234	235		33F		33K	
SNO-1,2,3,4	35A	35A	35B	380	35A		
	233	234		23C		23N	
RECTIFIERS	AC	AC	+	-			
BR-1	43	44	80	60			
BR-2	53	54	80	61			
BR-3	60	61		81			
RN	206	209	208R	209R			
RNO	506	307	506R	308R			
REO	406	209	406R	209R			
RE	306	307	306R	307R			

STANDARD LUG CONFIGURATION
(CONSULT FACTORY FOR OPTIONAL CONFIGURATIONS)
REAR VIEW OF ENCLOSURE



2/3-POLE SWITCH



4-POLE SWITCH

2 OF 10

LEGEND	REFERENCE	NOTES

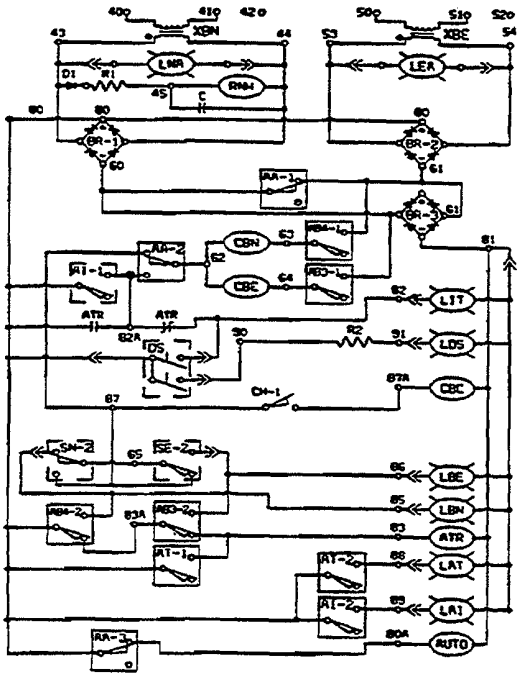
REVISIONS				
RV	ECN NO.	DATE	DRFT	ENG
D	S-6358	03/11/96	RMC	SB
E	S-6619	11/22/96	SG	SB

ZENITH CONTROLS, INC.

TITLE: BYPASS & ATS COMPONENT LOCATIONS
MODEL: ZBTSCTH160/300 (1600-3000 AMPS)

DRFT: IRAY	DATE: 1/27/94	SCALE: N/A	CHK: WCH	APPD
ENGR: JC				

DWG NO. 40A 7002



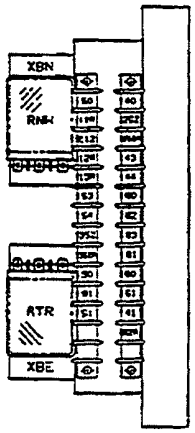
LNA - NORMAL AVAILABLE LIGHT
LEA - EMERGENCY AVAILABLE LIGHT
RNH - NORMAL VOLTAGE RELAY
DI - DIODE
RI - RESISTOR, RNH
C - CAPACITOR, RNH
BR-1,-2,-3 - BRIDGE RECTIFIER

AA-1 - LIMIT SWITCH, ATS IN AUTO

AB4-1- LIMIT SWITCH, BYPASS NORMAL
CBN - NORMAL TRANSFER OPERATOR
AA-2 - LIMIT SWITCH, ATS IN AUTO
AB3-1- LIMIT SWITCH, BYPASS EMERGENCY
CBE - EMERGENCY TRANSFER OPERATOR
LIT - ATS INHIBIT LIGHT
AI-1 - LIMIT SWITCH, ATS IN ISOLATE
LDS - DISCONNECT SWITCH IN INHIBIT POSITION
DS - ATS DISCONNECT SWITCH
R2 - RESISTOR, LDS
SN-2 - LIMIT SWITCH, ATS IN NORMAL
SE-2 - LIMIT SWITCH, ATS IN EMERGENCY
CBC - CRANK SOLENOID

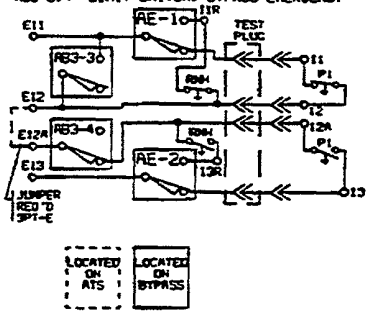
LBE - BYPASS EMERGENCY
LBN - BYPASS NORMAL LIGHT
AB4-2- LIMIT SWITCH, BYPASS NORMAL
AB3-2- LIMIT SWITCH, BYPASS EMERGENCY
AT-1 - LIMIT SWITCH, ATS IN TEST
ATR - AUTO/TEST RELAY
LAT - ATS TEST LOCATION
AT-2 - LIMIT SWITCH, ATS IN TEST
LAI - ATS ISOLATE LIGHT
AI-2 - LIMIT SWITCH, ATS IN ISOLATE
AUTO - AUTO LOCATION RELAY
AA-3 - LIMIT SWITCH, ATS IN AUTO

BYPASS SUBPANEL

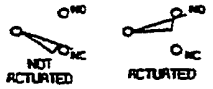


ENGINE START CIRCUIT

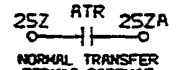
AE-1,2 - LIMIT SWITCH, ENGINE START TRANSFER
AB3-3,4- LIMIT SWITCH, BYPASS EMERGENCY



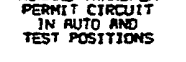
LIMIT SWITCHES



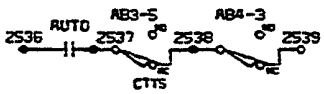
PERMIT CIRCUITS



NORMAL TRANSFER PERMIT CIRCUIT IN AUTO AND TEST POSITIONS



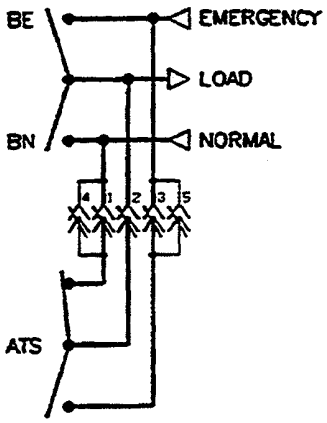
EMERGENCY TRANSFER PERMIT CIRCUIT IN AUTO AND TEST POSITIONS



CLOSED TRANSITION PERMIT CIRCUIT (IN AUTO LOCATION ONLY)

LIMIT SWITCH CHART

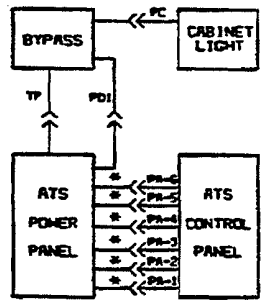
X = ACTUATED	ATS LOCATION: AUTO	TEST	ISO	ATS MODE: REMOVE	NORM	EMERG.	BYPASS MODE: NORM	EMERG.	OPEN
AA	X								
AT		X							
AI			X	X					
AE			X	X					
SN					X				
SE						X			
AB4							X		
AB3								X	



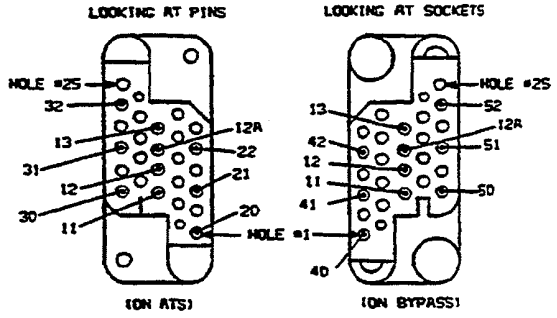
ATS LOCATION	LOAD CARRYING CONTACTS 1	2	3	ATS TEST PLUG (TP) 4	5
AUTO	X	X	X	X	X
TEST	0	0	0	X	X
ISOLATE	0	0	0	0	0

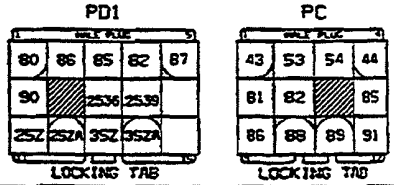
X = CLOSED
0 = OPEN

ATS TEST PLUG (TP)



* SEE INTERCONNECT PLUGS ON SCHEMATIC SHEET





NOTES

ATS SHOWN IN NORMAL POSITION, BYPASS OPEN WITH NO POWER AVAILABLE.

RV	ECN NO.	DATE	DRF	ENG
D	S-6358	03/11/96	RMC	SB
E	S-6619	11/22/96	SG	SB

ZENITH CONTROLS, INC.

TITLE: BYPASS CONTROL CIRCUIT SCHEMATIC
MODEL: ZBTSCTH160/300 (1600-3000 AMPS)
DRFT: TRAY | DATE: | SCALE: | CHK: | APP'D
ENGR: JC | 01/27/94 | N/A | WCH | SB
DWG NO.: 46A-7002 | E

LEGEND & OPERATION
AUTOMATIC TRANSFER SWITCH (ATS)

FOR USE ON EMERGENCY OR STANDBY SYSTEMS - RATED FOR TOTAL SYSTEM & MOTOR LOAD

A. LEGEND

N1,2,3.(N).....Normal Line_____
E1,2,3.(N).....Emergency Line_____
T1,2,3.(N).....Load Connections
B1,2,3.....Solid State Phase Relay(s)
Dropout _____%
Pickup _____%
AS.....Alarm Silence Relay
CE.....Main Transfer Operator, Close into Emergency
CEO.....Main Transfer Operator, Open from Emergency
CN.....Main Transfer Operator, Close into Normal
CNO.....Main Transfer Operator, Open from Normal
CCE.....CE Control Relay, Emergency Closing
CCEO.....CEO Control Relay, Emergency Opening
CCN.....CN Control Relay, Normal Closing
CCNO.....CNO Control Relay, Normal Opening
CR,CR2.....Normal Control Relay
DS.....Disconnect Switch
DT.....Timer, Delay Open To Normal
DTR.....Normal Transfer Latch Relay
DW.....Timer, Delay Open To Emergency
DWR.....Emergency Transfer Latch Relay
D1.....Diode #1
D2.....Diode #2
E.....Engine Start Contact
EFOAR.....Emergency Fail to open Alarm Relay
EFOR.....Emergency Fail to open Relay
ETT.....Emergency Trip Timer
GND.....Ground
LTCS.....Latch Test Cycle Start
NB.....Neutral Bar (if required)
NFOAR.....Normal Fail to open Alarm Relay
NFOR.....Normal Fail to open Relay
OLC.....Open Last Close Timer
PAR.....Power Available Relay
PART.....Power Available Timer
PT-1,2.....Potential Transformers Normal
PT-3,4.....Potential Transformers Emergency
RAE.....Emergency Available Relay
RAI.....Normal Available Relay
RE.....Bridge Rectifier, CE
REO.....Bridge Rectifier, CEO
RN.....Bridge Rectifier, CN
RNE.....Bridge Rectifier, XNE
RNO.....Bridge Rectifier, CNO
RT.....Emergency Control Relay
RTCS.....Relay Test Cycle Start
SCL.....SYNC Check Latch
SE,SEO.....Cutout Switch, Emergency
SN,SNO.....Cutout Switch, Normal
ST.....SYNC Timer
STR.....Shunt Trip Relay
VFSM.....Emergency Volt-Freq. Relay
Pickup {90% of rated Voltage, and 95% of rated Frequency
XE.....Control Transformer, Emergency
XN.....Control Transformer, Normal
XNE.....Control Transformer - Norm./Emerg.
25(ANSI).....Sync Check Relay
47N,E(ANSI).....Phase sequencing - Norm./Emerg.
27/59N,E(ANSI).Over/Undervoltage - Norm./Emerg.

B. OPERATION (OPEN TRANSITION)

(See note #4)

When the Normal Line falls to the preset dropout point, the phase relays will dropout disconnecting the CR relay.
When the Emergency Line voltage & frequency reach the preset pickup point, the VFSM relay picks up. RT relay picks up to operate the CCNO relay through the SE & SNO cutout switches causing the emergency main transfer operator CNO to operate. The load is now transferred to the Open position. The SNO limit switch operates to disconnect the CCNO relay and CNO main transfer operator. The transfer switch is now mechanically locked open. Limit switch SNO is now activated, picking up the DW timer. After a set time delay, DW will pick up the CCE relay which will then pick up CE main transfer operator. The load is now transferred to the Emergency line. The SE limit switch operates to disconnect the CCE relay and CE main transfer operator. The transfer switch is now mechanically locked in Emergency.

When the Normal Line voltage exceeds the preset pick up point, the phase relays B1, B2, & B3 pick up. CR relay picks up to operate the CCEO relay through the SN & SEO cutout switches, causing the main transfer operator CEO to operate. The load is now transferred to the Open position. The SEO limit switch operates to disconnect the CCEO relay and CEO main transfer operator. The transfer switch is now mechanically locked Open. Limit switch SEO is now activated, picking up the DT timer. After a set time delay, DT will pick up the CCN relay which will then pick up the CN main transfer operator. The load is now re-transferred back to the Normal line. The SN limit switch operates to disconnect the CCN relay and CN main transfer operator. The transfer switch is now mechanically locked in Normal.

DS - Disconnect Switch
When the Disconnect Switch is placed in the INHIBIT position the circuit to the main transfer operators CN/CNO and CE/CEO is opened and transfer cannot take place.

TS - Test Switch
The Test Switch simulates a normal line failure when activated.
To test, activate the Test Switch allowing the transfer switch to transfer to the EMERGENCY position. De-activate the Test Switch. The transfer switch will reset to the NORMAL position. Testing at least once a month is recommended. For hospital emergency systems, test once a week.

C. ACCESSORIES

The ZTSCTH series transfer switch is wired so that accessories can be easily added to the switch. The following is a description of the accessories which are supplied on this unit.

- ☐ A1 Auxiliary contact, S.P.D.T., operates on normal line failure.
- ☐ A1E Auxiliary contact, S.P.D.T., operates on emergency line failure.
- ☐ A3 Auxiliary contact closes when the transfer switch is in the Emergency position.
- ☐ A4 Auxiliary contact closes when the transfer switch is in Normal position.
- ☐ A6 Motor Disconnect. To de-energize external motor control circuit 5 seconds (adjustable) prior to transfer in either direction.
- ☐ C Plant Exerciser. Automatically starts generator for selected time intervals.
- ☐ C/D Plant Exerciser. Automatically starts generator to run unloaded or simulate a power failure and starts generator to run under load.
- ☐ E Engine Start Contact: 1 Normally Open, 1 Normally Closed.
- ☐ F Auxiliary Fan Contact, S.P.N.O. Closes when generator is running.
- ☐ H Time delay to engine start, non-adjustable. Factory set 1 or 3 seconds. When the Normal line fails the relay de-energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.
- ☐ J1 Adjustable under frequency sensor.
- ☐ J2 Adjustable over/under frequency sensor.
- ☐ K Frequency meter to indicate load frequency.
- ☐ L1 Pilot Light. Switch in Emergency Position.
- ☐ L2 Pilot Light. Switch in Normal Position.
- ☐ L3 Pilot Light. Normal source available.
- ☐ L4 Pilot Light. Emergency source available.
- ☐ M1 Ammeter; Single phase.
- ☐ M2 Ammeter; Three phase
- ☐ M3 Voltmeter; Single phase.
- ☐ M4 Voltmeter; Three phase.
- ☐ P1 Time Delay to Engine Start (solid state). Adjustable over time range .5 to 6 seconds. When the Normal line fails the relay de-energizes. After the set time delay, its contacts close to start the engine. When Normal line restores and the transfer switch is in Normal position, the relay energizes and the engine start contacts open to shut down the engine.
- ☐ P2 Time Delay to Engine Start (Pneumatic). Adjustable over time range 1/6 to 300 seconds. When the Normal line fails, the relay de-energizes. After the set time delay its contacts close to start the engine. When Normal line restores and the transfer switch is in the Normal position, the relay energizes and the engine start contacts open to shut down the engine.
- ☐ O2 Connections for remote peak shave or area protection relays. Includes bypass for automatic return to Normal if Emergency line fails and Normal is present.
- ☐ R1 Solid State Adjustable Overvoltage Relay(s). Set at 110% of pickup, 105% of dropout of nominal Line rate, unless otherwise specified.
- ☐ R4 In-Phase monitor. Prevents transfer until two sources are in-phase. For use of isochronous governors.
- ☐ R43 In-phase monitor. Prevents transfer until two sources are in-phase. For use with mechanical governors.
- ☐ S1 Four-position Engine Control Selector Switch. "STOP", "HAND CRANK", "TEST", "AUTOMATIC"
- ☐ T Time delay, re-transfer to Normal. When the Normal line restores and the phase relays operate, the T timer is energized. After the set time delay, its contacts close the circuit to the CR relay which operates to restore the load to the Normal line. RT relay is supplied to bypass T contacts if Emergency is de-energized during timing. CAUTION-DO NOT SET TIMER AT THE "0" POINT.
- ☐ T3 W3 Presignal auxiliary Contact, S.P.D.T: Operates 0-30 seconds (adjustable) prior to transfer in either direction.
- ☐ U Time delay, engine cool-down. When the transfer switch is restored to the Normal position and the engine is signaled to shut down, the U timer operates to maintain the engine start circuit closed. At the end of the set time, the engine contacts open to shut down the engine. CAUTION-DO NOT SET TIMER AT THE "0" POINT.
- ☐ W Time delay, transfer to Emergency. When the Normal line fails and the engine has started, the VFSM relay energizes. The W timer energizes. After the set time delay, its contacts close to energize the RT relay. CAUTION-DO NOT SET TIMER AT THE "0" POINT.
- ☐ YE Pushbutton Transfer to Emergency. Provides manual control of transfer to emergency source. If time delay accessory W is supplied pushbutton bypasses time delay for immediate transfer; otherwise, transfer to emergency will be automatic after time delay. If time delay accessory W is not supplied, transfer will be non-automatic (by pushbutton only).
- ☐ YN Pushbutton to Retransfer to Normal. Provides manual control of retransfer to nr source. If time delay accessory T is sup pushbutton bypasses time delay for immed retransfer; otherwise, retransfer to normal will be automatic after time delay. If time delay accessory T is not supplied, retransfer will be non-automatic (by pushbutton only).

Other: _____

NOTES:

1. ⚠ CAUTION: In using a 3 phase, 4 wire delta or open delta power supply (usually 120/240 volts, sometimes listed as 120/208 volts) with one leg having a grounded center tap, one line will be 160 to 208 volts to ground. When such a system is used it is necessary to connect the high leg to N2. DO NOT CONNECT 120 VOLT LOAD CIRCUIT TO THE HIGH LEG.
2. GROUNDING TERMINAL: A grounding terminal (GND) is provided. When installing open type switches connect this to the metal enclosure or conduit.
3. ⚠ WARNING - TO ENSURE AGAINST SHOCK OR ACCIDENT HAZARD, DISCONNECT ALL SOURCES OF SUPPLY BEFORE SERVICING.
4. OPEN TRANSITION OPERATION CAN BE SELECTED WITH BOTH SOURCES AVAILABLE. OPEN TRANSITION OCCURS BY DEFAULT WHEN THE LOAD-CONNECTED SOURCE FAILS.
5. ON SINGLE PHASE UNITS WHERE THE EMERGENCY SOURCE IS A UTILITY LINE, CONNECT EMERGENCY LINE SO THAT MINIMUM VOLTAGE IS MEASURED FROM N1 TO E1.
6. ON SINGLE PHASE (2 POLE) UNITS, CENTER POLE AND PHASE RELAYS (B2,B3) ARE NOT SUPPLIED ALSO 47N & 47E ARE ELIMINATED.

3Ø 27/59N & E ARE REPLACED BY 1Ø 27/59N & E.

ACCESSORY LIST:

NOTES:

ZENITH CONTROLS, INC.

REVISIONS					TITLE: LEGEND AND ACCESSORIES				
RV	ECN NO.	DATE	DRF	ENG	MODEL: ZBTSCTH160/300 (1600-3000 AMP)				
D	S-6358	03/11/96	RMC	SB	DRFT: IRAY	DATE: 1/27/94	SCALE: N/A	CHK: WM	APPD: JB
E	S-6619	11/22/96	SG	SB	ENGR: JC				
					DWG NO.: 46A-7002			4 of 10	E

D. LEGEND (PILOT DEVICES)

ASL.....Alarm Silence Light
ASPB.....Alarm Silence Pushbutton
EFOL.....Emergency Fail to open light
FSL.....Fail to SYNC Light
L1.....Emergency Position Light
L2.....Normal Position Light
L3.....Normal Available Light
L4.....Emergency Available Light
NFOL.....Normal Fail to open Light
RESET-1.....Fail to Open Lockout Reset
RESET-2.....Shunt Trip Reset
SL.....SYNC Light (Dark SYNC)
STL.....Shunt Trip Light
TMS.....Transition Mode Selector
TS.....Test Switch maintained, keyed

E. OPERATION - CLOSED TRANSITION

Zenith Closed Transition Transfer Switches are designed to Transfer load between two available sources, without interrupting power to the load (make before break). Paralleling of the two sources occurs within a predefined window of synchronization and lasts less the 100ms. The initial source is then disconnected.

To test the ATS, turning the Test Switch (TS) to Test initiates transfer by dropping out the Engine Start Relay. Turning the "TS" disables the circuit which transfers to Normal and enables the circuit which transfers to Emergency. The ATS closes into Emergency only after the SYNC Check Relay ensures the proper phase relationship of both sources. After the ATS closes into Emergency the SE limit switch becomes activated to de-energize the CCE relay and energize the CCNO relay, which opens the ATS out of Normal. When the ATS has opened out of Normal, the SNO-2 limit switch activates to de-energize the CCNO relay. The ATS has now closed into Emergency Power without interrupting the load.

Turning the "TS" to "AUTO" initiates transfer to Normal. Turning the "TS" disables the circuit which transfers to Emergency and enables the circuit which transfers to Normal. The ATS closes into Normal only after the SYNC Check Relay ensures proper phase relationship of both sources. After the ATS closes into Normal the SN limit switch becomes activated to de-energize the CCN relay and energize the CCEO relay, which opens the ATS out of Emergency. When the ATS has opened out of Emergency, the SEO-2 limit switch activates to de-energize the CCEO relay. The ATS has now closed back into Normal Power without interrupting the load.

The ATS defaults to an open transition transfer when the Normal source fails. This signals the generator to start. After the generator voltage and frequency are at the proper level, the ATS transfers to Emergency. Closed transition transfer is not possible with one source available. One can select an Open Transition transfer via the Transition Mode Selector (TMS) for testing also.

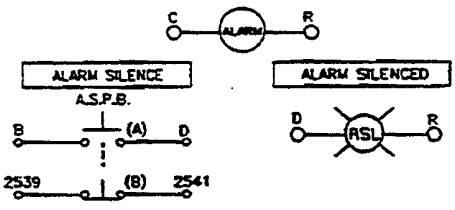
If while in Closed Transition Mode, the ATS fails to open the source it is attempting to "transfer out of", the source that the ATS just closed into will be opened leaving the ATS in its initial source while disabling all other transfer operations until the problem is corrected and the "reset" has been turned. Also a dry contact to shunt trip the generator circuit breaker is available to remove the generator from the bus if neither operator opened.

A 24 VDC control circuit is supplied to control the Alarm and Warning indicators. To insure continuous power to this circuit, the customer supplies the 24 VDC.

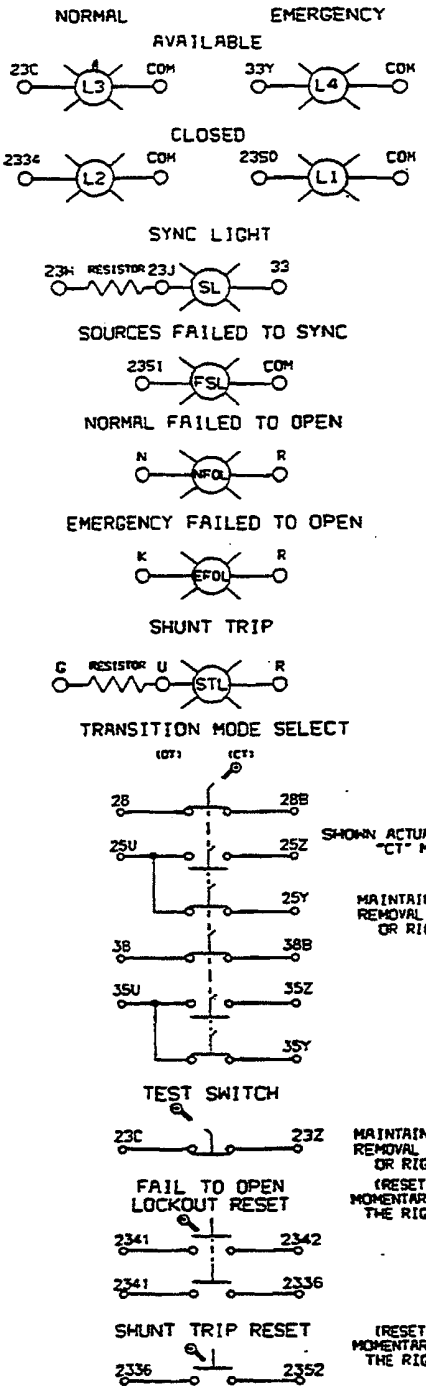
F. PARALLELING REQUIREMENTS

A. The unit is Factory set to accomplish transfer within 5 electrical degrees (at 0.1 Hz ΔF).
B. Requires an Isochronous Governor with an operating frequency of 60 ±0.2 Hz.
C. Requires a shunt trip breaker on the Generator set with a response time not exceeding 50 ms.

CABINET FRONT



CABINET FRONT



LEGEND	REFERENCE	NOTES

REVISIONS				
RV	ECN NO.	DATE	DRF	ENG
D	S-6358	03/11/96	RMC	SB
E	S-6619	11/22/96	SG	SB

ZENITH CONTROLS, INC.

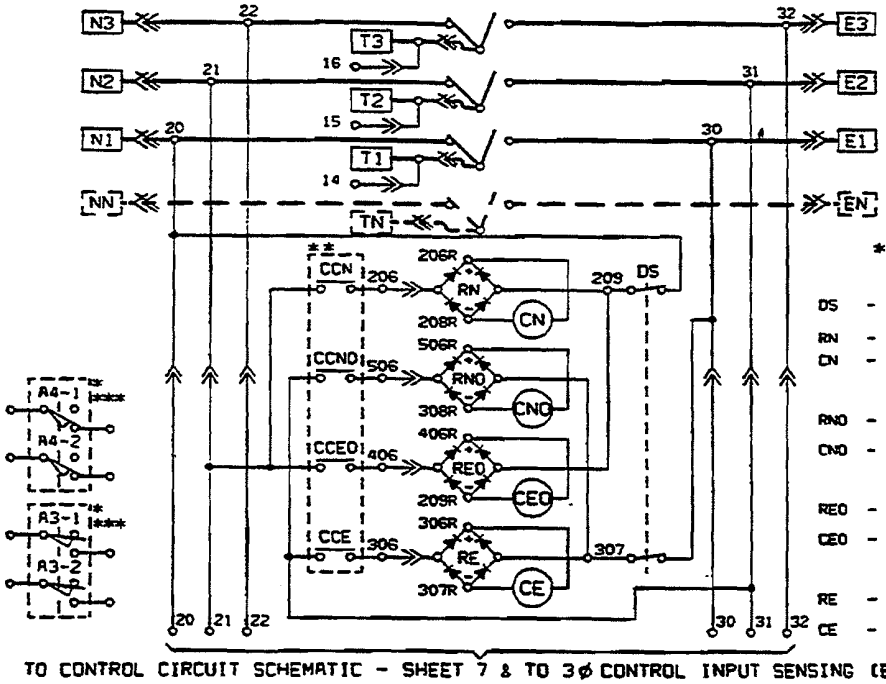
TITLE: CT OPERATION & CABINET FRON
MODEL: ZBTSCTH160/300 (1600-3000 AF

DRFT: IRAY	DATE:	SCALE:	CHK:	APP
ENGR: JC	1/27/94	N/A	WKH	

DWG NO.: 46A-7002 E

POWER CIRCUIT SCHEMATIC

N1.2.3.NN - NORMAL SOURCE (TO BYPASS ISOLATION SWITCH)
T1.2.3.N - LOAD (TO BYPASS ISOLATION SWITCH)
E1.2.3.EN - EMERGENCY SOURCE (TO BYPASS ISOLATION SWITCH)



TO CONTROL CIRCUIT SCHEMATIC - SHEET 7 & TO 3Ø CONTROL INPUT SENSING (BELOW)

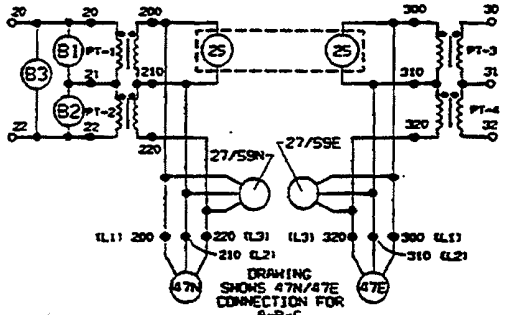
VOLTAGE SYSTEMS

	VOLTS	NO. OF PHASES	NO. OF WIRE
-3	240V. 60HZ	3	3
-31	208. 60HZ	3	3
-38	120/240.60HZ	3	
-4	120/208.60HZ	3	
-5	480.60HZ	3	
-7	277/480.60HZ	3	4
-9	240/416.60HZ	3	4
-91	220/380V.60HZ	3	4
-92	220/380V.50HZ	3	4

* SWITCHED OR SOLID NEUTRAL AS SPECIFIED FOR 4 WIRE SYSTEM

DS - DISCONNECT SWITCH FOR SERVICING
RN - BRIDGE RECTIFIER. CN
CN - TRANSFER OPERATOR. CLOSE INTO NORMAL
RNO - BRIDGE RECTIFIER. CNO
CNO - TRANSFER OPERATOR. OPEN FROM NORMAL
REO - BRIDGE RECTIFIER. CEO
CEO - TRANSFER OPERATOR. OPEN FROM EMERGENCY
RE - BRIDGE RECTIFIER. CE
CE - TRANSFER OPERATOR. CLOSE INTO EMERGENCY

3Ø CONTROL SENSING

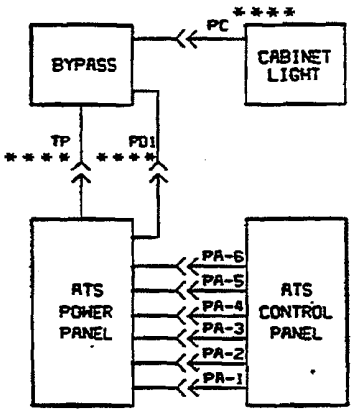


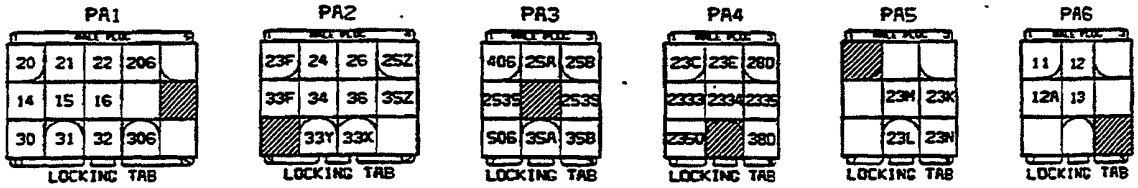
PHASE ROTATION SEQUENCE. (PARENTHESIS=DEVICE TERMINAL #'s)
IF PHASE ROTATION SEQUENCE IS A-C-B
SWAP L2 & L3 TERMINAL INPUTS ON EACH 47 RELAY.

LEGEND:

PT- 1.2 - NORMAL POTENTIAL TRANSFORMERS
PT- 3.4 - EMERGENCY POTENTIAL TRANSFORMERS
B1.2.3 - UNDER VOLTAGE RELAYS. 64
27/59N - NORMAL UNDER/OVER VOLTAGE RELAY. 92
27/59E - EMERGENCY UNDER/OVER VOLTAGE RELAY. 92
47N - PHASE SEQUENCING NORMAL. 92
47E - PHASE SEQUENCING EMERGENCY. 92
2S - SYNC CHECK RELAY. 93

INTERCONNECT PLUGS





LEGEND	REFERENCE	NOTES
—●— WIRE CONNECTION —○— WIRE ON MAIN TERMINAL BLOCK —≫— WIRE IN DISCONNECT PLUG * OPTIONAL ** LOCATED ON CONTROL PANEL *** MECHANICALLY ACTUATED. LOCATED ON POWER PANEL **** SEE BYPASS CONTROL		ZBTSCTH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS

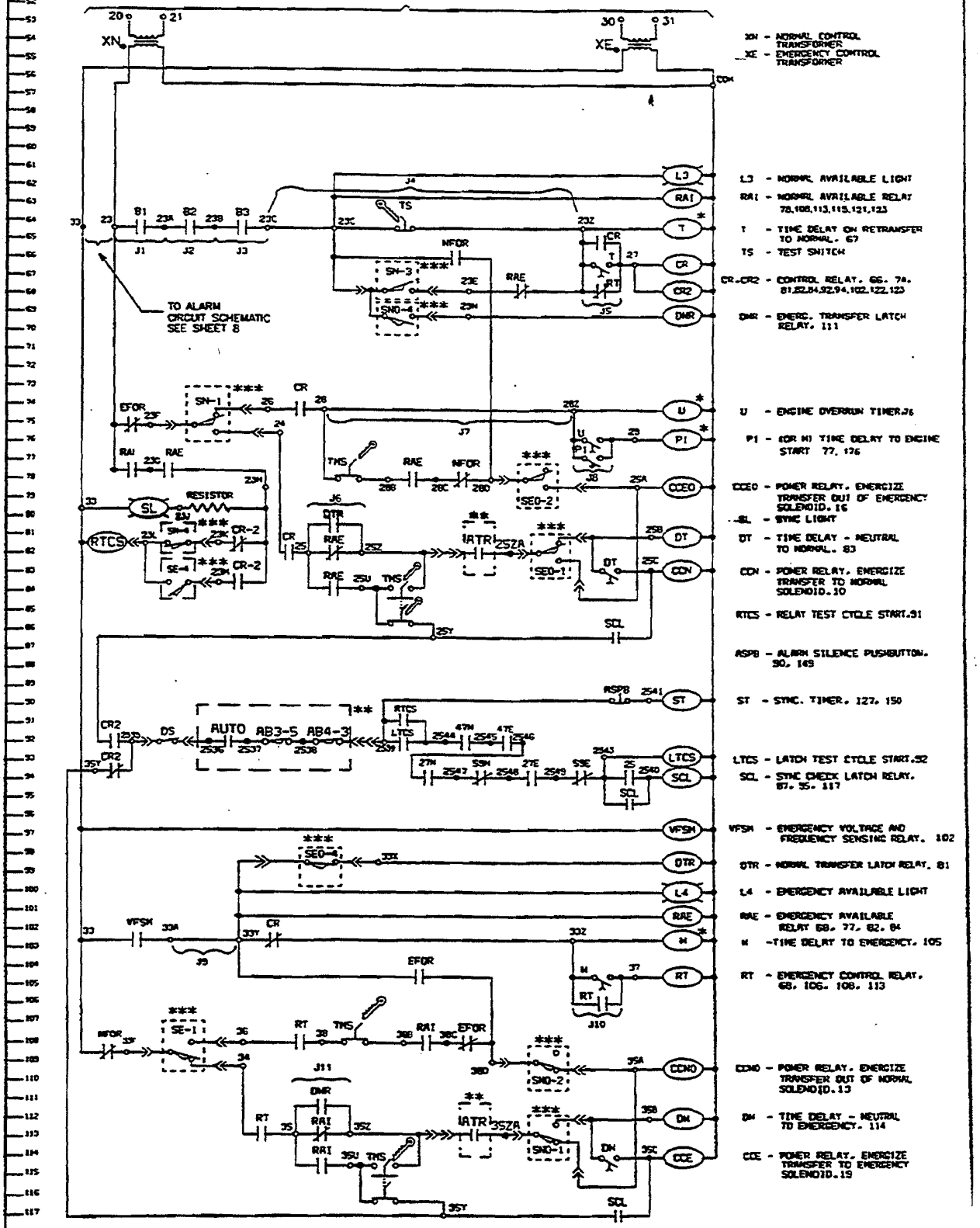
RV	ECN NO.	DATE	DRF	ENG
D	S-6556	03/11/96	RMC	SB
E	S-6619	11/22/96	SG	SB

ZENITH CONTROLS, INC.

