LAKESHORE
ELECTRIC CORPORATION

ENGINEER'S GUIDEBOOK

LAKESHORE
ELECTRIC CORPORATION

ENGINEER'S GUIDEBOOK

TRANSFER SWITCHES

LAKESHORE
ELECTRIC CORPORATION

Full Load Ampere Ratings

Generator Ratings - 3ϕ Amperes - 80% Power Factor

KVA	KW	208V	240V	480V	600V	2400V	4160V	13800V
50	40	139	120	60	48	12.1	7	2
62.5	50	173	152	76	61	15.1	8.7	3
75	60	208	181	91	72	18.1	10.5	3
93.8	75	261	226	113	90	22.6	13	4
100	80	278	240	120	96	24.1	13.9	4
125	100	347	301	150	120	30	17.5	5
156	125	433	375	188	150	38	22	7
187	150	520	450	225	180	45	26	8
219	175	608	527	264	211	53	31	9
250	200	694	601	301	241	60	35	10
312	250	866	751	376	300	75	43	13
375	300	1040	903	451	361	90	52	16
438	350	1220	1053	527	422	105	61	18
500	400	1390	1203	602	481	120	69	21
625	500	1735	1504	752	602	150	87	26
750	600	2080	1803	902	721	180	104	31
875	700	2430	2104	1052	842	210	121	37
1000	800	2780	2405	1203	962	241	139	42
1125	900	3120	2709	1354	1082	271	156	47
1250	1000	3470	3009	1504	1202	301	174	52
1563	1250	4350	3765	1885	1503	376	218	65
1875	1500	5205	4520	2260	1805	452	261	78
2188	1750	-	5280	2640	2106	528	304	92
2500	2000	-	6020	3015	2405	602	348	105
2812	2250	-	6780	3400	2710	678	392	118
3125	2500	-	7520	3765	3005	752	435	131
3750	3000	-	9040	4525	3610	904	522	157
4375	3500	-	10550	5285	4220	1055	610	183
5000	4000	-	12040	6035	4810	1204	695	209

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Full Load Ampere Ratings

Motor Rating - 3ϕ AC Motors - 80% Power Factor
Full Load Current in Amperes
Induction-Type Squirrel Cage & Wound Rotor

HP	110-120V	220-240V	440-480V	550-600V	2300V
1/2	4.4	2.2	1.1	0.9	-
3/4	6.4	3.2	1.6	1.3	-
1	8.4	4.2	2.1	1.7	-
1 1/2	12	6.0	3.0	2.4	-
2	13.6	6.8	3.4	2.7	-
3	-	9.6	4.8	3.9	-
5	-	15.2	7.6	6.1	-
7 1/2	-	22	11	9	-
10	-	28	14	11	-
15	-	42	21	17	-
20	-	54	27	22	-
25	-	68	34	27	-
30	-	80	40	32	-
40	-	104	52	41	-
50	-	130	65	52	-
60	-	154	77	62	16
75	-	192	96	77	20
100	-	248	124	99	26
125	-	312	156	125	31
150	-	360	180	144	37
200	-	480	240	192	49
250	-	-	302	242	60
300	-	-	361	289	72
350	-	-	414	336	83
400	-	-	477	382	95
450	-	-	515	412	103
500	-	-	590	472	118

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Full Load Ampere Ratings

Single Phase Amperes - 80% Power Factor

KVA	KW	115V	120V	230V	240V
6.3	5	54.4	52.4	27.2	26.2
9.4	7.5	81.6	78.4	40.8	39.2
12.5	10	108.8	104.8	54.4	52.4
18.7	15	163	157	81.6	78.4
25	20	218	210	108.8	104.8
31.3	25	272	262	136	131
37.5	30	326	314	163	157
50	40	435	419	218	210
62.5	50	544	524	272	262
75	60	652	628	326	314
93.8	75	816	784	408	392
100	80	870	838	435	420
125	100	1088	1048	544	524

Amperes - DC

KW	115V	120V	125V	230V	240V	250V
1	8.7	8.4	8	4.4	4.2	4
3	26	25	24	13	12.5	12
5	43.4	41.6	40	21.7	20.8	20
10	87	84	80	43.5	42	40
20	174	168	160	87	84	80
25	217	210	200	108.5	105	100
30	260	250	240	130	125	120
40	348	336	320	174	168	160
50	434	420	400	217	210	200
60	520	500	480	260	250	240
75	651	630	600	325.5	315	300
100	870	840	800	435	420	400

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Performance Data: Transfer Switches

Interrupting Ratings in Symmetrical RMS Amperes by Voltage

MOLDED CASE TRANSFER SWITCHES

	"S"	"S"	"H"	"H"	"V"	"V"
Amp Rating of Transfer Switch	240 Vac	480 Vac	240 Vac	480 Vac	240 Vac	480 Vac
100	65,000	35,000	100,000	65,000	200,000	100,000
225	65,000	35,000	100,000	65,000	200,000	100,000
400	65,000	35,000	100,000	65,000	200,000	100,000
600	65,000	35,000	100,000	65,000	200,000	100,000
800	65,000	50,000	100,000	65,000	200,000	100,000
1000	65,000	50,000	100,000	65,000	200,000	100,000
1200	65,000	50,000	100,000	65,000	200,000	100,000

INSULATED CASE TRANSFER SWITCHES

	"S"	"S"	"H"	"H"	"V"	"V"
Amp Rating of Transfer Switch	240 Vac	480 Vac	240 Vac	480 Vac	240 Vac	480 Vac
800	65,000	65,000	100,000	100,000	200,000	150,000
1200	65,000	65,000	100,000	100,000	200,000	150,000
1600	65,000	65,000	100,000	100,000	200,000	150,000
2000	65,000	65,000	100,000	100,000	200,000	150,000
2500	65,000	65,000	100,000	100,000	200,000	150,000
3000	65,000	65,000	100,000	100,000	200,000	150,000
4000	65,000	65,000	100,000	100,000	200,000	150,000

Legend:

"S" = Standard Interrupting Rating of Transfer Switch

"H" = High Interrupting Rating of Transfer Switch

"V" = Very High Interrupting Rating of Transfer Switch

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Performance Data: Transfer Switches

OVERLOAD AND ENDURANCE TEST

	OVERLOAD	TEST	ENDURANCE	TEST
Amp Rating of Transfer Switch	# of Operations	Amperage	Total Cycles	Maximum Current
100	50	600	6,000	200
225	50	1350	6,000	450
400	50	2400	4,000	800
600	50	3600	3,000	1200
800	50	4800	3,000	1600
1000	50	6000	3,000	2000
1200	50	7200	3,000	2400
1600	25	9600	3,000	3200
2000	25	12000	3,000	4000
2500	3	15000	3,000	5000

DIELECTRIC TESTS

All test reports include post-endurance dielectric tests for 60 cycles, 1000 Volts plus twice rated voltage (1960 Volts minimum).

TEMPERATURE RISE TESTS

All test reports include temperature rise tests within UL 1008, 50° limits.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Location of Factory
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

30 Cycle Ratings
Short Circuit Studies & Coordination Studies

A Short Circuit Study and a Coordination Study are two highly important steps that should be taken to protect personnel and the electrical distribution system.

The Short Circuit Study will determine the magnitude of current available at various points of the electrical distribution system, if a fault occurs. It is imperative that the protective devices on the line side of the selected point in the Short Circuit Study be capable of sensing and interrupting the fault current available. Likewise, any non-protective devices in that segment of the distribution system that would be exposed to a fault of the magnitude calculated in the Short Circuit Study, must be able to withstand that fault current for the calculated time duration.

The Coordination Study is made to determine the proper settings of the protective devices in the distribution system so that the area of an outage, due to a fault, is limited to the affected portion of the distribution system. This will leave the remainder of the system undisturbed, preserving the continuity of service in the unaffected areas. Isolation of a faulted circuit from the remainder of the installation is mandatory in today's modern electrical systems to prevent widespread power blackouts.

This isolation is achieved by selective coordination as calculated in the Coordination Study. For circuit breaker coordination, the engineer must take into account the fact that when a high fault current occurs on a circuit having several breaker in series, the instantaneous trip on all breakers may operate without coordination. This would result in a widespread isolation of the faulted portion of the circuit instead of a controlled, selective portion where the fault originated. In these cases, the instantaneous protection can be suppressed and the short time delay setting used to improve system coordination. While the use of circuit breaker short-time delay settings may negate some degree of protection and increase any arc flash hazard, the avoidance of a widespread power blackout is mitigated.

How does this affect the selection of the transfer switch in the installation? Quite simply, any transfer switch being placed in an electrical distribution system must not only have the ability to withstand the fault current calculated by the Short Circuit Study, but it also must be able to sustain that fault for the time duration required by the Coordination Study; this time frame is typically less than a few milliseconds.

Since most transfer switches on the market are series rated for only 3 cycles when coordinated with upstream protective devices, care should be taken when applying these transfer switches where the specific requirements of the Short Circuit and Coordination Studies indicate the potential of a fault in excess of that minimal three cycle duration.