TITLE: POWER CIRCUIT & 3Ø CONTROL SENSING				
MODEL: ZBTSCTH160/300 (1600-3000 AMP)				
DRFT: IRAY	DATE:	SCALE:	CHK:	APPD
ENGR: JC	1/27/94	N/A	WGH	SB
DWG NO.: 46A-7002		60F10		E

CONTROL CIRCUIT SCHEMATIC

TO POWER CIRCUIT SCHEMATIC, SHEET 6



XN - NORMAL CONTROL TRANSFORMER
XE - EMERGENCY CONTROL TRANSFORMER

L3 - NORMAL AVAILABLE LIGHT

RAI - NORMAL AVAILABLE RELAY 78,108,113,115,121,123

T - TIME DELAY ON RETRANSFER TO NORMAL, 67

TS - TEST SWITCH

CR, CR2 - CONTROL RELAY, 66, 74, 81,82,84,92,94,102,122,123

DMR - EMERG. TRANSFER LATCH RELAY, 111

U - ENGINE OVERRUN TIMER,76

P1 - (OR H) TIME DELAY TO ENGINE START 77, 176

CCEO - POWER RELAY, ENERGIZE TRANSFER OUT OF EMERGENCY SOLENOID, 16

SL - SYNC LIGHT

DT - TIME DELAY - NEUTRAL TO NORMAL, 83

CDN - POWER RELAY, ENERGIZE TRANSFER TO NORMAL SOLENOID, 10

RTCS - RELAY TEST CYCLE START,91

ASPB - ALARM SILENCE PUSHBUTTON, 30, 149

ST - SYNC. TIMER, 127, 150

LTCS - LATCH TEST CYCLE START,52

SCL - SYNC CHECK LATCH RELAY, 87, 55, 117

VFSN - EMERGENCY VOLTAGE AND FREQUENCY SENSING RELAY, 102

DTR - NORMAL TRANSFER LATCH RELAY, 81

L4 - EMERGENCY AVAILABLE LIGHT

RAE - EMERGENCY AVAILABLE RELAY 68, 77, 82, 84

M - TIME DELAY TO EMERGENCY, 105

RT - EMERGENCY CONTROL RELAY, 68, 106, 108, 113

CDNO - POWER RELAY, ENERGIZE TRANSFER OUT OF NORMAL SOLENOID, 13

DN - TIME DELAY - NEUTRAL TO EMERGENCY, 114

CDE - POWER RELAY, ENERGIZE TRANSFER TO EMERGENCY SOLENOID, 19

JUMPER	CONNECT POINT	STANDARD ETTS COMPONENTS
J1	23-23A	B1
J2	23A-23B	B2
J3	23B-23C	B3
J4	23C-23Z	TS
J5	23Z-27	T
J6	25-25Z	DTR, RAE
J7	26-26Z	
J8	26Z-29	U
J9	33A-33Y	
J10	33Z-37	M
J11	35-35Z	DMR, RAI

NOTE:
ZBTSCTH shown in Normal position with no power available

LEGEND
- WIRE CONNECTION
- WIRE ON MAIN TERMINAL BLOCK
- WIRE IN DISCONNECT PLUG
- * OPTIONAL
- ** LOCATED ON BYPASS OR BYPASS SUBPANEL
- *** MECHANICALLY ACTUATED LOCATED ON POWER PANEL

LIMIT SWITCH STATE (X = ACTIVATED)

ATS POSITION	SN	SNO	SEO	SE
NORMAL	X		X	
PARALLED	X			X
EMERGENCY		X		X
OPEN		X	X	

REVISIONS					
RV	ECN NO.	DATE	DRF	ENG	
D	S-6358	3/11/96	RMC	SB	
E	S-6619	11/22/96	SG	SB	

ZENITH CONTROLS, INC.

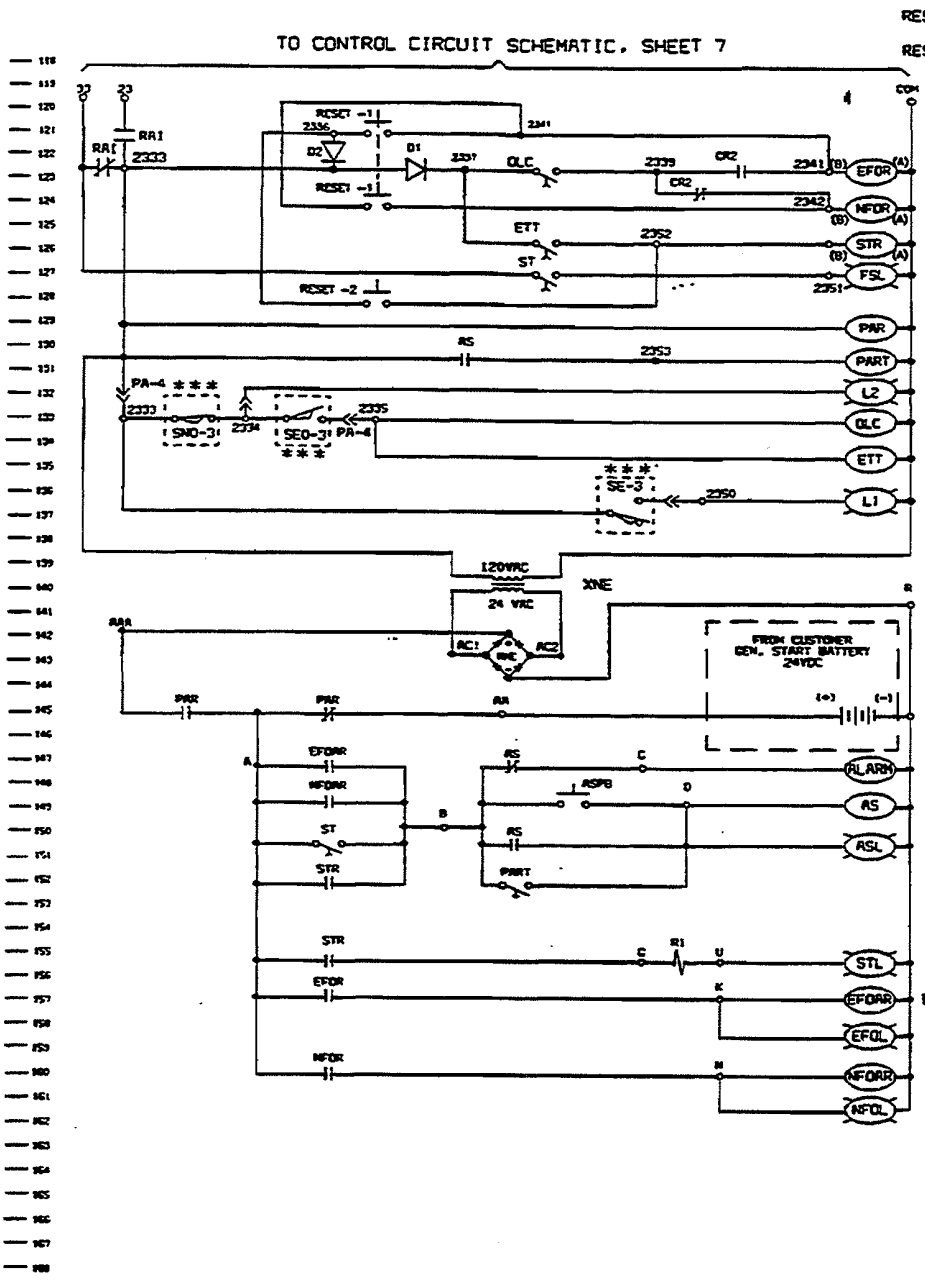
TITLE: CONTROL CIRCUIT SCHEMATIC
MODEL: ZBTSCTH160/300 (1600-3000 AMP)

DRFT: IRAY	DATE: 1/27/94	SCALE: N/A	CHK: WLA	APPD SB
ENGR: JC				

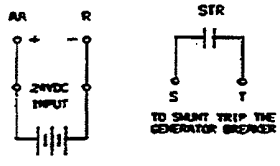
DWG NO 46A-7002 SHT 7 OF 10 REV E

CADD: 55K

ALARM CIRCUIT SCHEMATIC



CUSTOMER CONNECTIONS



ENGINE START
SEE BP CONTROL CIRCUIT SCHEMATIC & BP & ATS COMPONENT LOCATIONS

A3, A4
SEE POWER CIRCUIT SCHEMATIC AND LAYOUT

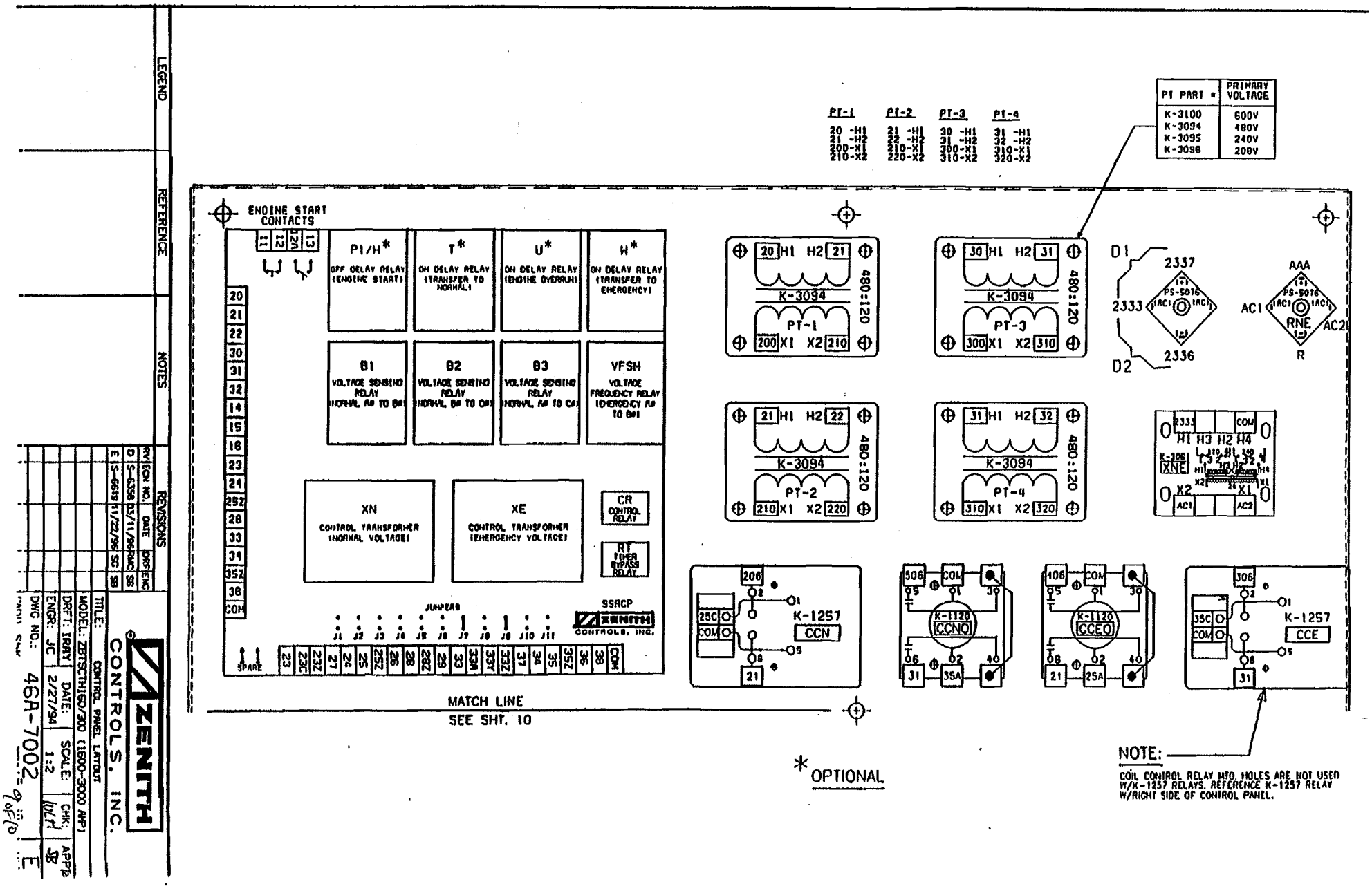
CONTACT RATING		
RELAY	CONTACT	RATING
P1		10 AMPS @ 32 VDC.
	A3,A4	20 AMPS,125

LEGEND	REFERENCE	NOTES
WIRE CONNECTION WIRE ON MAIN TERMINAL BLOCK WIRE IN DISCONNECT PLUG *** MECHANICALLY ACTUATED LOCATED ON POWER PANEL		ZBTSCTH SHOWN IN NORMAL POSITION WITH NO POWER AVAILABLE.

REVISIONS				
RV	ECN NO.	DATE	DRFT	ENG
D	S-6358	03/11/96	RMC	SB
E	S-6619	11/22/96	SG	SB

ZENITH CONTROLS, INC.

TITLE: ALARM CIRCUIT SCHEMATIC & CUSTOMER CONNECTIONS				
MODEL: ZBTSCTH160/300 (1600-3000 AMP)				
DRFT: IRAY	DATE:	SCALE:	CHK:	APPD
ENGR: JC	1/27/94	N/A	WCH	SB
DWG NO.: 46A-7002				E



LEGEND | REFERENCE | NOTES

REVISIONS

REV	ECN NO.	DATE	DR	ENG
D	S-6358	05/11/95	RMC	SS
E	S-6619	11/22/96	SS	SB

ZENITH CONTROLS, INC.

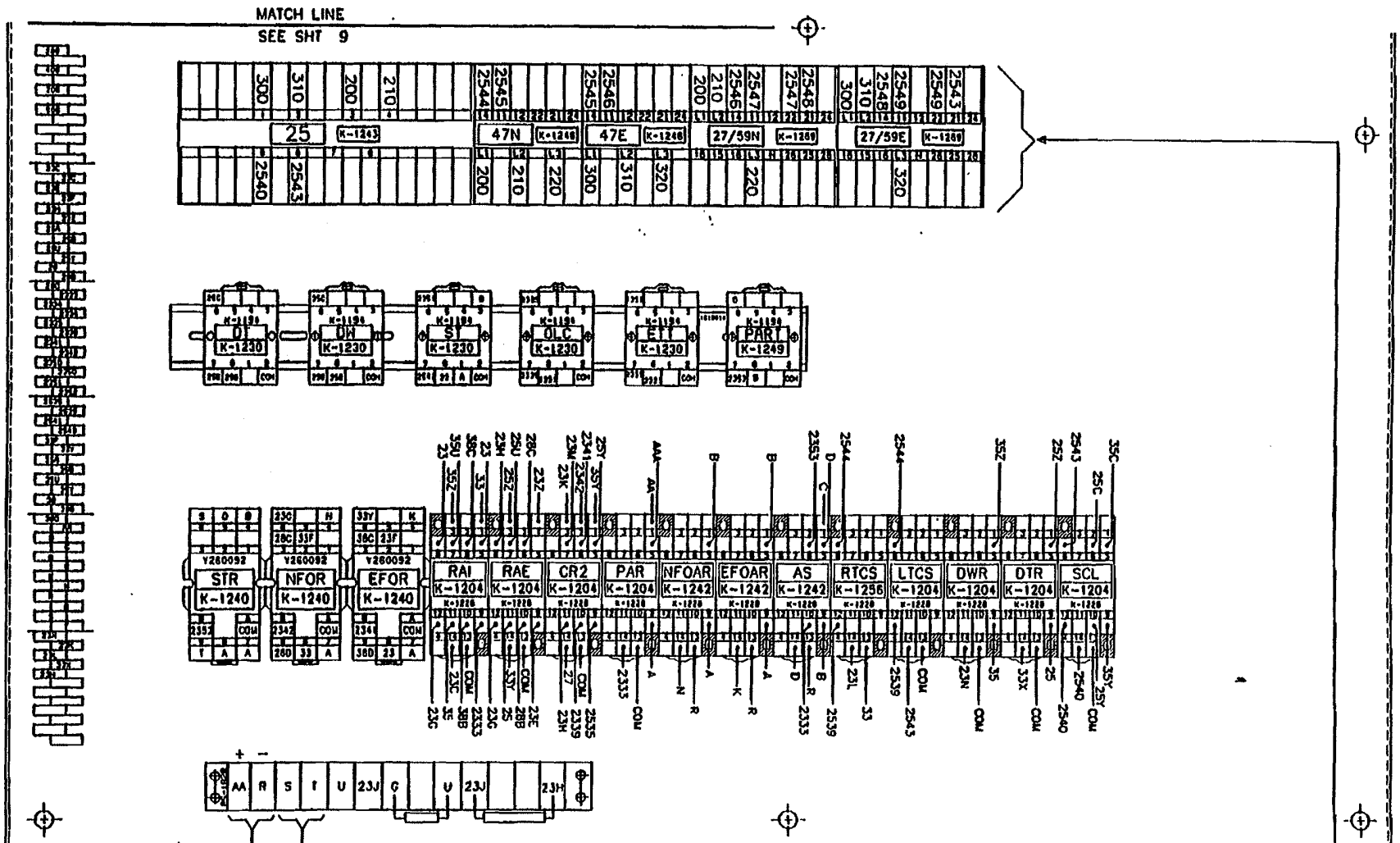
TITLE: CONTROL PANEL LAYOUT

MODEL: ZSTSCTH1600/300 (1600-3000 AMP)

DRFT: IRAY	DATE: 2/27/94	SCALE: 1:2	CHK: [illegible]	APPR: SB
ENGR: JC				

DWG NO.: 46A-7002 | E

PRINTS CW



WIRE NUMBER TO TERMINAL NUMBER CONNECTIONS ON 47N, 47E FOR A-B-C PHASE SEQUENCE. SHAP TERMINAL L2 & L3 INPUTS FOR A-B-C PHASE SEQUENCE.

27/59N	47N	25 BUS	27/59E	47E	GEN.
200-L1	200-L1	200-3	300-L1	300	
210-L2	210-L2	210-4	310-L2	310	
220-L3	220-L3		320-L3	320	

CTTS-Frequency, Phase Angle & Voltage window relays

PART # ON DEVICE	SETTINGS
K-1243	0.2 Hz ΔF @ NOMINAL V (±20%)
K-1269	95% UNDERVOLTAGE PICK-UP & 105% OVERVOLTAGE PICK-UP DIFFERENTIAL SETTINGS AT MINIMUM

LEGEND | REFERENCE | NOTES

REVISIONS

REV	ECN NO.	DATE	DRF	ENG
D	S-6356	03/11/96	RMC	KL
E	S-6619	11/22/96	SC	SB

ZENITH CONTROLS, INC

TITLE: CONTROL PANEL LAYOUT

MODEL: ZBTS-2H160/300 (1600-3000 AMP)

DRFT: TRAY | DATE: 1/27/94 | SCALE: 1:2 | CHK: | APP'D:

ENGR: JC

DWG NO.: 46A-7002 REV: E

SHT 10 OF 10

GE Zenith Controls



18R-2000
2/01

Software User Guide

Table of Contents

Page

Overview of ZNET 1000 1
Contacting GE Zenith Controls 2
System Requirements 3
    ZNET 1000 System Requirements 3
    Installing ZNET 1000 Software 3
Getting Started 4
    Before You Begin 4
Quick Guide 5
    Before Starting 5
    Configuring Your Network 5
    Starting and Running the ZNET 1000 Software 5
ZNET Architecture 6
    ZNET 100 6
    ZNET 200L 6
Topology 7
    Singly Terminated Network (Daisy Chain) 7
    Doubly Terminated Network (Backbone with Drops) 7
STATUS Screen 8
AUX Screen 12
MISCELLANEOUS Screen 13
VOLTAGE & FREQUENCY Screen 14
TIMERS Screen 15
PICKUP & DROPOUT Screen 16
EXERCISER Screen 17
VOLTAGE TRENDS Screen 18
ATS CONFIGURATION Screen 19
NETWORK CONFIGURATION Screen 20
Glossary 21
Preparing Your Network 28
    Communication Hardware Requirements 28
    On Site Communications 28
    Remote Site Communications 28
    Connecting to the Network 28
Security 29
    System Security 29
    Changing Password 29
Configuring Your Network 30
    Defining Node Name, Description, Subnet and Node 30
Configuring ATS 31
    Characterizing Devices in the Network 31

Table of Contents *(cont'd)*

Page

Appendix A: List of Logged Events 32
Appendix B: List of Minimum/Maximum Settings 34
Appendix C: List of Do's & Don'ts 35
Appendix D: LonTalk Adapter Connections 36
Appendix E: Connection for Remote Accessing 37
Appendix F: LonWork Network Connection using PCLTA-10 38
Appendix G: LonWork Network Connection using PCC-10 39
Appendix H: LonWork Network Connection using SLTA-10 40
Appendix I: ZNET 200 Network Card and MX200 Assembly 41
Appendix J: ZNET 100 Network Card and MX100 Assembly 42
Appendix K: SLTA-10 Configuration Dip Switch Settings 43
Appendix L: Miscellaneous Part Numbers 45
Index 46

Overview of ZNET 1000

Introduction

The ZNET 1000 software provides the user with a set of operating screens for monitoring and controlling four groups of eight Automatic Transfer Switch (ATS) units each. The software monitors the primary discrete status of all the switches. This includes switch position, source availability, test and timer operating indication for MX100 and MX200 controllers.

The software also sends operator commands to the ATS controllers. The command mode is password protected so that only authorized personnel can make modifications. For MX100 and MX200 controllers, the two common commands are Test and Timer Bypass.

⚠ WARNING

**This software is protected by copyright law and international treaties.
Unauthorized reproduction or distribution of this program may result in civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law.**

Contacting GE Zenith Controls

If you need additional assistance, please contact the customer support department at one of the following locations:

Headquarters

GE Zenith Controls
830 W. 40th Street
Chicago, IL 60609 USA
Phone: 773 299-6600
Fax: 773 247-7805

Center of Excellence

GE Zenith Controls
1 Oak Hill Center, Suite 301
Westmont, IL 60559
Phone: 773 299-6600
Fax: 630 850-6899

www.geindustrial.com

System Requirements

ZNET 1000 System Requirements

- Minimum Pentium 133 MHz
- Microsoft Windows 95/98 or Microsoft Windows NT 4.0 (or later)
- Mouse or pointing device
- SVGA display
- 16 MB RAM (32 MB recommended)
- 20 MB free hard drive space

Installing ZNET 1000 Software

1. Place the ZNET 1000 software CD in your CD-ROM drive.
2. Open Windows Explorer.
3. Select the CD-ROM drive.
4. Open the ZNET 1000 folder and then the DISK1 subfolder.
5. Double-click on the setup icon to start the installation program.
6. Follow the on-screen directions to complete the installation.

Getting Started

Before You Begin

To ensure a successful communicating session with your Lonworks network, it's advisable that you follow the following checklist:

- Be sure that there is a physical connection between your computer and the Lonworks network. If you are using a SLTA-10 Lonworks adapter, make sure that it's powered, the power LED located next to the DB9 connector should be lit. Also, make sure that the SLTA-10 Lonworks adapter is connected between the serial port of your PC and the Lonworks network (See Appendix D and H).

- If you are planning to dial-in a remote network, make sure your modem is connected to a working phone line. The phone line must be a direct line. Be sure also that the modem and the SLTA-10 adapter on the remote network are properly configured and ready. The modem must be configured for auto-answer mode, and the SLTA-10 adapter must be configured for remote connecting (See Appendix D and E).

- GE Zenith Controls recommends that Belden 8471 type cable (GE Zenith Part #WMW-453) is used to link all devices on your network.

Quick Guide

Before Starting

- Make sure that all connections are made, i.e. between your PC and the Lonworks network (See Appendix D).

- If the SLTA-10 Lonworks adapter is used make sure that it is powered by verifying the power LED located next to the DB9 connector is lit (See Appendix D).

Configuring Your Network

Your network must be configured so that the ZNET 1000 knows how many devices are on the network and what each device represents. The following is the procedure for configuring your network:

- Start the ZNET 1000 software by double-clicking on the ZNET 1000 icon on the desktop.
- Select a Lonworks adapter from the Adapter submenu.
- Select Config from the Program submenu to continue.
- Select Network Configuration from the Display submenu.
- Place the cursor in the designated fields under Node Name, Description, Subnet and Node to fill in the information. For example: ATS1, MX100, 1, 1 are the configuration parameters for Node Name, Description, Subnet, and Node, respectively.
- Click on the OK button when finished entering all devices on your network.
- Enter the configuration password to authorize the Network configuration changes.
- Answer 'Yes' to 'New Configuration File?' if you are configuring more than one system. If you configuring one system ***only***, answer 'No'.
- Select ATS Configuration from the drop-down menu of the Display menu.
- Select ATS Type, Model, Phase sensed and Mode. Put a checkmark under T3, W3, YE and YN if you want to enable these options. Note that T3 and W3 options must be provided and that T3, W3, YN and YE bypass must be enabled on the corresponding microprocessor controller in order for the timer bypass function to work properly.
- Click on the OK button when finished entering all devices on your network.
- Enter the configuration password to authorize the ATS configuration changes.
- Quit the ZNET 1000 program and restart it for new parameters to take affect.

Starting and Running the ZNET 1000 Software

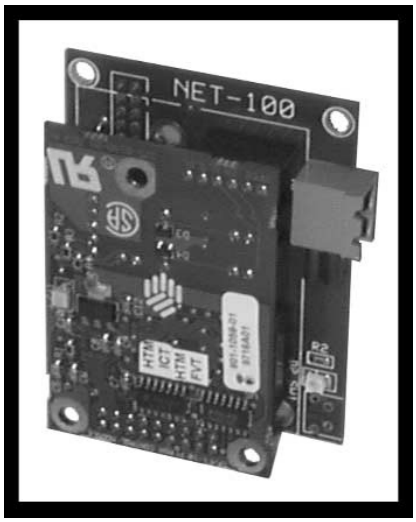
- Double click on the ZNET 1000 icon on your computer desktop to start the program.

- After the software finishes loading the screens, select an adapter, which you have connected to the Lonworks network and your PC, from the Adapter submenu.

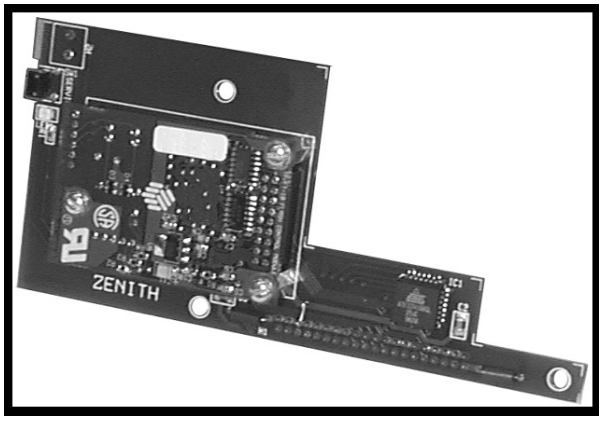
- Select Run from the Program submenu to run the program.

ZNET Architecture

ZNET 100 Network Card

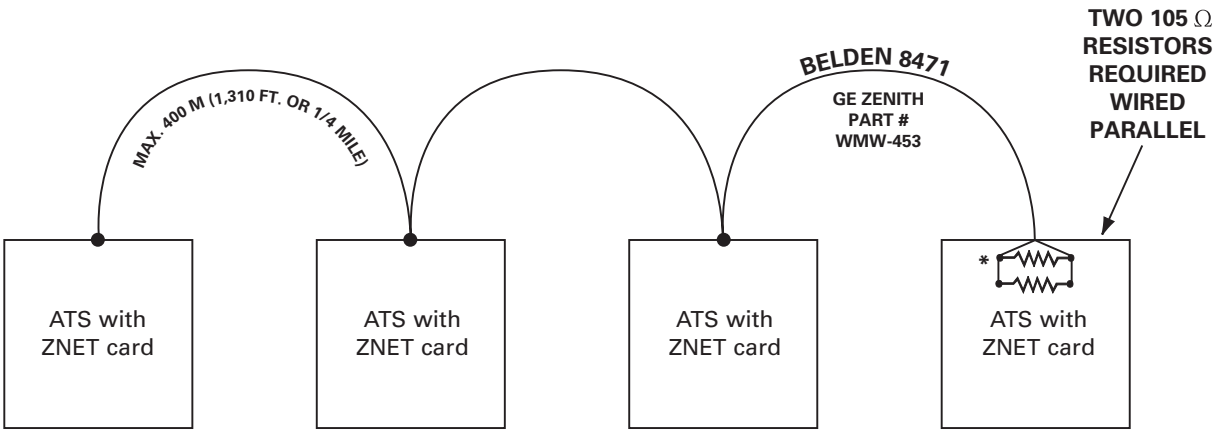


ZNET 200L Network Card



Topology

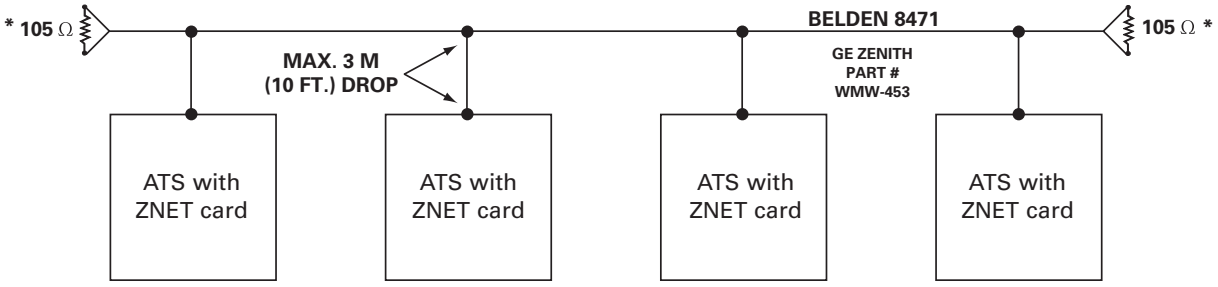
Singly Terminated Network (Daisy Chain)



MAXIMUM TOTAL NETWORK CABLE LENGTH: 500 M (1,640 FT.)

*** TWO RESISTORS PROVIDED WITH ANNUNCIATOR**

Doubly Terminated Network (Backbone with Drops)

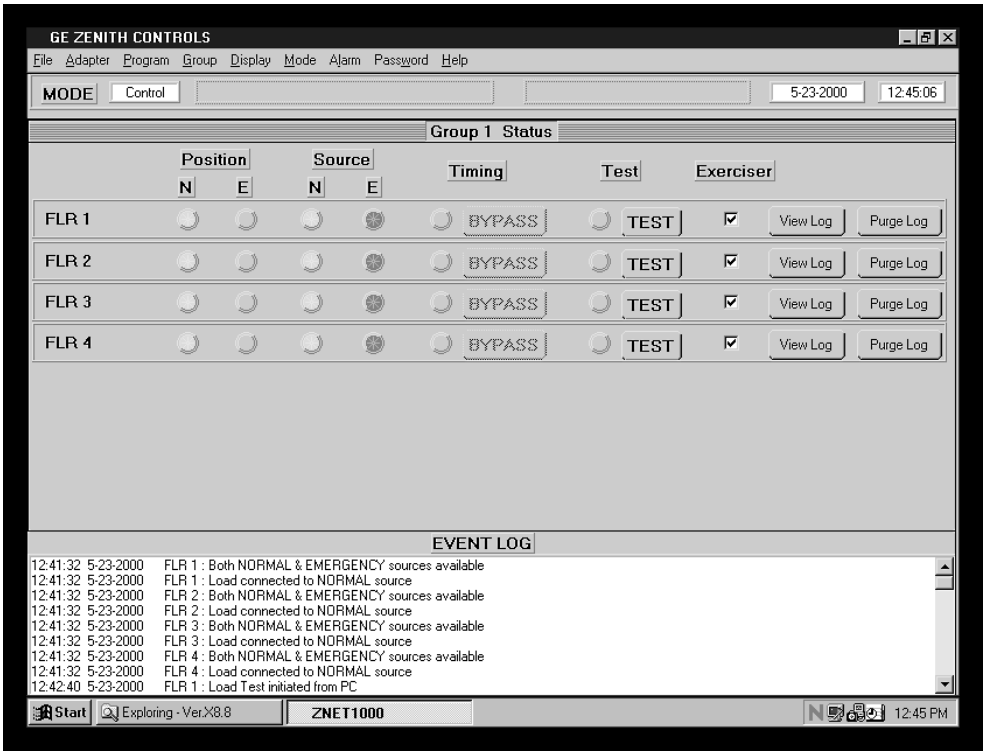


MAXIMUM TOTAL LENGTH: 2,700 M (8,850 FT. OR 1.7 MILES)

*** TWO RESISTORS PROVIDED WITH ANNUNCIATOR**

Belden 8471 – GE Zenith Part # WMW-453
105 Ω resistor – GE Zenith Part # PS-4085

STATUS Screen



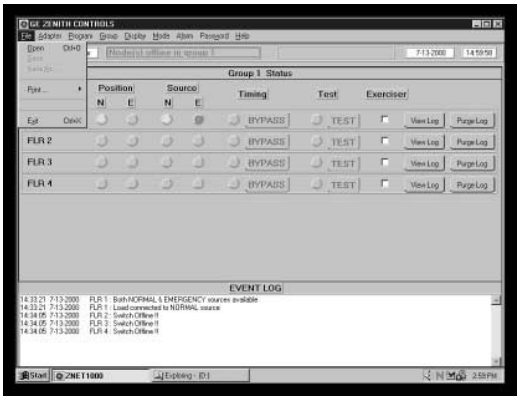
FILE

This menu provides the user with the following options:

Open: To open a different configuration file of a different network for monitoring and control.

Print: To print the displayed screen to a file or to the specified printer.

Exit: To terminate the ZNET 1000 software.



FILE Menu Options

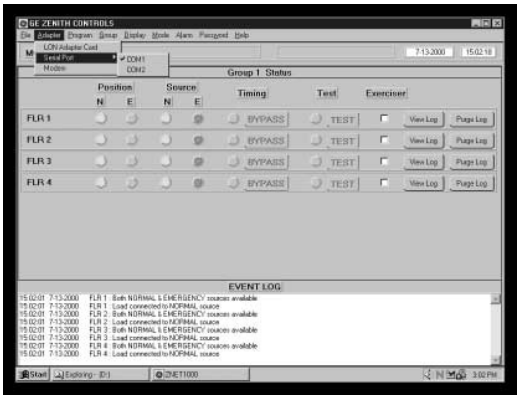
ADAPTER

The ZNET 1000 software can communicate with a Lonworks network using one of these adapters:

PC LonTalkAdapter (LON Adapter Card): Select this option if the user has a PCLTA card or a PCC-10 installed (See Appendix D).

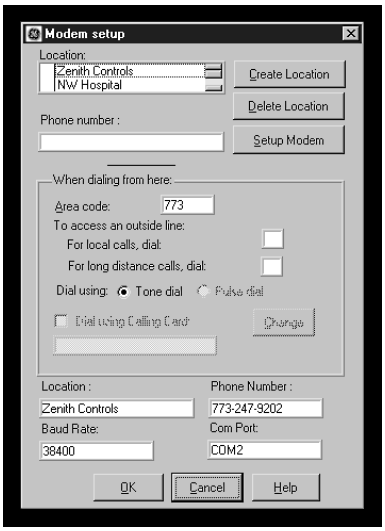
Serial LonTalkAdapter (Serial Port): Select this option if the user is using a serial communication port in conjunction with the SLTA Lonworks adapter (See Appendix D).

Remote SLTA (Modem): Select this option if the user is using a modem to connect to a remote Lonworks network (See Appendix D and E).

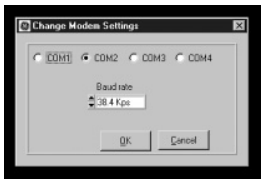


ADAPTER Menu Options

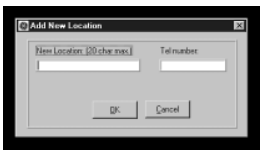
STATUS Screen *(cont'd)*



MODEM SETUP Screen



CHANGE MODEM SETTINGS Screen

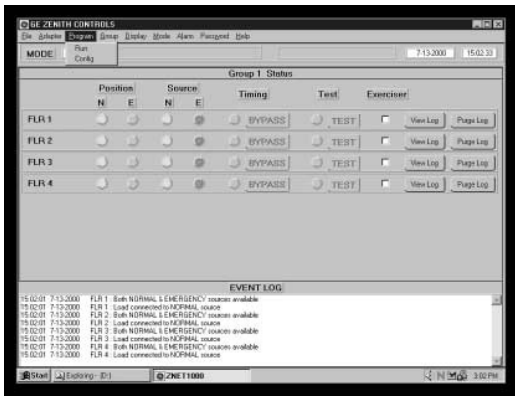


ADD NEW LOCATION Screen

PROGRAM

Run: When selected it will run the ZNET 1000 software.

Config: This option allows the user to configure a Lonworks network. Refer to "Configuring Your Network" on Page 30.



PROGRAM Menu Options

GROUP

There are four groups available 1, 2, 3 and 4. Each group can provide monitoring and control for up to 8 connected ATS units. By checking a group number, the user puts that group online for monitoring and control. This function is also applied when a group of ATS units are being configured. **Note that node number must be unique in all four groups, i.e. cannot have nodes with same node number.**

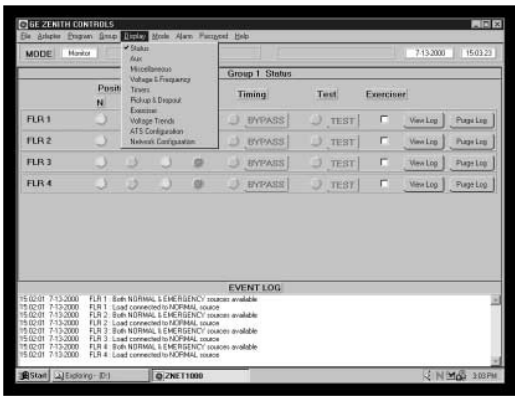


GROUP Menu Options

STATUS Screen *(cont'd)*

DISPLAY

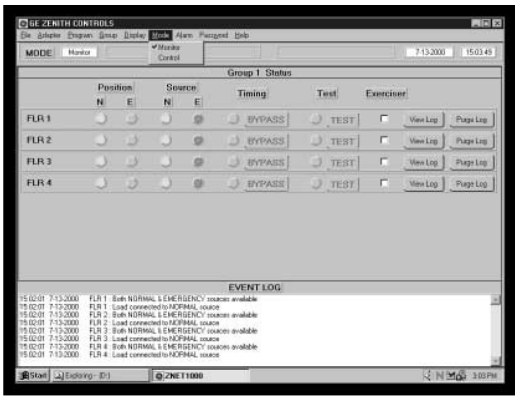
Ten screens (Status, Aux, Miscellaneous, Voltage and Frequency, Timers, Pickup and Dropout, Exerciser, Voltage Trends, ATS Configuration and Network Configuration) are available for viewing. Place a check-mark to the left of a screen's name to have it displayed.



DISPLAY Menu Options

MODE

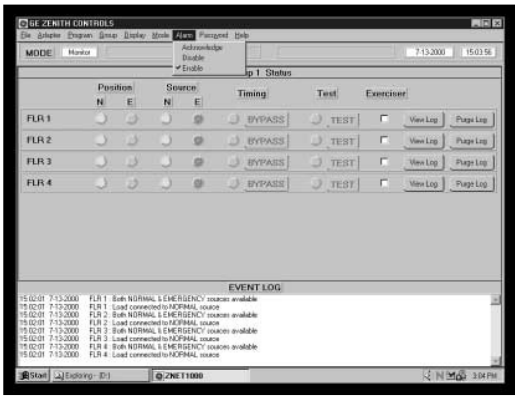
This allows for changing between Monitor or Control mode. A password is required to change from Monitor to Control mode. **The factory default password is "zenith"**. In Control mode, the user can initiate a test, bypass an active timer by clicking on the appropriate command buttons, modify the parameters, etc.



MODE Menu Options

ALARM

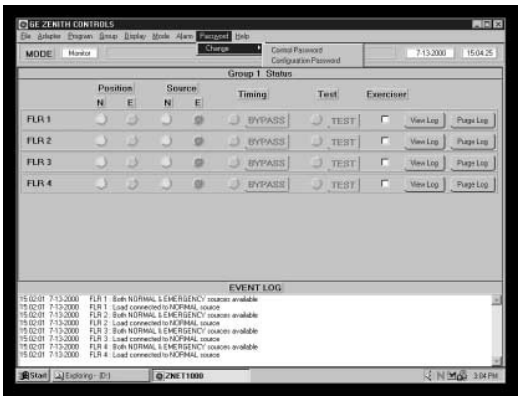
This feature provides the user a means to acknowledge the alarm function. The alarm goes off as ATSs transfer to Emergency position. **The alarm is enabled by default**. Selecting the Acknowledge option from the Alarm sub-menu will silence the alarm. Selecting the Disable option will silence the alarm and disable it until it is enabled again.



ALARM Menu Options

PASSWORD

This option lets the user change the current password to a new password. There are two passwords: control and configuration. The ***Control*** password is required to change from Monitor to Control mode. **The default control password is "zenith"**. The ***Configuration*** password is needed when changing configuration settings. **The default configuration password is "configure"**.

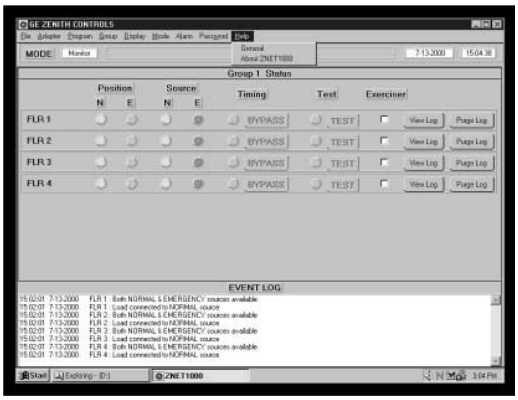


PASSWORD Menu Options

STATUS Screen *(cont'd)*

HELP

ZNET 1000 online help. Contains a hypertext link for connecting to the GE Zenith Controls home page if the user has access to the Internet.



HELP Menu Options

2 ***Mode:*** indicates the software present operation mode, MONITOR or CONTROL. Monitor mode, in which only monitoring is allowed. Control mode on the other hand, controls such as test, timer bypassing, and setting changes are allowed.

4 ***Description:*** user defined field. This is performed in the Network Configuration screen while the actual network is configured.

5 ***Position:*** Displays the physical position of the ATS as in Normal or Emergency. Green indicates the transfer switch is in the Normal position. Red indicates the transfer switch is in the Emergency position.

6 ***Source:*** Displays the availability of voltage for either sources, it is possible for both sources to be available simultaneously. Green indicates the Normal source is available. Red indicates the Emergency source is available. Green and Red simultaneously indicate both Normal and Emergency sources are available. (Refer to Page 16, "Pickup and Dropout Screen" for Normal and Emergency voltage setpoints).

7 ***Timing Bypass:*** Click on this button to bypass the T or W delay timer provided that the timer bypass options are enable on transfer switch and in the ZNET 1000 software.

9 ***Test:*** Click on this button to perform a Test, which simulates a Normal source power outage. It also allows canceling of a test while a test is in progress. Note that the software must be in CONTROL mode.

NO LOAD test: Starts the generator but does not transfer the load to the Emergency source.

FAST LOAD test: Presets timer values to a maximum 30 seconds during the test. After completion of the test, all timers are reset to their original values.

STD LOAD test: Uses current timer settings, starts the generator, and transfer the load to the Emergency source.

10 ***Exerciser:*** Indicates the exerciser's enable/disable status. A checkmark indicates that the exerciser of the selected transfer switch is enabled and no checkmark indicates the exerciser of the selected transfer switch is disabled. Enabling and disabling the exerciser option in software is done in the Exerciser screen (Ref. Page 17).

11 ***View Log:*** Clicking on this button will display the logged events of the selected transfer switch.

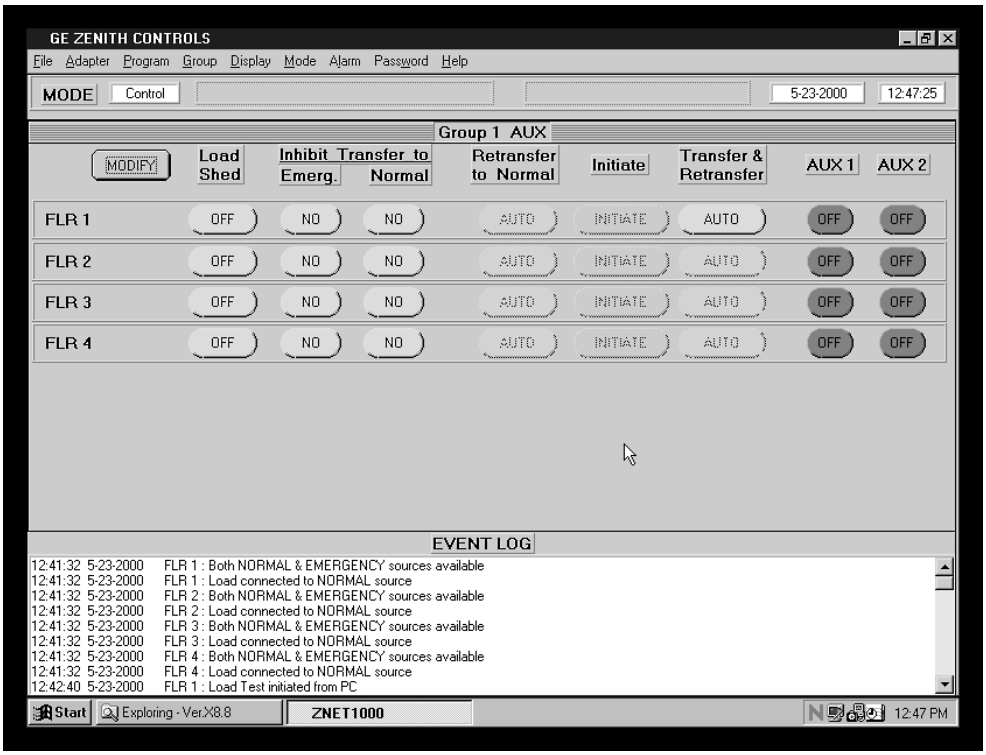
12 ***Purge Log:*** Clicking on this button allows the user to purge the event log of the corresponding transfer switch.

13 ***System Date/Time:*** Indicates the current date and time. Used to identify events for event logging.

15 ***Event Log:*** The window that shows events, which has occurred to transfer switches on the Lonworks network, since the ZNET 1000 software last started.

16 ***Scroll Bar:*** Lets the user scroll through the events log window. This function is available since only nine lines can be displayed at a time.

AUX Screen (this screen is not available in ZNET1050)



1 ***Modify.*** Command button, when clicked, will prompt for the configuration password. Once the correct password is entered, the user can make any control or setting changes in this screen. **Note that the ZNET 1000 software must be in control mode in order for this function to work.**

2 ***Load Shed.*** Click on this button to activate/deactivate the R15/ R15D option. Red indicates active; Green indicates inactive.

3 ***Inhibit Transfer to Emergency.*** A setting to prevent transferring to the Emergency position. Click on this button to activate/deactivate the Q3 option. Red indicates active; Green indicates inactive.

4 ***Inhibit Transfer to Normal.*** A setting to prevent transferring to the Normal position. Click on this button to activate/ deactivate the Q7 option. Red indicates active; Green indicates inactive.

5 ***Retransfer to Normal.*** A setting of 'auto' enables the T timer function. A setting of 'manual' requires the entry of 'initiate'. Note that this function is valid only if the corresponding transfer switch is equipped with the S5 option. And also in order for this function to perform correctly, the S5 must be selected under Mode in the ATS configuration screen.

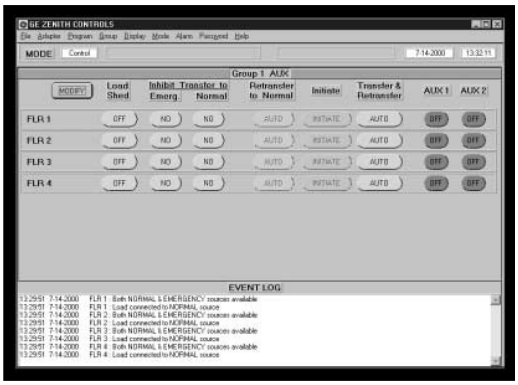
6 ***Initiate.*** A command to manually transfer to Emergency or to retransfer to the Normal position.

7 ***Transfer and Retransfer.*** A control option that can be enabled/disabled and activate via software. Note that this function is valid only if the corresponding transfer switch is equipped with the S12 option. And also in order for this function to perform correctly, the S12 must be selected under Mode in the ATS configuration screen.

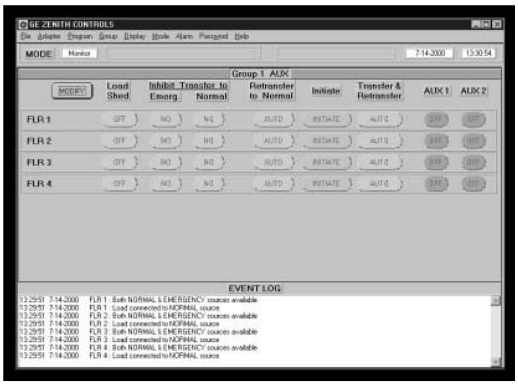
8 ***Aux1.*** A command to enable or disable the input or output.

9 ***Aux2.*** A command to enable or disable the input or output.

Note: *R15, Q3 and Q7 options are hardware/software inputs. In this version, the user must look at the event log to make sure the action actually takes place.*

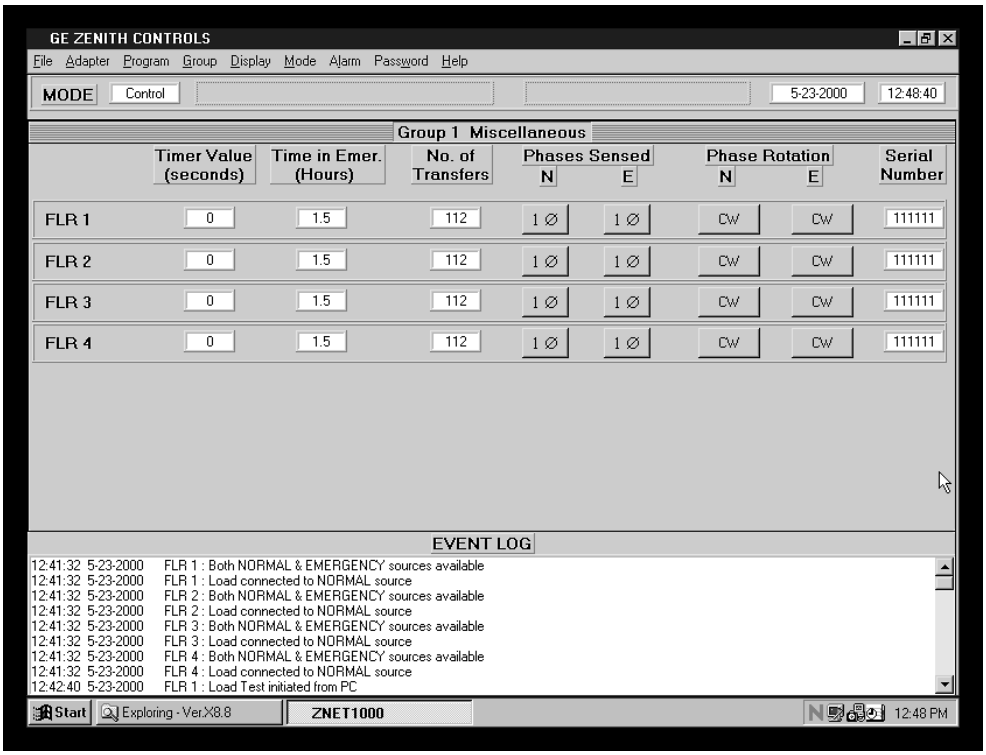


AUXILIARY Control Mode Screen



AUXILIARY Monitor Mode Screen

MISCELLANEOUS Screen



1 ***Timer Value.*** Reflect the active timer in real-time.

2 ***Time in Emergency.*** Indicates the number of hours that the selected switch has been in the Emergency position.

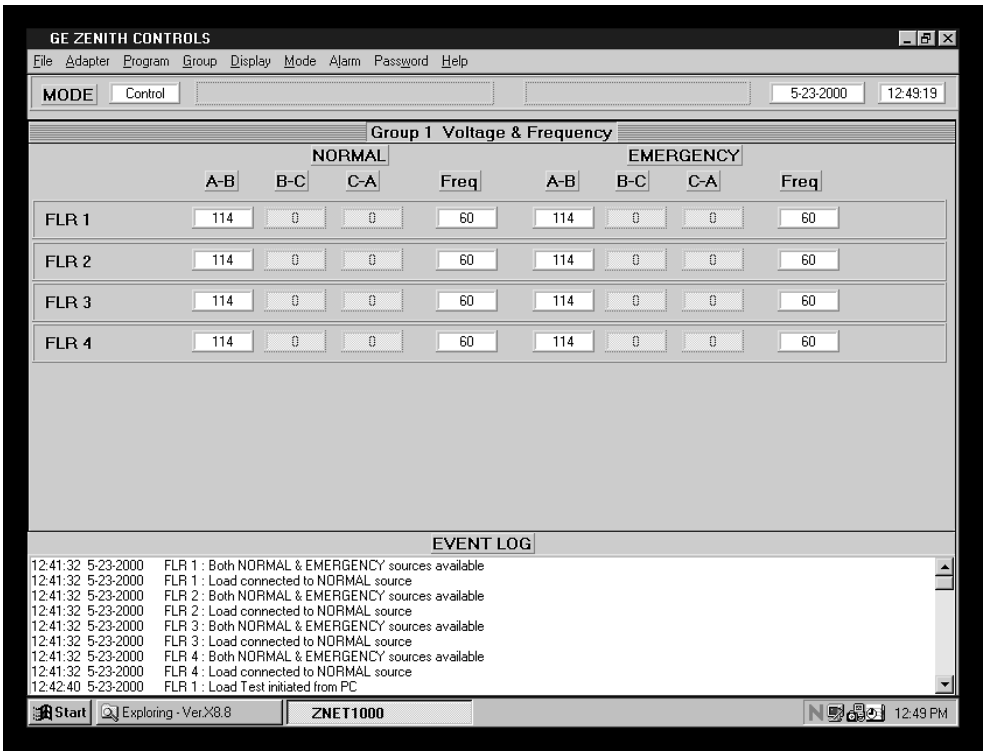
3 ***Number of Transfers.*** Indicates the total number of times that the selected switch has transferred to the Emergency position.

4 ***Phases Sensed.*** Indicates one or three phases sensed for pickup or dropout either source depending on user specification in ATS configuration screen.

5 ***Phase Rotation.*** Indicates CW or CCW (clockwise or counterclockwise respectively) to represent ABC or ACB phase rotation of either source.

6 ***Serial Number.*** The unique identification number of the switch, assigned in the factory for reference purposes.

VOLTAGE & FREQUENCY Screen (this screen is not available in ZNET1050)



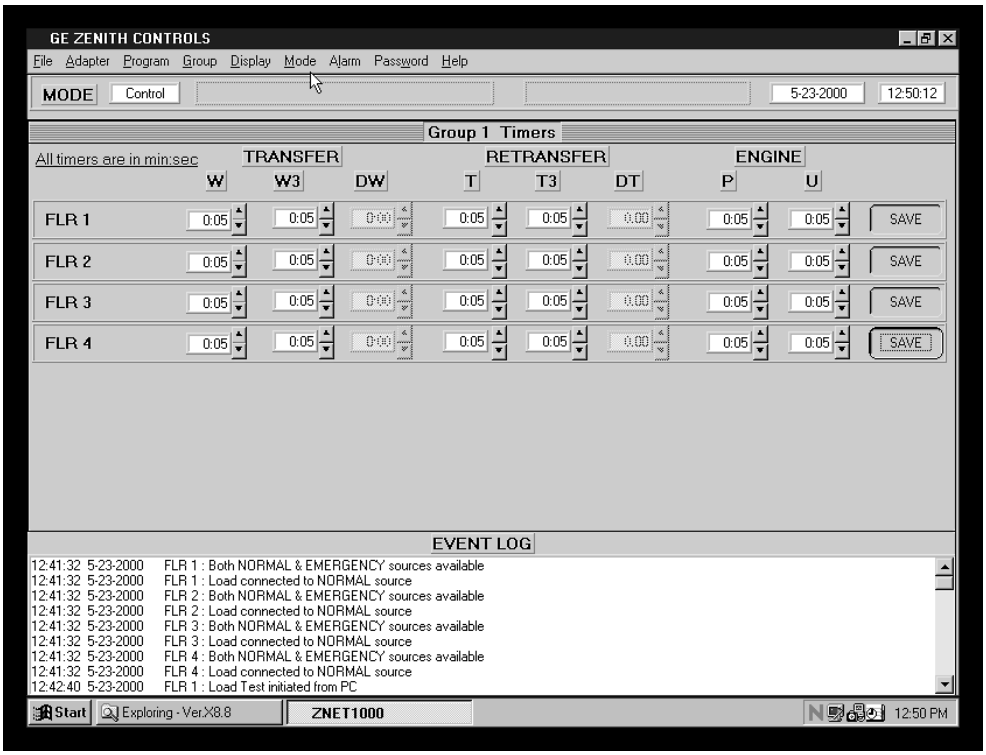
1 ***Normal Voltage.*** Displays the real-time Normal source's voltage, in volts.

2 ***Normal Frequency.*** Indicates the real-time Normal source's frequency, in hertz.

3 ***Emergency Voltage.*** Displays the real-time Emergency source's voltage, in volts.

4 ***Emergency Frequency.*** Displays the real-time Emergency source's frequency, in hertz.

TIMERS Screen (this screen is not available in ZNET1050)



1 ***W Timer.*** A user input value for a timer representing the time delay commencing on completion of the P timer. Allows for generator set warm-up and stability. Switch will transfer on completion. The W timer range is 0 to 5 minutes in one-second increments.

2 ***W3 Timer.*** An additional time segment starting on completion of the W timer. Used as a pre-signal before transfer. Switch will transfer to Emergency on completion. The W3 timer range is 0 to 60 seconds in one-second increments.

3 ***DW Timer.*** Delay timer from Open to Emergency position (Delay) switches. Will commence timing on completion of the W timer. The DW timer range is 0 to 10 minutes in one-second increments.

4. ***T Timer.*** Delay timer to transfer to Normal. The T timer range is 0 to 60 minutes in one-second increments.

5 ***T3 Timer.*** An additional time segment starting on completion of the T timer. Used as a pre-signal before transfer. Switch will transfer to Emergency on completion. The T3 timer range is 0 to 60 seconds in one-second increments.

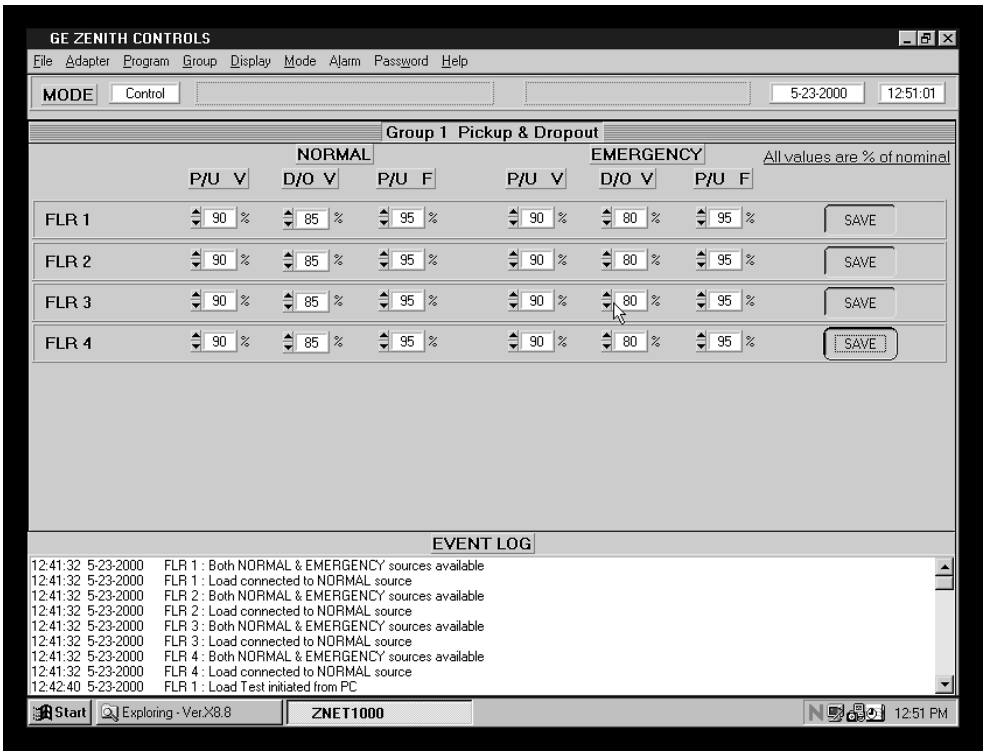
6 ***DT Timer.*** Delay timer from Open to Normal position (Delay) switches will commence timing on completion of the T timer. The DT timer range is 0 to 10 minutes in one-second increments.

7 ***P Timer:*** The amount of time that the preferred source is unacceptable before the engine start signal is issued. P timer range is 0 to 10 seconds in 1/10 second increments.

8 ***U Timer:*** Generator set engine cool-down time after retransfer to Normal. The U timer range is 0 to 60 minutes in one-second increments.

9 ***Modify.*** Clicking on the button of the selected transfer switch will let the user changes the timer settings. Note that the button's labels changed as the button is toggled. Click on the button again to save timer settings changes. Note that the ZNET 1000 software must be in Control mode.

PICKUP & DROPOUT Screen (this screen is not available in ZNET1050)



1 ***Normal P/U Voltage.*** Indicates the existing Normal pickup voltage setting, in percent of nominal voltage, that when reached will signal the next sequence. The normal P/U voltage range is 85 to 100% in 1% increments.

2 ***Normal D/O Voltage.*** Indicates the existing Normal dropout voltage setting, in percent of nominal voltage, that when reached will signal the next sequence. The normal D/O voltage range is 75 to 98% in 1% increments. Normal D/O voltage must be a minimum of 2% below the normal P/U voltage setting.

3 ***Normal P/U Frequency.*** Indicates the existing Normal pickup frequency setting, in percent of nominal frequency, that when reached will signal the next sequence. The normal P/U frequency range is 90 to 100% in 1% increments.

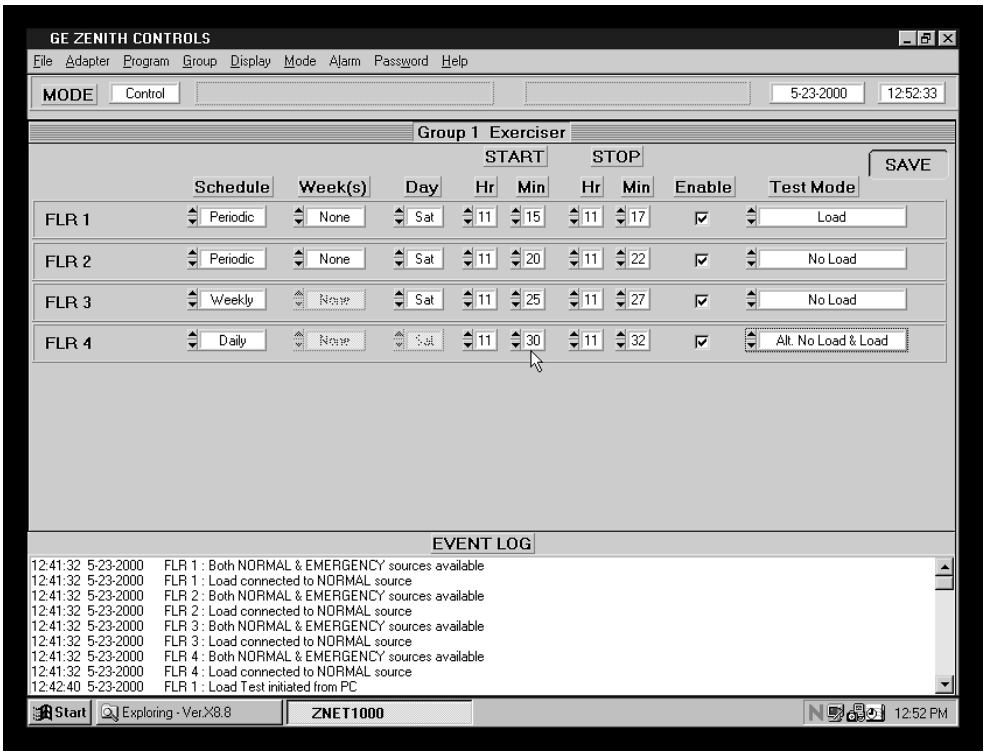
4 ***Emergency P/U Voltage.*** Indicates the existing Emergency pickup voltage setting, in percent of nominal voltage, that when reached will signal the next sequence. The emergency P/U voltage range is 85 to 100% in 1% increments.

5 ***Emergency D/O Voltage.*** Indicates the existing Emergency dropout voltage setting, in percent of nominal voltage, that when reached will signal the next sequence. The emergency D/O voltage range is 75 to 98% in 1% increments. Emergency D/O voltage must be a minimum of 2% below the emergency P/U voltage setting.

6 ***Emergency P/U Frequency.*** Indicates the existing Emergency pickup frequency setting, in percent of nominal frequency, that when reached will signal the next sequence. The emergency P/U frequency range is 90 to 100% in 1% increments.

7 ***Modify.*** Clicking on the button of the selected transfer switch will let the user change the Pickup/Dropout voltage and frequency settings. Note that the button's labels change as the button is toggled. Click on the button again to save the settings changes. Note that the ZNET 1000 software must be in Control mode.

EXERCISER Screen



1 ***Schedule.*** How often the ATS should be tested, i.e. Daily, Weekly or Periodic. This function is independent of the exerciser function for the microprocessor controller.

Daily: Indicates the selected transfer switch is to perform an exercise daily at the scheduled time.

Weekly: Indicates the selected transfer switch is to perform an exercise weekly on the selected day of the week and at the scheduled time.

Periodic: Indicates the selected transfer switch is to perform an exercise on the selected day of the week and week(s) of the month.

2 ***Start.*** The time at which the Automatic Transfer Switch will start the test as scheduled.

3 ***Stop.*** The time at which the Automatic Transfer Switch will stop the test as scheduled.

4 ***Enable.*** Enable the selected Automatic Transfer Switch to perform a test as scheduled. Exerciser Enable/Disable status is indicated on the status screen.

5 ***Test Mode.*** Specify what type of test to be performed, i.e. Load test, No Load test, or Alt No Load and Load.

Load Test: Uses current timer settings, starts the generator and transfers the load to the Emergency Source.

No Load Test: Starts the generator, but does not transfer the load to the Emergency Source.

Alt No Load and Load: Toggles the test mode between ***No Load*** and ***Load Test***.

6 ***Modify.*** Clicking on this button will allow the user to schedule a new exerciser or change the existing exerciser schedule of transfer switches. Note that the button's labels changed as the button is toggled. Click on the button again to save the settings changes. Note that the ZNET 1000 software must be in CONTROL mode.

VOLTAGE TRENDS Screen (this screen is not available in ZNET1050)

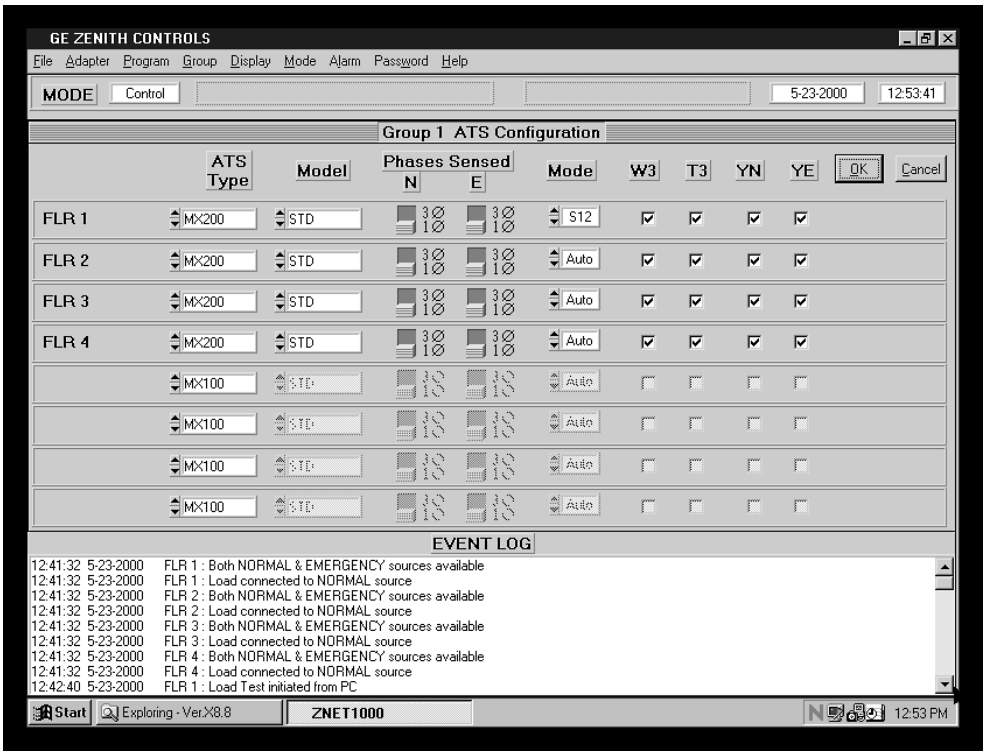


1 ***Normal Three-Phase Voltage.*** Displays real-time percentage of nominal three-phase voltage of Normal source. The trend screen is a one-hour window and has a one-minute resolution.

2 ***Emergency Three-Phase Voltage.*** Displays real-time percentage of nominal three-phase voltage of Emergency source. The trend screen is a one-hour window and has a one-minute resolution.

Note that if the system being monitored is a single-phase, then only Vab would be shown.

ATS CONFIGURATION Screen



1 ***ATS Type.*** Specify what type of microprocessor controller the switch is equipped with a MX200 or MX100.

2 ***Model.*** Specify the switch type whether it is a Standard (STD), Delay (DELAY), or Closed-Transition (CTTS) type.

3 ***Phase Sensed.*** Specify the number of phases to be sensed, i.e. single or three phase power system.

4 ***Mode.*** Select the mode in which the corresponding ATS is configured, such as S5, S12 or Auto.

5 ***W3.*** This option lets user enable or disable W3 function via software. Note that this only has effect within the ZNET 1000 software, i.e. affecting the timer bypass feature in the Status screen.

6 ***T3.*** This option lets user enable or disable T3 function via software. Note that this only has effect within the ZNET 1000 software i.e. affecting the timer bypass feature in the Status screen.

7 ***YN.*** If enabled, retransfer to the Normal position when Initiate command button is clicked.

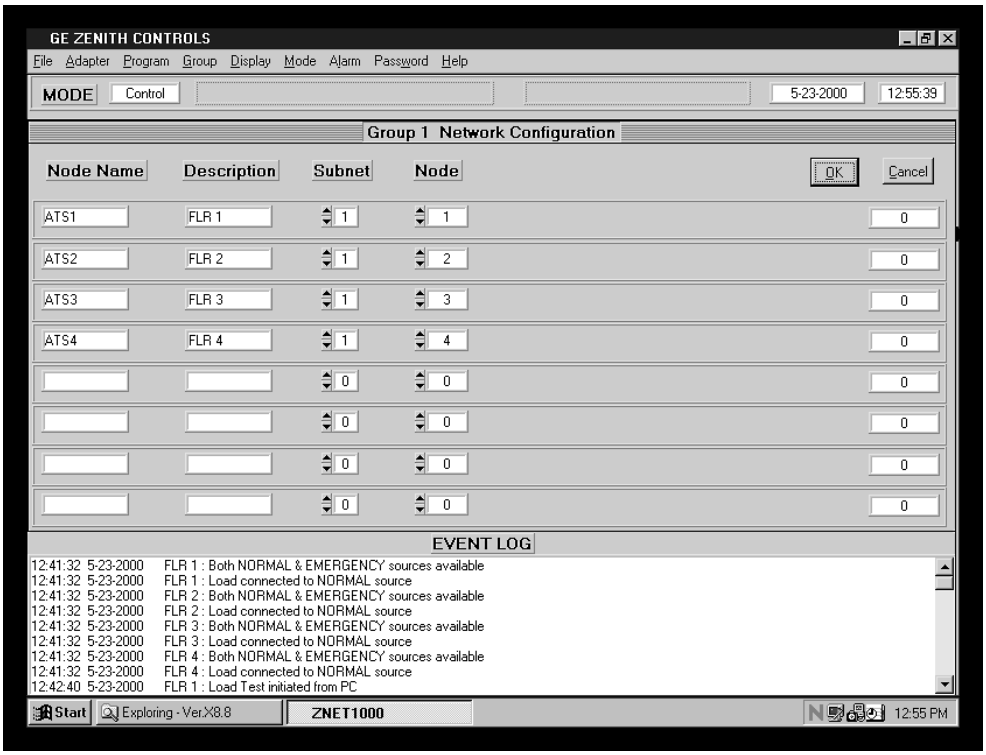
8 ***YE.*** If enabled, transfer to the Emergency position when Initiate command button is clicked.

9 ***OK.*** Click on this button will prompt for the configuration password. Restart the ZNET 1000 software in order for new configuration to take effect.

10 ***Cancel.*** Ignores the changes that were made and reverts to the status screen.

Note: Information in this screen is input by the user. The software relies on the user for accuracy of the information.

NETWORK CONFIGURATION Screen



1 ***Node Name.*** The name of the device. Node name is limited to 15 characters.

2 ***Description.*** A brief description, which the log-file uses as a reference. Node description is limited to 15 characters.

3 ***Subnet.*** The subnet on which the device is connected. Subnet typically has a value of 1 unless there are more than 127 devices in the network.

4 ***Node.*** Node represents the node number of the device. This is a unique address, which is assigned at the factory during the binding process. The node number is located on the network card behind the back cover of the MX controller.

5 ***OK.*** Clicking on this button will prompt the user for the configuration password. Restart the ZNET 1000 software in order for the new configuration to take effect.

6 ***Cancel.*** Ignores the changes that were made and reverts to the status screen.

Glossary

Adapter

The hardware that links your PC to a Lonworks network. Select the Lon Adapter Card option if you want to connect to a Lonworks network via a PCLTA-10 or a PCC-10 adapter installed in your PC. Select the Serial Port option if you want to connect to a Lonworks network via a SLTA-10 adapter connected to your PC serial port. Select the Modem option if you want to dial-in to a remote Lonworks network.

Alarm

This feature provides user a mean to acknowledge the alarm function. The alarm goes off as ATS transfers to Emergency position. Selecting acknowledge option from the Alarm menu bar will silence the alarm. The alarm is enabled by default. Selecting Disable will silence the alarm until it is enabled again.

ATS Type

Specify what type of controller the switch is equipped with, i.e. MX100 or MX200 microprocessor controllers.

Aux 1 & 2

A command to enable or disable the input or output of either function.

Bypass Timing

An override command to immediately complete the time out of a timer without regard to time remaining.

Config

Enables entry of switch type, equipment identification, timer values and ability to bypass timers during operation.

Date/Time

Reflects the time/date setting of the computer. Used to identify events for the event log.

Day

The day of the week on which the Automatic Transfer Switch will start the test as scheduled.

Description

The name of the device which the log file used as a reference.

Display

Ten screens: Status, Aux., Misc., Volt/Freq., Timers, Pick Up/Drop Out, Exerciser, Voltage Trends, ATS Config and Network Config.

Drop Out Voltage/Frequency

The percent of nominal that when reached will signal the next sequence.

DT Timer

Delay timer from open to Normal position (Delay type switch). The DT timer range is 0 to 10 minutes in one-second increments.

DW Timer

A timer used with three position (Delay) switches. Will commence timing on completion of the W timer. The DW timer range is 0 to 10 minutes in one-second increments.

Emergency

Alternate power plants or Engine Generator set.

Enable

Enables the selected Automatic Transfer Switch to perform a test as scheduled.

Engine

Engine generator set.

Exerciser

A feature that enables periodic and timed running of the generator based on a user-programmed input.

Group

Switches are displayed in groups of eight or less. There are four groups available: 1, 2, 3 and 4. By putting a check mark on a group, the user puts that group online for monitoring and control. This function is also applied when a group of switches is being configured. Note that the node number is unique in all four groups.

Inhibit Transfer to N or E

A setting to prevent transferring to the selected position or source.

Initiate

A command to manually transfer to Emergency or to retransfer to Normal.

Load Shed

A setting to enable or disable the function of transferring the load off the emergency source.

Mode

Indicates the mode on which the corresponding ATS is configured, such as S5, S12 or Auto.

Model

Specify the switch type: Delay, Standard or Closed Transition.

- Standard Transition (Two Positions): Normal and Emergency
- Delay Transition (Three Positions): Normal, Center Off and Emergency
- Closed Transition: Make Before Break in either direction

Node

Node represents the node number of the device. The node number is a unique address that is assigned by the manufacturer during the binding process. The node number is located on the network card behind the back cover of the MX controller.

Node Name

A brief identification of the type of the Automatic Transfer Switch.

Normal

Utility power (preferred source).

Number of Transfer

A count of the number of times that the switch transferred to Emergency.

P Timer

The amount of time that the preferred source is unacceptable before the engine start signal is issued. The P timer range is 0 to 10 seconds in 1/10 second increments.

Password

This option enables the user to change the current password.

Phase Rotation

A setting of CW or CCW (clockwise or counterclockwise) to represent ABC or ACB phase rotation of either source.

Phase Sensed

A selection of one or three phases sensed for pickup or dropout of either source.

Pick Up Voltage/Frequency

The percent of nominal that when reached will signal the next sequence.

Position

Displays the physical position of the switch as in Normal or Emergency.

Print

Select to send data to printer or to disk as a file.