Lake Shore Electric Corporation has been manufacturing our Insulated Case Transfer Switches since 1922. These transfer switches have our published interrupting ratings that are not series rated. They are capable of operating as a standalone device, not dependent on upstream protection. However, they may also be adjusted to allow downstream breakers to clear for up to 30 cycles. In addition, they all carry a 60 cycle rating.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switches - Microprocessor Standard and Factory Options Overview

Standard Automatic Transfer Switch Features

HMI Interface

The standard HMI LED's show the following for both sources: Source Available, Load fed from Unit Closed Source, Unit Tripped and Reverse Power. There are two other general LED's for Switch not in Automatic and Ground Fault to indicate system trouble.

There are five modes of operation. Four of which are selectable by using the HMI Panel; Automatic, Hand Crank, Load Test, Off/Reset and Fault.

The fifth mode, Fault, is not selectable. In the Fault mode, the transfer switch has failed to perform some function. If the MP7650 receives a Fault or trouble condition, the display will begin to scroll through the present operating mode that the unit is in and all of the troubles and/or faults it has registered.

Standard Timers / Equipment

TDES Time Delay Engine Start. This timer is adjustable from 0 to 300 seconds and is FACTORY SET AT 3 SECONDS. It is initiated upon sensing the loss of normal power and once timed out will initiate an engine start signal.

TDE Time Delay Emergency. This timer is adjustable from 0 to 300 seconds and is FACTORY SET AT 3 SECONDS. It is initiated upon the sensing of the emergency source and once timed out will initiate the transfer to the emergency source.

TDN Time Delay Neutral. This timer is adjustable from 0 to 300 seconds and is FACTORY SET AT 3 SECONDS. It is initiated upon the opening of one source and will inhibit the closing of the oncoming source until it has timed out.

TDR Time Delay Return. This timer is adjustable from 0.0 to 60.0 minutes and is FACTORY SET AT 12 MINUTES. It is initiated upon the restoration of normal power and will inhibit the switch from retransferring to the normal source until it has timed out. If at any time during the timing cycle normal power is not maintained, this timer will be terminated and will be reinitiated when normal power returns.

TDEC Time Delay Engine Cool down. This timer is adjustable from 0.0 to 60.0 minutes and is FACTORY SET AT 10 MINUTES. This timer is initiated upon the retransfer of the switch to the normal source and will keep the engine running until it has timed out.

MRT Minimum Run Timer. This timer is adjustable from 0.0 to 60.0 minutes and FACTORY SET AT 10 MINUTES. It is initiated upon the initiation of starting the engine generator set and will keep the engine running until it has timed out.

KPE Keypad Enable Switch. Provides a control input that allows the HMI interface to be enabled/disabled located internally to the transfer switch.

ORPB Override Push Button. Provides for immediate return to Normal position by manual operation when Normal source voltage is present bypassing the TDR timer.

LTS Load Test Switch, Maintained. Provides engine starting plus transfer of the load to the Emergency source without having to fail the Normal Source.

MDS Maintenance Disconnect Switch. Provides Protection for the Maintenance worker(s) making any required changes to the ATS controls. (**NOTE:** this does not kill power to the incoming bus of the ATS.) Reference a units schematic diagrams for specific controls disconnected.

PFRN Phase Failure Relay Normal. Provides for close differential monitoring of the Normal Source voltage to ensure that it is within acceptable limits. The factory setting for the PFRN is 90% Pickup and 80% Dropout of the nominal voltage.

FVR Frequency / Voltage Relay (Single Phase Monitoring) Provides Protection against transferring to the Emergency Source until the generator has reached operating frequency and voltage.

PE Plant Exerciser. Provides for regular automatic exercising of the Emergency Power System on a pre-selected schedule.

When the exercise period is in effect, the first line of the display will read "Exerciser On". The Plant Exerciser operates on a weekly, or monthly, basis and is configured as follows:

1. Disabled Mode
2. Enabled Mode: With or Without Load
3. 24 hr. Selectable for Start Time
4. Time Duration of Exercise Period: (hh:mm) from 00:01 through 24:00
5. Day(s) Available for Exercise Selection: (S M T W T F S)
6. Weeks of the month available for exercise selection (1. 2. 3. 4. 5)

ACSP Aux Contacts for Switch Position. Provides two form "C" contacts for each source, which indicate switch position. NOR and EMR.

TRBL System Trouble Contacts. Provides two form "C" contacts that indicate some form of trouble condition has been detected. (i.e.: Breaker tripped, Ground Fault Detected, System Failed to Open/Close a Unit, etc.)

ES Engine Start Contacts. Provides one form "C" contact which changes state when the microprocessor determines the normal source is unavailable.

SH Space Heaters for all Outdoor Equipment. This option provides 350 Watt, 250 Volt strip heater(s) run at 120Vac. Total power consumption per heater is 81W. These are used in conjunction with a wall mount style thermostat to help eliminate moisture build-up in the enclosure and prevent freezing. Standard on all outdoor equipment.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Factory Options

The following configurations are available for ease of ordering the most common timer groups utilized on transfer switches.

Additional Timers Included with Specific Options as Noted in the Following Sections

SFT — Synchronize Fail Timer. This timer is adjustable from 0.0 to 60.0 minutes and is FACTORY SET AT 10 SECONDS. It is only used for closed transition transfer switches. It is initiated at the time that actual transfer is permitted by the controller. If it times out prior to a transfer being complete, it will display "Trouble: SFT timed out", but will not terminate operation of the transfer switch. This is to alert the operator that the system took longer to synchronize than expected. The operator can clear this message by pressing "Enter" and then select "Clear Trouble". The operator can also program the MP7650 to continue to try for a closed transition transfer or to do an open transition transfer when this timer times out. This also drops out the trouble relay to annunciate that this transfer switch requires attention.

TDBT — Time Delay Before Transfer. This timer is adjustable from 0 to 300 seconds and is FACTORY SET AT 10 SECONDS. It is initiated when the switch is ready to transfer and upon its completion the transfer will take place. This is typically used in elevator circuits.

SPPT — Single Phase Protection Timer. This timer is adjustable from 0 to 300 seconds and is FACTORY SET AT 10 SECONDS. The SPPT timer begins timing when the under voltage relay drops out. IF the transfer to emergency begins before this timer times out, this timer is turned off. If this timer times out before the transfer to emergency begins, an output is sent to trip the normal breaker to trip it open. This is to prevent damage to the load in case the system is on a utility single phase condition. On insulated case breakers this operates without any operator intervention because opening and tripping the breaker are the same mechanism and the breaker does not need to be reset.

Factory Options

PFRN/O — Phase Failure Relay Normal / Overvoltage. Provides for close differential monitoring of the Normal source to ensure that it is within acceptable limits with respect to overvoltage. The usual setting for the PFRN/O is 115% Pickup and 110% Dropout. This relay can also be adjusted to as close a differential as 2% (i.e. 116% Pickup and 114% Dropout), and is available as follows:

PFRE — Phase Failure Relay Emergency. Provides protection against transferring the load to the Emergency source until voltage has reached acceptable limits. In the event the relay drops out when Normal power is available, the TDR will be bypassed and retransfer to Normal will be initiated immediately. This relay is available as follows:

PFRE/0 — Phase Failure Relay Emergency / Overvoltage. Provides for close differential monitoring of the Emergency source to ensure that it is within acceptable limits with respect to overvoltage. The usual setting for the PFRE/O is 115% Pickup and 110% Dropout. This relay can also be adjusted to as close a differential as 2% (i.e. 116% Pickup and 114% Dropout), and is available as follows:

MRTN — Manual Return to Normal Push Button. Provides immediate return to the Normal source when Normal voltage is present, by **Manual operation only** (TDR is not present). This option will replace the momentary ORPB and an operator will be required to force the unit back to normal.

CBTN — Circuit Breaker Trip on Normal. Provides overcurrent protection within the transfer switch. This feature may eliminate the requirement to install separate overcurrent protective device on the Normal source.

CBTE — Circuit Breaker Trip on Emergency. Provides overcurrent protection within the transfer switch. This feature may eliminate the requirement to install separate overcurrent protective device on the Emergency source.

SE — Suitable for Use as Service Entrance Equipment. Provides for transfer switch (Dual Motor & Insulated Case only) to be approved for service entrance. Includes overcurrent protection on the Service Source, solid neutral bus with neutral-to-ground bonding link and special instructions nameplates to be installed by the customer.

ED — Emergency Disconnect. Electrically trips both units and places the transfer switch in the neutral position. This is done from a selector switch located on the door of the transfer switch.

Note: This switch is provided with all service entrance equipment.

GFP — Ground Fault Protection. When a ground fault is detected, the Normal and Emergency source will be opened isolating the ground fault from external voltage sources.

GFI — Ground Fault Indication. When a ground fault is detected, the transfer switch will continue operating as usual. Only an indication light will be provided to show that there is a ground fault condition present on the system.

ACBT — Aux Contact Before Transfer (Elevator Control). Provides two sets of dry form "C" contacts which change state prior to transfer in either direction. This option will activate the TDBT timer in the microprocessor controls.