Program

The program menu provides two options: Run and Config. When the Run option is selected, the software will open the network interface and start communicating with your network online (if the network has already been configured). If the Config option is selected, the software runs in the off-line mode in which you can configure the network. Your network must be configured after the software is installed.

Retransfer

To switch the load from Emergency source back to Normal source.

Retransfer to Normal

A setting of 'auto' enables the T timer function. If the Manual option is selected, the Automatic Transfer Switch will retransfer to Normal position only by clicking on the Initiate command button.

S5

When this option is selected, clicking on the INITIATE command button will cause the corresponding ATS to retransfer to the Normal position.

S12

When this option is selected, the ATS will transfer to either direction only by clicking on the corresponding INITIATE command button.

Schedule

How often the ATS should be tested, i.e. Daily, Weekly or Periodic.

Serial Number

The serial number of the ATS for reference purposes.

Source

Displays the availability of voltage for either source. It is possible for both sources to be available simultaneously.

Start

The time at which the Automatic Transfer Switch will start the test as scheduled.

Stop

The time at which the Automatic Transfer Switch will stop the test as scheduled.

Subnet

The subnet on which the device is connected. Subnet typically has a value of 1 unless there are more than 127 devices in the network.

T Timer

Delay timer to transfer to Normal. The T timer range is 0 to 60 minutes in one-second increments.

T3 Timer

Pre-signal to Normal transfer timer. The T3 timer range is 0 to 60 seconds in one-second increments.

Test Function

A command to start the generator for operation and function.

Test Mode

Specify what type of test to be performed i.e. Load test, No Load test or Alt No Load and Load.

Time in Emergency

The amount of time in hours that the switch was in the Emergency position.

Timer Value

Reflects the active timer in real time.

Transfer

To switch the load from Normal source to Emergency source.

Transfer & Retransfer

If the Auto option is selected, the ATS transfers and retransfers automatically. If the Manual option is selected, the ATS will transfer to either position only by clicking on the INITIATE command button.

Transfer to Emergency

A setting of 'auto' enables the W timer function. If the Manual option is selected, the ATS will transfer to the Emergency position only by clicking on the INITIATE command button.

U Timer

Generator set Engine cool-down time after return to Normal. The U timer range is 0 to 60 minutes in one-second increments.

View Log

A command to display the comprehensive events log of the switch selected. Each connected and configured device has an event log. The log for each device is created after the configuring and maintained as long as the software can communicate with that device.

Voltage/Frequency

The real-time values of system voltage/frequency for either source for each phase.

W Timer

A user input value for a timer representing the time delay commencing on completion of the P timer. Allows for generator set warm-up and stability. Switch will transfer on completion. The W timer range is 0 to 5 minutes in one-second increments.

W3 Timer

An additional time segment starting on completion of the W timer. Used as a pre-signal before transfer. Switch will transfer to Emergency on completion of time-out. W3 timer range is 0 to 60 seconds in one-second increments.

Week(s)

Reflect a random number of weeks the selected ATS will perform a test as scheduled.

YE

If enabled, the ATS will transfer to the Emergency position when the Initiate command button is clicked.

YN

If enabled, the ATS will retransfer to the Normal position when the Initiate command button is clicked.

Preparing Your Network

Communication Hardware Requirements

A LonTalk Adapter is required to interface your computer to the Lonworks network. There are three kinds of adapters: PCLTA-10 Lon Adapter card, PCC-10 adapter card and SLTA-10 (Serial Port). The PCLTA-10 adapter is a card that installs into the ISA bus of your computer. The SLTA-10 adapter on the other hand is portable. It interfaces your computer and the Lonworks network via a serial port. The PCC-10 adapter card installs into the PCMCIA slot of your laptop.

On Site Communications

On site communication implies that the local Lonworks network is monitored and controlled at a centralized location, in an office for instance, via a twisted-pair cable. A LonTalk adapter is required.

Remote Site Communications

Remote site communication implies that a remote Lonworks network is monitored and controlled at a centralized location, in an office for instance, via a phone line. A SLTA-10 adapter and a modem are required at the remote site.

A modem is also required for this software to call and to connect to the remote Lonworks network.

Connecting to the Network

Remote connecting, for this option you start up the program as normal. Then select the Modem option in the drop-down menu under the Adapter menu bar. Select a remote site that you wish to dial-in. Click OK when finished. Next, click on Run in the drop-down menu under the Program menu bar to continue. After a few seconds, you should be connected to the remote Lonworks network.

On-site connecting, for this option you start the program and select the appropriate adapter that your system is equipped under the Adapter menu. Click on Run under the Program menu. After a few seconds, you should be connected the local Lonworks network.

Security

System Security

Control network is password protected. This feature allows only authorized personnel to modify parameters of devices within the network via the software. It also allows authorized personnel to test devices on the network.

Changing Password

The manufacturer default password is ‘zenith’ and the configuration password is ‘configure’. These passwords can be changed as the user wishes just by clicking on the Password in the menu bar and follow the directions. Note that the new password is saved in the configuration file, therefore you must initiate a configuration save and save the new passwords.

Configuring Your Network

Defining Node Name, Description, Subnet and Node

In order for the ZNET 1000 software to work, the network needs to be configured first. This step needs to be done once after the starting of the software for the first time. This procedure is required so that the software knows how many devices and their addresses are in the network. Follow the procedure to configure the network:

- Start the ZNET 1000 software by double-clicking on the ZNET 1000 icon on the desktop.
- Select a Lonworks adapter from the Adapter submenu.
- Select Config from the Program submenu.
- Select Network Configuration from the Display submenu.
- Place the cursor in the designated fields under Node Name, Description, Subnet and Node to fill in the information. For example: ATS1, MX100, 1, 1 are the configuration parameters for Node Name, Description, Subnet, and Node, respectively.
- Click on the OK button when finished entering all devices on your network.
- Enter the configuration password to authorize the Network configuration changes.
- Answer 'Yes' to 'New Configuration File?' if you are configuring more than one system. If you configuring one system ***only***, answer 'No'.
- Select ATS Configuration from the drop-down menu of the Display menu.
- Select ATS Type, Model, Phase sensed and Mode. Put a checkmark under T3, W3, YE and YN if you want to enable these options. Note that T3 and W3 options must be provided and that T3, W3, YN and YE bypass must be enabled on the corresponding microprocessor controller in order for the timer bypass function to work properly.
- Click on the OK button when finished entering all devices on your network.
- Enter the configuration password to authorize the ATS configuration changes.
- Quit the ZNET 1000 program and restart it for new parameters to take affect.

Configuring ATS

Characterizing Devices in the Network

In order for the ZNET 1000 software to work properly, all connected devices on the network need to be identified. Follow the procedure to identify devices in your network:

1. Start the ZNET 1000 software as normal.

2. Change the mode from Monitor to Control (optional).

3. Select the ATS Configuration from the Display menu bar.

4. Select ATS Type, Model, Phase sensed and Mode. Put a check mark under T3, W3, YE and YN if you want to enable these options. Note that T3 and W3 options must be provided and that T3, W3, YN and YE bypass must be enabled on the corresponding microprocessor controller in order for the timer bypass function to work properly.

5. Click on the OK command button when finished configuring all the devices on the network.

6. Enter the configuration password to authorize the ATS configuration changes.

7. Quit the program and restart it for the configuration to take effect.

Appendix A

List of Logged Events

Both NORMAL & EMERGENCY source unavailable

NORMAL source unavailable

EMERGENCY source unavailable

Both NORMAL & EMERGENCY sources available

Load OPEN

Load connected to NORMAL source

Load connected to EMERGENCY source

Failure

Test running

Test stopped

Delay to Engine Start

Delay to Emergency Presignal

Delay to Emergency

Delay to Open

Delay to Normal Presignal

Delay to Normal

Delay to Open

Delay to Engine Stop

Transfer to Emergency disabled

Transfer to Emergency enabled

Retransfer to Normal disabled

Retransfer to Normal enabled

Load Shed activated

Load Shed deactivated

Appendix A *(cont'd)*

List of Logged Events

ATS in Manual Mode for Transfer/Retransfer

ATS in Auto Mode

ATS in Manual mode for Retransfer to Normal

ATS in Auto Mode

AUX1 output activated

AUX1 output deactivated

AUX2 output activated

AUX2 output deactivated

Time delay bypassed from PC

Test terminated from PC

CTTS test initiated from PC

CTTS test terminated from PC

Switch Offline

Switch Online

Fast Load Test initiated from PC

Load Test initiated from PC

No Load Test initiated from PC

Exerciser Test (No Load) terminated

Exerciser Test (Load) terminated

Exerciser Test (Load) initiated

Exerciser Test (No Load) initiated

Initiate manual transfer from PC

Initiate manual retransfer from PC

Timer setting(s) modified

Pickup/Dropout setting(s) modified

Appendix B

List of Minimum/Maximum Settings

Subnet:	0 - 63	P timer:	0 - 10 seconds
Node:	0 - 127	U timer:	0 - 3600 seconds
Hour:	0 - 23	W timer:	0 - 300 seconds
Min:	0 - 59	W3 timer:	0 - 60 seconds
Normal P/U Voltage:	85 - 100%	DW timer:	0 - 120 seconds or 10 minutes
Normal D/O Voltage:	75 - 98%	T timer:	0 - 3600 seconds
Normal P/U Frequency:	90 - 100%	T3 timer:	0 - 60 seconds
Emergency P/U Voltage:	85 - 100%	DT timer:	0 - 120 seconds or 10 minutes
Emergency D/O Voltage:	75 - 98%		
Emergency P/U Frequency:	90 - 100%		

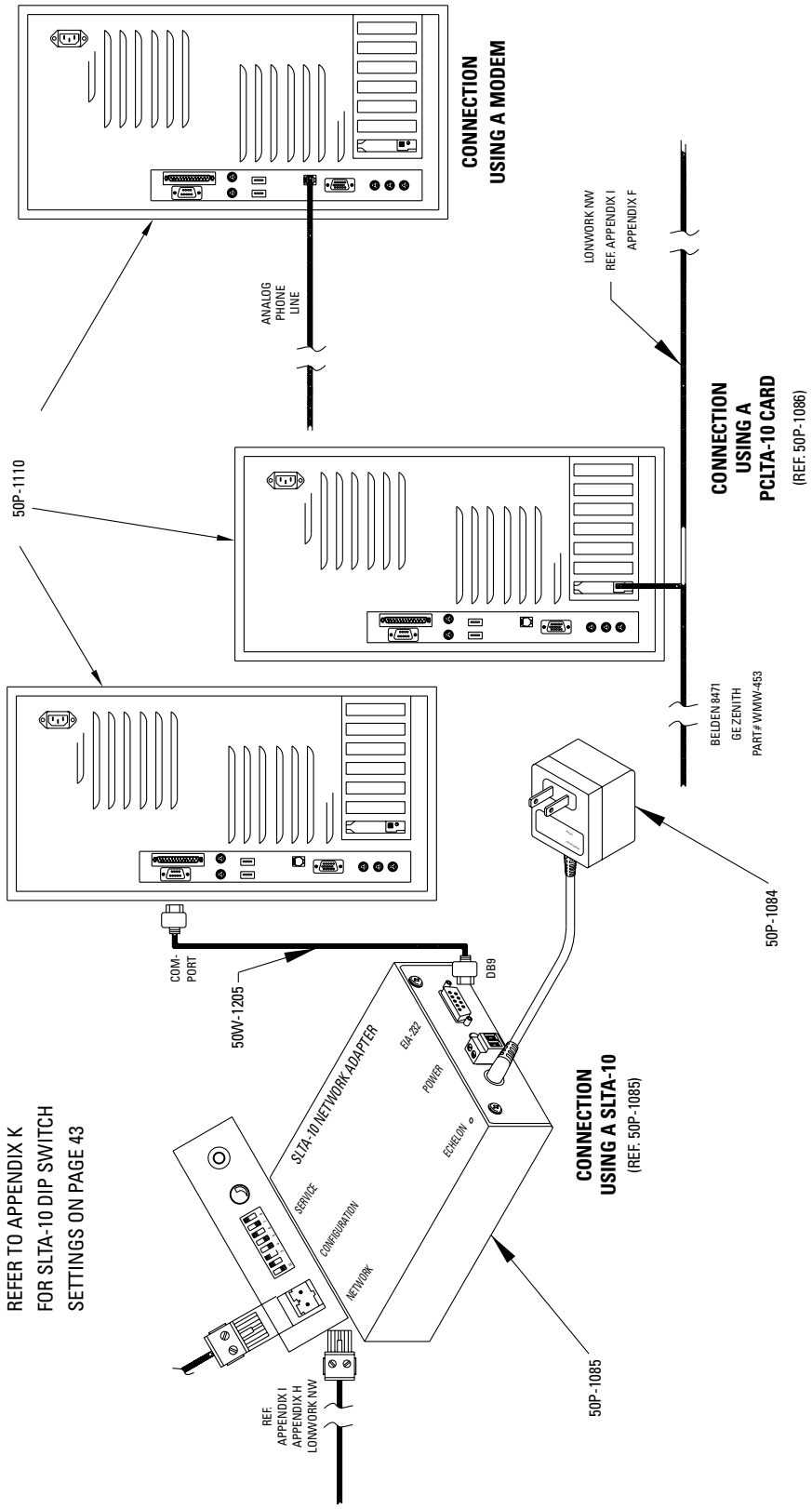
Appendix C

List of Do's and Don'ts

- Do include only devices that are going to be connected and powered in the configuration file during the network configuration process.
- Don't leave the ZNET 1000 software running in Control mode unattended.
- Do re-configure the network if there are devices within the network that are going to be down or disconnected for a period of time.
- Don't try to connect to two separate networks at the same time, i.e. modem and serial port or Lon Adapter Card and Serial. The ZNET 1000 software only responds to one network adapter at any given time.

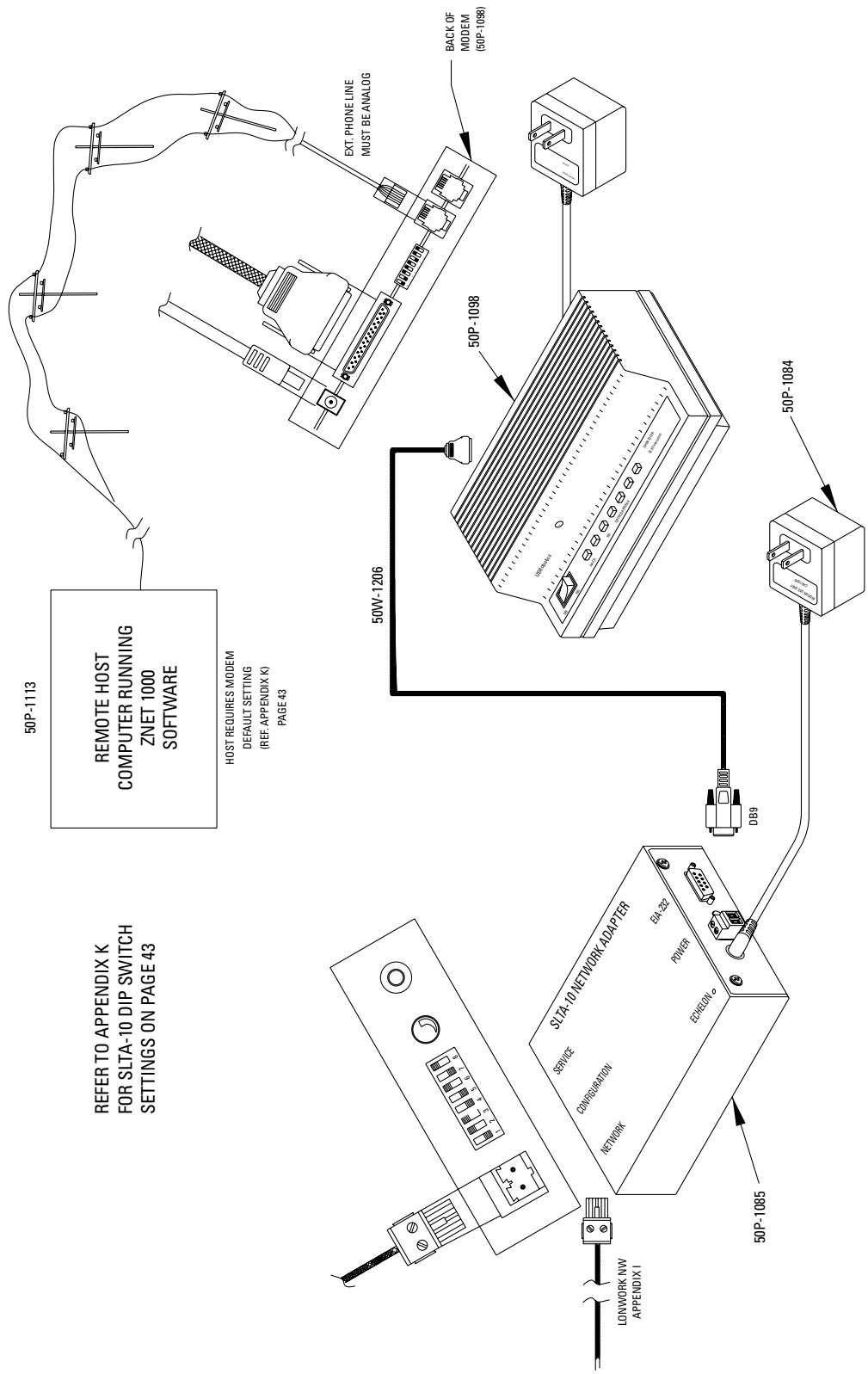
Appendix D

LonTalk Adapter Connections



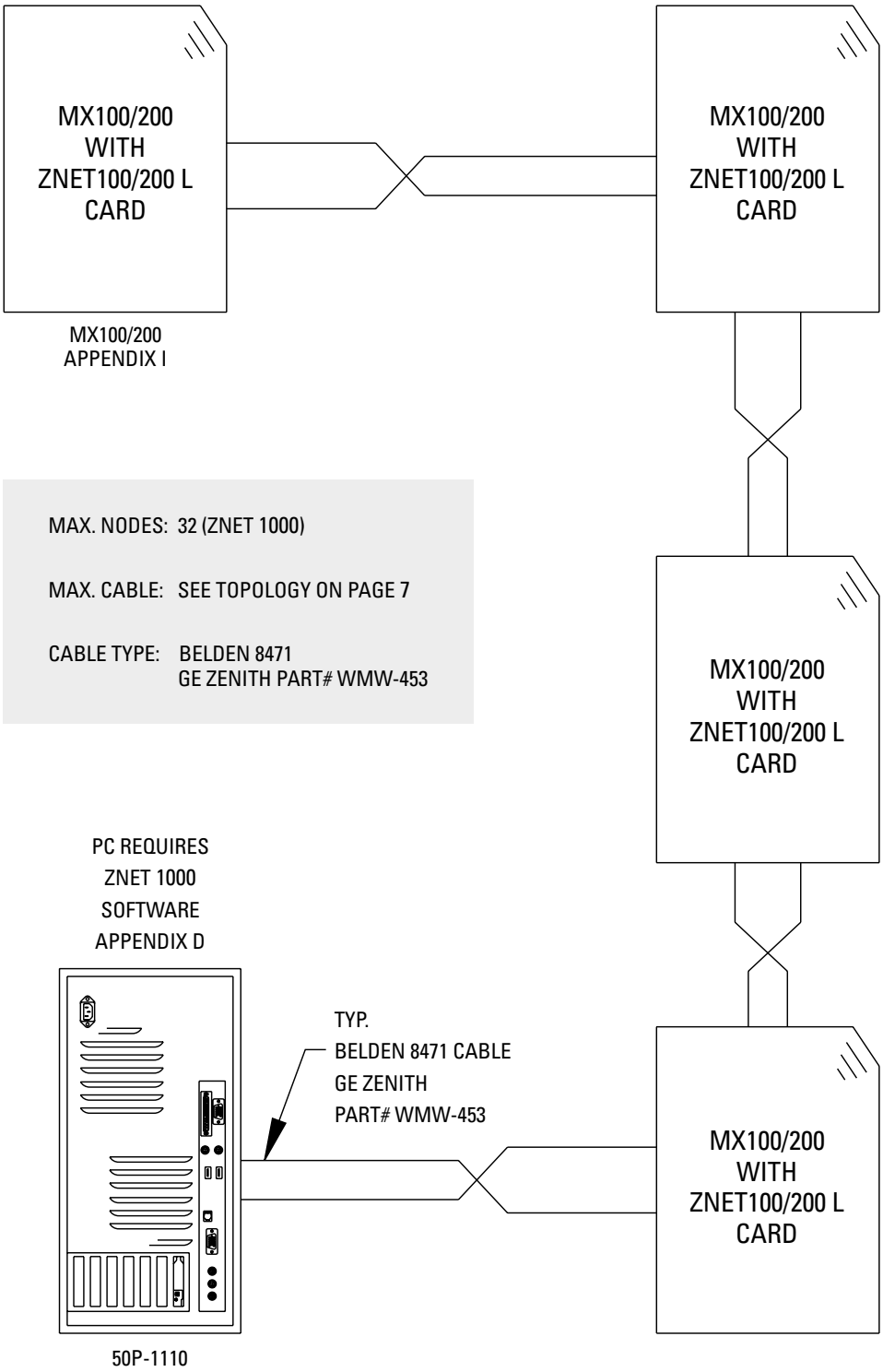
Appendix E

Connection for Remote Accessing



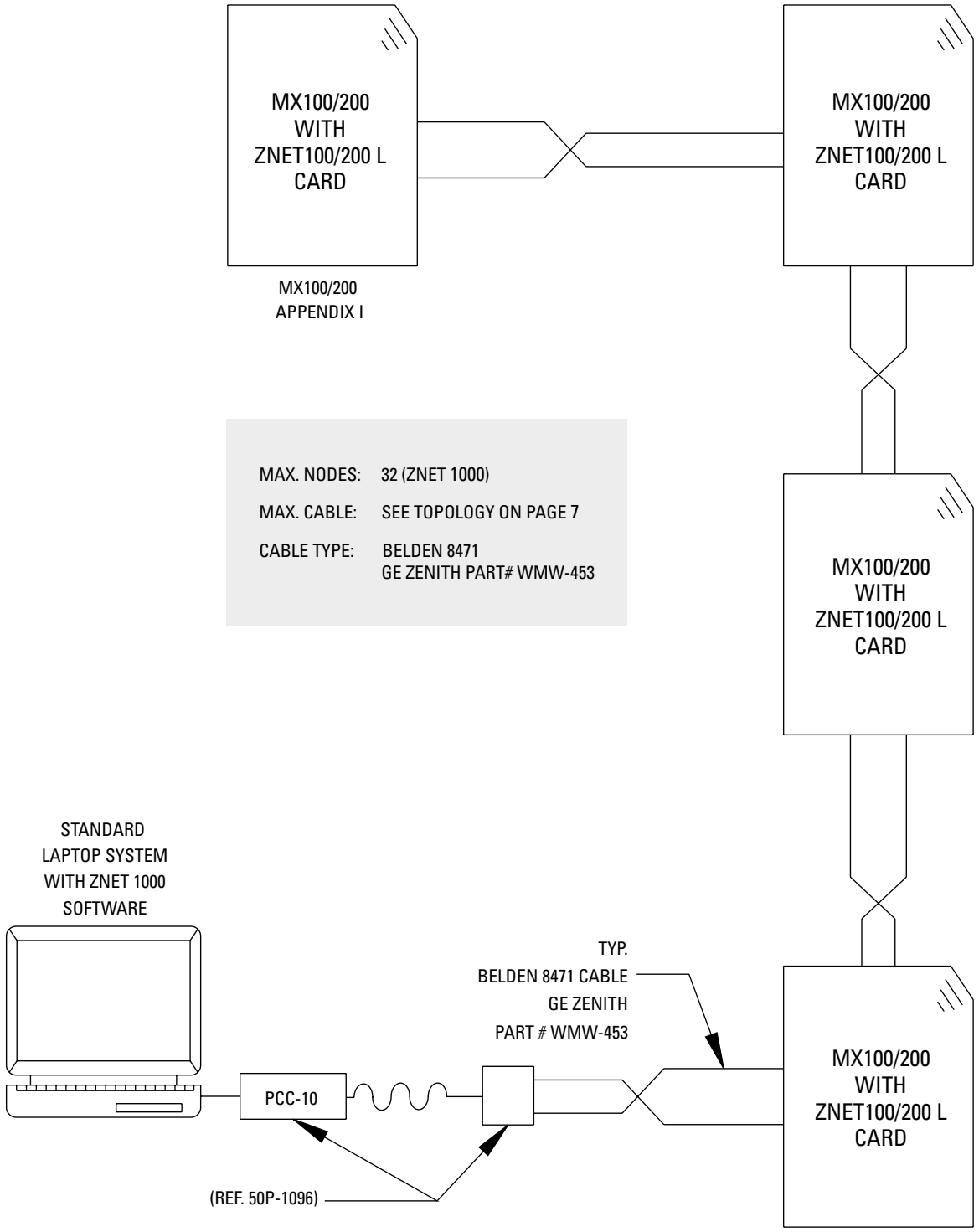
Appendix F

LonWork Network Connection Using PCLTA-10



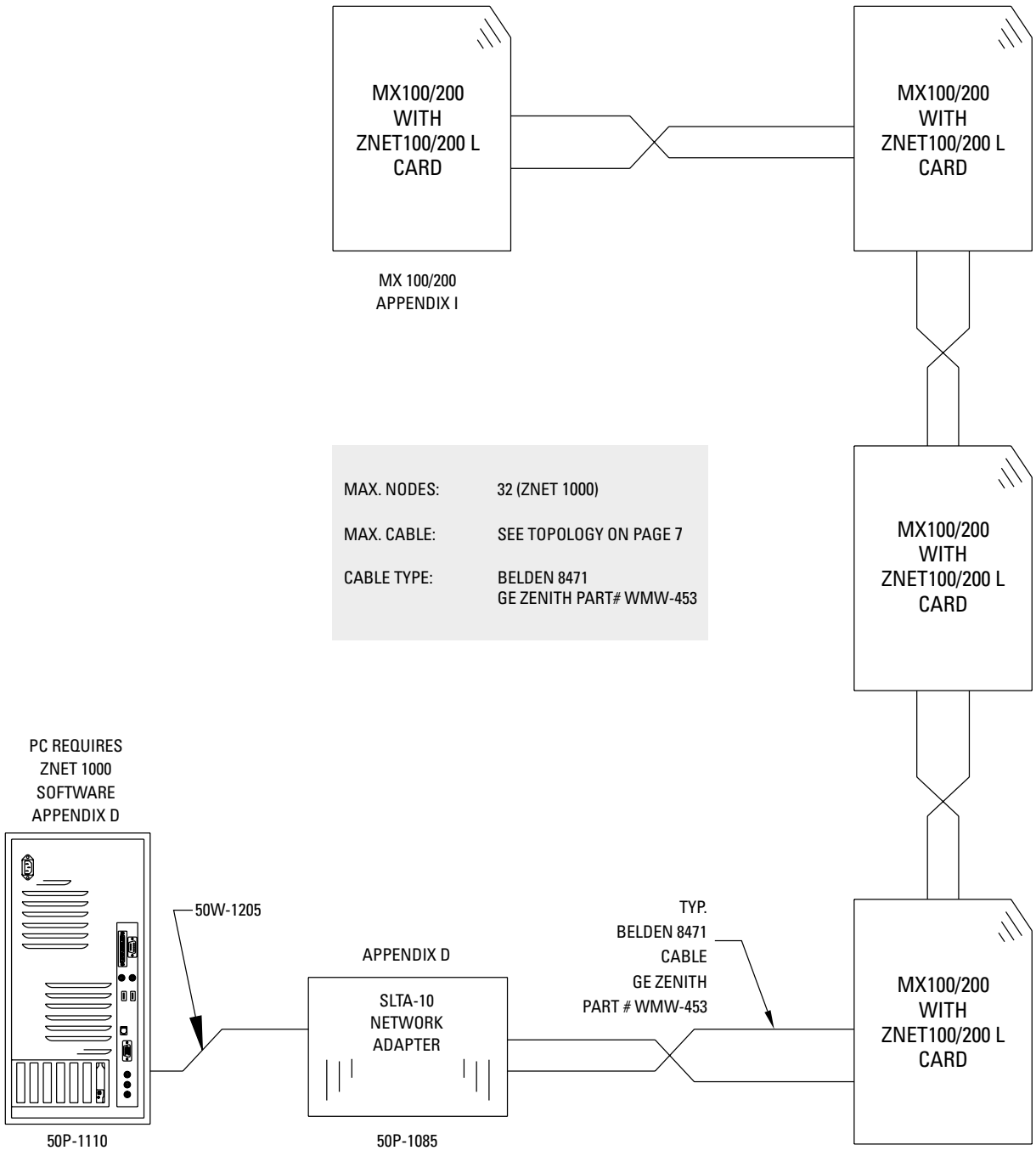
Appendix G

LonWork Network Connection Using PCC-10



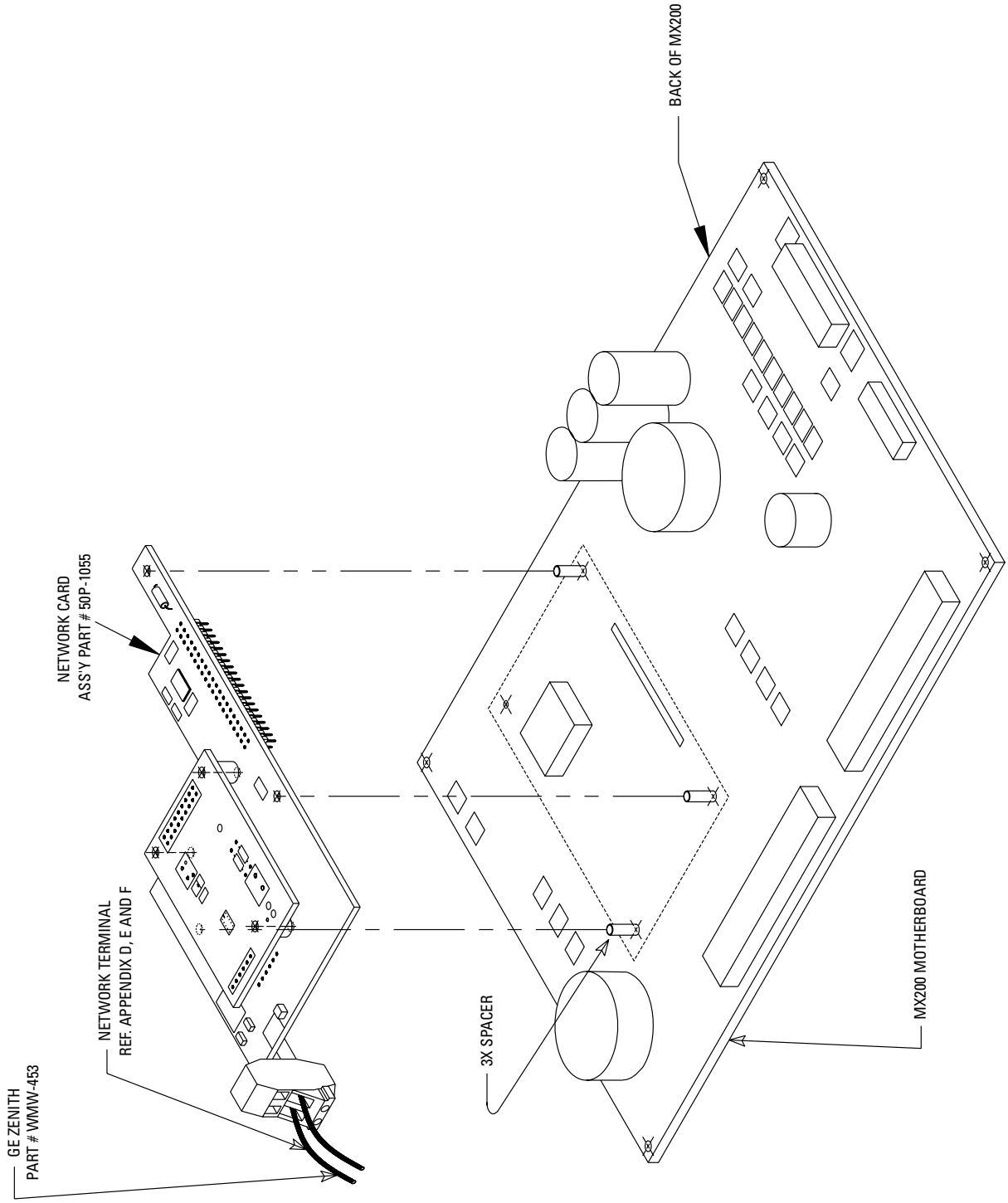
Appendix H

LonWork Network Connection Using SLTA-10



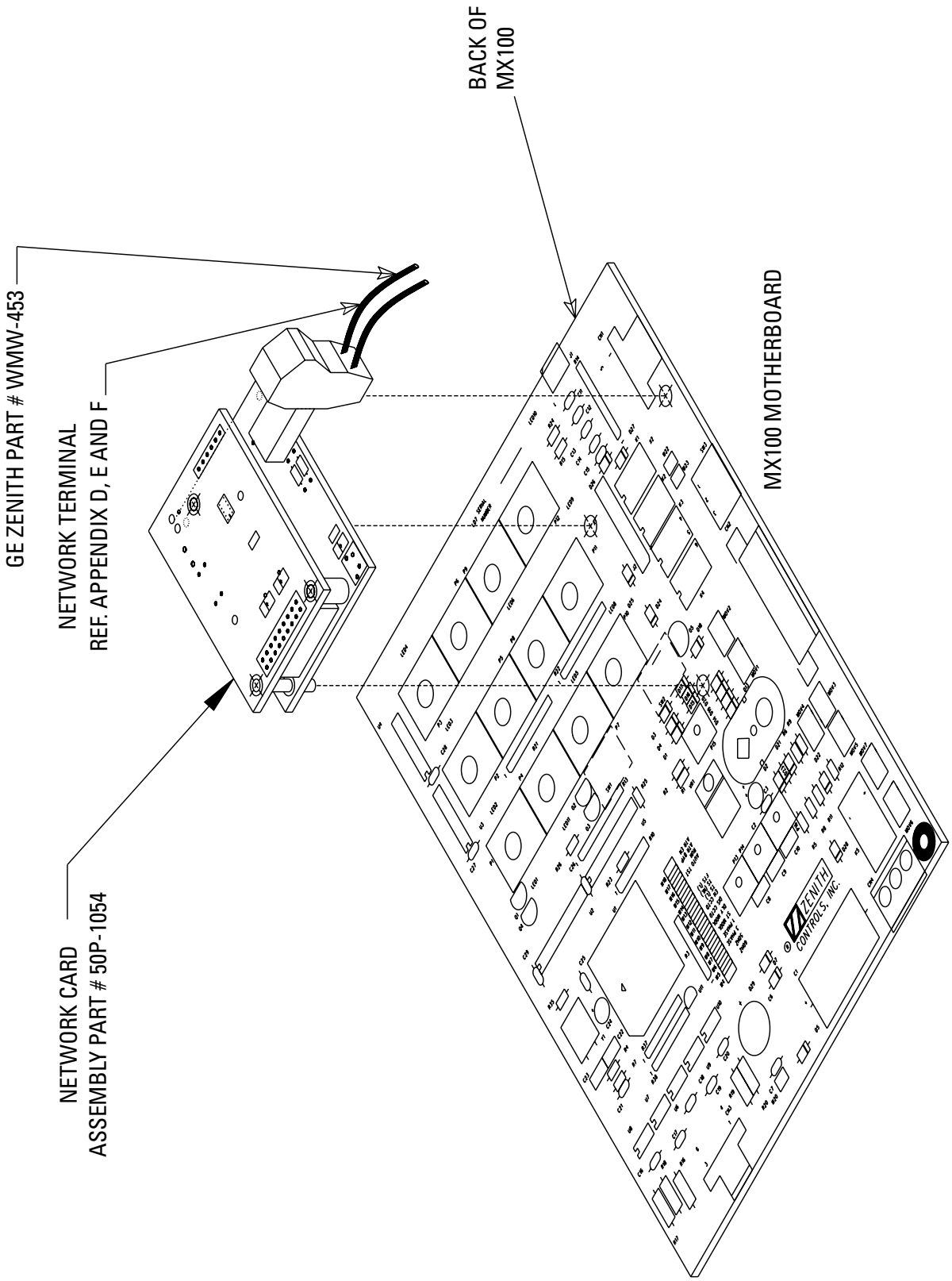
Appendix I

ZNET200 Network Card and MX200 Assembly



Appendix J

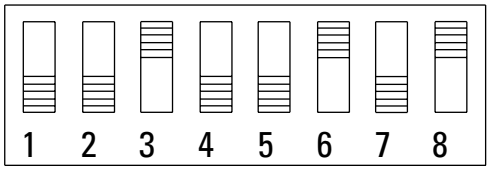
ZNET100 Network Card and MX100 Assembly



Appendix K

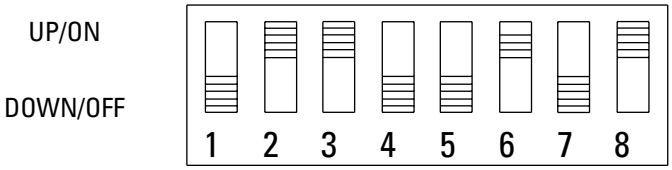
SLTA-10 Configuration Dip Switch Settings

There are eight configuration switches on the SLTA-10 adapter's switch block (S1). The inputs are read by the SLTA-10 firmware to configure or enable features. *Figure 1.0* and *Figure 1.0A* show the factory default settings of the SLTA-10 adapter for Local Host and Remote Host respectively. Changes to the switch configurations will not occur until the power is cycled on the SLTA-10 adapter.



LOCAL HOST

Figure 1.0 – Default Settings for Local Host



REMOTE HOST

Figure 1.0A – Default Settings for Remote Host

Switch1 controls the network interface link protocol used between the SLTA-10 adapter and a local host. Default position is DOWN.

Switch2 controls the use of the SLTA-10 adapter with modem. If the SLTA-10 adapter is connected directly to a host, then switch2 should be set to Local host state (down position). This is the SLTA-10 adapter default setting. If the SLTA-10 adapter is connected to a modem, then switch2 must be set to the Remote Host state (up position) and switch1 must be set to ALERT/ACK (down position).

Switch3 enables (down position) or disables (up position) network communication after reset. Default position is UP.