ACSA — Aux Contact Source Available. Provides two sets of dry form "C" contacts for each source. These contacts will change states when their respective sources are within acceptable voltage ranges.

CTT — Closed Transition Transfer. Provides transfer of power from one source to another without interruption of power to the load; "Make before Break" transfer. Applicable to Dual Motor and Insulated Case switches only. This option will activate the SFT timer in the microprocessor controls.

IPM — In Phase Monitor. Monitors Normal and Emergency source for proper synchronization prior to transfer when both sources are available and is disabled if either source fails. Functions in both directions; Normal to Emergency and Emergency to Normal. Available on Single Motor Transfer Switches only.

SPD — Surge Protection Devices. This option provides hard-wired secondary surge arrestors on both the normal and emergency sources. This provides a degree of protection for voltage surges and lightning strikes. They are suitable for use in service entrance locations and meet the requirements of NEC 280, UL 1449 and ANSI C62.11. They protect surges up to 40 kA per Phase.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

Factory Options Continued . . .

SPP Single Phase Protection. This option provides a phase sequence and voltage sensing relay, PSR, in place of the standard voltage sensing relay, PFR. The units are available as "Under Voltage" pick up only or "Over and Under Voltage" pick up.

This protective relay will be placed on the normal side breaker, but may be included on the emergency side breaker as well. This option will activate the SPPT timer in the microprocessor controls.

RD Remote Disconnect. This option provides a shunt trip input to the transfer switch. The Shunt trips electrically trip the control units from a remote location, (not a protective type trip), so that either, or both, of the control units can be tripped. This will put the transfer switch in the Fault mode and prevent automatic operation. Customer interconnection can be made at a terminal block inside the enclosure. Reference the transfer switches specific drawings.

LDI Load Demand Inhibit. This option provides an input to the transfer switch. The input is a two-wire connection on the Relay Interface Board and is marked "LDI". It is pre-wired to the customer connection terminal blocks.

This option, when the input is active, will force the transfer switch from the emergency source and onto the normal source. If the normal source is not available, the transfer switch will be forced to the neutral position.

Once the transfer switch has been forced off of the emergency source and the LDI input is still active, the transfer switch will be prohibited from connecting to the Emergency Source.

Once that input has been removed, normal operations will resume.

PS Peak Shave. This option provides an input to the transfer switch. The input is a two-wire connection on the Main Control Board and is marked "PS". It is pre-wired to the customer connection terminal blocks.

This option, when the input is active, will force the transfer switch to connect the load to the emergency source. Should emergency fail, the switch will return the load connections to the normal source.

Once that input has been removed, normal operations will resume.

FPC Fire Pump Control. This allows the transfer switch to meet or exceed NFPA 20 (Chapter 10), U.L. 1008 and NEMA ICS 227-47 requirements for an Automatic Transfer Switch to be used in a Fire Pump Circuit. The transfer switch is dedicated to the fire pump load exclusively and is both electrically or manually operable and mechanically held. An Isolating Switch, located within the Transfer switch enclosure and externally operable, is provided ahead of the input terminals of the emergency side of the switch.

BC Battery Charger. This option provides a 12Vdc battery and charger kit for the MP7650 processor controls; generator battery voltage not required to be run to the transfer switch. It will automatically fix the transfer switch code to "M" for the relay DC voltage. Please refer to the transfer switches schematics for reference.

MLT Maintained Load Test Switch. This option replaces the standard momentary Load Test Switch with a maintained switch. The option also comes with a parallel terminal block connection for remote connection. Reference the transfer switches specific drawings.

MFM Multifunction Metering. This option provides a multifunction meter on the load output that may be setup to monitor single or three phase systems. For three phase transfer switches, the unit can be setup to monitor delta or wye, 3-wire or 4-wire, systems. The unit measures the following:

1. Phase Voltage (V)
2. Phase to Neutral Voltage (V)
3. Phase Current (I)
4. Frequency (Hz)
5. Active Power (W)
6. Active Energy (kWh)
7. Reactive Power (VAR)
8. Apparent Power (VA)
9. Reactive Energy (VARh)
10. Power Factor (PF)
11. Instantaneous Amp Demand
12. Instantaneous Watt Demand
13. Instantaneous VA Demand
14. Maximum Amp Demand
15. Maximum Watt Demand
16. Maximum VA Demand

RS-485 (Modbus) communication is the standard output from this option. Ethernet 10/100 Base-T connectivity is available upon request.

If other communications protocols are needed, please consult the factory for the appropriate converter.

DPS Dual Prime Source. Provides for selection between two generators or two utilities. For Dual Prime Power consult factory for details. Connection Type either "**Generator to Generator**" or "**Utility to Utility**".

Utility to Utility will not have an engine start (ES) signal and will be configured as described below.

Generator to Generator will have an engine start (ES) signal available for the emergency generator. The preferred source generator must be controlled via the customer controls. The preferred source will still be selected via the HMI panel as described below.

There are four modes of operation for this configuration. Three of which are selectable by using the HMI Panel.

1. Automatic - U1 Preferred
2. Automatic - U2 Preferred
3. Off/Rese
4. Fault

Note: Fault is not selectable for the same reasons discussed under the HMI Interface section.

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Microprocessor Controls
MP7650 System

Introduction

The Lake Shore Electric Corporation MP7650 Control System is a sophisticated, state of the art, microprocessor based controller for automatic transfer switches. This system consists of five components:

- HMI (Human / Machine Interface) Panel
- Main Control Board
- Power Supply Board
- Relay Interface Board
- System Ribbon Cable

This powerful and versatile controller incorporates a full range of automatic transfer switch accessories, which are user selectable.

The MP7650 is fully programmable with four input keys and a two lines, 40 character, backlit LCD display.

All timer settings can be viewed on the LCD. Additionally, all timer values are displayed on the LCD during operation.

Diagnostic messages are displayed on the LCD.

System status is displayed by the diagnostic LED array.

Power can be supplied by either the engine battery system or an alternate power supply, 12 or 24 Vdc.

Components are mounted on printed circuit boards to provide a compact, rugged design. Solid-state devices assure dependable operation, even in severe environments, and have a projected electrical life of over one million cycles.

The MP7650 provides optimum flexibility of transfer switch controls. All adjustments are easily accessible at the HMI Panel.

The form "C", dry engine start contact provides a convenient interface to almost any engine starting control. Additional dry contacts from the Relay Interface Board provide a convenient interface for remotely monitoring the transfer switch as necessary.

The controller provides for five modes of operation:

- Off / Reset
- Automatic
- Hand Crank
- Load Test
- Fault

Note: The fault mode will display an explanation of the fault condition should one exist. Depending on the Fault, a trained operator will need to reset the transfer switch accordingly. All required PPE must be used for operator safety.

Product Features

- **UL 1008 Listed**
- **LCD Backlit Display, 2 Lines, 20 Characters Each, User Input Keypad - 4 Buttons (Membrane Style)**
- **MP7650 Control Inputs**
  - Key Pad Disable
  - Load Test (Cycled or Maintained*)
  - Override Pushbutton
  - Remote Load Test*
  - Synchronizer*
  - Load Demand Inhibit*
  - Ground Fault Protection Relay*
  - Reverse Power Condition* (Normal & Emergency)
  - Remote Disconnect*
  - Peak Shave*
- **System Status LED's**
  - System Not in Automatic
  - System Ground Fault*
  - Source Available (Normal & Emergency)
  - Switch Position (Normal & Emergency)
  - Reverse Power* (Normal & Emergency)
  - Switch Withdrawn* (Normal & Emergency)
  - Switch Tripped* (Normal & Emergency)
  - Switch in Test* (Normal & Emergency)
- **Maximum: 48 Diagnostic LED's for System Troubleshooting**
- **Dry, Form "C", Contacts for Customer Interface**
  - SIN Switch in Normal 2 Sets
  - SIE Switch in Emergency 2 Sets
  - NOR Normal Source Available* 2 Sets
  - EMR Emergency Source Available* 2 Sets
  - TBRL Trouble 2 Sets
  - ES Engine Start 1 Set
  - EC Pre-transfer Signal* 2 Sets
- **Dry, Form "C", Contacts for System Control**
  - TN Normal Tripped* 1 Set
  - TE Emergency Tripped* 1 Set
  - CE Close Emergency 1 Set
  - CN Close Normal 1 Set
  - OE Open Emergency* 1 Set
  - ON Open Normal* 1 Set
- **Up to 9 field programmable timers**
  - TDES Time Delay Engine Start
  - TDE Time Delay Emergency
  - TDN Time Delay Neutral*
  - TDR Time Delay Return
  - TDEC Time Delay Engine Cool Down
  - MRT Minimum Run Timer
  - TDBT Time Delay Before Transfer*
  - SFT Synchronize Fail Timer*
  - SPPT Single Phase Protection Timer*
- **Engine Exerciser Clock for weekly testing with or without load**
- **Available for open or closed transition**

*** Only available with certain accessories, consult factory for details.**

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE ELECTRIC CORPORATION

Operation Instructions

NOTE 1: All the following instructions are to be performed using the keypad and HMI screen located on the front of the ATS. Reference Figure 1.

NOTE 2: At any time throughout programming, the "ESC" pad may be pressed to return to the previous screen without accepting any new values.

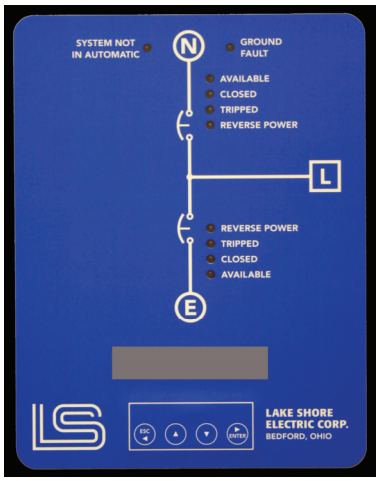


Figure 1

Operational Display Examples

During normal operation, the LCD on the HMI panel will display the mode selected, the status of the exerciser, time and date. Figure 2 shows a standard display of the controller in the automatic position with a programmed load test exerciser period. Also displayed is the time and date.

AUTO - EXERCISE W/LOAD
08:25 Fri 1 APR, 2016

Figure 2

Whenever the controller requires any action, the LCD displays the status of each timer. Figure 3 shows a standard display of the controller waiting for the TDES to time out before the engine is started.

AUTO - EXERCISE W/LOAD
Awaiting TDES: 3 sec

Figure 3

Whenever there is a fault, the operation of the switch is modified as described in Figure 4. The LCD displays the appropriate error message. Figure 4 shows a standard display of the controller displaying a Close Normal Failed fault.

FAULT - Close NOR failed
08:27 Fri 1 APR, 2016

Figure 4

FAULT RESET Instructions

1. Depress "Enter".
2. The display will read "MAIN MENU / Reset Faults / Troubles".
3. Depress "Enter" again and the display will read "Reset Faults / Troubles, Clear all now? No".
4. The word "No" will be underlined.
5. Depress either "⇓" or "⇑" until "Yes", the desired value, is displayed.
6. Depress "Enter" to clear or "ESC" to cancel.
7. All faults / troubles will be reset and the display will show the operating mode again.

RESET to Factory Defaults Instruction

1. Depress "Enter".
2. The display will read "MAIN MENU / Reset Faults / Troubles".
3. Depress "⇑" until "Restore Factory Defaults" is displayed.
4. Depress "Enter" again and the display will instruct operator to hold the "⇓" and "⇑" arrows for 5 seconds.
5. Continue to hold the "⇓" and "⇑" arrows until the countdown is complete.
6. The display will temporarily read "Factory Defaults Restored".
7. The display will show Main Menu/LED Test.
8. Depress "Escape" to complete or "ESC" to cancel.
9. The display will show the operating mode again.

Setting Mode of Operation

1. Depress the "Enter" key on the LCD pad.
2. The LCD displays "Main Menu/Select Mode".
3. Depress "Enter" and the LCD displays "MODE SELECT/AUTO".
   a. To select "Manual" mode, depress "⇓" and the display will advance to the next mode of operation.
4. Depress "Enter" once the appropriate mode of operation has been selected.
5. The display will return to the operating mode again.

Setting Date & Time

1. Depress the "Enter" key on the LCD pad.
2. The LCD displays "Main Menu/Select Mode".
3. Depress "⇓" and the LCD will display "Main Menu/Set Current Time & Date".
4. Depress "Enter" this will select that you wish to set the current time and/or date.
5. The display will show "Auto DST Changes? Yes". Default is "Yes" to update at Daylight Savings Time.
6. Depress either "⇓" or "⇑" until desired value is shown.
7. Depress "Enter" to store value or "ESC" to cancel.
8. The LCD will now display the current time and date stored.
9. A single character will be underlined.
10. Depress either "⇓" or "⇑" until the desired value is displayed.
11. Depress "Enter" to store value or "ESC" to cancel.
12. The curser will advance to the next character.
13. Repeat the process until the correct Time & Date values have been entered into the non-volatile memory.
14. Press "ESC" to have the display show the operating mode again.

LAKESHORE ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Setting Timers

NOTE: Timer settings can be reviewed by going through the SET UP TIMERS routine.

1. Depress the “Enter” key on the LCD pad.
2. The LCD will display “Main Menu/Select Mode”.
3. Depress “⇓” twice and the LCD will display “Main Menu/Set Timers”.
4. Depress “Enter” this will select that you wish to set any or all of the timers.
5. The LCD displays “SET UP TIMERS/Select Timer: TDES”.
6. To skip modifying a timer, depress “⇓” and the display will advance to the next timer.
7. Timers are displayed in the following order.

   NOTE: Several timers are optional. If the timer does not apply to your application, it will not be shown.

   a. TDES - Time Delay to Engine Start
   b. TDE - Time Delay to Emergency
   c. TDBT - Time Delay Before Transfer.
   d. SPPT - Single Phase Protection Timer
   e. TDN - Time Delay in Neutral
   f. TDR - Time Delay to Return
   g. TDEC - Time Delay for Engine Cool Down
   h. MRT - Minimum Run Timer
   i. SFT - Synchronize Fail Timer
8. To change the TDES timer, depress “Enter”.
9. The LCD displays “SET UP TIMERS/Set Time TDES: XXX sec”.
10. The first digit of the available time range will be underlined.
11. Depress either “⇓” or “⇑” until the desired value is displayed.
12. Depress “Enter” to store value or “ESC” to cancel.

    NOTE: The value for the timer will only be saved after hitting “Enter” after modifying the 3rd digit for the timer setting.
13. The LCD will sequence through all the timers in the same manner.
14. Repeat steps 8 thru 13 to modify other timers.

Plant Exerciser

When the exercise period is in effect, the first line of the display will read “Exerciser On”. The Plant Exerciser operates on a weekly, or monthly, basis and is configured as follows:

1. Disabled Mode
2. Enabled Mode: With or Without Load
3. 24 hr. Selectable for Start Time

   (Time of Day Plant Exercise Will Start)
4. Time Duration of Exercise Period: (hh:mm) from 00:01 through 24:00
5. Day(s) Available for Exercise Selection: (S M T W T F S)
6. Weeks of the month available for exercise selection:

   (1. 2. 3. 4. 5)

Setting Plant Exerciser

Note: If no days are selected (i.e. left in lower case), the exerciser will be disabled. This will be displayed in the operational display as “DO NOT EXERCISE”.

1. Depress the “Enter” key on the LCD pad.
2. The LCD displays “Main Menu/Select Mode”.
3. Depress “⇓” three times.
4. The LCD displays “Main Menu/Set Up Plant Exerciser”.
5. Depress “Enter”.
6. The LCD displays “SET UP EXERCISER/Load? Yes : Start: XX:XX.
7. The first Letter of “Yes or No” will be underlined.
8. Depress either “⇓” or “⇑” to change between “Yes” or “No”.
9. Depress “Enter”.
10. This will advance the underlined text to the first digit of the start time (XX:XX).
11. Depress either “⇓” or “⇑” until the desired value is displayed.
15. Depress “Enter” to store value or “ESC” to cancel.

    NOTE: The value for the time of day to start the plant exerciser will only be saved after hitting “Enter” after modifying the 4th digit.
12. The LCD displays “SET UP EXERCISER/Duration (hh:mm): XX:XX.
13. The first digit of the hour and minute duration timer is underlined.
14. Depress either “⇓” or “⇑” until the desired value is displayed.
16. Depress “Enter” to store value or “ESC” to cancel.

    NOTE: The value for the time duration will only be saved after hitting “Enter” after modifying the 4th digit.
15. Depress “Enter” until the LCD then displays “SET UP EXERCISER/Days (Caps = ON) : s m t w t f s”.
16. Notice that the first character will be underlined.
17. Depress “⇓” or “⇑” to change the selected days case.
    a. Capital - Exercise Performed
    b. Lower Case - No Exercise
18. Depress “Enter” to store value.
19. Depress “Enter” until the LCD then displays “SET UP WEEKS OF MONTH (NUMBER = ON; • = OFF) : 1 • 3 • 5”.

    (NOTE: If the “5th” week is selected and there is no 5th week in the month, the plant exerciser will not run.)
20. Notice that the first character will be underlined.
21. Depress “⇓” or “⇑” to change the selected number to a dot.
    a. Number - Exercise Performed
    b. Dot - No Exercise
22. Depress “Enter” to store value or “ESC” to cancel.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Standard Time Delays and Their Functions

TDES Time Delay Engine Start. This timer is adjustable from 0 to 300 seconds and is FACTORY SET AT 3 SECONDS. It is initiated upon sensing the loss of normal power and once timed out will initiate an engine start signal.

TDE Time Delay Emergency. This timer is adjustable from 0 to 300 seconds and is FACTORY SET AT 3 SECONDS. It is initiated upon the sensing of the emergency source and once timed out will initiate the transfer to the emergency source.