Switch4 controls Network Services Interface NSI Mode firmware and MIP Mode firmware. The down position is for the MIP Mode firmware and it is the default setting.

Switch5 is used to select automatic baud rate detection-the autobaud feature. **Autobaud must not be used when the SLTA-10 is used with a modem.** The default for an SLTA-10 adapter is Autobaud Disable (down position).

SLTA-10 Configuration Dip Switch Settings *(cont'd)*

Switch6 through Switch8 are used to set the SLTA-10 adapter serial bit rate. This setting is only used if autobaud operation is disabled. The SLTA-10 adapter is configured for 38,400 bps with autobaud disabled. See *Figure 2*.



Figure 2 – SLTA-10 Adapter Serial Baud Rate Switches 6, 7, and 8

Appendix L

Miscellaneous Part Numbers

Part Number	Description
50P-1110	Complete PC System with PCLTA card
50P-1054	LonWorks Communication Card for MX100
50P-1055	LonWorks Communication Card for MX200

Required Parts for Connection Using Different Adapters

Connection Using	Required Parts and Description	Quantity
Modem (Ref. Appendix D)	50P-1113 – ZNET 1000 Software Package ***Note:*** Required 50C-3012 at the Transfer Switch end	1
PCLTA-10 (Ref. Appendix D)	50P-1113 – ZNET 1000 Software Package 50P-1086 – PCLTA-10 LonTalk Adapter Card 50P-1123 – LonTalk Adapter Driver for Windows 95/98 50P-1115 – LonTalk Adapter Driver for Windows NT	1 1 1 1
PCC-10 (Ref. Appendix G)	50P-1113 – ZNET 1000 Software Package 50P-1096 – PCC-10 LonTalk Adapter Card and Cable 50P-1123 – LonTalk Adapter Driver for Windows 95/98 50P-1115 – LonTalk Adapter Driver for Windows NT	1 1 1 1
SLTA-10 (Ref. Appendix D)	50P-1113 – ZNET 1000 Software Package 50P-1085 – SLTA-10 Serial LonTalk Adapter 50P-1084 – 120V AC Power Adapter 50W-1205 – RS232, DB9 Straight Through Cable	1 1 1 1

Index

A

Adapter, 8, 21
- LON Adapter Card, 8
- Serial Port, 8
- Modem, 8

Alarm, 10, 21
ATS Type, 19, 21
Automatic Transfer Switches, 1
Aux 1 & 2, 12, 21

B

Before Starting, 5
Belden 8471, 4, 7
Bypass Timing, 21

C

Configuring ATS, 31
Configuring Your Network, 5, 30
Control, 11, 12
Controllers, 1
Controlling, 1
Customer Support, 2

D

Date/Time, 21
Day, 21
Description, 11, 20, 22
Display, 10, 22
Do's and Don'ts, 35
Dropout Voltage/Frequency, 22

E

Emergency, 22
Emergency Frequency, 14
Emergency Voltage, 14
Enable, 22
Engine, 22
Exerciser, 11, 22

G

Group, 9, 23

H

Help, 11

I

Inhibit Transfer to N or E, 12, 23
Initiate, 12, 23
Installing ZNET 1000 Software, 3

L

List of Logged Events, 32-33
List of Minimum/Maximum Settings, 34

L

Load Shed, 12, 23
Lonworks Network, 5, 8, 9
Log Events, 11

M

Mode, 11,19, 23
Model, 19, 23
Modem, 8, 9
Monitoring, 1

N

Node, 20, 23
Node Name, 20, 23
Normal, 23
Normal Frequency 14
Normal Voltage, 14
Number of Transfer, 13, 24

P

Password, 10, 24
- Control, 10
- Configuration, 10

Phase Rotation, 13, 24
Phase Sensed, 13, 19, 24
Position, 11, 24
Preparing Your Network, 28
Print, 24
Program, 9, 24
- Run, 9
- Config, 9

Purge Log, 11

Q

Quick Guide, 5

R

Retransfer, 25
Retransfer to Normal, 12, 25

S

S5, 25
S12, 25
Schedule, 17, 25
- Daily, 17
- Weekly, 17
- Periodic, 17

Security, 29
Serial Number, 13, 25
Serial Port, 4, 8
SLTA-10 Lonworks Adapter, 8
Source Availability, 1
Source, 11, 25

S

Start, 17, 25
Starting and Running the ZNET 1000 Software, 5
Stop, 17, 25
Subnet, 20, 26
Switch Position, 1
System Requirements, 3

T

Test, 11, 26
- NO LOAD, 11
- FAST LOAD, 11
- STD LOAD, 11

Test Mode, 17
Time in Emergency, 13, 26
Timing Bypass, 11
Timer Value, 13, 26
Timer
- W Timer, 15, 27
- W3 Timer, 15,19, 27
- DW Timer, 15, 22
- T Timer, 15, 26
- T3 Timer, 15,19, 26
- DT Timer, 15, 22
- P Timer, 15, 24
- U Timer, 15, 27

Transfer, 2, 26
Transfer & Retransfer, 12, 26
Transfer to Emergency, 27

V

View Log, 11, 27
Voltage/Frequency, 27

W

Week, 27

Y

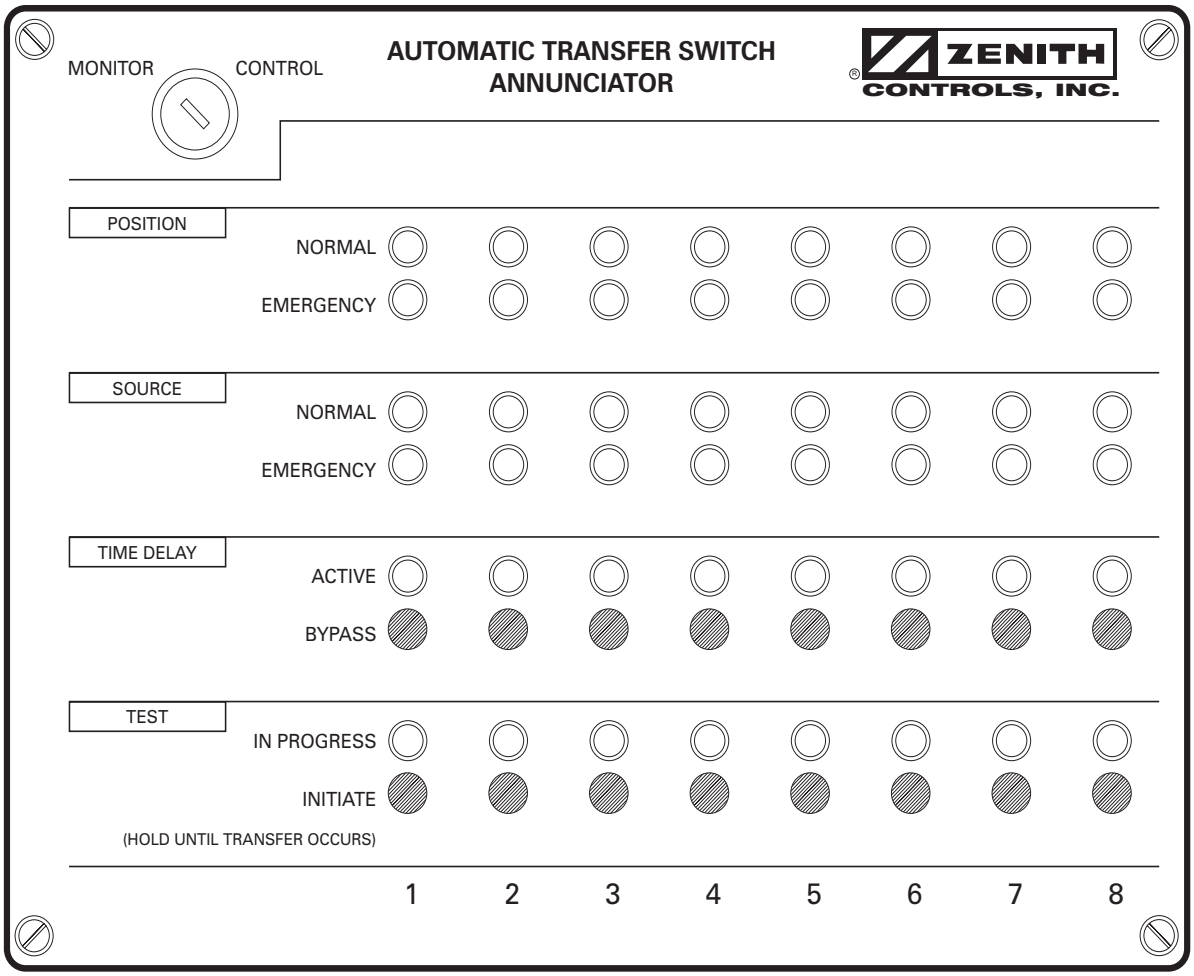
YE, 19, 27
YN, 19, 27



GE Zenith Controls

GE Industrial Systems – Power Equipment Business
General Electric Company
830 West 40th Street, Chicago, IL 60609 USA
773 299-6600, Fax: 773 247-7805
www.geindustrial.com

OPERATION AND MAINTENANCE MANUAL
TRANSFER SWITCH NETWORK ANNUNCIATOR
ZNET900A, ZNET900B AND ZNET901



ZENITH CONTROLS, INC.

ISO 9001

18R-1000A
10/98

Table of Contents

Page

Overview and Features 1

Installation 2

ZNET900(A/B) Annunciator 2

ZNET901 Expansion Unit for Annunciation 3

Topology 4

Singly Terminated Network (Daisy Chain) 4

Doubly Terminated Network (Backbone with Drops) 4

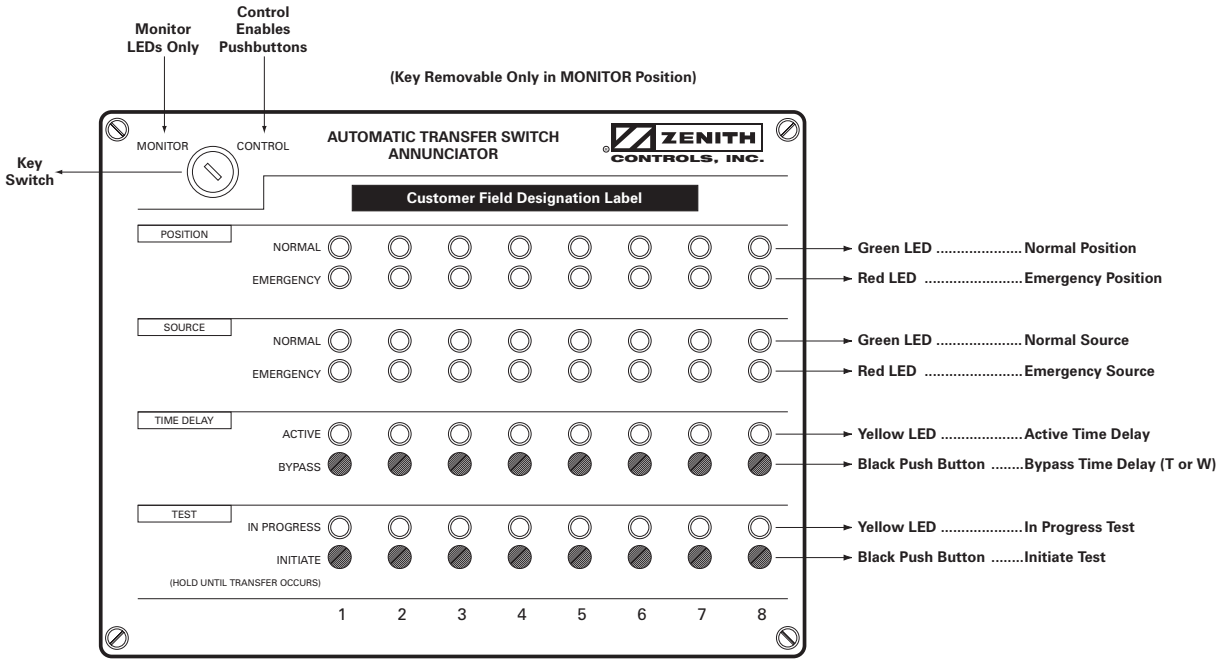
User Settings 5-6

Dip Switch Designations 5-6

Maintenance and Testing 7

Troubleshooting 7

Overview and Features



KEY SWITCH —
The **MONITOR** position allows operation of LEDs only. *(Key can be removed in this position)* The **CONTROL** position allows operation of LEDs and the pushbuttons. *(Key cannot be removed in this position)*

POSITION — Normal LED (Green)
Indicates that the corresponding Transfer Switch load is connected to the Normal source.

POSITION — Emergency LED (Red)
Indicates that the corresponding Transfer Switch load is connected to the Emergency source.

SOURCE — Normal LED (Green)
Indicates that the corresponding Transfer Switch has an acceptable Normal source.

SOURCE — Emergency LED (Red)
Indicates that the corresponding Transfer Switch has an acceptable Emergency source.

TIME DELAY — Active LED (Yellow)
This flashing LED indicates that the corresponding Transfer Switch has a timer functioning. Timers monitored includes all timers associated with delaying transfer in either direction. **Note:** Not available in closed transition mode.

TIME DELAY — Bypass Push Button
Will instantaneously lapse T or W timer whichever is timing concurrent with pushbutton activation. *(Key Switch must be in the Control position)* **Note:** Not available in closed transition mode.

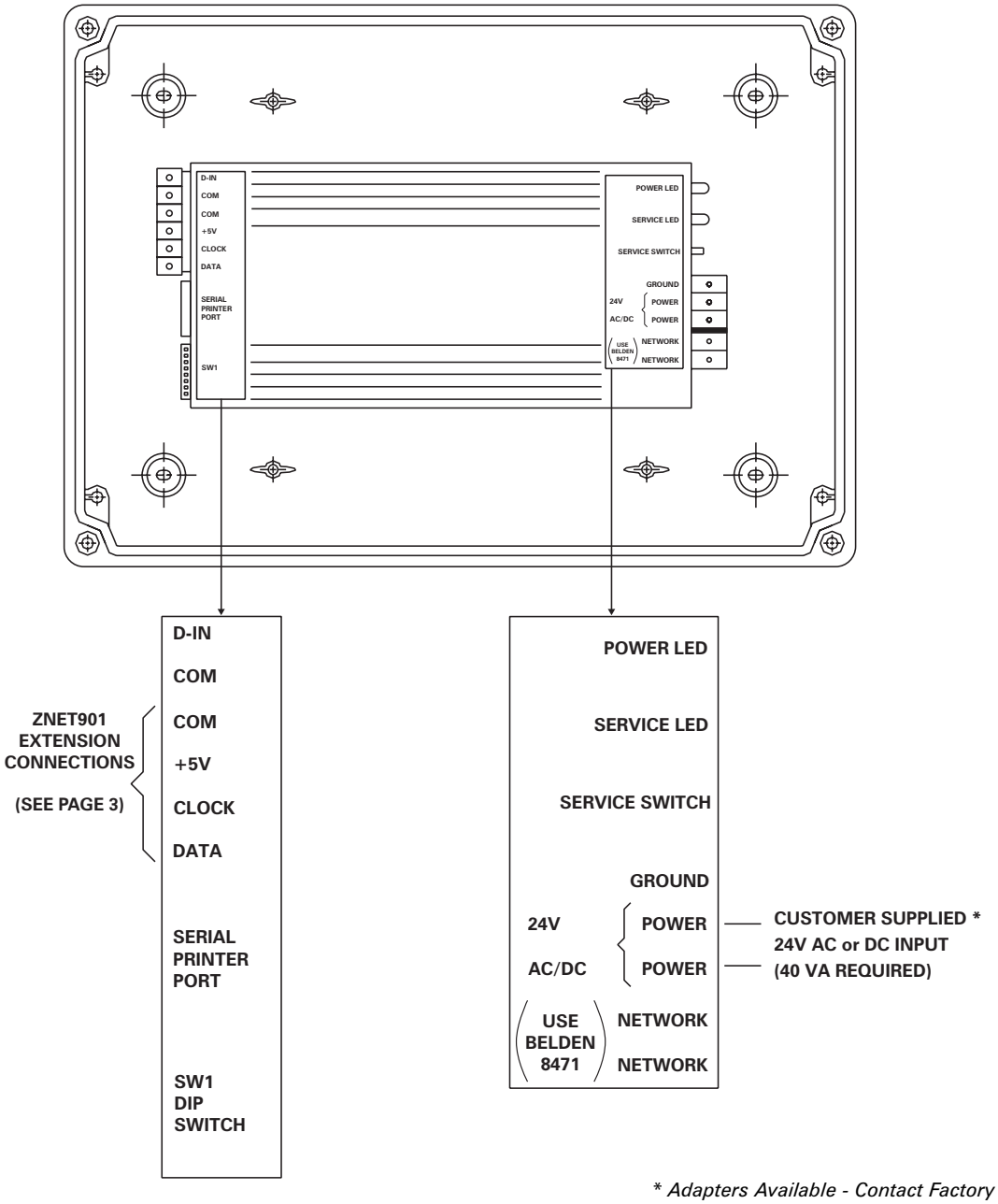
TEST — In Progress LED (Yellow)
Indicates the corresponding Transfer Switch is in a test mode. Indication will occur whether the test is initiated at the annunciator or locally at the ATS.

TEST — Initiate Push Button
Begins a test sequence (power loss simulation) but must be held until transfer occurs. Transfer is complete once the Emergency Position and Emergency Source LEDs are both illuminated. Releasing before test is complete will cancel the test. *(Key Switch must be in the Control position)*

Installation

ZNET900(A/B) Annunciator

1. Remove cover panel (see Figure below).
2. Mount unit to wall.
3. Connect network connection as shown.
4. Connect power input as shown.
5. Reinstall cover.

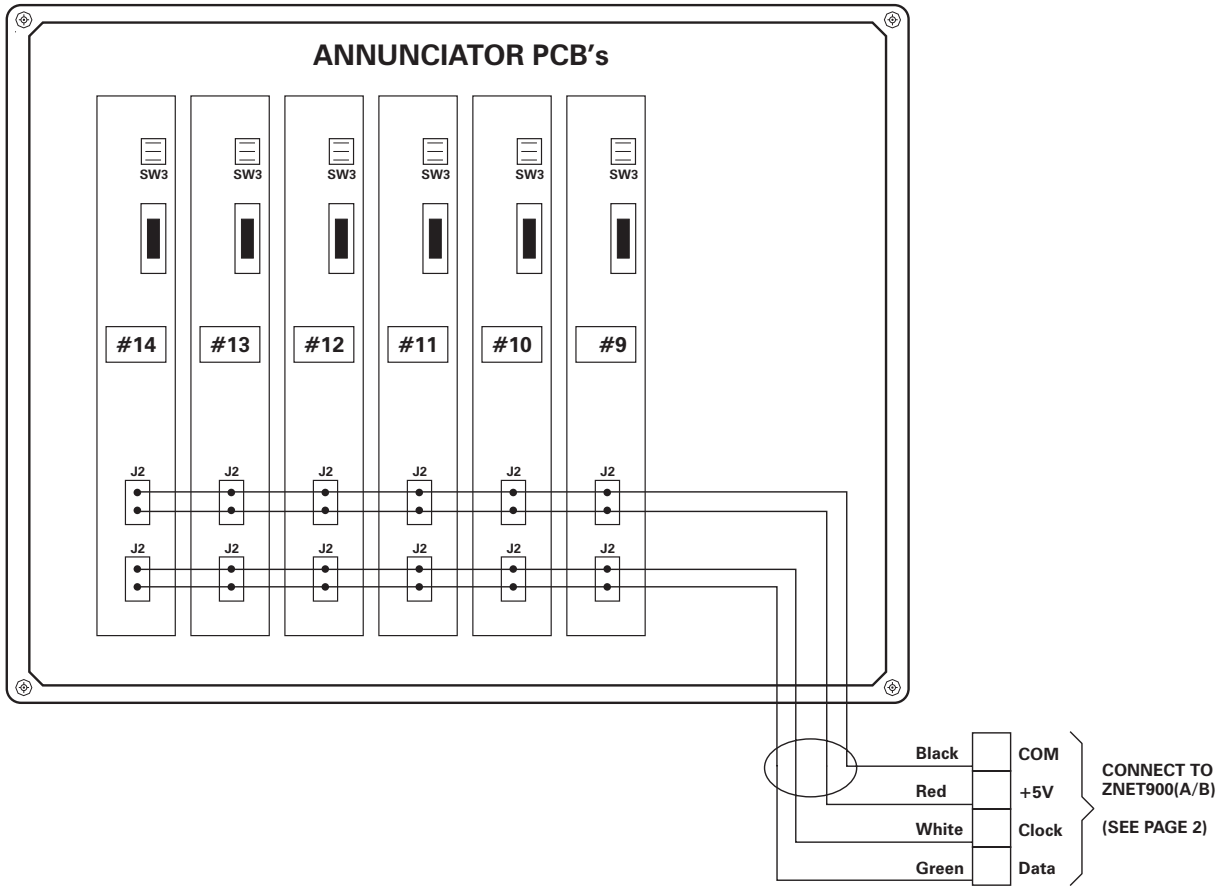


** Adapters Available - Contact Factory*

ZNET901 Extension Unit for Annunciator

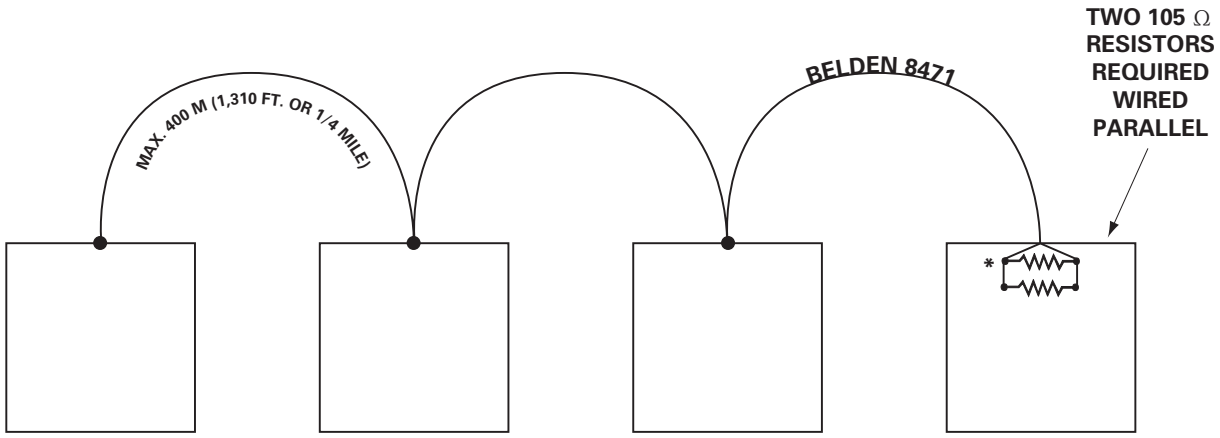
1. Remove cover panel (see Figure below).
2. Mount extension unit no further than 2' - 0" (two feet) from ZNET900(A/B).
3. Connect extension unit to ZNET900(A/B) by wiring the 4 wires to the slots designated for COM, 5VDC, clock and data. Be sure to match the wire colors.
4. Reinstall cover.

NOTE: Extension unit does not require network or power connections.



Topology

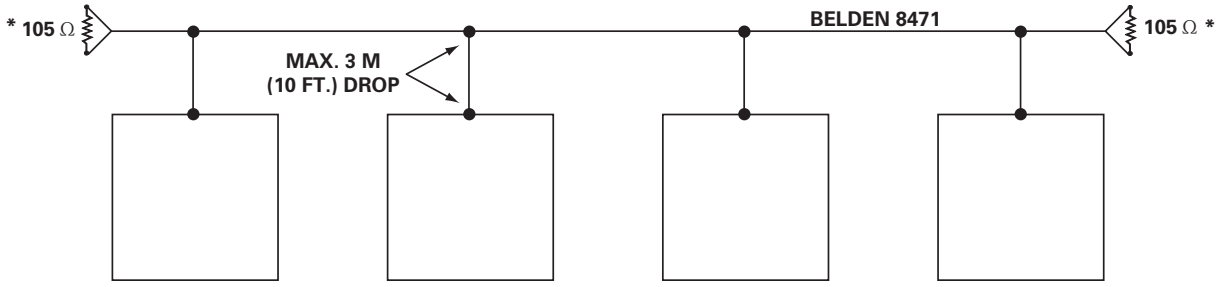
Singly Terminated Network (Daisy Chain)



MAXIMUM TOTAL NETWORK CABLE LENGTH: 500 M (1,640 FT.)

*** TWO RESISTORS PROVIDED WITH ANNUNCIATOR**

Doubly Terminated Network (Backbone with Drops)



MAXIMUM TOTAL LENGTH: 2,700 M (8,850 FT. OR 1.7 MILES)

*** TWO RESISTORS PROVIDED WITH ANNUNCIATOR**

User Settings

DIP Switch Designations

NOTE: This setting is necessary only if optional printer is used.

Entry of the time and date values for the clock/calendar are entered via the 8-position DIP switch SW1 (see Page 2). The service push button switch is used to trigger the data entry. The sequence of operations is as follows:

1. **Record the current settings of the DIP switches.**

	8	7	6	5	4	3	2	1
ON								
OFF								

2. Set switches 8 thru 4 OFF and 3 thru 1 ON. Press the service switch. The printer will print the message “Start clock-calendar set.”

3. Set switches 3 thru 1 according to the following table to set different fields. Switches 8 thru 4 are set to the value of the field in binary code. Press the service switch. The printer will print a message with the field name and the value. It is only necessary to set those fields which need to be changed.

	SW3	SW2	SW1
High digit of the Year (0-9)	OFF	ON	ON
Low digit of the Year (0-9)	ON	OFF	ON
Month (01-12)	OFF	OFF	ON
Date (01-31)	ON	ON	OFF
Hour (00-24)	OFF	ON	OFF
High digit of the Minute (0-5)	ON	OFF	OFF
Low digit of the Minute (0-9)	OFF	OFF	OFF

DIP Switch Designations *(cont'd)*

The setting of the switches 8 thru 4 for different values shown on the right:

4. Set switches 8 thru 4 OFF and 3 thru 1 ON. Press the service switch. The entered values are loaded into the real-time clock/ calendar. The printer will print the message "End clock/calendar set."

5. Restore DIP switches to the original settings recorded in the first step.

NOTE: The DIP switches (switch 4 through switch 8) are also used to set the annunciator ID which printed out in the event log in all the messages. The ID values (0 through 31) are set as indicated in the table on the right. The ID value is read only upon power up of the unit and therefore changing the DIP switch settings during the clock/calendar setting does not affect the ID number. However, the switches should be returned to their original settings after completing the clock/calendar set procedure so that the original ID setting is not affected.

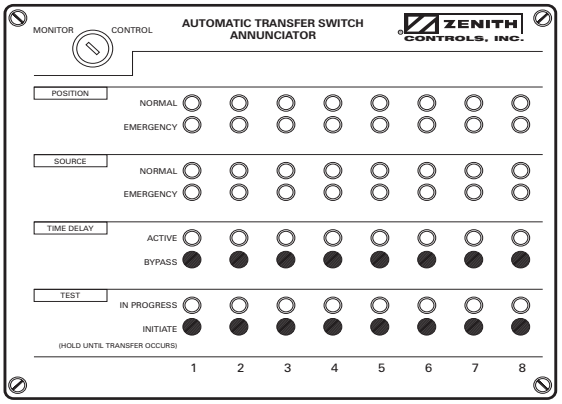
	SW8	SW7	SW6	SW5	SW4
0	OFF	OFF	OFF	OFF	OFF
1	ON	OFF	OFF	OFF	OFF
2	OFF	ON	OFF	OFF	OFF
3	ON	ON	OFF	OFF	OFF
4	OFF	OFF	ON	OFF	OFF
5	ON	OFF	ON	OFF	OFF
6	OFF	ON	ON	OFF	OFF
7	ON	ON	ON	OFF	OFF
8	OFF	OFF	OFF	ON	OFF
9	ON	OFF	OFF	ON	OFF
10	OFF	ON	OFF	ON	OFF
11	ON	ON	OFF	ON	OFF
12	OFF	OFF	ON	ON	OFF
13	ON	OFF	ON	ON	OFF
14	OFF	ON	ON	ON	OFF
15	ON	ON	ON	ON	OFF
16	OFF	OFF	OFF	OFF	ON
17	ON	OFF	OFF	OFF	ON
18	OFF	ON	OFF	OFF	ON
19	ON	ON	OFF	OFF	ON
20	OFF	OFF	ON	OFF	ON
21	ON	OFF	ON	OFF	ON
22	OFF	ON	ON	OFF	ON
23	ON	ON	ON	OFF	ON
24	OFF	OFF	OFF	ON	ON
25	ON	OFF	OFF	ON	ON
26	OFF	ON	OFF	ON	ON
27	ON	ON	OFF	ON	ON
28	OFF	OFF	ON	ON	ON
29	ON	OFF	ON	ON	ON
30	OFF	ON	ON	ON	ON
31	ON	ON	ON	ON	ON

Maintenance and Testing

Troubleshooting

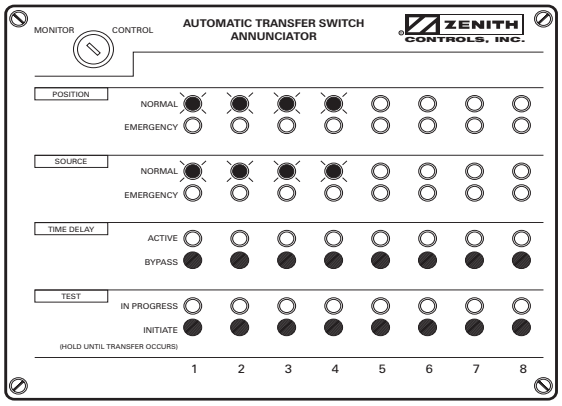
None of the the LEDs will illuminate:

1. Check power supply for proper connection to annunciator unit. (Power LED inside unit will be illuminated if power supply is connected properly). See Page 1.



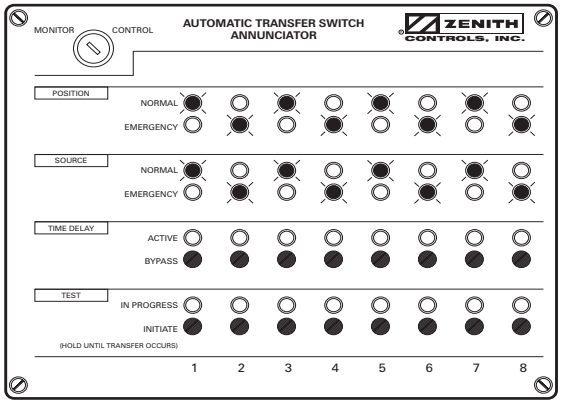
Some of the LEDs not illuminating:

1. Are there less units on the network than there are available slots?
2. Are network terminations on remote ATS units connected?
3. Do all ATS units have power?
4. Do all ATS units have installed network interface cards?



The position and source availability LEDs flash on and off:

1. This indicates that network connections are open between annunciator and corresponding ATS.
2. Are there less units on the network than there are available slots?
3. Are network terminations on remote ATS units connected?
4. Do all ATS units have power?
5. Do all ATS units have network interface cards installed and network cable connected?





830 West 40th Street
Chicago, IL 60609 USA

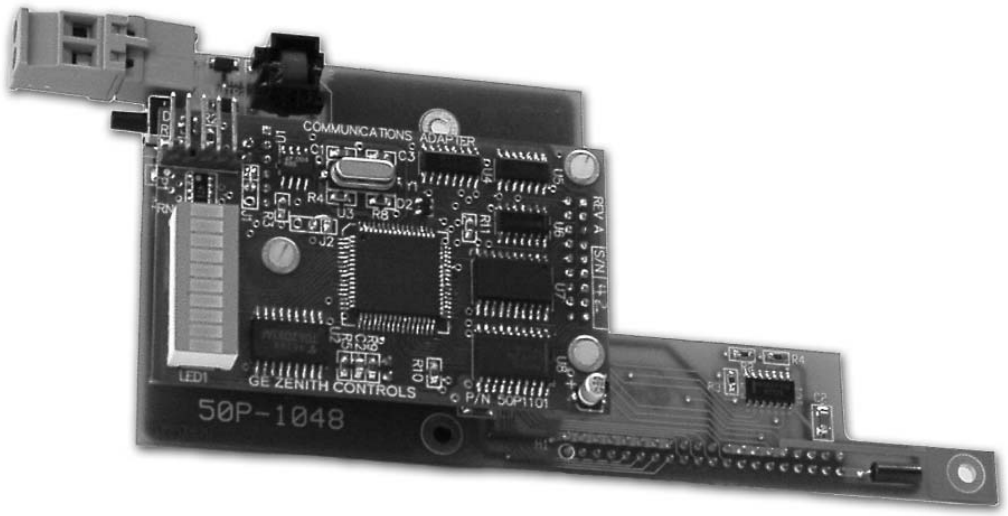
Phone: 773 247-6400
Fax: 773 247-7805

www.zenithcontrols.com
E-Mail: zenith@zenithcontrols.com

© 1998 Zenith Controls, Inc.

MX200 SERIES
Modbus Card – 50P-1105

GE Zenith Controls



50R-2200B
12/00

Operation and Maintenance Manual

Table of Contents

Page

Overview 1
LED Indicator 2
Installation 3
Installing the Network Card on the MX200 3
Termination Resistor 3
Configuring a Modbus Network Card 3
Downloading New Firmware 4
Testing a Modbus Network 4
Appendix A – Read Only Register List 5
Appendix B – Read/Write Register List 7
Appendix C – Modbus Network Card 8
Appendix D – Connections for Configuring and Testing the Modbus Card 9
Appendix E – Connections for Downloading New Firmware 10
Appendix F – RS485 Multi-Drop Connection 11
Appendix G – Location of Modbus Card on MX200 12
Appendix H – Modbus Protocol Illustration 13
Appendix I – MX200 Menus 16
Troubleshooting 17
Bill of Materials 18
Components for the Modbus Option (ZNET200M) 18
Components for the Modbus Card Configuration 18
Components for Downloading New Firmware 18

Disclaimer

GE Zenith Controls disclaims any and all liability for use of third-party application software that will be used to control the Automatic Transfer Switches.

⚠ WARNING ⚠

Automatic Transfer Switches are often used in critical applications. Failure of an ATS to operate properly could cause serious personal injury (including death) and property damage. Therefore, extreme caution must be used when designing or using programming software that will communicate with the ATS. Improper use of the Modbus network variables will cause the Automatic Transfer Switch to malfunction. Always conduct a full test and debug of the programming software prior to installing and using it in the system.

Overview

The Modbus card is a network card designed for the MX200. If the MX200 is ordered with the Modbus option, the Modbus card will reside on the back of the MX200 board and it will be part of the MX200 assembly. The purpose of this card is to allow the MX200 to be available on a Modbus network as a slave device. This allows a master device, such as a programmable logic controller (PLC), to obtain information from the MX200 and have that information available for control, data acquisition and monitoring.

Every Modbus network consists of one master device and at least one slave device. All devices on the network are daisy-chained using a twisted pair cable (see Appendix F). Each slave device is assigned a unique address (factory default for each MX200 Modbus card is Slave Address 1), which is a number from 1-247. This number enables the master to distinguish between the various slaves on the network. It also allows the master device to send a query command to the addressed slave. When the addressed slave receives this command it will send back an appropriate response to the master. *Table 1* shows a list of Modbus commands which the MX200 Modbus network card supports. Reference Appendix H for a more detailed description of the Modbus commands.

Modbus Command	Modbus Command Description
01	Read Coil Status
03	Read Holding Register
05	Write Single Coil
06	Write Single Holding Register
15	Write Multiple Coils
16	Write Multiple Holding Registers

Table 1 – Supported Modbus Commands

The Modbus commands allow the master device to read data from, and write data to, specific memory locations in the MX200. These memory locations, which are listed in Appendix A and B, make up the Modbus network variables for the MX200. These variables allow the reading of MX200 status, configuration, voltage and frequency, serial number, time on emergency, number of transfers, timer values, and pickup/dropout settings. The variables, which can be written to (reference Appendix B), include timer values, pickup/dropout settings, and control variables. Appendix A lists the Read Only memory locations and Appendix B lists the Read/Write memory locations in the MX200.

Both lists contain the Parameter Name column that displays the name of the memory locations. The non-indented names in that column are 16-bit registers while the indented ones are individual bits, which make up the 16-bit registers. For example, Status 0, a non-indented name, is a 16-bit register that consists of the following eight bits:

- Automatic Transfer Relay
- ATS Not in Auto Mode
- Fault
- Exerciser Enabled
- Load Test Running
- Normal Source Available
- Load, No Load, Fast Load Test Status
- Emergency Source Available

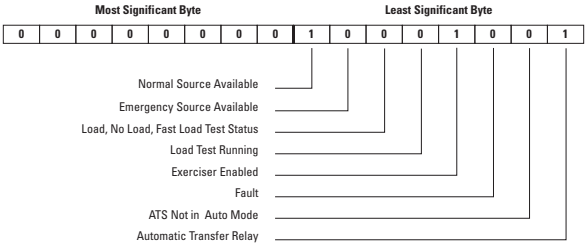


Figure 1 – Status 0 Register

These eight bits make up the least significant byte of the Status 0 register, while the most significant byte of the Status 0 register contains zeros. *Figure 1* shows an example of what the Master device would see if it read back the entire Status 0 register. In this example, the Master device would read back the decimal value of 137 from the Status 0 register. When this value is decoded, the Master finds out that the normal source is available, the exerciser is on and the automatic transfer relay is on. The Master also has the option of reading the individual bits, indented under Status0. This allows the Master to know the status of each parameter without doing any decoding. The second column contains the actual addresses for the network variables. These addresses are used when the Master is reading a Holding Register (16-bit reg). The third column contains addresses that are used when the Master is reading a Coil (individual bit). The remaining columns show the values, ranges (only in Appendix B) and register types for the network variables.

LED Indicator

The Modbus card has a 10-segment LED module (Refer to Appendix E for location). These LED's display the slave address of the card as well as the transmit and receive status. The first LED from the bottom indicates the receive status. The second LED indicates the transmit status. When a Modbus packet has been successfully transmitted or received, the associated LED will light for 100ms. If another packet is sent or received before the 100ms elapses, the LED on time will be extended by another 100ms. LED's 3-10 display the slave address of the MX200 as a binary number with each LED corresponding to a bit. *Figure 2* shows the 10-segment LED module along with LED's 3, 5, and 6 being lit. The lit LED's correspond to slave address 13 for the MX200.