TDN Time Delay Neutral. This timer is adjustable from 0 to 300 seconds and is FACTORY SET AT 3 SECONDS. It is initiated upon the opening of one source and will inhibit the closing of the oncoming source until it has timed out.

TDR Time Delay Return. This timer is adjustable from 0.0 to 60.0 minutes and is FACTORY SET AT 12 MINUTES. It is initiated upon the restoration of normal power and will inhibit the switch from retransferring to the normal source until it has timed out. If at any time during the timing cycle normal power is not maintained, this timer will be terminated and will be reinitiated when normal power returns.

TDEC Time Delay Engine Cool down. This timer is adjustable from 0.0 to 60.0 minutes and is FACTORY SET AT 10 MINUTES. This timer is initiated upon the retransfer of the switch to the normal source and will keep the engine running until it has timed out.

MRT Minimum Run Timer. This timer is adjustable from 0.0 to 60.0 minutes and FACTORY SET AT 10 MINUTES. It is initiated upon the initiation of starting the engine generator set and will keep the engine running until it has timed out.

Optional Time Delays and Their Functions

SFT Synchronize Fail Timer. This timer is adjustable from 0.0 to 60.0 minutes and is FACTORY SET AT 10 SECONDS. It is only used for closed transition transfer switches. It is initiated at the time that actual transfer is permitted by the controller. If it times out prior to a transfer being complete, it will display “Trouble: SFT timed out”, but will not terminate operation of the transfer switch. This is to alert the operator that the system took longer to synchronize than expected. The operator can clear this message by pressing “Enter” and then select “Clear Trouble”. The operator can also program the MP7650 to continue to try for a closed transition transfer or to do an open transition transfer when this timer times out. This also drops out the trouble relay to annunciate that this transfer switch requires attention.

TDBT Time Delay Before Transfer. This timer is adjustable from 0 to 300 seconds and is FACTORY SET AT 10 SECONDS. It is initiated when the switch is ready to transfer and upon its completion the transfer will take place. This is typically used in elevator circuits.

SPPT Single Phase Protection Timer. This timer is adjustable from 0 to 300 seconds and is FACTORY SET AT 10 SECONDS. The SPPT timer begins timing when the under voltage relay drops out. IF the transfer to emergency begins before this timer times out, this timer is turned off. If this timer times out before the transfer to emergency begins, an output is sent to trip the normal breaker to trip it open. This is to prevent damage to the load in case the system is on a utility single phase condition. On insulated case breakers this operates without any operator intervention because opening and tripping the breaker are the same mechanism and the breaker does not need to be reset.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Relay Interface Board

The Relay Interface Board (RIB) is the electro mechanical interfacing device between the MP7650 microprocessor controls, the power panel and the user interfaces. When the transfer switch is ordered, 12-volt dc or 24-volt dc operation must be selected. Although the power supply will accept any voltage within its range, the relays that populate the Relay Interface Board must be either 12-volt dc or 24-volt dc. Please insure that the relay voltage agrees with your dc power source voltage.

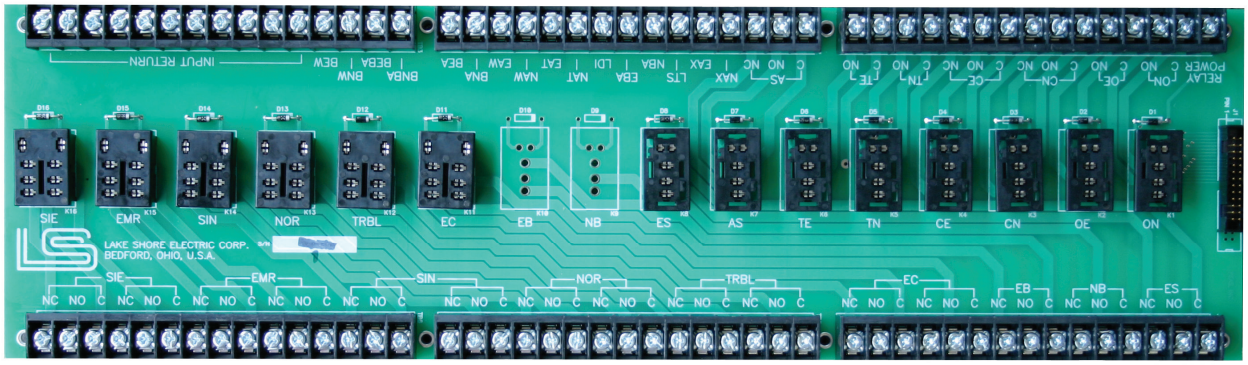


Figure 5 - Relay Interface Board

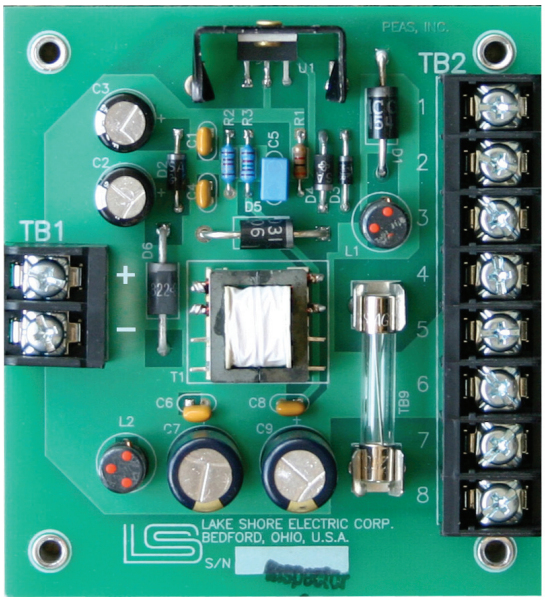


Figure 6 - Power Supply Board

Power Supply Board

The Power Supply (PS) unit accepts a 12-volt dc or 24-volt dc input. It is designed to function on the engine starting batteries. Voltage regulation for the power supply is within 2% from no load to full load. External voltage sources can vary from 7 volts dc to 36 volts dc without harm to the MP7650 or interruption of its operation.

This is a negative ground system. The board has provision to accommodate a large external “hold-up” capacitor for installations that may experience momentary input-voltage dropouts or reversals. For more information on the use of a “hold-up” capacitor in this circuit, please contact the factory.

TB1

1	+ Battery Input (Positive)
2	- Battery Input (Negative)

TB2

1	Battery Output to MDS, unfused
2	Battery Input from MDS, unfused
3	Battery Output to Relay Interface Board
4	Battery Output, spare
5	Battery Negative
6	Battery Negative
7	9VDC regulated Output
8	Capacitor Input

LAKESHORE
ELECTRIC CORPORATION

MBE CERTIFIED

LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

LAKESHORE
ELECTRIC CORPORATION

MP7650 – Field Replaceable Unit (F.R.U.)

Figure 7

Figure 8

Figure 9

Figure 10

Microprocessor System Specifications

MP7650 Microprocessor System	
Operating Voltage	12Vdc or 24Vdc
Power Consumption: Passive Monitoring	24 ~ 48 VA ≅ 2A @ Selected Voltage
Power Consumption: Operating MC Units	Max Inrush: 260 VA
Power Consumption: Operating IC Units	Max Inrush: 500 VA
Customer Connection Contact Type	Form "C" Dry Contacts [C, NO, NC]
Customer Connection Contact Rating	10 Amps Max Contacts
Ambient Temperature: Operating	-20°C to +60°C [-4°F to 140°F]
Ambient Temperature: Storage	-40°C to +80°C [-40°F to 176°F]
Humidity	5 to 85% RH, no condensation
Weight	51.5 oz., 3.2 lbs. (F.R.U.)
Industrial Control Equipment	UL 1008 Listed
Construction	Solid State Circuitry
Dimensions (W x H x D)*	7" x 10 3/8 " x 1 ½"
Mounting (W x H)*	7 ½" x 7"

* Reference Figure 10.

Microprocessor System Order Guide

MP7650 Microprocessor System Part Numbers	
Field Replaceable Unit, F.R.U.	70LSEMP1850000
HMI Overlay for Front of Door Fixed IC or MC Units Drawout IC Units	 58NPTOL7678000 58NPTOL7678001
Keypad	43XYMKP4408300
Relay Interface Board, RIB	70LSEMP1857400
ICE Cube Relays, 12Vdc 1 Pole 2 Pole Hold Down Spring	 32IDEDC1940001 32IDEDC1940002 43IDESP1940180
ICE Cube Relays, 24Vdc 1 Pole 2 Pole Hold Down Spring	 32IDEDC1940004 32IDEDC1940005 43IDESP1940180
Power Supply Board, PSB	70LSEMP1857301
Communication Ribbon Cable IC Units, 100" MC Units, 72"	 70LSEMP1858526 70LSEMP1857526
Standard Control Switches Keypad Enable, KPE Override Pushbutton, ORPB Load Test Switch, LTS	 02CASTS1673562, Maintained 02CASPB1673561, Momentary 02CASPB1673561, Momentary

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Auxiliary Contact Before Transfer

Introduction

This option provides two (2) sets of form "C" Contacts, which change state prior to transfer in either direction. The time delay between initiation of these contacts and switch transfer is field adjustable.