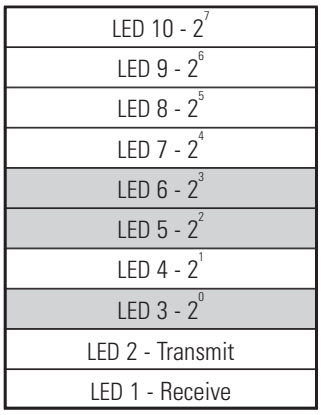


Figure 2 – LED Module

Installation

Installing the Network Card on the MX200

If the Modbus network card is not installed on the MX200, do the following to install it:

1. Open the ATS cabinet. If the ATS has power going to it, be EXTREMELY cautious not to touch any energized parts.
2. Unscrew the black metal cover from the back of the MX200. Be sure not to lose any screws.
3. Remove the two Engine Start wires from the P-Relay(s) if applicable (not applicable in Utility-Utility applications). Use electrical tape to tape over the exposed ends of both wires.
4. Remove the J5 and J6 plugs from the MX200 (located on bottom of board), this will remove power from the MX200. When power is removed from the MX200, the ATS will not transfer.
5. Obtain a grounding wrist strap and put the elastic end of the strap on your wrist. Attach the alligator clip end to the MX200 chassis or an equivalent earth ground.
6. Remove the three screws from the metal standoffs on the MX200. Connect the Modbus network card to the MX200 and fasten it to the controller with the three screws (Reference Appendix G).
7. Once the Modbus card is installed connect the J5 and J6 plugs back into the MX200.
8. Screw the black metal cover back on and connect the two Engine Start wires to the P-Relay(s) if applicable.
9. Close the ATS cabinet.
10. Once the MX200 has power, the network option needs to be enabled. Go into the CNFG menu and enable the network option (Reference Appendix I).
11. When the network option is enabled, exit the CNFG menu.

Termination Resistor

Located on the bottom of the Modbus card is jumper J6 (See Appendix C), which enables or disables a termination resistor on the board *(Figure 3)*. Jumper J6 is disabled when it comes from the factory.

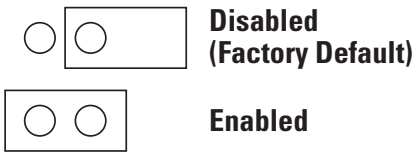


Figure 3 – Jumper J6

The only time that Jumper J6 should be enabled is when its corresponding Modbus card is the last device on the network.

Configuring a Modbus Network Card

The Modbus card can be configured in a variety of ways. The configuration of the card includes configuring the slave address, RTU or ASCII mode, baud rate, parity, and stop bits **(the default settings are Slave Address 1, RTU mode, 9600 Baud, No Parity and 2 Stop Bits).** These slave settings will be setup by the user and must match the master device settings for proper communications. The user configures these settings using a Modbus Configuration software package (GE Zenith Part # 50P-1111) that allows for the changes to be made and then writes them to the card. This software can also read the configuration of the card. The following is a procedure for configuring the Modbus Network card (See Appendix D for wiring connections).

1. In order to change the configuration settings the user must first make sure that **J4 is jumped and J6 is not jumped on the card** (Refer to Appendix C for location). **Make sure that the power to the Modbus card is off when doing this.**
2. Make sure that the Modbus Network Card Assembly is installed on the MX200. If it is not, refer to the "Installing the Network Card on the MX200" section on this page.
3. Power down MX200 and connect one end (DB9 female) of the RS232/485 converter (GE Zenith Part # 50W-1208) to the PC that has the Configuration software. The other end of the cable needs to be connected to the RS485 connector of the Modbus card. Check to make sure that the polarity connections are correct.
4. Power up the MX200 and Modbus card.
5. Run the Configuration software on the PC.
6. When loaded, check settings in the Configure PC's Serial port section, make changes as needed. The serial port settings are 9600 baud, no parity, 8 data bits and 1 stop bit.
7. Click on the CONFIG button to configure the specified serial port.
8. Click on the READ button to read the device's current configuration.
9. Click on the MODIFY button to enable parameter changing.
10. Make necessary changes in the Device information section.
11. Click on the WRITE button to write new configuration to the device.
12. To verify that the configuration was written to the device, click the READ button and verify the settings in the Device information section.
13. **Cycle power to ATS/MX200 controller to enable settings on the Modbus card.**

Installation *(cont'd)*

Downloading New Firmware

The Modbus Network card firmware can be updated in the field by downloading the new firmware to the onboard Flash using the Configuration software (GE Zenith Part # 50P-1111). This allows the Modbus card to be updated with new firmware upgrades. The downloading procedure is as follows (See Appendix E for wiring connections):

1. Power down the MX200 and carefully remove the Modbus card. Make sure that you are wearing a grounding wrist strap or following proper electrostatic device handling procedures. Failure to do this may result in damage to the Modbus card.
2. Check to make sure there is no jumper on J4 (Refer to Appendix C for location). If there is, remove it.
3. Connect one end (DB9 female) of the programming adapter (GE Zenith Part # 50P-1103) to the RS232 serial port on the PC.
4. Connect the other end (DB9 male) of the programming adapter to the programmer cable (GE Zenith Part # 50P-1102).
5. Connect the 5-pin connector of the programming cable to the Modbus card's 5-pin header; be sure to line up the brown color wire with pin 1 of Modbus card's 5-pin header.
6. Plug in the AC adapter. This AC adapter provides power throughout the firmware downloading process.
7. Run the Configuration software on the PC.
8. When loaded, check settings in the Configure PC's Serial port section, make changes as needed. The serial port settings are 9600 baud, no parity, 8 data bits and 1 stop bit.
9. Click on the CONFIG button to configure the specified serial port.
10. Click on the DOWNLOAD button to start the downloading firmware process.
11. Answer YES if you are ready to download firmware.
12. Select the GE Zenith Controls supplied ".s19" firmware file (GE Zenith Part # 50P-1112) from the file selection window and click OK. This is the new firmware file that will be downloaded to the card.

Testing a Modbus Network

The Modbus network can be tested using the components in the Modbus Configuration package (GE Zenith Part # 50P-1124). Reference Appendix D for connections.

1. If testing a network consisting of more than one card, make sure that all of the cards are daisy chained as shown in Appendix F. Verify that all Modbus cards are in the run mode (termination jumper J4 must not be installed). Termination jumper (J6) is only installed on the last card on the network.
2. Connect one end (DB9 female) of the RS232/485 converter (GE Zenith Part # 50W-1208) to the PC that contains the Configuration software (GE Zenith Part # 50P-1111). The other end of the cable needs to be connected to the RS485 connector of the Modbus card. Check to make sure that the polarity connections are correct.
3. Run the Configuration software on the PC.
4. Press the TEST button and then verify that the settings in the Communication Settings section match the settings of the Modbus network. If necessary, make changes to the settings and click the NEXT button.
5. The software will now scan the network and display the serial number of all MX200 controllers, which have the Modbus card attached. The user can select any of the listed serial numbers and execute a load test on a controller associated with the selected serial number, but only one controller can be tested at a time.

Appendix A – Read Only Register List

Parameter Name	Holding Register	Coil	Value	Register Type
Status 0	40001			Read-Only
Automatic Transfer Relay		1	1 = On , 0 = Off	Read-Only
ATS Not in Auto Mode		2	1 = Not in Auto	Read-Only
Fault		3		Read-Only
Exerciser Enabled		4	1 = Enabled	Read-Only
Load test running		5	1 = Running	Read-Only
Load, No Load, Fast Load Test status		6	1 = Running	Read-Only
Emergency Source available		7	1 = Available	Read-Only
Normal Source available		8	1 = Available	Read-Only
Status 1	40002			Read-Only
SN limit switch		9	1 = On , 0 = Off	Read-Only
SE limit switch		10	1 = On , 0 = Off	Read-Only
SNO limit switch		11	1 = On , 0 = Off	Read-Only
SEO limit switch		12	1 = On , 0 = Off	Read-Only
Emergency Phase Rotation		13	1 = On , 0 = Off	Read-Only
Normal Phase Rotation		14	1 = On , 0 = Off	Read-Only
Number of Phases on Emergency		15	1 = Three , 0 = Single	Read-Only
Number of Phases on Normal		16	1 = Three , 0 = Single	Read-Only
Status 2	40003			Read-Only
N/A		17		Read-Only
S5 selector switch		18	1 = On , 0 = Off	Read-Only
S12 selector switch		19	1 = On , 0 = Off	Read-Only
Load Shed input		20	1 = On , 0 = Off	Read-Only
Q7 input		21	1 = On , 0 = Off	Read-Only
Q3 input		22	1 = On , 0 = Off	Read-Only
Auxiliary 2 Input		23	1 = On , 0 = Off	Read-Only
Auxiliary 1 Input		24	1 = On , 0 = Off	Read-Only
Timer ID	40004			Read-Only
Timer Bit 0		25	See Table 2	Read-Only
Timer Bit 1		26	See Table 2	Read-Only
Timer Bit 2		27	See Table 2	Read-Only
N/A		28		Read-Only
N/A		29		Read-Only
N/A		30		Read-Only
N/A		31		Read-Only
N/A		32		Read-Only
Timer active		33	1 = Timer running	Read-Only
Normal Position Status		34	1 = Normal Position	Read-Only
Emergency Position Status		35	1 = Emergency Position	Read-Only
MX200 - Mod Card Comm Error		36	1 = Comm Error	Read-Only
N/A		37		Read-Only
N/A		38		Read-Only
N/A		39		Read-Only
N/A		40		Read-Only
Timer Countdown Value	40005		Seconds	Read-Only
Normal Voltage Ph1-Ph2	40006		Volts	Read-Only
Normal Voltage Ph2-Ph3	40007		Volts	Read-Only
Normal Voltage Ph3-Ph1	40008		Volts	Read-Only
Emergency Voltage Ph1-Ph2	40009		Volts	Read-Only
Emergency Voltage Ph2-Ph3	40010		Volts	Read-Only
Emergency Voltage Ph3-Ph1	40011		Volts	Read-Only
Normal Frequency (scaled value)	40013		Freq Value = scaled value/10	Read-Only
Emergency Frequency (scaled value)	40015		Freq Value = scaled value/10	Read-Only
Time On Emergency	40016		Seconds	Read-Only
Number of Transfers	40017			Read-Only
N/A	40018			Read-Only
Serial Number - MSR	40019			Read-Only
Serial Number - LSR	40020			Read-Only
Nominal Full Scale Voltage Value	40021			Read-Only

Appendix A – Read Only Register List *(cont'd)*

Parameter Name	Holding Register	Coil	Value	Register Type
Net Config 0	40022			Read-Only
T3 Timer Bypass Option		41	1 = Configured	Read-Only
T3 Timer Option		42	1 = Configured	Read-Only
W3 Timer Bypass Option		43	1 = Configured	Read-Only
W3 Timer Option		44	1 = Configured	Read-Only
T Timer Bypass Option		45	1 = Configured	Read-Only
W Timer Bypass Option		46	1 = Configured	Read-Only
In Phase Monitor / Closed Transition		47	1 = Configured (Std ATS) 1 = Configured (Delay ATS)	Read-Only
ATS Type		48	1 = Delay , 0 = Standard	Read-Only
Net Config 1	40023			Read-Only
S12 Auto/Manual Option		49	1 = Configured	Read-Only
S5 Auto/Manual Bypass Option		50	1 = Configured	Read-Only
Phase Sequence Check Option		51	1 = Configured	Read-Only
Emg Over Frequency Option		52	1 = Configured	Read-Only
Emg Over Voltage Option		53	1 = Configured	Read-Only
Norm Over Frequency Option		54	1 = Configured	Read-Only
Norm Under Frequency Option		55	1 = Configured	Read-Only
Norm Over Voltage Option		56	1 = Configured	Read-Only
Net Config 2	40024			Read-Only
N/A		57		Read-Only
N/A		58		Read-Only
N/A		59		Read-Only
N/A		60		Read-Only
N/A		61		Read-Only
N/A		62		Read-Only
N/A		63		Read-Only
N/A		64		Read-Only
Normal Voltage Ph1-Ph2	40025		A/D Raw Value (See Note 1)	Read-Only
Normal Voltage Ph2-Ph3	40026		A/D Raw Value (See Note 1)	Read-Only
Normal Voltage Ph3-Ph1	40027		A/D Raw Value (See Note 1)	Read-Only
Emergency Voltage Ph1-Ph2	40028		A/D Raw Value (See Note 1)	Read-Only
Emergency Voltage Ph2-Ph3	40029		A/D Raw Value (See Note 1)	Read-Only
Emergency Voltage Ph3-Ph1	40030		A/D Raw Value (See Note 1)	Read-Only
Normal Period Count	40031		Raw Value Unsigned Integer (See Note 1)	Read-Only
Emergency Period Count	40032		Raw Value Unsigned Integer (See Note 1)	Read-Only

NOTE 1: Registers 40025-40027 (Normal) and 40028-40030 (Emergency) contain unscaled voltage values. In order to obtain a full-scale voltage value, use the following formula:
*Voltage = (A/D Raw Value / 192) * Full Scale Voltage (Register 40021)*

NOTE 2: Registers 40031 (Normal) and 40032 (Emergency) contain unscaled frequency values. In order to obtain a full-scale frequency value, use the following formula: *Scaled Frequency = (20,000,000 / Period Count)*

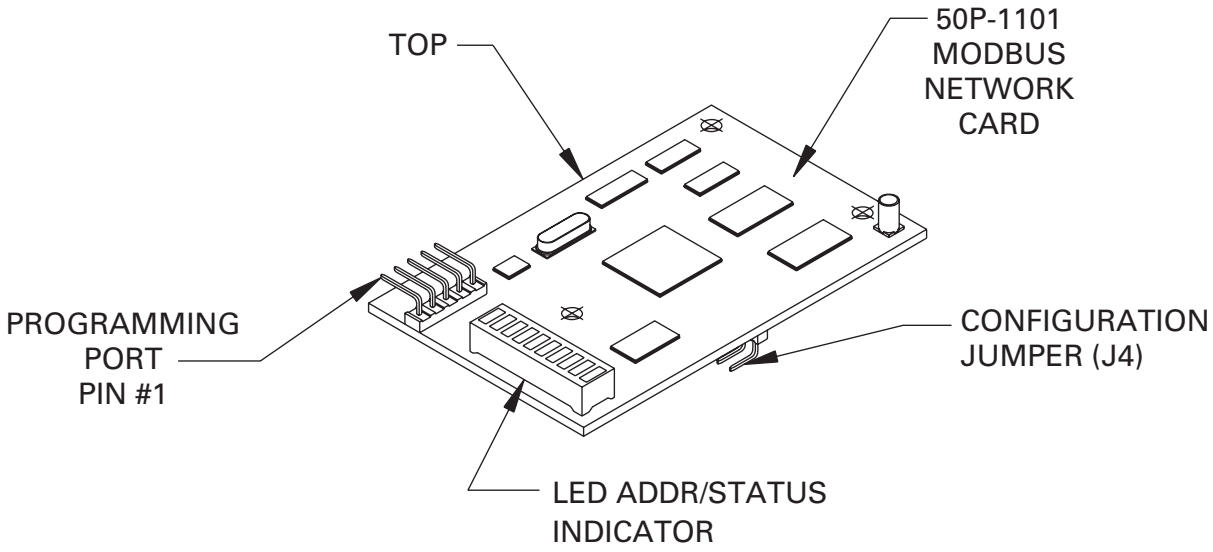
Timer Bits 0, 1, and 2 stand for the specific timer which is counting down during a transfer. The table below shows the combinations of the Timer Bits that make up each timer for a certain type of ATS. Starting from left to right are Timer Bits 2, 1, and 0.

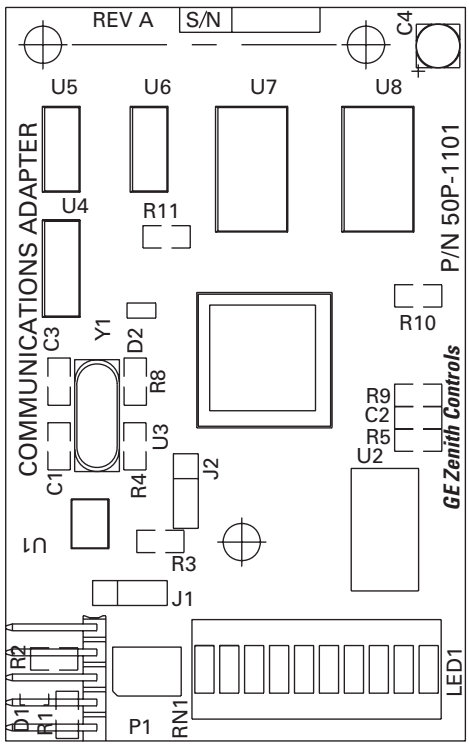
ATS Type	TIMER							
	P	W	W3	DW	T	T3	DT	U
Standard	111	101	N/A	N/A	010	N/A	N/A	000
Standard with Pre-Signal	111	110	101	N/A	011	010	N/A	000
Delay	111	100	N/A	101	001	N/A	010	000
Delay with Pre-Signal	111	110	100	101	011	001	010	000

Table 2 – Timer Bits

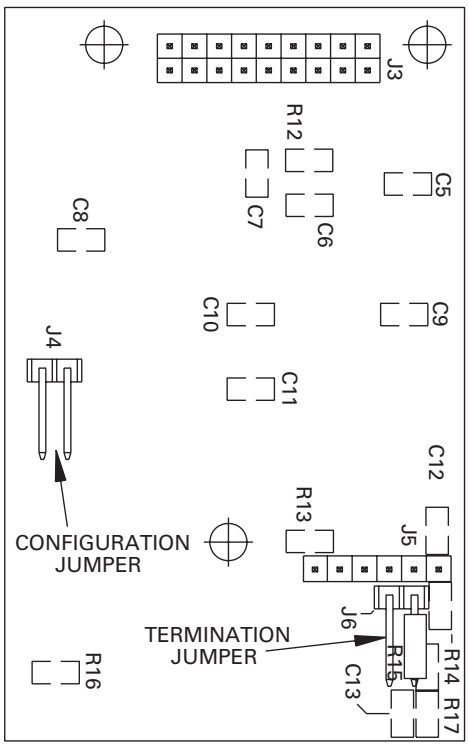
Parameter Name	Holding Register	Coil	Value	Range	Register Type
P time	40033		10 seconds max	0-1000 1/100 of a second	Read/Write
W time	40034		5 minute max	0-300 seconds	Read/Write
W3 time	40035		1 minute max	0-60 seconds	Read/Write
DW time	40036		10 minute max	0-600 seconds	Read/Write
T time	40037		1 hour max	0-3600 seconds	Read/Write
T3 time	40038		1 minute max	0-60 seconds	Read/Write
DT time	40039		10 minute max	0-600 seconds	Read/Write
U time	40040		1 hour max	0-3600 seconds	Read/Write
Normal Pickup Voltage	40041			85-100 percent	Read/Write
Normal Dropout Voltage	40042			75-98 percent	Read/Write
Emergency Pickup Voltage	40043			85-100 percent	Read/Write
Emergency Dropout Voltage	40044			75-98 percent	Read/Write
Normal Pickup Frequency	40045			90-100 percent	Read/Write
Emergency Pickup Frequency	40046			90-100 percent	Read/Write
Net Control 0	40047				Read/Write
N/A		65			Read/Write
N/A		66			Read/Write
N/A		67			Read/Write
YE control		68		1 = On , 0 = Off	Read/Write
YN control		69		1 = On , 0 = Off	Read/Write
No Load Test control		70		1 = On , 0 = Off	Read/Write
Load Test control		71		1 = On , 0 = Off	Read/Write
Fast Load Test control		72		1 = On , 0 = Off	Read/Write
Net Control 1	40048				Read/Write
N/A		73			Read/Write
S5 control		74		1 = On , 0 = Off	Read/Write
S12 control		75		1 = On , 0 = Off	Read/Write
LS control		76		1 = On , 0 = Off	Read/Write
Q7 control		77		1 = On , 0 = Off	Read/Write
Q3 control		78		1 = On , 0 = Off	Read/Write
AUX2 control		79		1 = On , 0 = Off	Read/Write
AUX1 control		80		1 = On , 0 = Off	Read/Write

Appendix C – Modbus Network Card





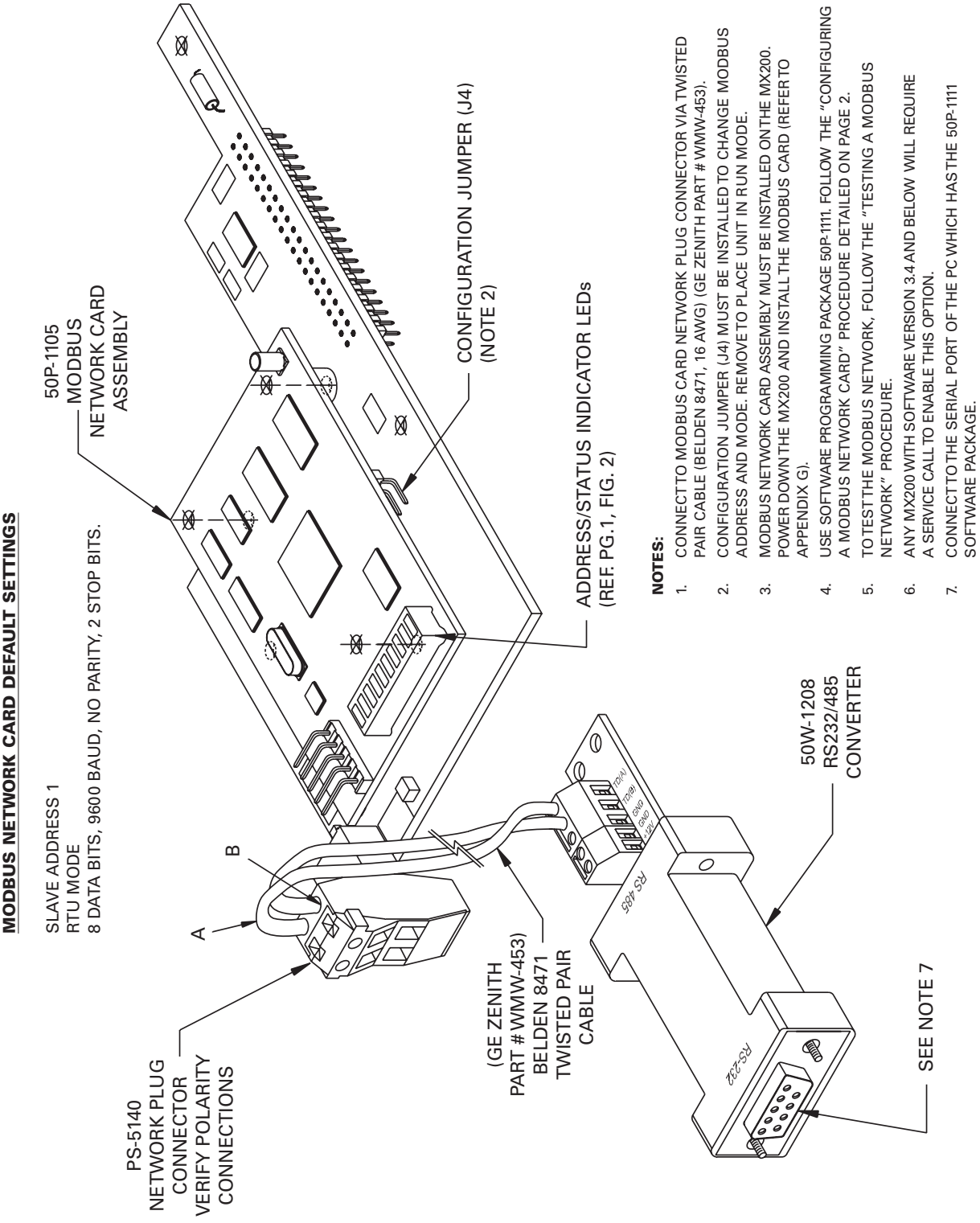
TOP OF MODBUS CARD



BOTTOM OF MODBUS CARD

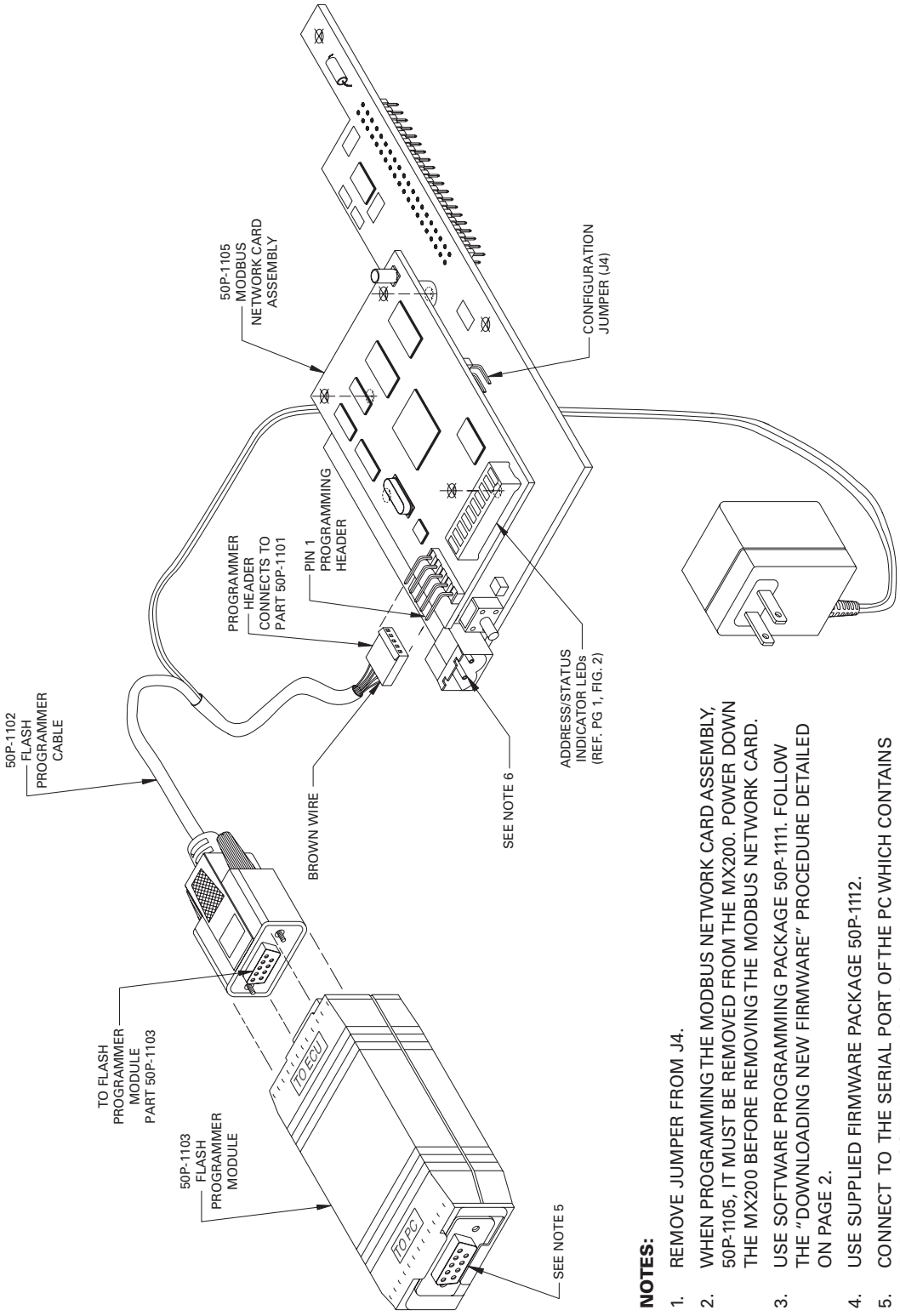
Appendix D

Connections for Configuring and Testing the Modbus Card



Appendix E

Connections for Downloading New Firmware

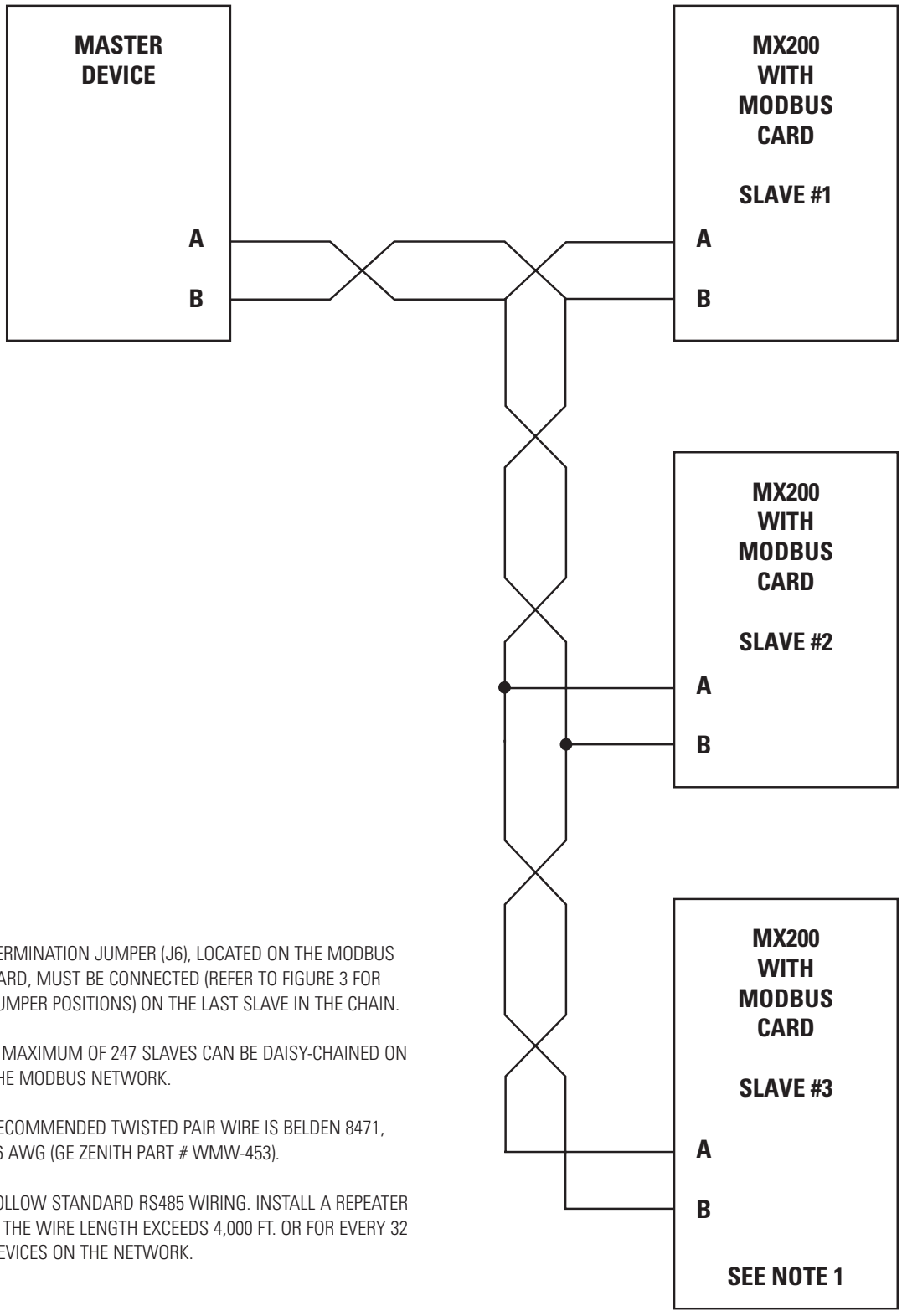


NOTES:

1. REMOVE JUMPER FROM J4.
2. WHEN PROGRAMMING THE MODBUS NETWORK CARD ASSEMBLY, 50P-1105, IT MUST BE REMOVED FROM THE MX200. POWER DOWN THE MX200 BEFORE REMOVING THE MODBUS NETWORK CARD.
3. USE SOFTWARE PROGRAMMING PACKAGE 50P-1111. FOLLOW THE "DOWNLOADING NEW FIRMWARE" PROCEDURE DETAILED ON PAGE 2.
4. USE SUPPLIED FIRMWARE PACKAGE 50P-1112.
5. CONNECT TO THE SERIAL PORT OF THE PC WHICH CONTAINS THE 50P-1111 SOFTWARE PACKAGE.
6. DISCONNECT THE MX200 FROM THE NETWORK BY REMOVING THE NETWORK PLUG CONNECTOR FROM ASSEMBLY.

Appendix F

RS485 Multi-Drop Connection

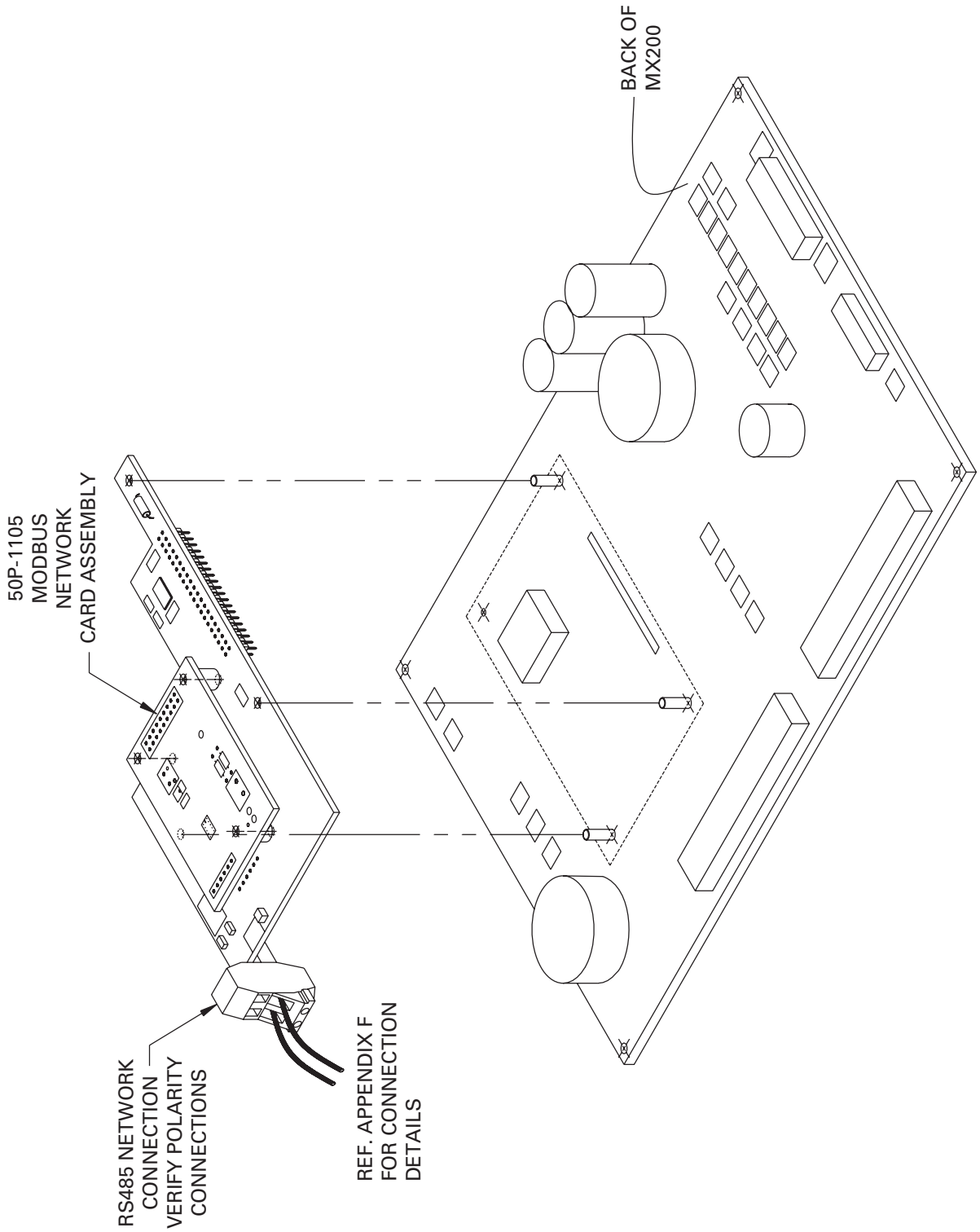


NOTE:

1. TERMINATION JUMPER (J6), LOCATED ON THE MODBUS CARD, MUST BE CONNECTED (REFER TO FIGURE 3 FOR JUMPER POSITIONS) ON THE LAST SLAVE IN THE CHAIN.
2. A MAXIMUM OF 247 SLAVES CAN BE DAISY-CHAINED ON THE MODBUS NETWORK.
3. RECOMMENDED TWISTED PAIR WIRE IS BELDEN 8471, 16 AWG (GE ZENITH PART # WMW-453).
4. FOLLOW STANDARD RS485 WIRING. INSTALL A REPEATER IF THE WIRE LENGTH EXCEEDS 4,000 FT. OR FOR EVERY 32 DEVICES ON THE NETWORK.

Appendix G

Location of Modbus Card on MX200



Appendix H

Modbus Protocol Illustration

For a detailed specification of the Modbus protocol, reference the Modicon website address **"public.modicon.com/support/Support_Pages/modbussupportpage.htm"**.

The Modbus protocol provides the internal standard for parsing messages. During communications on a Modbus network, the protocol determines how each slave will know its device address, recognize a message addressed to it, determine the kind of action to be taken, and extract any data or other information contained in the message. If a reply is required, the slave will construct the reply message and send it using Modbus protocol.

The following is a brief description of the Modbus commands supported by the Modbus Network Card. Each command consists of the following:

- a sample query message that is sent out by the master device to the designated slave
- the slave's reply message to the master device

The query and reply messages show how the information is packeted and sent out using the Modbus Protocol.

Each query message consists of the following:

- *Slave Address* – address of the slave you wish to establish communications with.
- *Function Code* – code that lets the slave know what command is being requested, e.g. read coil, write single coil.
- *Starting Address High/Low Order* – high and low byte of the address the master reads from or writes to. Coils and Registers are addressed starting at 0. For instance Coil 1 is address 0 and Register 1 is address 0.
- *Error Check Field* – contains either a CRC (RTU mode) or LRC (ASCII mode) error check value.

The query message for specific functions requires some of the following information:

- *Number of Data Points High/Low Order* – high and low byte of the number of addresses the master wants to read.
- *Data High/Low Order* – high and low byte of the data that will be written to the slave device.
- Number of Coils High/Low Order – high and low byte for the number of coils to force ON or OFF.
- *Number of Regs High/Low Order* – high and low byte for the number of registers to preset.
- *Byte Count* – is the number of data bytes which are sent to the slave.

These query and reply messages are for both RTU and ASCII modes depending on whether the Error Check Field contains a CRC or LRC respectively. Each value in the query message is a hexadecimal value.

Read Coil Status (Function Code 01)

Query

This function allows the master device to obtain the ON/OFF bit status of various coils from the addressed slave.

Figure H1 is a sample read coil status request to read coils 9-24 (MX200 status bits) from slave device 5.

Slave Address	Function Code	Starting Address *High* Order	Starting Address *Low* Order	No. of Data Points *High* Order	No. of Data Points *Low* Order	Error Check Field (LRC or CRC)
5	01	00	08	00	10	—

Figure H1 – Read Coil Status Query Message

Response

An example response to the Read Coil Satus is shown in *Figure H2*. The response includes the slave address, function code, number of data bytes sent, the data, and error checking.

Slave Address	Function Code	Byte Count	Data Coil Status 9-16	Data Coil Status 17-24	Error Check Field (LRC or CRC)
5	01	02	C1	A2	—

Figure H2 – Read Coil Status Response Message

The data consists of one bit per coil (1=ON, 0=OFF). The status of coils 9-16 is C1 (hex) or 1100 0001 (binary). Reading left to right, coils 16, 15, and 9 are ON and the remainder is OFF. The other data byte is decoded similarly.

Read Holding Register (Function Code 03)

Read holding registers allows the master device to obtain the binary contents of holding registers 4xxxx in the addressed slave.

Query

Figure H3 is an example that reads registers 40006-40007 from slave 8.

Slave Address	Function Code	Starting Address *High* Order	Starting Address *Low* Order	No. of Data Points *High* Order	No. of Data Points *Low* Order	Error Check Field (LRC or CRC)
8	03	00	05	00	02	—

Figure H3 – Read Holding Register Query Message

Modbus Protocol Illustration *(cont'd)*

Response

The slave responds with its address, function code, number of data bytes, and the data. The contents of the registers requested (data) are two bytes each. The first byte includes the high order bits and the second, the low order bits.

Slave Address	Function Code	Byte Count	*High* Order Data	*Low* Order Data	*High* Order Data	*Low* Order Data	Error Check Field (LRC or CRC)
8	03	04	00	76	00	78	—

Figure H4 – Read Holding Register Response Message

Register 40006 , Normal Voltage Ph1-Ph2, has a value of 118 (76 hex) and register 40007, Normal Voltage Ph2-Ph3 has a value of 120 (78 hex).

Write Single Coil (Function Code 05)

This function forces a single coil either ON or OFF. A value of 65,280 (FF00 Hex) will set the coil ON and the value zero will turn it OFF; all other values are illegal and will not affect that coil.

Query

Figure H5 is an example of a request to slave number 3 to turn ON coil 71.

Slave Address	Function Code	Starting Address *High* Order	Starting Address *Low* Order	Data *High* Order	Data *Low* Order	Error Check Field (LRC or CRC)
3	05	00	46	FF	00	—

Figure H5 – Write Single Coil Query Message

Response

The slave's normal response to the Write Single Coil query is to return the original message after the coil state has been altered.

Slave Address	Function Code	Starting Address *High* Order	Starting Address *Low* Order	Data *High* Order	Data *Low* Order	Error Check Field (LRC or CRC)
3	05	00	46	FF	00	—

Figure H6 – Write Single Coil Response Message

Write Single Holding Register (Function Code 06)

This function allows the master to modify the contents of one holding register.

Query

Figure H7 is an example of a request to preset register 40041 (Normal Pickup Voltage) to 92 (00 5C hex) in slave device 17.

Slave Address	Function Code	Starting Address *High* Order	Starting Address *Low* Order	Data *High* Order	Data *Low* Order	Error Check Field (LRC or CRC)
11	06	00	28	00	5C	—

Figure H7 – Write Single Holding Register Query Message

Response

The slave's response to the Write Single Holding Register query is to return the original message after the registers have been altered.

Slave Address	Function Code	Starting Address *High* Order	Starting Address *Low* Order	Data *High* Order	Data *Low* Order	Error Check Field (LRC or CRC)
11	06	00	28	00	5C	—

Figure H8 – Write Single Holding Register Response Message

Write Multiple Coils (Function Code 15)

Forces each coil in a sequence of coils to either ON or OFF. The requested ON/OFF states are specified by contents of the query data field. A logical '1' in a bit position of the field requests the corresponding coil to be ON and a logical '0' requests it to be OFF. Coils are addressed starting at 0. For examples coil 1 is addressed as 0.

Query

The following example is a request to force a series of sixteen coils starting at coil 41 (addressed as 40, or 28 hex) in slave device 9.

The query data contents consist of two bytes: 3C 9B hex (0011 1100 1001 1011 binary). The binary bits correspond to the coils in the following way:

Bit:	0	0	1	1	1	1	0	0		1	0	0	1	1	0	1	1
Coil:	48	47	46	45	44	43	42	41		56	55	54	53	52	51	50	49

The first byte sent (3C hex) addresses coils 41-48, with the least significant bit addressing coil 41. The second byte sent (9B hex) addresses coils 49-56, with the least significant bit addressing coil 49.

Slave Address	Function Code	Starting Address *High* Order	Starting Address *Low* Order	Number of Coils *High* Order	Number of Coils *Low* Order	Byte Count	Data *High* Order	Data *Low* Order	Error Check Field (LRC or CRC)
9	15	00	28	00	10	02	3C	9B	–

Figure H9 – Write Multiple Coils Query Message

Modbus Protocol Illustration *(cont'd)*

Response

The response from the slave is an echo of the slave address, function code, starting address and number of coils forced.

Slave Address	Function Code	Starting Address *High* Order	Starting Address *Low* Order	Number of Coils *High* Order	Number of Coils *Low* Order	Error Check Field (LRC or CRC)
9	15	00	28	00	10	—

Figure H10 – Write Multiple Coils Response Message

Write Multiple Holding Registers (Function Code 16)

Presets values into a sequence of holding registers.

Query

The following is an example to preset two registers starting at 40034 (W-Time) to 9 hex (9 seconds) and 40035 (W3-time) to 32 hex (50 seconds), in slave device 17.

Slave Address	Function Code	Starting Address *High* Order	Starting Address *Low* Order	Number of Regs *High* Order	Number of Regs *Low* Order	Byte Count	Data *High* Order	Data *Low* Order	Data *High* Order	Data *Low* Order	Error Check Field (LRC or CRC)
11	16	00	21	00	02	04	00	09	00	32	–

Figure H11 – Write Multiple Registers Query Message

Response

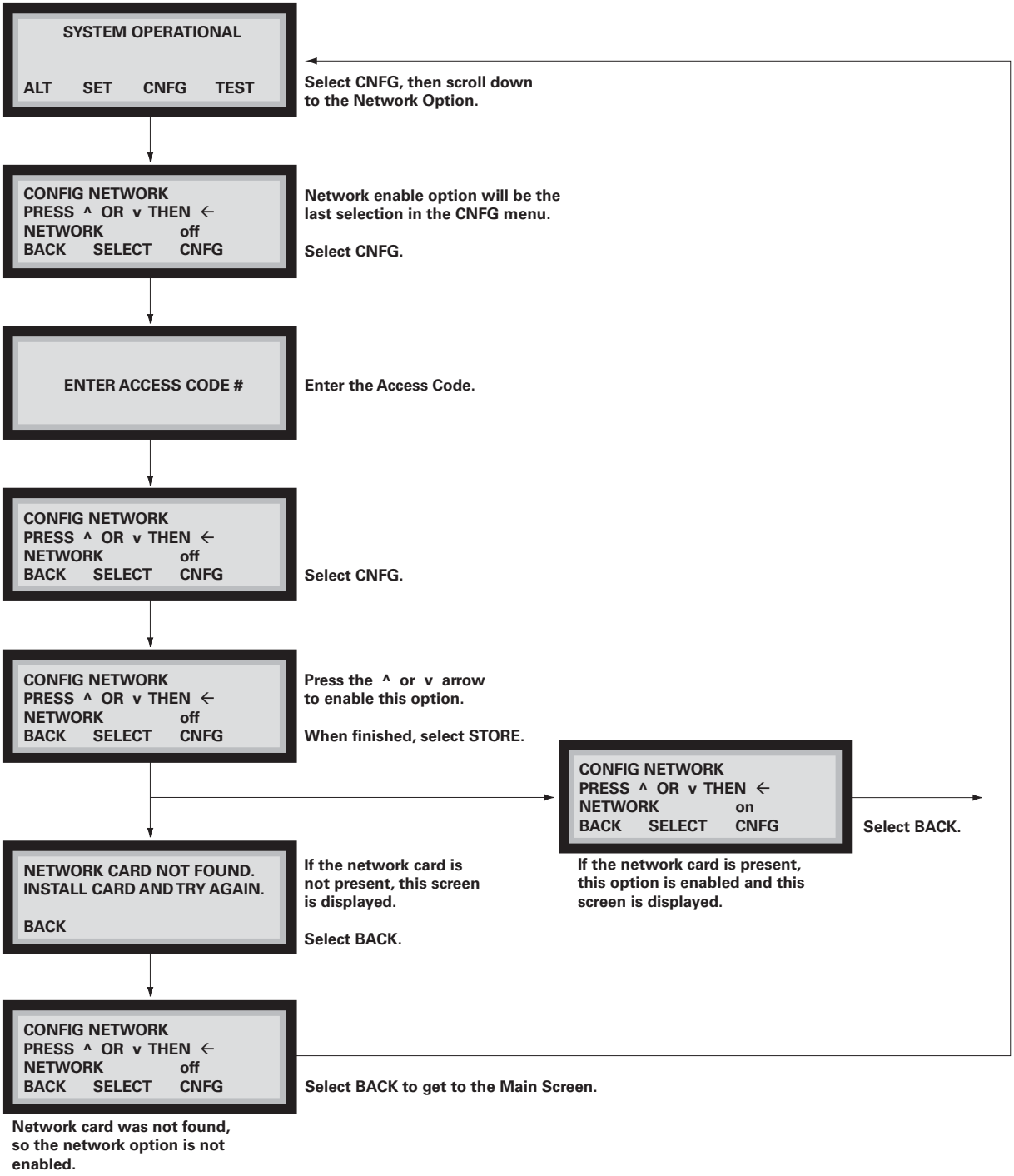
The response from the slave is an echo of the slave address, function code, starting address and number of registers to be loaded.

Slave Address	Function Code	Starting Address *High* Order	Starting Address *Low* Order	Number of Regs *High* Order	Number of Regs *Low* Order	Error Check Field (LRC or CRC)
11	16	00	21	00	02	—

Figure H12 – Write Multiple Registers Response Message

Appendix I

MX200 Menus *(for MX200 Versions 3.5 and Higher)*



Troubleshooting

Problem	Possible Cause	Corrective Action
Trouble downloading firmware	Modbus card is installed on the MX200 and it has power going to it.	Remove the Modbus card from the MX200, and make sure it has no power and retry the download.
	Configuration jumper, J4, is installed.	Remove the J4 jumper.
	Flash programmer cable is not connected correctly to the Modbus cards' programming header.	See **Appendix E** for the proper connections. Make sure when inserting the programmer cable header to the Modbus card's programming header, that the brown wire lines up with pin 1.
	Flash programmer module is not connected correctly to the Flash programmer cable.	See **Appendix E** for the proper connections. Make sure that the end labeled "TO PC" on the programmer module is connected to the PC's serial port and the other end goes to the programmer cable.
	Wrong COM port or baud rate.	Select the correct COM port and baud rate.
	Power supply for the Flash programmer cable is not connected to an AC outlet.	Connect the power supply to an AC outlet.
Trouble configuring the Modbus card	Modbus card is not installed on the MX200.	Install the Modbus card on the MX200.
	MX200 does not have power.	Power up the MX200.
	Configuration jumper, J4, is not installed.	Install the configuration jumper J4.
	Wire between the RS232/485 converter and Modbus card is not connected.	See **Appendix D** for the proper connections. Connect the twisted wire between the converter and the Modbus card.
	Polarity connections are incorrect.	Make sure that A on the Modbus card is connected to A on the converter and B is connected to B.
	Wrong COM port or baud rate.	Select the correct COM port and baud rate.
	RS232/485 converter is not connected to the PC.	Connect the RS232/485 converter to the PC's serial port.
No communications between the MX200 Modbus card and the Master device	MX200 does not have power.	Power up the MX200 controller.
	Communicating with the wrong addressed slave.	Verify that the address on the Modbus card matches the address you are communicating with. See Figure 2 for reference.
	Network wire connection from the Master to the Modbus card is broken or the wire is not connected to the Modbus card.	Check the wire connection from the Master to the Modbus card. Connect the wire to the Network card if necessary.
	Not using the twisted pair wire to make the network connection.	Make sure that the wire is a twisted pair wire (Belden 8471, 16 AWG) (GE Zenith Part # WMW-453).
	Configuration jumper, J4, is installed.	Remove the J4 configuration jumper.
	Proper polarity markings are not being followed.	Connect A to A and B to B on the network, reference Appendix F.
	Termination jumper, J6, is not installed on the last slave in the chain.	Install the termination jumper, J6, on the last slave in the chain. Make sure no other devices have jumper J6 installed.
	Modbus card communication configuration does not match the Master's.	Verify that the Master and Modbus card slave have the same baud rate, data bits, parity, stop bits and ASCII or RTU protocol selected.
	Twisted pair wire length exceeded 4,000 ft.	Install repeater if wire length exceeds 4,000 ft.
	RS485 multi-drop consists of more than 32 devices.	Install one repeater for every 32 devices on the network.
	MX200 network option not enabled.	Call **GE Zenith Controls** Technical Support.
All LED's on the LED module are off.	Modbus card is not installed on the MX200.	Install the Modbus card on the MX200.
	MX200 does not have power.	Power up the MX200 controller.
	The Modbus card is damaged.	Call **GE Zenith Controls** Technical Support.

Bill of Materials

Components for the Modbus Option (ZNET200M)

	Part Description	GE Zenith Part Number	Quantity
Assembly	Modbus Network Card Assembly	50P-1105	1
Individual Replacement Components	Modbus Network Card	50P-1101	1
	MX200 Network Adapter Card	50P-1048	1
	Network Plug Connector	PS-5140	1
	Miniature Support Post	PS-7363	3
	Operations and Maintenance Manual	50R-2200	1

Components for the Modbus Card Configuration

	Part Description	GE Zenith Part Number	Quantity
Assembly	Modbus Card Configuration Assembly	50P-1124	1
Individual Replacement Components	RS232/485 Converter	50W-1208	1
	Belden 8471 Twisted Pair Cable	WMW-453	6 Feet
	Network Plug Connector	PS-5140	1
	Configuration Software for Modbus Communications Card	50P-1111	1
	Operations and Maintenance Manual	50R-2200	1

Components for Downloading New Firmware

	Part Description	GE Zenith Part Number	Quantity
Assembly	Firmware Download Assembly	50P-1125	1
Individual Replacement Components	Flash Programmer Module	50P-1103	1
	Flash Programmer Cable	50P-1102	1
	Configuration Software for Modbus Communications Card	50P-1111	1
	Modbus Communications Card Firmware	50P-1112	1
	Operations and Maintenance Manual	50R-2200	1

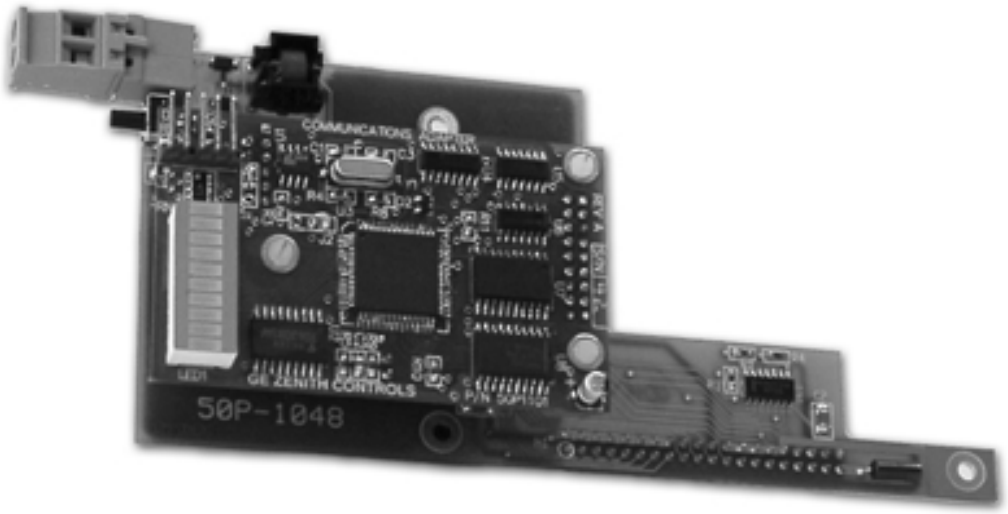


GE Zenith Controls

GE Industrial Systems – Power Equipment Business
General Electric Company
830 West 40th Street, Chicago, IL 60609 USA
773 299-6600, Fax: 773 247-7805
www.zenithcontrols.com

MX200 SERIES
Modbus Card – 50P-1105

GE Zenith Controls



50R-2200-(addendum)
3/02

Operation and Maintenance Manual

Table of Contents

Page

Overview 1
- LED Indicator 2

Installation 3
- Installing the Network Card on the MX200 3
- Termination Resistor 3
- Configuring a Modbus Network Card 3
- Downloading New Firmware 4
- Testing a Modbus Network 4

Appendix A – Read Only Register List 5
Appendix B – Read/Write Register List 7
Appendix C – Modbus Network Card 8
Appendix D – Connections for Configuring and Testing the Modbus Card 9
Appendix E – Connections for Downloading New Firmware 10
Appendix F – RS485 Multi-Drop Connection 11
Appendix G – Location of Modbus Card on MX200 12
Appendix H – Modbus Protocol Illustration 13
Appendix I – MX200 Menus 16
Troubleshooting 17
Bill of Materials 18
- Components for the Modbus Option (ZNET200M) 18
- Components for the Modbus Card Configuration 18
- Components for Downloading New Firmware 18

Disclaimer

GE Zenith Controls disclaims any and all liability for use of third-party application software that will be used to control the Automatic Transfer Switches.

⚠ WARNING ⚠

Automatic Transfer Switches are often used in critical applications. Failure of an ATS to operate properly could cause serious personal injury (including death) and property damage. Therefore, extreme caution must be used when designing or using programming software that will communicate with the ATS. Improper use of the Modbus network variables will cause the Automatic Transfer Switch to malfunction. Always conduct a full test and debug of the programming software prior to installing and using it in the system.

Overview

The Modbus card is a network card designed for the MX200. If the MX200 is ordered with the Modbus option, the Modbus card will reside on the back of the MX200 board and it will be part of the MX200 assembly. The purpose of this card is to allow the MX200 to be available on a Modbus network as a slave device. This allows a master device, such as a programmable logic controller (PLC), to obtain information from the MX200 and have that information available for control, data acquisition and monitoring.

Every Modbus network consists of one master device and at least one slave device. All devices on the network are daisy-chained using a twisted pair cable (see Appendix F). Each slave device is assigned a unique address (factory default for each MX200 Modbus card is Slave Address 1), which is a number from 1-247. This number enables the master to distinguish between the various slaves on the network. It also allows the master device to send a query command to the addressed slave. When the addressed slave receives this command it will send back an appropriate response to the master. *Table 1* shows a list of Modbus commands which the MX200 Modbus network card supports. Reference Appendix H for a more detailed description of the Modbus commands.

Modbus Command	Modbus Command Description
01	Read Coil Status
03	Read Holding Register
05	Write Single Coil
06	Write Single Holding Register
15	Write Multiple Coils
16	Write Multiple Holding Registers

Table 1 – Supported Modbus Commands

The Modbus commands allow the master device to read data from, and write data to, specific memory locations in the MX200. These memory locations, which are listed in Appendix A and B, make up the Modbus network variables for the MX200. These variables allow the reading of MX200 status, configuration, voltage and frequency, serial number, time on emergency, number of transfers, timer values, and pickup/dropout settings. The variables, which can be written to (reference Appendix B), include timer values, pickup/dropout settings, and control variables. Appendix A lists the Read Only memory locations and Appendix B lists the Read/Write memory locations in the MX200.

Both lists contain the Parameter Name column that displays the name of the memory locations. The non-indented names in that column are 16-bit registers while the indented ones are individual bits, which make up the 16-bit registers. For example, Status 0, a non-indented name, is a 16-bit register that consists of the following eight bits:

- Automatic Transfer Relay
- ATS Not in Auto Mode
- Fault
- Exerciser Enabled
- Load Test Running
- Normal Source Available
- Load, No Load, Fast Load Test Status
- Emergency Source Available

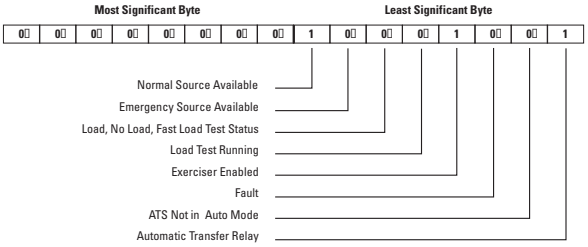


Figure 1 – Status 0 Register

These eight bits make up the least significant byte of the Status 0 register, while the most significant byte of the Status 0 register contains zeros. *Figure 1* shows an example of what the Master device would see if it read back the entire Status 0 register. In this example, the Master device would read back the decimal value of 137 from the Status 0 register. When this value is decoded, the Master finds out that the normal source is available, the exerciser is on and the automatic transfer relay is on. The Master also has the option of reading the individual bits, indented under Status0. This allows the Master to know the status of each parameter without doing any decoding. The second column contains the actual addresses for the network variables. These addresses are used when the Master is reading a Holding Register (16-bit reg). The third column contains addresses that are used when the Master is reading a Coil (individual bit). The remaining columns show the values, ranges (only in Appendix B) and register types for the network variables.

LED Indicator

The Modbus card has a 10-segment LED module (Refer to Appendix E for location). These LED's display the slave address of the card as well as the transmit and receive status. The first LED from the bottom indicates the receive status. The second LED indicates the transmit status. When a Modbus packet has been successfully transmitted or received, the associated LED will light for 100ms. If another packet is sent or received before the 100ms elapses, the LED on time will be extended by another 100ms. LED's 3-10 display the slave address of the MX200 as a binary number with each LED corresponding to a bit. *Figure 2* shows the 10-segment LED module along with LED's 3, 5, and 6 being lit. The lit LED's correspond to slave address 13 for the MX200.

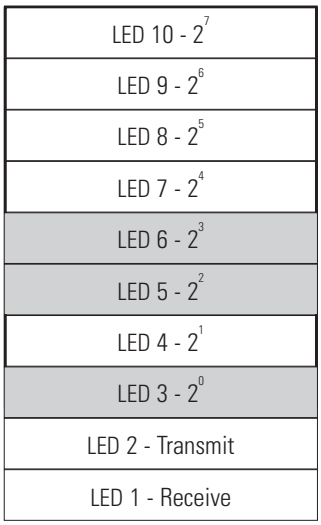


Figure 2 – LED Module

Installation

Installing the Network Card on the MX200

If the Modbus network card is not installed on the MX200, do the following to install it:

1. Open the ATS cabinet. If the ATS has power going to it, be EXTREMELY cautious not to touch any energized parts.
2. Unscrew the black metal cover from the back of the MX200. Be sure not to lose any screws.
3. Remove the two Engine Start wires from the P-Relay(s) if applicable (not applicable in Utility-Utility applications). Use electrical tape to tape over the exposed ends of both wires.
4. Remove the J5 and J6 plugs from the MX200 (located on bottom of board), this will remove power from the MX200. When power is removed from the MX200, the ATS will not transfer.
5. Obtain a grounding wrist strap and put the elastic end of the strap on your wrist. Attach the alligator clip end to the MX200 chassis or an equivalent earth ground.
6. Remove the three screws from the metal standoffs on the MX200. Connect the Modbus network card to the MX200 and fasten it to the controller with the three screws (Reference Appendix G).
7. Once the Modbus card is installed connect the J5 and J6 plugs back into the MX200.
8. Screw the black metal cover back on and connect the two Engine Start wires to the P-Relay(s) if applicable.
9. Close the ATS cabinet.
10. Once the MX200 has power, the network option needs to be enabled. Go into the CNFG menu and enable the network option (Reference Appendix I).
11. When the network option is enabled, exit the CNFG menu.

Termination Resistor

Located on the bottom of the Modbus card is jumper J6 (See Appendix C), which enables or disables a termination resistor on the board *(Figure 3)*. Jumper J6 is disabled when it comes from the factory.

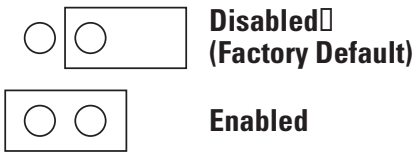


Figure 3 Jumper J6

The only time that Jumper J6 should be enabled is when its corresponding Modbus card is the last device on the network.

Installation *(cont'd)*

Downloading New Firmware

The Modbus Network card firmware can be updated in the field by downloading the new firmware to the onboard Flash using the Configuration software (GE Zenith Part # 50P-1111). This allows the Modbus card to be updated with new firmware upgrades. The downloading procedure is as follows (See Appendix E for wiring connections):

1. Power down the MX200 and carefully remove the Modbus card. Make sure that you are wearing a grounding wrist strap or following proper electrostatic device handling procedures. Failure to do this may result in damage to the Modbus card.
2. Check to make sure there is no jumper on J4 (Refer to Appendix C for location). If there is, remove it.
3. Connect one end (DB9 female) of the programming adapter (GE Zenith Part # 50P-1103) to the RS232 serial port on the PC.
4. Connect the other end (DB9 male) of the programming adapter to the programmer cable (GE Zenith Part # 50P-1102).
5. Connect the 5-pin connector of the programming cable to the Modbus card's 5-pin header; be sure to line up the brown color wire with pin 1 of Modbus card's 5-pin header.
6. Plug in the AC adapter. This AC adapter provides power throughout the firmware downloading process.
7. Run the Configuration software on the PC.
8. When loaded, check settings in the Configure PC's Serial port section, make changes as needed. The serial port settings are 9600 baud, no parity, 8 data bits and 1 stop bit.
9. Click on the CONFIG button to configure the specified serial port.
10. Click on the DOWNLOAD button to start the downloading firmware process.
11. Answer YES if you are ready to download firmware.
12. Select the GE Zenith Controls supplied ".s19" firmware file (GE Zenith Part # 50P-1112) from the file selection window and click OK. This is the new firmware file that will be downloaded to the card.

Testing a Modbus Network

The Modbus network can be tested using the components in the Modbus Configuration package (GE Zenith Part # 50P-1124). Reference Appendix D for connections.

1. If testing a network consisting of more than one card, make sure that all of the cards are daisy chained as shown in Appendix F. Verify that all Modbus cards are in the run mode (termination jumper J4 must not be installed). Termination jumper (J6) is only installed on the last card on the network.
2. Connect one end (DB9 female) of the RS232/485 converter (GE Zenith Part # 50W-1208) to the PC that contains the Configuration software (GE Zenith Part # 50P-1111). The other end of the cable needs to be connected to the RS485 connector of the Modbus card. Check to make sure that the polarity connections are correct.
3. Run the Configuration software on the PC.
4. Press the TEST button and then verify that the settings in the Communication Settings section match the settings of the Modbus network. If necessary, make changes to the settings and click the NEXT button.
5. The software will now scan the network and display the serial number of all MX200 controllers, which have the Modbus card attached. The user can select any of the listed serial numbers and execute a load test on a controller associated with the selected serial number, but only one controller can be tested at a time.

Appendix A – Read Only Register List

Parameter Name	Holding Register	Coil	Value	Register Type
Status 0	40001			Read-Only
Automatic Transfer Relay		1	1 = On , 0 = Off	Read-Only
ATS Not in Auto Mode		2	1 = Not in Auto	Read-Only
Fault		3		Read-Only
Exerciser Enabled		4	1 = Enabled	Read-Only
Load test running		5	1 = Running	Read-Only
Load, No Load, Fast Load Test status		6	1 = Running	Read-Only
Emergency Source available		7	1 = Available	Read-Only
Normal Source available		8	1 = Available	Read-Only
Status 1	40002			Read-Only
SN limit switch		9	1 = On , 0 = Off	Read-Only
SE limit switch		10	1 = On , 0 = Off	Read-Only
SNO limit switch		11	1 = On , 0 = Off	Read-Only
SEO limit switch		12	1 = On , 0 = Off	Read-Only
Emergency Phase Rotation		13	1 = On , 0 = Off	Read-Only
Normal Phase Rotation		14	1 = On , 0 = Off	Read-Only
Number of Phases on Emergency		15	1 = Three , 0 = Single	Read-Only
Number of Phases on Normal		16	1 = Three , 0 = Single	Read-Only
Status 2	40003			Read-Only
N/A		17		Read-Only
S5 selector switch		18	1 = On , 0 = Off	Read-Only
S12 selector switch		19	1 = On , 0 = Off	Read-Only
Load Shed input		20	1 = On , 0 = Off	Read-Only
Q7 input		21	1 = On , 0 = Off	Read-Only
Q3 input		22	1 = On , 0 = Off	Read-Only
Auxiliary 2 Input		23	1 = On , 0 = Off	Read-Only
Auxiliary 1 Input		24	1 = On , 0 = Off	Read-Only
Timer ID	40004			Read-Only
Timer Bit 0		25	See Table 2	Read-Only
Timer Bit 1		26	See Table 2	Read-Only
Timer Bit 2		27	See Table 2	Read-Only
N/A		28		Read-Only
N/A		29		Read-Only
N/A		30		Read-Only
N/A		31		Read-Only
N/A		32		Read-Only
Timer active		33	1 = Timer running	Read-Only
Normal Position Status		34	1 = Normal Position	Read-Only
Emergency Position Status		35	1 = Emergency Position	Read-Only
MX200 - Mod Card Comm Error		36	1 = Comm Error	Read-Only
N/A		37		Read-Only
N/A		38		Read-Only
N/A		39		Read-Only
N/A		40		Read-Only
Timer Countdown Value	40005		Seconds	Read-Only
Normal Voltage Ph1-Ph2	40006		Volts	Read-Only
Normal Voltage Ph2-Ph3	40007		Volts	Read-Only
Normal Voltage Ph3-Ph1	40008		Volts	Read-Only
Emergency Voltage Ph1-Ph2	40009		Volts	Read-Only
Emergency Voltage Ph2-Ph3	40010		Volts	Read-Only
Emergency Voltage Ph3-Ph1	40011		Volts	Read-Only
Normal Frequency (scaled value)	40013		Freq Value = scaled value/10	Read-Only
Emergency Frequency (scaled value)	40015		Freq Value = scaled value/10	Read-Only
Time On Emergency	40016		Seconds	Read-Only
Number of Transfers	40017			Read-Only
N/A	40018			Read-Only
Serial Number - MSR	40019			Read-Only
Serial Number - LSR	40020			Read-Only
Nominal Full Scale Voltage Value	40021			Read-Only

Appendix A – Read Only Register List *(cont'd)*

Parameter Name	Holding Register	Coil	Value	Register Type
Net Config 0	40022			Read-Only
T3 Timer Bypass Option		41	1 = Configured	Read-Only
T3 Timer Option		42	1 = Configured	Read-Only
W3 Timer Bypass Option		43	1 = Configured	Read-Only
W3 Timer Option		44	1 = Configured	Read-Only
T Timer Bypass Option		45	1 = Configured	Read-Only
W Timer Bypass Option		46	1 = Configured	Read-Only
In Phase Monitor / Closed Transition		47	1 = Configured (Std ATS) 1 = Configured (Delay ATS)	Read-Only
ATS Type		48	1 = Delay , 0 = Standard	Read-Only
Net Config 1	40023			Read-Only
S12 Auto/Manual Option		49	1 = Configured	Read-Only
S5 Auto/Manual Bypass Option		50	1 = Configured	Read-Only
Phase Sequence Check Option		51	1 = Configured	Read-Only
Emg Over Frequency Option		52	1 = Configured	Read-Only
Emg Over Voltage Option		53	1 = Configured	Read-Only
Norm Over Frequency Option		54	1 = Configured	Read-Only
Norm Under Frequency Option		55	1 = Configured	Read-Only
Norm Over Voltage Option		56	1 = Configured	Read-Only
Net Config 2	40024			Read-Only
N/A		57		Read-Only
N/A		58		Read-Only
N/A		59		Read-Only
N/A		60		Read-Only
N/A		61		Read-Only
N/A		62		Read-Only
N/A		63		Read-Only
N/A		64		Read-Only
Normal Voltage Ph1-Ph2	40025		A/D Raw Value (See Note 1)	Read-Only
Normal Voltage Ph2-Ph3	40026		A/D Raw Value (See Note 1)	Read-Only
Normal Voltage Ph3-Ph1	40027		A/D Raw Value (See Note 1)	Read-Only
Emergency Voltage Ph1-Ph2	40028		A/D Raw Value (See Note 1)	Read-Only
Emergency Voltage Ph2-Ph3	40029		A/D Raw Value (See Note 1)	Read-Only
Emergency Voltage Ph3-Ph1	40030		A/D Raw Value (See Note 1)	Read-Only
Normal Period Count	40031		Raw Value Unsigned Integer (See Note 1)	Read-Only
Emergency Period Count	40032		Raw Value Unsigned Integer (See Note 1)	Read-Only

NOTE1: Registers 40025-40027 (Normal) and 40028-40030 (Emergency) contain unscaled voltage values. In order to obtain a full-scale voltage value, use the following formula:
*Voltage = (A/D Raw Value / 192) * Full Scale Voltage (Register 40021)*

NOTE2: Registers 40031 (Normal) and 40032 (Emergency) contain unscaled frequency values. In order to obtain a full-scale frequency value, use the following formula: *Scaled Frequency = (20,000,000 / Period Count)*

Timer Bits 0, 1, and 2 stand for the specific timer which is counting down during a transfer. The table below shows the combinations of the Timer Bits that make up each timer for a certain type of ATS. Starting from left to right are Timer Bits 2, 1, and 0.