Product Description for Microprocessor Controls (Option ACBT)

For this option, the automatic transfer switch (ATS) provides a pre-transfer signal called Time Delay Before Transfer (**TDBT**) and two sets of form "C" contacts called **EC**.

- **EC** - Two form "C" contacts are provided on the Relay Interface Board and labeled EC (Elevator Control).
- **Time Delay Before Transfer -** This timer is adjustable from 0 to 300 seconds and is FACTORY SET AT 10 SECONDS. It is initiated when the switch is ready to transfer and upon its completion the transfer will take place. This is typically used in elevator circuits.

When the controller is ready to begin a transfer in either direction, it picks up a relay (EC) and starts timer TDBT. Upon completion of timer TDBT, the controller actually starts the transfer. Upon completion of the transfer, the output relay (EC) is dropped out.

While this timer is timing out, its status will be displayed on the HMI LCD display. (See Example Below)

AUTO - EXERCISE W/LOAD Awaiting TDBT: 4 sec

NOTE: This timer is not initiated wherever there is a failure of either power source, since its implementation would only serve to delay a transfer to the available source.

Product Description for Electromechanical Controls (Option 35)

a. Single Motor Operation

For this option, the automatic transfer switch (ATS) provides pre-transfer signals called Elevator Control Timer on Normal **ECTN** and Elevator Control Timer on Emergency **ECTE** and two sets of form "C" contacts are provided; one is **ECRN** and one is **ECRE**.

When the transfer switch senses that the preferred power source is out of acceptable limits, a signal is sent by the transfer switch to start the on-site engine generator set. When the output of the engine generator set has attained an acceptable level, the automatic transfer switch energizes relay ECRE and timer ECTE.

When ECRE is energized, a set of dry contacts, one normally open and one normally closed, immediately change state. This sends a signal to the elevator controller that a transfer is about to occur.

The time delay between the change in state of these contacts and actual transfer of the switch is field adjustable through timer ECTE. Once this timer has timed out, the automatic transfer switch transfers the load from the normal to the emergency power source, and ECRE and ECTE are de-energized allowing the set of dry contacts to revert to their original state.

Once the normal source has returned to within acceptable limits and associated time delays have been timed out to prepare for a return of the load to the normal source, relay ECRN and timer ECTN are energized. When ECRN is energized, a set of dry contacts, one normally open and one normally closed, change state signaling the elevator controller that a transfer of the power source is about to occur. When ECTN times out, the ATS transfers the load from the emergency source to the normal source. Once the transfer is complete, ECRN and ECTN are de-energized and revert to their original state. Please note that the engine maintain timer (EMT) is necessary for this option to function.

- **ECTN and ECTE** - These timers are field adjustable from .03 seconds to 30 minutes
- **ECRN and ECRE** - Two form "C" contacts are provided in the controls section; one is labeled ECRN and one is ECRE (Elevator Control Relay for Normal and Emergency).

b. Dual Motor Operation

Operation of the Elevator Control, Option 35, when applied on a Lake Shore Electric Corporation Dual Motor transfer switch is similar to that as described in section [a Single Motor Operation]. However, instead of transferring to the Normal or Emergency positions after the ECT timers have timed out, the transfer switch transfers to a neutral position, which starts the Time Delay to Transfer (TDT) timer.

At this time the ECRN and ECRE relays and the ECTN and ECTE timers are de-energized and revert to their original state. Once the TDT timer has timed out, the transfer switch completes the transfer operation.

Order Guide

Part Number Examples:

1. ICFA32000BPSB**/ACBT** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with Option ACBT.
2. MCDA30400CESA**/35** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option ACBT.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Auxiliary Contact Source Available

Introduction

This option provides two (2) sets of form "C" Contacts for each source. These contacts will change state dependent on their sources being available and within proper operating parameters required by the ATS.

Product Description for Microprocessor Controls (Option ACSA)

For this option, the automatic transfer switch (ATS) provides two (2) sets of form "C" Contacts for each source called NOR and EMR.

- **NOR** - Normal Relay - This relay changes state when the normal source power is available. When the normal source power is not available, the contact is in the "de-energized" state.
- **EMR** - Emergency Relay - This relay changes state when the normal unit closes or opens. When the normal unit is open, the contact is in the "de-energized" state.

This contacts provided immediate indication once the source is within operating parameters.

NOTE: Depending on other accessories that have been order with the transfer switch, one of the EMR contacts may be used for the transfer switch controls. Please refer to unit specific drawings to determine if only one (1) set of form "C" contacts is available for the emergency source.

This feature is available on all firmware versions for the microprocessor controller.

Reference Figure 1 when connecting into the aux contacts on the Relay Interface Board.

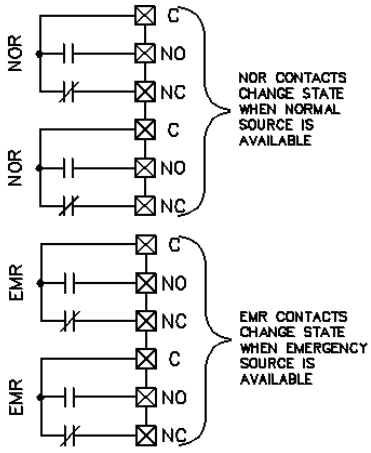


Figure 1

Product Description for Electromechanical Controls (Option 24J), Available for Automatic or Manual Transfer Switches

For this option, the automatic transfer switch (ATS) provides two (2) sets of form "C" Contacts for each source called NSAR and ESAR.

- **NSAR** - Normal Source Available Relay - This relay changes state when the normal source power is available. When the normal source power is not available, the contact is in the "de-energized" state.
- **ESAR** - Emergency Source Available Relay - This relay changes state when the normal unit closes or opens. When the normal unit is open, the contact is in the "de-energized" state.

This contacts provided immediate indication once the source is within operating parameters.

Reference Figure 2 when connecting into the aux contacts on the Electromechanical Control Panel

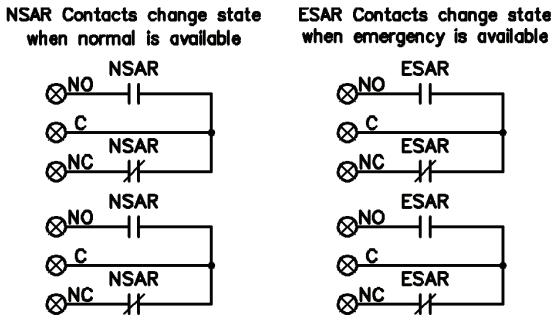


Figure 2

Order Guide

Part Number Examples:

1. ICFA32000BPSB**/ACSA** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with Option ACSA.
2. MCDA30400CESA**/24J** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option 24J.
3. MCDM30400CESA**/24J** - Molded Case MTS, 3 pole, 400 Amp, 277/480Vac, **Manual Transfer Switch**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option 24J.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Auxiliary Contact Switch Position

Introduction

This option provides two (2) sets of form "C" Contacts for each sources control unit (either a molded case or insulated case switch/breaker unit). These contacts will change state dependent on the position of their control unit.

Product Description for Microprocessor Controls (Option ACSP)

For this option, the automatic transfer switch (ATS) provides two (2) sets of form "C" Contacts for each control unit called SIN and SIE.

- **SIN** - Switch in Normal - This relay changes state when the switch is in the normal position. When the switch is not on the normal source, the contact is in the "de-energized" state.
- **SIE** - Switch in Emergency - This relay changes state when the switch is in the emergency position. When the switch is not on the emergency source, the contact is in the "de-energized" state.

These contacts provided immediate indication when the switch changes position.

This feature is available on all firmware versions for the microprocessor controller.

NOTES:

Automatic Transfer Switches with Microprocessor Controls - this is a standard feature.

Reference Figure 1 when connecting into the aux contacts on the Relay Interface Board.

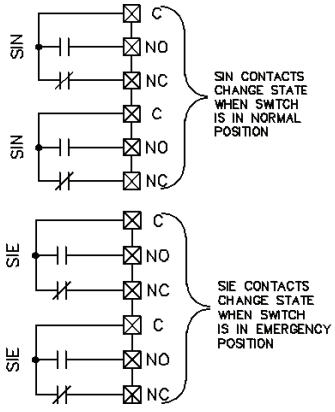


Figure 1

Product Description for Electromechanical Controls (Option 18 & 19), Available for Automatic or Manual Transfer Switches

For this option, the automatic transfer switch (ATS) provides two (2) sets of form "C" Contacts for each control unit called ACRN and ACRE.

- **ACRN (18)** - Aux Contact Relay on Normal - This relay changes state when the switch is in the normal position. When the switch is not on the normal source, the contact is in the "de-energized" state.
- **ACRE (19)** - Aux Contact Relay on Emergency - This relay changes state when the switch is in the emergency position. When the switch is not on the emergency source, the contact is in the "de-energized" state.

These contacts provided immediate indication when the switch changes position.

Reference Figure 2 when connecting into the aux contacts on the Electromechanical Control Panel.

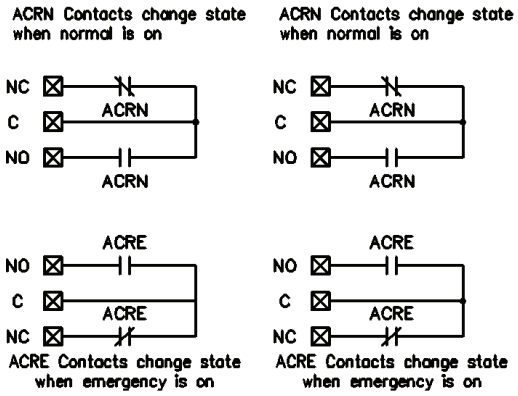


Figure 2

Order Guide

Part Number Examples:

1. ICFA32000BPSB - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with included option ACSP.
2. MCDA30400CESA**/18/19** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Options 18 and 19.
3. MCDM30400CESA**/18/19** - Molded Case MTS, 3 pole, 400 Amp, 277/480Vac, **Manual Transfer Switch**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Options 18 and 19.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Battery Charger System 12Vdc

Introduction

This option provides a 12Vdc battery and charger kit for the MP7650 processor controls installed into a molded case ATS.

It will automatically fix the transfer switch code to "M" for the DC voltage. Please refer to the transfer switches' schematic for unit specific reference.

Product Description for Microprocessor Controls (Option BC)

For this option, custom wiring is added to the ATS to include a 12 Volt, 7AH (Amp-Hours) battery to power the microprocessor controls. This will also include a battery charger to keep the equipment running continuously.

See Figure 1 for general wiring of the battery charger system.

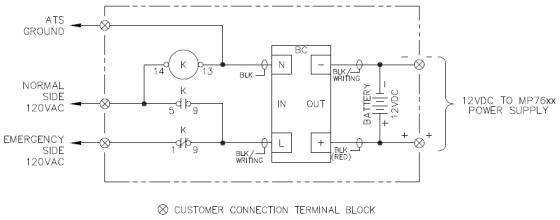


Figure 1

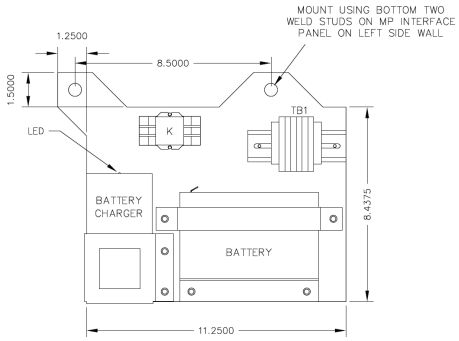


Figure 2

Recommendations

The general operating battery life is approximately two years before replacement is recommended.

Lake Shore Electric Corporation believes in providing the customer with a full turnkey solution to their needs. If the equipment does not fully meet your needs, please consult the factory for further information.

Product Specifications

BATTERY INFORMATION	
Nominal Voltage	12 volts, (6 cells)
Nominal Capacity	20-hr. (350mA to 10.50 volts), 7.00 AH
Energy Density (20-hr. rate)	1.49 W-h/in^3 (90.95 W-h/l)
Specific Energy (20-hr. rate)	17.50 W-h/lb. (38.58 W-h/kg)
Internal Resistance (approx.)	23 milliohms
Max Discharge Current (7 Min.)	21.0 amperes
Max Short-Duration Discharge Current (10 Sec.)	70.0 amperes
Battery Shelf Life (% of nominal capacity at 68°F (20°C))	1 Month, 97% 3 Months, 91% 6 Months, 83%
Ambient Temperature: Operating	Charge: -20°C to 50°C [-4°F to 122°F] Discharge: -40°C to 60°C [-40°F to 140°F]
CHARGER INFORMATION	
Overload Protection	<3A
Short Circuit Protection	Within 5 sec.
Reversed Polarity Protection	Prohibit
Ambient Temperature: Operating	0°C to +40°C [32°F to 104°F]
Ambient Temperature: Storage	-30°C to +85°C [-22°F to 185°F]
Operating Relative Humidity	8% to 90%
Storage Relative Humidity	5% to 95%
Indicator Status: Green LED On	Empty Load or Float Charge
Indicator Status: Red LED On	Bulk Charge
GENERAL EQUIPMENT INFORMATION	
Weight	Approx. 11.7 lbs.
Warranty	1 year
Industrial Control Equipment	UL 1008 Listed
Dimensions (W x H x D)*	12 ½" x 10" x 3" *
Mounting Holes (w)*	8 ½" apart, diameter 9/16" hole

* Reference Figure 2.

Order Guide

Part Number Examples:

1. MCDA30400CMSA/**BC** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **12Vdc Microprocessor Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option BC.
2. 70LSEBA9907047 - When ordering the battery charger option by itself for field installation into existing unit.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Circuit Breaker Trip - Normal and/or Emergency

Introduction

The 2014 National Electric Code (NEC), Article [240] provides the requirements for selecting and installing overcurrent protection devices (OCPDs).

An overcurrent exists when current exceeds the rating of conductors or equipment. It can result from overload, short circuit, or ground fault.

- **Overload** - A condition in which equipment or conductors carry current exceeding their rated ampacity.
- **Short Circuit** - The unintentional electrical connection between any two normal current-carrying conductors of a circuit; (i.e.: line-to-line (L-L) or line-to-neutral (L-N)).
- **Instantaneous** - The inrush current created when a load is initially connected to the power source. The over current protection must be sized to accommodate the expected inrush values of connected loads. It must also be sized to accommodate the total amount of fault, short circuit, current available to the load, if the breaker is closed on a fault.
- **Ground Fault** - An unintentional, electrically conducting connection between a current carrying, ungrounded conductor of a circuit and ground; either equipment or earth ground. During a ground fault, dangerous voltages and abnormally large currents exist.

An example of one of the potential outcomes of any of the faults mentioned above is an Arc Flash, shown in Figure 1.

Figure 1 - Arc Flash Example

This situation is very dangerous for the workers and any other people in the vicinity. It is important that every precaution that can be made to eliminate potential hazards be taken.

Over Current Protection Devices, (OCPDs)

OCPDs protect circuits and equipment, but they protect circuits in one way and equipment in another.

An OCPD protects a circuit by opening when current reaches a value that would cause an excessive temperature rise in the conductors.

The interrupting rating must be sufficient for the maximum possible fault / inrush current available on the line-side terminals of the equipment.

An OCPD protects equipment by physically opening when it detects a short circuit, to high of an instantaneous inrush current, or ground fault. Every piece of electrical equipment must have short-circuit current ratings that permit the OCPDs (for that equipment) to clear the faults without extensive damage to the electrical components of the load.

Conductor overload protection is not required where circuit interruption would create a hazard (i.e., a fire pump transfer switch). Short-circuit protection is still required.

Circuit breakers must be capable of being opened and closed by hand. Non-manual means of operating a circuit breaker, such as electrical shunt trip or pneumatic operation, are permitted only if the circuit breaker can also be manually operated.

Product Description (Option: MP [CBTN / CBTE], EM [23A / 23B])

This option provides standard circuit breaker trips within either, or both, control units of the transfer switch. When automatic controls are utilized in the ATS, the control units will come complete with bell alarms. Bell alarms will only change state when the breaker is tripped due to an overcurrent/fault event, not every time the breakers changes states. When tripped, the bell alarm provides the appropriate input to the controls and the appropriate light will be illuminated on the HMI.

At any point during normal operation, in the event that one, or both, control units are tripped open from an overcurrent/fault event, the trouble (TRBL) contacts will switch states. There are two (2) sets of form "C" Contacts provided for the TRBL signal to indicate a trouble condition.

Please note that these contacts will change state in any trouble event, not just an overcurrent condition.

Also note this option is available for manual transfer switches as options 23A or 23B.

Order Guide

Part Number Examples:

1. ICFA32000BPSB/CBTN/CBTE - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure, with Options Circuit Breaker on Normal and Emergency.
2. MCDA30400CESA**/23A/23B** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Options 23A and 23B.
3. MCDM30400CESA**/23A/23B** - Molded Case MTS, 3 pole, 400 Amp, 277/480Vac, **Manual Transfer Switch**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Options 23A and 23B.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Closed Transition Transfer (CTT)

Introduction

Closed Transition Transfer allows the automatic transfer switch to transfer between sources without interruption of power to the load. This is accomplished by synchronizing the two sources prior to transfer; performing a "**make before break**" transfer.

Upon closure of the oncoming source, the source from which power is being transferred is disconnected; the actual time the sources are paralleled is typically less than 100 milliseconds.

The closed transition or "**make before break**" transfer is possible only if both power sources are available and synchronized. If either of the sources are not available, the transfer switch reverts to an open transition or "**break before make**" transfer arrangement. Closed Transition Transfer is available on Dual Motor Operator and Insulated Case automatic transfer switches.