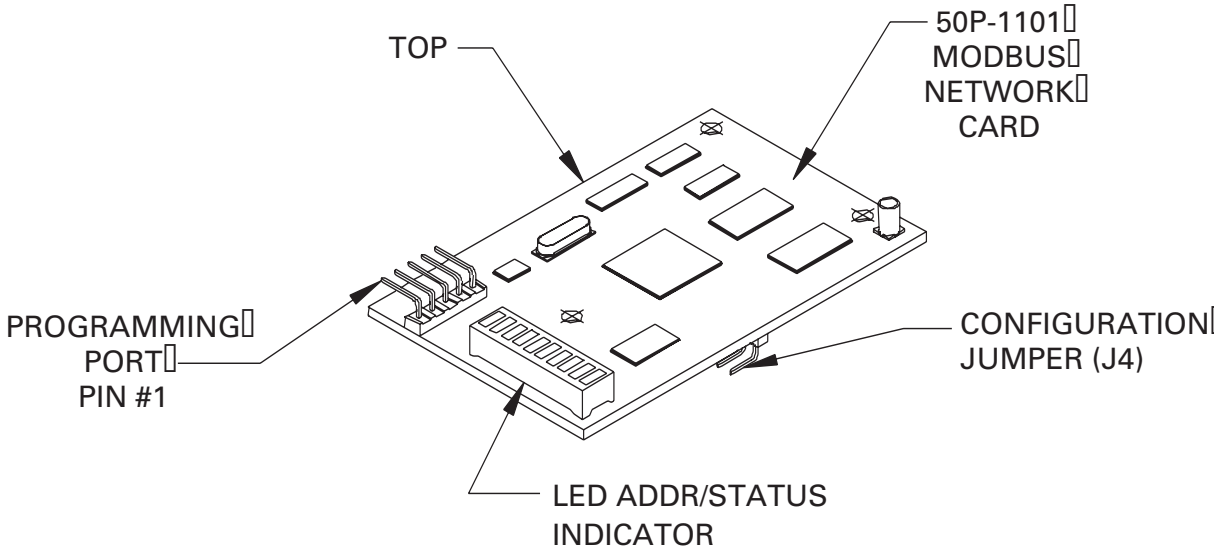
ATS Type	TIMER							
	P	W	W3	DW	T	T3	DT	U
Standard	111	101	N/A	N/A	010	N/A	N/A	000
Standard with Pre-Signal	111	110	101	N/A	011	010	N/A	000
Delay	111	100	N/A	101	001	N/A	010	000
Delay with Pre-Signal	111	110	100	101	011	001	010	000

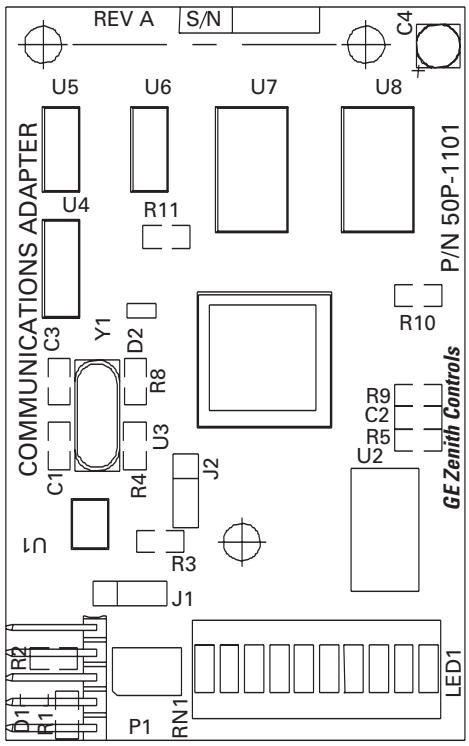
Table 2 Timer Bits

Appendix B – Read/Write Register List

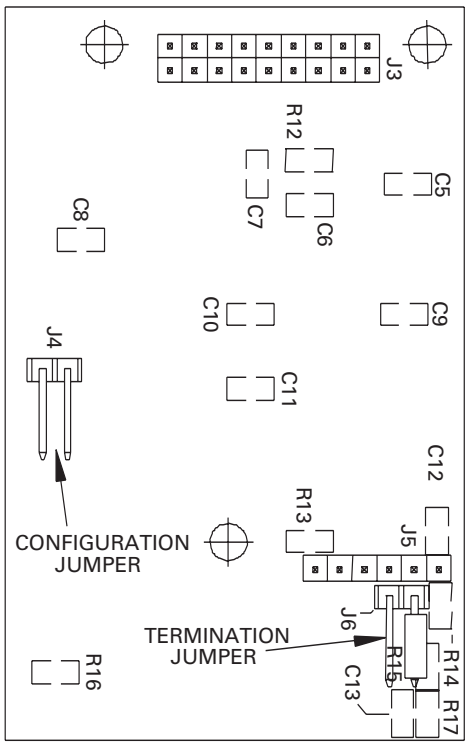
Parameter Name	Holding Register	Coil	Value	Range	Register Type
P time	40033		10 seconds max	0-1000 1/100 of a second	Read/Write
W time	40034		5 minute max	0-300 seconds	Read/Write
W3 time	40035		1 minute max	0-60 seconds	Read/Write
DW time	40036		10 minute max	0-600 seconds	Read/Write
T time	40037		1 hour max	0-3600 seconds	Read/Write
T3 time	40038		1 minute max	0-60 seconds	Read/Write
DT time	40039		10 minute max	0-600 seconds	Read/Write
U time	40040		1 hour max	0-3600 seconds	Read/Write
Normal Pickup Voltage	40041			85-100 percent	Read/Write
Normal Dropout Voltage	40042			75-98 percent	Read/Write
Emergency Pickup Voltage	40043			85-100 percent	Read/Write
Emergency Dropout Voltage	40044			75-98 percent	Read/Write
Normal Pickup Frequency	40045			90-100 percent	Read/Write
Emergency Pickup Frequency	40046			90-100 percent	Read/Write
Net Control 0	40047				Read/Write
N/A		65			Read/Write
N/A		66			Read/Write
N/A		67			Read/Write
YE control		68		1 = On , 0 = Off	Read/Write
YN control		69		1 = On , 0 = Off	Read/Write
No Load Test control		70		1 = On , 0 = Off	Read/Write
Load Test control		71		1 = On , 0 = Off	Read/Write
Fast Load Test control		72		1 = On , 0 = Off	Read/Write
Net Control 1	40048				Read/Write
N/A		73			Read/Write
S5 control		74		1 = On , 0 = Off	Read/Write
S12 control		75		1 = On , 0 = Off	Read/Write
LS control		76		1 = On , 0 = Off	Read/Write
Q7 control		77		1 = On , 0 = Off	Read/Write
Q3 control		78		1 = On , 0 = Off	Read/Write
AUX2 control		79		1 = On , 0 = Off	Read/Write
AUX1 control		80		1 = On , 0 = Off	Read/Write

Appendix C – Modbus Network Card





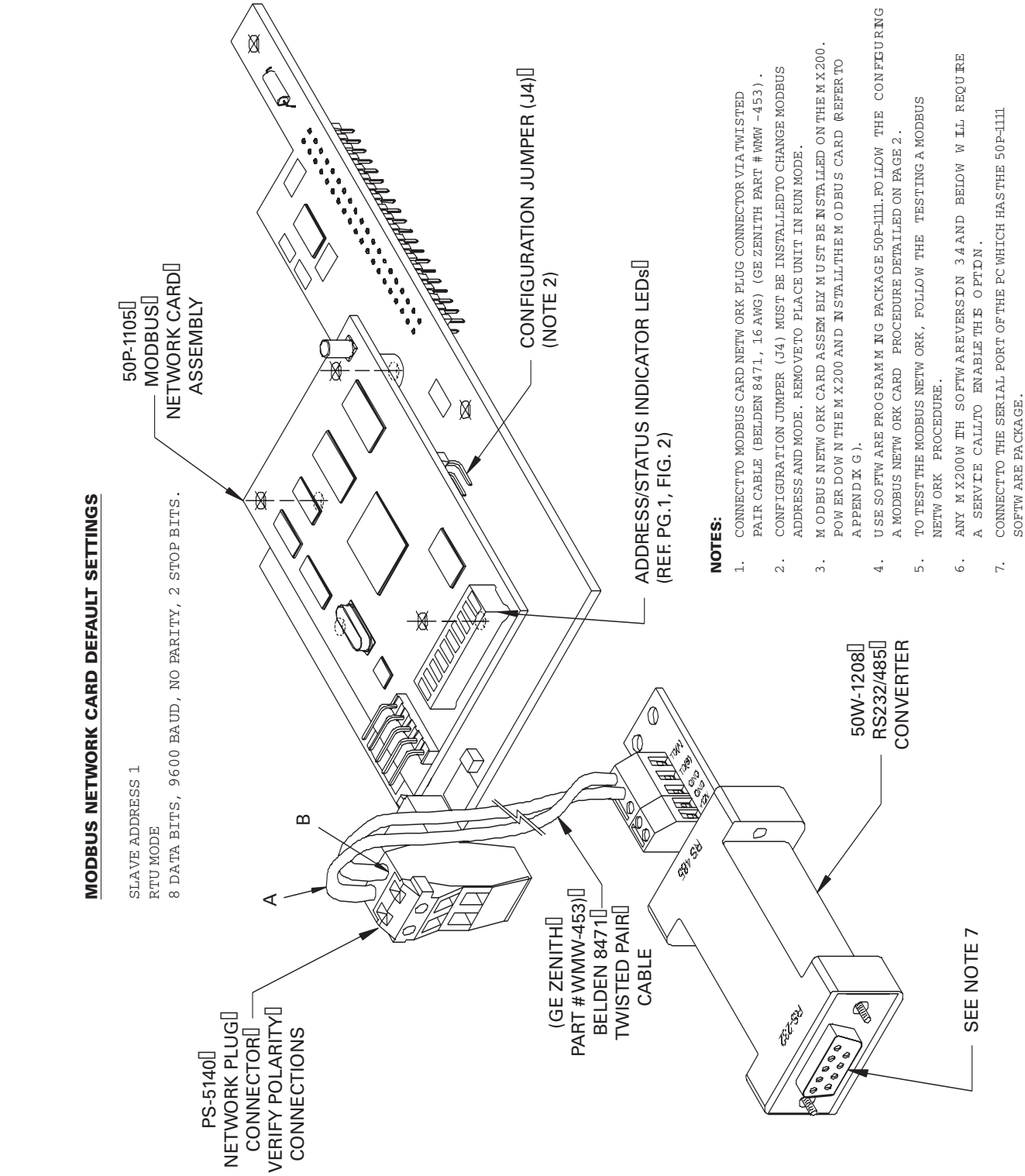
TOP OF MODBUS CARD



BOTTOM OF MODBUS CARD

Appendix D

Connections for Configuring and Testing the Modbus Card



MODBUS NETWORK CARD DEFAULT SETTINGS

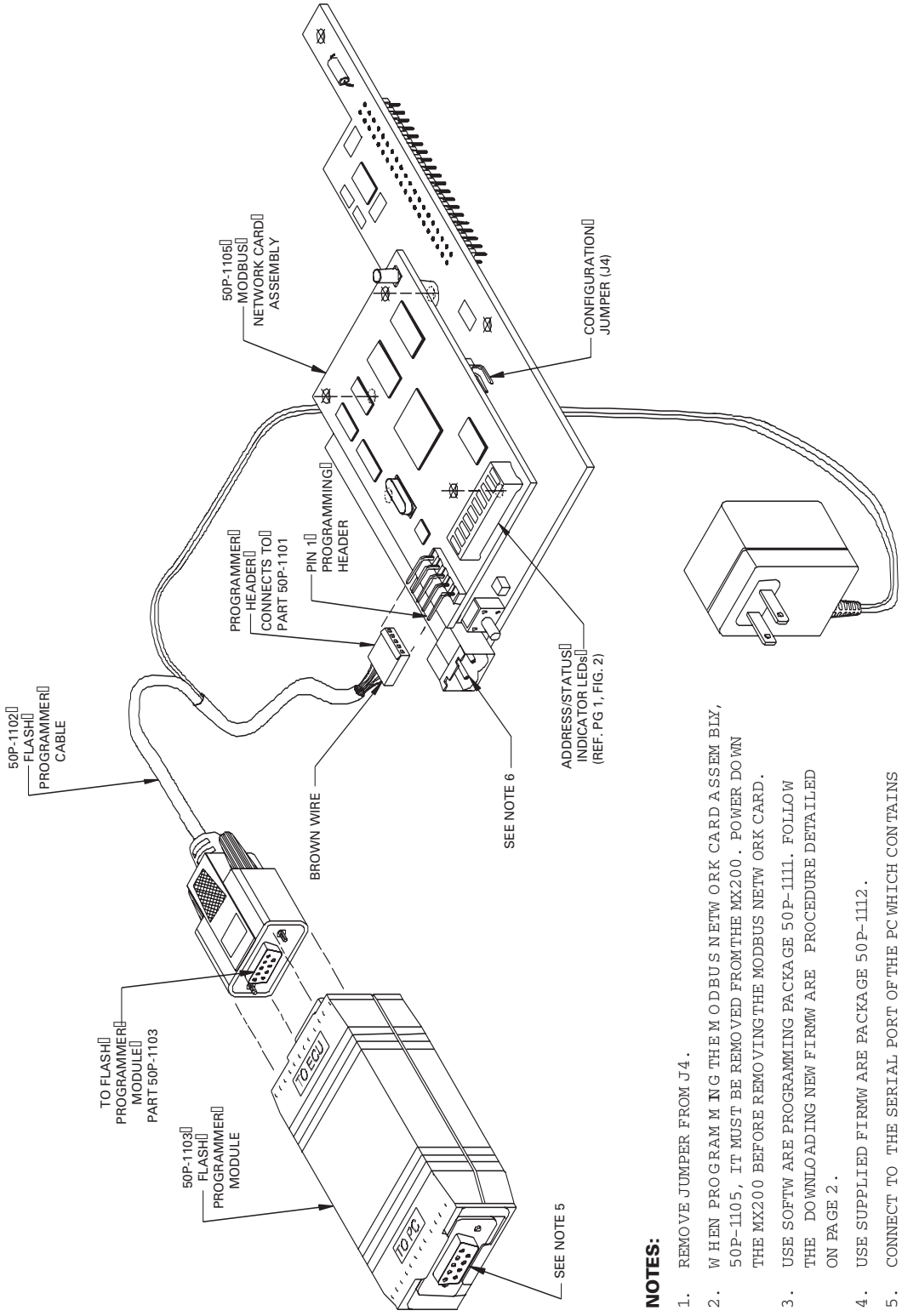
SLAVE ADDRESS 1
RTU MODE
8 DATA BITS, 9600 BAUD, NO PARITY, 2 STOP BITS.

NOTES:

1. CONNECT TO MODBUS CARD NETWORK PLUG CONNECTOR VIA TWISTED PAIR CABLE (BELDEN 8471, 16 AWG) (GE ZENITH PART # WMW-453).
2. CONFIGURATION JUMPER (J4) MUST BE INSTALLED TO CHANGE MODBUS ADDRESS AND MODE. REMOVE TO PLACE UNIT IN RUN MODE.
3. MODBUS NETWORK CARD ASSEMBLY MUST BE INSTALLED ON THE MX200. POWER DOWN THE MX200 AND INSTALL THE MODBUS CARD (REFER TO APPENDIX G).
4. USE SOFTWARE PROGRAMMING PACKAGE 50P-1111. FOLLOW THE CONFIGURING A MODBUS NETWORK CARD PROCEDURE DETAILED ON PAGE 2.
5. TO TEST THE MODBUS NETWORK, FOLLOW THE TESTING A MODBUS NETWORK PROCEDURE.
6. ANY MX200 WITH SOFTWARE VERSION 3.4 AND BELOW WILL REQUIRE A SERVICE CALL TO ENABLE THIS OPTION.
7. CONNECT TO THE SERIAL PORT OF THE PC WHICH HAS THE 50P-1111 SOFTWARE PACKAGE.

Appendix E

Connections for Downloading New Firmware

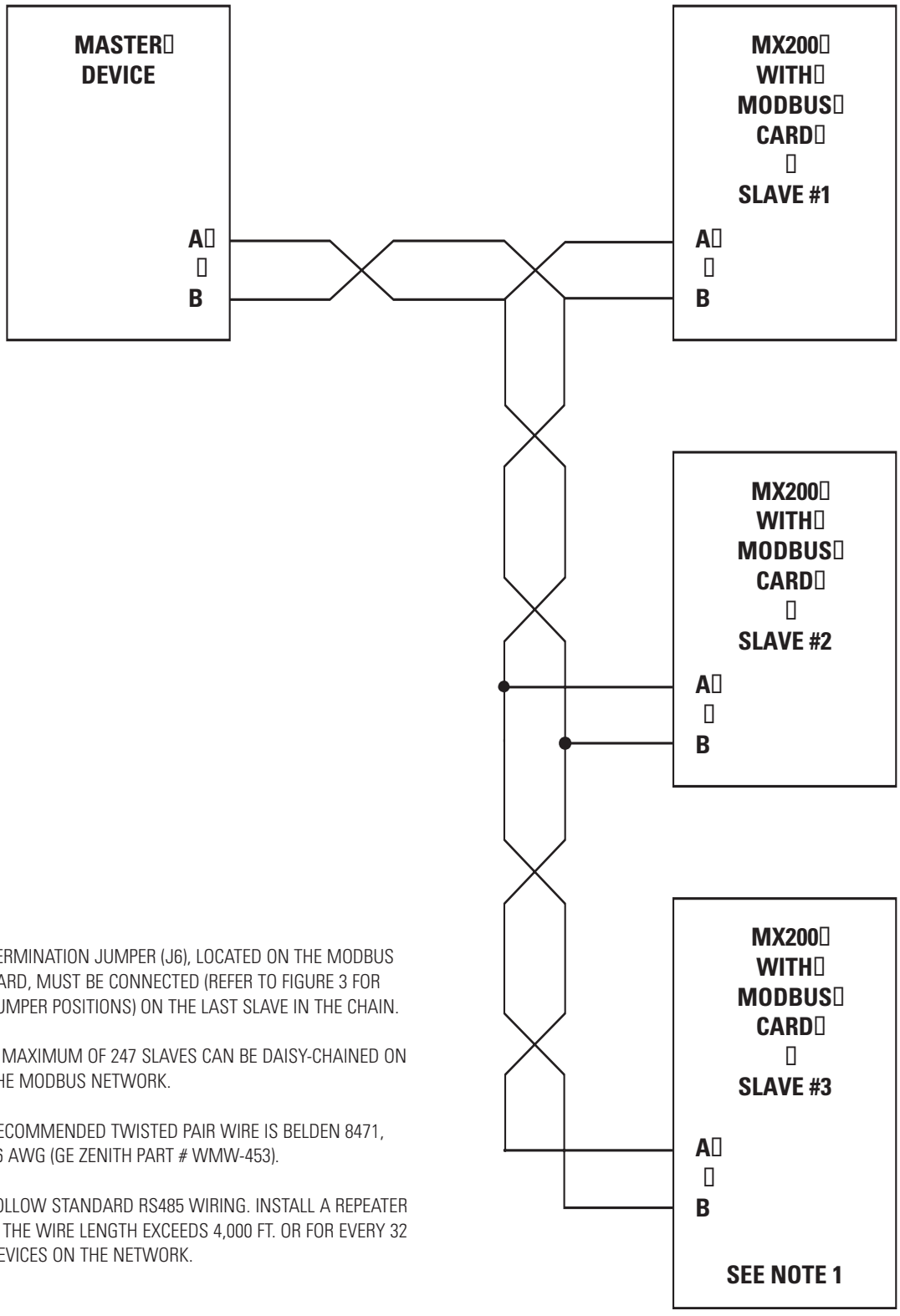


NOTES:

1. REMOVE JUMPER FROM J4.
2. WHEN PROGRAMMING THE MODBUS NETWORK CARD ASSEMBLY, 50P-1105, IT MUST BE REMOVED FROM THE MX200. POWER DOWN THE MX200 BEFORE REMOVING THE MODBUS NETWORK CARD.
3. USE SOFTWARE PROGRAMMING PACKAGE 50P-1111. FOLLOW THE DOWNLOADING NEW FIRMWARE PROCEDURE DETAILED ON PAGE 2.
4. USE SUPPLIED FIRMWARE PACKAGE 50P-1112.
5. CONNECT TO THE SERIAL PORT OF THE PC WHICH CONTAINS THE 50P-1111 SOFTWARE PACKAGE.
6. DISCONNECT THE MX200 FROM THE NETWORK BY REMOVING THE NETWORK PLUG CONNECTOR FROM ASSEMBLY.

Appendix F

RS485 Multi-Drop Connection

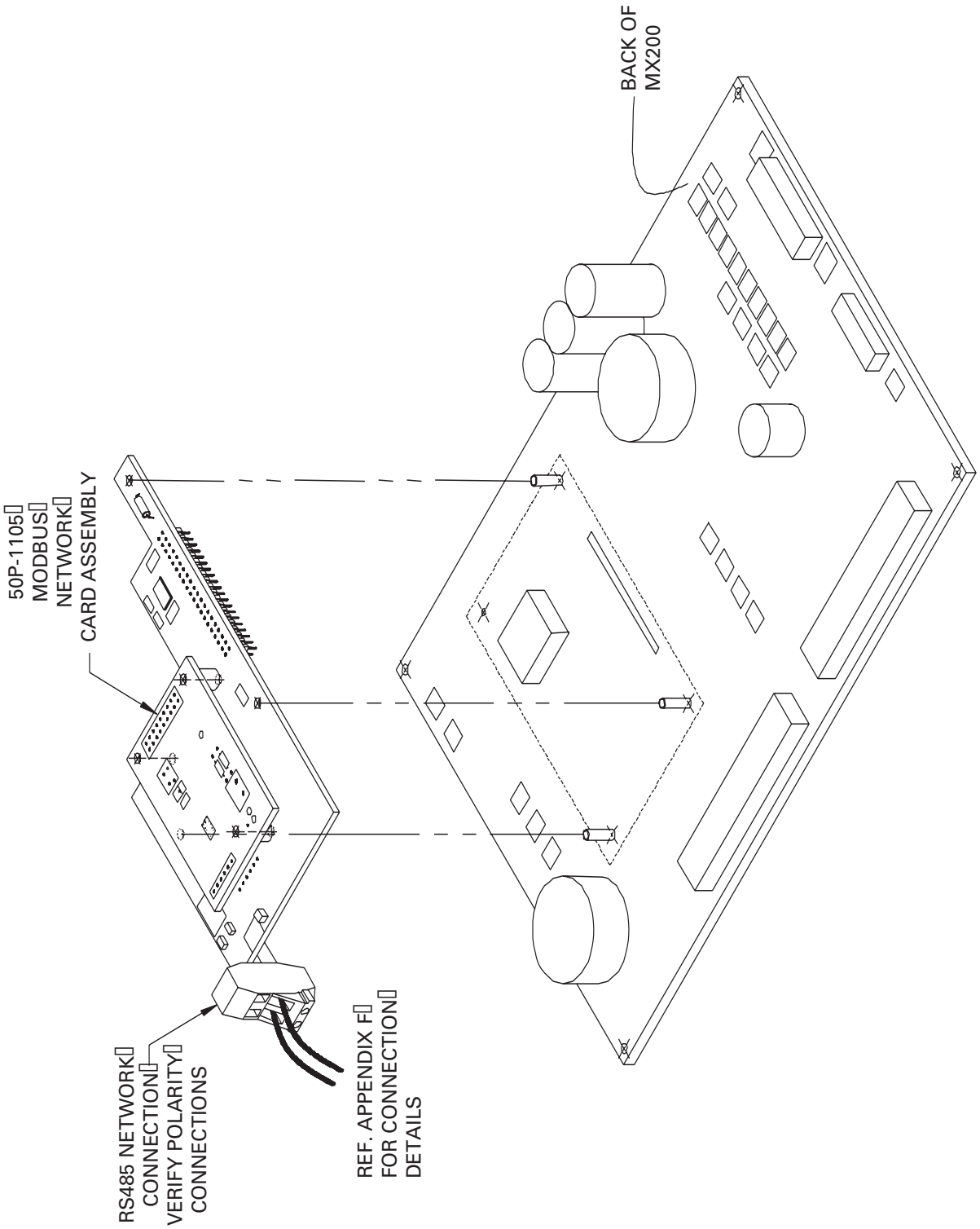


NOTE:

1. TERMINATION JUMPER (J6), LOCATED ON THE MODBUS CARD, MUST BE CONNECTED (REFER TO FIGURE 3 FOR JUMPER POSITIONS) ON THE LAST SLAVE IN THE CHAIN.
2. A MAXIMUM OF 247 SLAVES CAN BE DAISY-CHAINED ON THE MODBUS NETWORK.
3. RECOMMENDED TWISTED PAIR WIRE IS BELDEN 8471, 16 AWG (GE ZENITH PART # WMW-453).
4. FOLLOW STANDARD RS485 WIRING. INSTALL A REPEATER IF THE WIRE LENGTH EXCEEDS 4,000 FT. OR FOR EVERY 32 DEVICES ON THE NETWORK.

Appendix G

Location of Modbus Card on MX200



Appendix H

Modbus Protocol Illustration

For a detailed specification of the Modbus protocol, reference the Modicon website address **"public.modicon.com/support/Support_Pages/modbussupportpage.htm"**.

The Modbus protocol provides the internal standard for parsing messages. During communications on a Modbus network, the protocol determines how each slave will know its device address, recognize a message addressed to it, determine the kind of action to be taken, and extract any data or other information contained in the message. If a reply is required, the slave will construct the reply message and send it using Modbus protocol.

The following is a brief description of the Modbus commands supported by the Modbus Network Card. Each command consists of the following:

- a sample query message that is sent out by the master device to the designated slave
- the slave's reply message to the master device

The query and reply messages show how the information is packeted and sent out using the Modbus Protocol.

Each query message consists of the following:

- *Slave Address* – address of the slave you wish to establish communications with.
- *Function Code* – code that lets the slave know what command is being requested, e.g. read coil, write single coil.
- *Starting Address High/Low Order* – high and low byte of the address the master reads from or writes to. Coils and Registers are addressed starting at 0. For instance Coil 1 is address 0 and Register 1 is address 0.
- *Error Check Field* – contains either a CRC (RTU mode) or LRC (ASCII mode) error check value.

The query message for specific functions requires some of the following information:

- *Number of Data Points High/Low Order* – high and low byte of the number of addresses the master wants to read.
- *Data High/Low Order* – high and low byte of the data that will be written to the slave device.
- Number of Coils High/Low Order – high and low byte for the number of coils to force ON or OFF.
- *Number of Regs High/Low Order* – high and low byte for the number of registers to preset.
- *Byte Count* – is the number of data bytes which are sent to the slave.

These query and reply messages are for both RTU and ASCII modes depending on whether the Error Check Field contains a CRC or LRC respectively. Each value in the query message is a hexadecimal value.

Read Coil Status (Function Code 01)

Query

This function allows the master device to obtain the ON/OFF bit status of various coils from the addressed slave.

Figure H1 is a sample read coil status request to read coils 9-24 (MX200 status bits) from slave device 5.

Slave Address	Function Code	Starting Address *High* Order	Starting Address *Low* Order	No. of Data Points *High* Order	No. of Data Points *Low* Order	Error Check Field (LRC or CRC)
5	01	00	08	00	10	—

Figure H1 – Read Coil Status Query Message

Response

An example response to the Read Coil Satus is shown in *Figure H2*. The response includes the slave address, function code, number of data bytes sent, the data, and error checking.

Slave Address	Function Code	Byte Count	Data Coil Status 9-16	Data Coil Status 17-24	Error Check Field (LRC or CRC)
5	01	02	C1	A2	—

Figure H2 – Read Coil Status Response Message

The data consists of one bit per coil (1=ON, 0=OFF). The status of coils 9-16 is C1 (hex) or 1100 0001 (binary). Reading left to right, coils 16, 15, and 9 are ON and the remainder is OFF. The other data byte is decoded similarly.

Read Holding Register (Function Code 03)

Read holding registers allows the master device to obtain the binary contents of holding registers 4xxxx in the addressed slave.

Query

Figure H3 is an example that reads registers 40006-40007 from slave 8.

Slave Address	Function Code	Starting Address *High* Order	Starting Address *Low* Order	No. of Data Points *High* Order	No. of Data Points *Low* Order	Error Check Field (LRC or CRC)
8	03	00	05	00	02	—

Figure H3 – Read Holding Register Query Message

Modbus Protocol Illustration *(cont'd)*

Response

The slave responds with its address, function code, number of data bytes, and the data. The contents of the registers requested (data) are two bytes each. The first byte includes the high order bits and the second, the low order bits.

Slave Address	Function Code	Byte Count	*High* Order Data	*Low* Order Data	*High* Order Data	*Low* Order Data	Error Check Field (LRC or CRC)
8	03	04	00	76	00	78	—

Register 40006 , Normal Voltage Ph1-Ph2, has a value of 118 (76 hex) and register 40007, Normal Voltage Ph2-Ph3 has a value of 120 (78 hex).

Write Single Coil (Function Code 05)

This function forces a single coil either ON or OFF. A value of 65,280 (FF00 Hex) will set the coil ON and the value zero will turn it OFF; all other values are illegal and will not affect that coil.

Query

Figure H5 is an example of a request to slave number 3 to turn ON coil 71.

Slave Address	Function Code	Starting Address *High* Order	Starting Address *Low* Order	Data *High* Order	Data *Low* Order	Error Check Field (LRC or CRC)
3	05	00	46	FF	00	—

Figure H5 – Write Single Coil Query Message

Response

The slave's normal response to the Write Single Coil query is to return the original message after the coil state has been altered.

Slave Address	Function Code	Starting Address *High* Order	Starting Address *Low* Order	Data *High* Order	Data *Low* Order	Error Check Field (LRC or CRC)
3	05	00	46	FF	00	—

Figure H6 – Write Single Coil Response Message

Write Single Holding Register (Function Code 06)

This function allows the master to modify the contents of one holding register.

Query

Figure H7 is an example of a request to preset register 40041 (Normal Pickup Voltage) to 92 (00 5C hex) in slave device 17.

Slave Address	Function Code	Starting Address *High* Order	Starting Address *Low* Order	Data *High* Order	Data *Low* Order	Error Check Field (LRC or CRC)
11	06	00	28	00	5C	—

Figure H7 – Write Single Holding Register Query Message

Response

The slave's response to the Write Single Holding Register query is to return the original message after the registers have been altered.

Slave Address	Function Code	Starting Address *High* Order	Starting Address *Low* Order	Data *High* Order	Data *Low* Order	Error Check Field (LRC or CRC)
11	06	00	28	00	5C	—

Figure H8 – Write Single Holding Register Response Message

Write Multiple Coils (Function Code 15)

Forces each coil in a sequence of coils to either ON or OFF. The requested ON/OFF states are specified by contents of the query data field. A logical '1' in a bit position of the field requests the corresponding coil to be ON and a logical '0' requests it to be OFF. Coils are addressed starting at 0. For examples coil 1 is addressed as 0.

Query

The following example is a request to force a series of sixteen coils starting at coil 41 (addressed as 40, or 28 hex) in slave device 9.

The query data contents consist of two bytes: 3C 9B hex (0011 1100 1001 1011 binary). The binary bits correspond to the coils in the following way:

Bit:	0	0	1	1	1	1	0	0	1	0	0	1	1	0	1	1
Coil:	48	47	46	45	44	43	42	41	56	55	54	53	52	51	50	49

The first byte sent (3C hex) addresses coils 41-48, with the least significant bit addressing coil 41. The second byte sent (9B hex) addresses coils 49-56, with the least significant bit addressing coil 49.

Slave Address	Function Code	Starting Address *High* Order	Starting Address *Low* Order	Number of Coils *High* Order	Number of Coils *Low* Order	Byte Count	Data *High* Order	Data *Low* Order	Error Check Field (LRC or CRC)
9	15	00	28	00	10	02	3C	9B	–

Figure H9 – Write Multiple Coils Query Message

Modbus Protocol Illustration *(cont'd)*

Response

The response from the slave is an echo of the slave address, function code, starting address and number of coils forced.

Slave Address	Function Code	Starting Address *High* Order	Starting Address *Low* Order	Number of Coils *High* Order	Number of Coils *Low* Order	Error Check Field (LRC or CRC)
9	15	00	28	00	10	—

Figure H10 – Write Multiple Coils Response Message

Write Multiple Holding Registers (Function Code 16)

Presets values into a sequence of holding registers.

Query

The following is an example to preset two registers starting at 40034 (W-Time) to 9 hex (9 seconds) and 40035 (W3-time) to 32 hex (50 seconds), in slave device 17.

Slave Address	Function Code	Starting Address *High* Order	Starting Address *Low* Order	Number of Regs *High* Order	Number of Regs *Low* Order	Byte Count	Data *High* Order	Data *Low* Order	Data *High* Order	Data *Low* Order	Error Check Field (LRC or CRC)
11	16	00	21	00	02	04	00	09	00	32	–

Figure H11 – Write Multiple Registers Query Message

Response

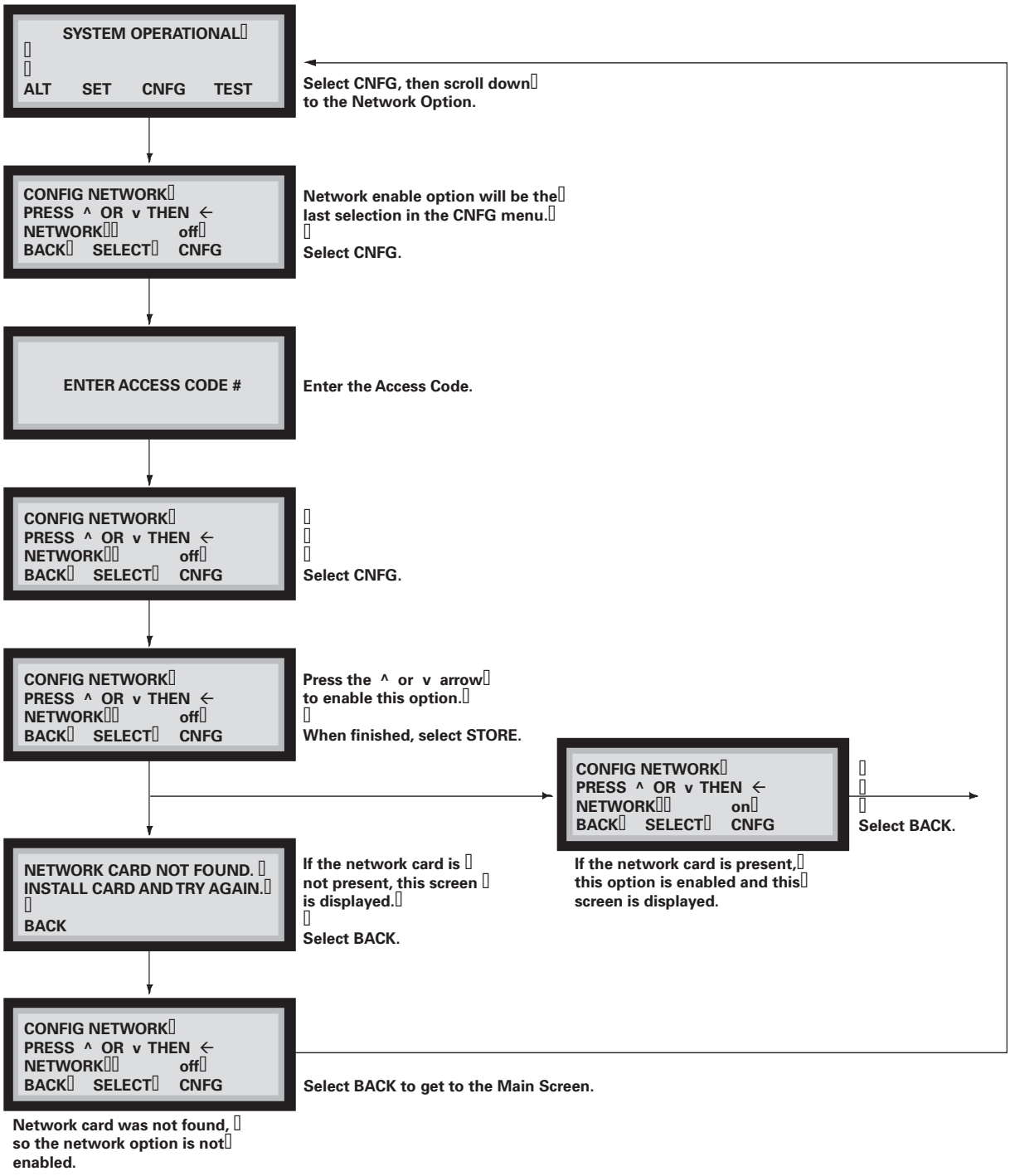
The response from the slave is an echo of the slave address, function code, starting address and number of registers to be loaded.

Slave Address	Function Code	Starting Address *High* Order	Starting Address *Low* Order	Number of Regs *High* Order	Number of Regs *Low* Order	Error Check Field (LRC or CRC)
11	16	00	21	00	02	—

Figure H12 – Write Multiple Registers Response Message

Appendix I

MX200 Menus *(for MX200 Versions 3.5 and Higher)*



Troubleshooting

Problem	Possible Cause	Corrective Action
Trouble downloading firmware	Modbus card is installed on the MX200 and it has power going to it.	Remove the Modbus card from the MX200, and make sure it has no power and retry the download.
	Configuration jumper, J4, is installed.	Remove the J4 jumper.
	Flash programmer cable is not connected correctly to the Modbus cards' programming header.	See **Appendix E** for the proper connections. Make sure when inserting the programmer cable header to the Modbus card's programming header, that the brown wire lines up with pin 1.
	Flash programmer module is not connected correctly to the Flash programmer cable.	See **Appendix E** for the proper connections. Make sure that the end labeled "TO PC" on the programmer module is connected to the PC's serial port and the other end goes to the programmer cable.
	Wrong COM port or baud rate.	Select the correct COM port and baud rate.
	Power supply for the Flash programmer cable is not connected to an AC outlet.	Connect the power supply to an AC outlet.
Trouble configuring the Modbus card	Modbus card is not installed on the MX200.	Install the Modbus card on the MX200.
	MX200 does not have power.	Power up the MX200.
	Configuration jumper, J4, is not installed.	Install the configuration jumper J4.
	Wire between the RS232/485 converter and Modbus card is not connected.	See **Appendix D** for the proper connections. Connect the twisted wire between the converter and the Modbus card.
	Polarity connections are incorrect.	Make sure that A on the Modbus card is connected to A on the converter and B is connected to B.
	Wrong COM port or baud rate.	Select the correct COM port and baud rate.
	RS232/485 converter is not connected to the PC.	Connect the RS232/485 converter to the PC's serial port.
No communications between the MX200 Modbus card and the Master device	MX200 does not have power.	Power up the MX200 controller.
	Communicating with the wrong addressed slave.	Verify that the address on the Modbus card matches the address you are communicating with. See Figure 2 for reference.
	Network wire connection from the Master to the Modbus card is broken or the wire is not connected to the Modbus card.	Check the wire connection from the Master to the Modbus card. Connect the wire to the Network card if necessary.
	Not using the twisted pair wire to make the network connection.	Make sure that the wire is a twisted pair wire (Belden 8471, 16 AWG) (GE Zenith Part # WMW-453).
	Configuration jumper, J4, is installed.	Remove the J4 configuration jumper.
	Proper polarity markings are not being followed.	Connect A to A and B to B on the network, reference Appendix F.
	Termination jumper, J6, is not installed on the last slave in the chain.	Install the termination jumper, J6, on the last slave in the chain. Make sure no other devices have jumper J6 installed.
	Modbus card communication configuration does not match the Master's.	Verify that the Master and Modbus card slave have the same baud rate, data bits, parity, stop bits and ASCII or RTU protocol selected.
	Twisted pair wire length exceeded 4,000 ft.	Install repeater if wire length exceeds 4,000 ft.
	RS485 multi-drop consists of more than 32 devices.	Install one repeater for every 32 devices on the network.
	MX200 network option not enabled.	Call **GE Zenith Controls** Technical Support.
All LED's on the LED module are off.	Modbus card is not installed on the MX200.	Install the Modbus card on the MX200.
	MX200 does not have power.	Power up the MX200 controller.
	The Modbus card is damaged.	Call **GE Zenith Controls** Technical Support.

Bill of Materials

Components for the Modbus Option (ZNET200M)

	Part Description	GE Zenith Part Number	Quantity
Assembly	Modbus Network Card Assembly	50P-1105	1
Individual Replacement Components	Modbus Network Card	50P-1101	1
	MX200 Network Adapter Card	50P-1048	1
	Network Plug Connector	PS-5140	1
	Miniature Support Post	PS-7363	3
	Operations and Maintenance Manual	50R-2200	1

Components for the Modbus Card Configuration

	Part Description	GE Zenith Part Number	Quantity
Assembly	Modbus Card Configuration Assembly	50P-1124	1
Individual Replacement Components	RS232/485 Converter	50W-1208	1
	Belden 8471 Twisted Pair Cable	WMW-453	6 Feet
	Network Plug Connector	PS-5140	1
	Configuration Software for Modbus Communications Card	50P-1111	1
	Operations and Maintenance Manual	50R-2200	1

Components for Downloading New Firmware

	Part Description	GE Zenith Part Number	Quantity
Assembly	Firmware Download Assembly	50P-1125	1
Individual Replacement Components	Flash Programmer Module	50P-1103	1
	Flash Programmer Cable	50P-1102	1
	Configuration Software for Modbus Communications Card	50P-1111	1
	Modbus Communications Card Firmware	50P-1112	1
	Operations and Maintenance Manual	50R-2200	1



GE Zenith Controls

GE Industrial Systems – Power Equipment Business
General Electric Company
830 West 40th Street, Chicago, IL 60609 USA
773 299-6600, Fax: 773 247-7805
www.geindustrial.com