Features

Closed Transition Automatic Transfer Switches are provided with the following features regardless of the selected transfer mode:

- Electrical Interlock Only
- Millisecond timers to ensure paralleling time is minimal
- Cross Tripping devices as backup to normal transfer means
- Reverse Power Relays for both sources to prevent back feeding Synchronizing relay
- Synchronize Fail Timer (SFT) – This timer is adjustable from 0.0 to 60.0 minutes and is FACTORY SET to 10 sec.
- Sync Check Relay (SCR)
- Reverse Power Relays - (RPRN) for Normal Power and (RPRE) for Emergency Power

Microprocessor Operation (Option CTT)

Closed Transition Transfer passively monitors and compares the frequency and phase angle of the power sources. When the alternate source's frequency and phase angle are within preset limits of the normal source, the sources will be paralleled and the alternate source will be disconnected within acceptable time limits. Again, the average time that the two sources are paralleled is under 100 milliseconds.

When offering closed transition transfer as an automatic transfer switch option, we feel that additional protective features should be added to ensure safety to the operator and equipment. Without exception, we provide all closed transition transfer switches with Reverse Power Relays on both sources. In addition, we provide an internal timer, which will trip the emergency source if both sources are paralleled for more than an acceptable time. As further redundant protection we will cross trip the normal switch if the emergency switch fails to properly open.

The Synchronize Fail Timer (SFT) timer is initiated once the closed transition is called for and will be reset upon completion of the transfer. The HMI Screen will display the following while waiting for the source to synchronize.

AUTO – EXERCISE w/LOAD Awaiting Synchronization

Should the timer time out before the transfer is made, the HMI display will show the following and the trouble contacts will change state.

AUTO – EXERCISE w/LOAD TROUBLE: SFT Timed Out

This is not considered a fault mode; therefore the automatic operation of the transfer switch will not be terminated. However, as long as both sources are available, and the sync check relay has detected a match in the phase angles of those two sources, the transfer will not be completed.

The operator can clear this message by using the following instructions on the HMI input.

1. Press "Enter"
2. Select "Clear Trouble"
3. Press "Enter" to finalize the selection.
4. Microprocessor controller will then resume normal operation.

The operator can also program the MP7650 to continue to try for a closed transition transfer or to do an open transition transfer when this timer times out. This also "Drops Out" the trouble relay to annunciate that this transfer switch requires attention.

As a safeguard, the Closed Transition Transfer Option provides a sync check relay (SCR) and a reverse power relays (RPRN and RPRE) for each source. In the event that both sources might be left in the closed position due to some form of a malfunction, the reverse power relays will sense a reverse power flow condition, if present, and trip/cross trip both sources. This will energize the trouble relay. The HMI panels will then display the following message along with the appropriate reverse power pilot light.

TROUBLE – Revers Power 08:24 Fri APR, 2016

If this is a molded case ATS that is tripped open by the Reverse Power Relays, the electromechanical controls will then be locked out. After this point, operator intervention is required to resume automatic operation.

If this is an insulated case ATS that has been instructed to "OPEN" by the Reverse Power Relays, the transfer switch will continue to operate as an open transition transfer switch.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Electromechanical Operation (Option 36)

Closed Transition Transfer passively monitors and compares the frequency and phase angle of the power sources. When the alternate source's frequency and phase angle are within preset limits of the normal source, the sources will be paralleled and the alternate source will be disconnected within pre-set time limits.

As a safeguard, the Closed Transition Transfer Option provides a sync check relay (SCR) and a reverse power relays (RPRN and RPRE) for each source. In the event that both sources might be left in the closed position due to some form of a malfunction, the reverse power relays will sense a reverse power flow condition, if present, and trip/cross trip both sources. In the event that the ATS is tripped open by the Reverse Power Relays, the electromechanical controls will then be locked out. After this point, regardless of the style of the ATS, operator intervention is required to resume automatic operation.

Recommendations

Where applications require extended or active paralleling operation, soft loading/unloading, utility peak shaving or distributed generation, Lake Shore Automatic Transfer Switches and Switchgear can be tailored to meet those needs. Please consult the factory for further information.

As in all applications which involve parallel operation with a utility grid, it is advised that the specific utility be consulted for prior approval on this type of application. Each utility has its own requirements and guidelines to be followed, such as additional protective relays. Please contact the Lake Shore Electric factory for products to meet such additional needs.

Order Guide

Part Number Examples:

1. MCDA30400CMSA**/CTT** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **12Vdc Microprocessor Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option CTT.
2. MCDA30400CESA**/36** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option 36.
3. ICFA32000CMSF**/CTT** - Insulated Case ATS, 3 pole, 2000 Amp, 277/480Vac, **12Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 3R Free Standing Enclosure with Option CTT.
4. ICFA32000CESF**/36** - Insulated Case ATS, 3 pole, 2000 Amp, 277/480Vac, **Electromechanical Controls**, 65kAIC @ 480Vac, NEMA 3R Free Standing Enclosure with Option 36.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Dual Prime Source

Introduction

The Dual Prime Source option provides the operator with the ability to select the Preferred Source input to the automatic transfer switch (ATS). The power sources can be two generators or two utilities.

As in a conventional transfer switch, the Dual Prime Source transfer switch is designed to transfer a load between two power sources with one power source designated as the Preferred Source while the other is designated as the Alternate Source.

This control is done one of two ways, with the microprocessor controls or electromechanical controls.

Product Features

- PFR1 – Standard Undervoltage Relay on Source 1
- PFR2 – Standard Undervoltage Relay on Source 2
- PSS – Preferred Source Selector Switch, (U1 or U2) or (G1 or G2)

Operation Instructions

General operation of a DPS ATS will depend on the power source type.

If the DPS is Utility to Utility, the ATS will monitor both sources for standard automatic operation. No engine start signal is required.

If the DPS is Generator to Generator, the ATS will monitor both sources for standard automatic operation and provide an engine start signal for the alternate source. The preferred source must have its own controls for standard operation.

Microprocessor Controls, DPS

Microprocessor controls provide diversity of operation for the DPS option, with the basic configuration code of the ATS. Ease of programing the microprocessor is a key feature.

The selection of the preferred source is done with the HMI panel. The units' plant exerciser may then be programmed for specific times the operator requires the ATS to transfer from the preferred source to the alternate source. With the microprocessor controls, the plant exerciser is a fixed feature on the ATS and offers diversity for Dual Prime Source ATS operation.

If a failure of the preferred source occurs, the transfer switch will transfer to alternate source. When the faulted Preferred Source is returned to service, the transfer switch will then retransfer the load back to the preferred source power.

There are other key features available with this option. Please see the Microprocessor Standard and Factory Options Overview datasheet to determine all required features for the ATS.

Electromechanical Controls, 33

Electromechanical controls provide the ATS with operational stability when installed in a noise prone area; i.e.: prone to many electromagnetic fields (EMF) that could potentially interrupt the microprocessor operation.

The selection of the preferred source is done with a selector switch; location may be on the door or internal to the ATS enclosure. The basic controls will allow for automatic selection of a preferred source.

In the event that the preferred source is lost, the unit will then transfer to the alternate source. Basic controls will not include a plant exerciser. When the faulted Preferred Source is returned to service, the transfer switch will then retransfer the load back to the Preferred Source power.

If a plant exerciser option is order with this option, a programmable time clock will alternate which power source the Load is feed from on a set time, or multiple times, during a seven day period.

Please review the Electromechanical Overview datasheet to determine all required features for the ATS. For Gen to Gen connection, Lake Shore Electric recommends P1 Control Board Selection, but P2, P4 and P7 are available for this option. For Utility to Utility connection, any version of the Positive Control Board may be used.

Typical Application of DPS for Redundant Onsite Power Systems

Specifying engineers may require two on-site power generation plants to insure that an alternate power source will be available. In Figure 1 below, ATS-1 is a standard Utility to Emergency ATS. ATS-2 is a Dual Prime Source automatic transfer switch, Gen to Gen connection.

Upon a Utility power outage, ATS-1 will signal ATS-2 to start the Preferred Source generator. ATS-2 will start the generator and provide power to ATS-1 which will transfer the load to the generator. If a failure occurs on the Preferred Source generator, the Alternate Source generator will be started by ATS-2 and its load transferred to the alternate source. ATS-2 will continue to supply power to the load through ATS-1.

When Utility power returns, ATS-1 will return to the utility position and the load transferred to the utility.

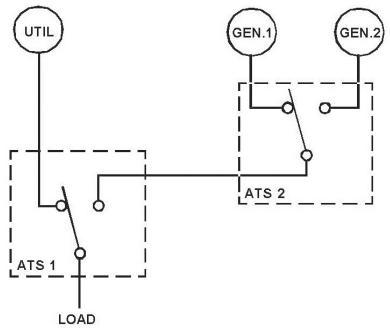


Figure 1

Order Guide

Part Number Examples:

1. ICFA32000BPSB**/DPS** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with Option Dual Prime Source.
2. MCDA30400CESA**/33** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option Dual Prime Source.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE ELECTRIC CORPORATION

Automatic Transfer Switch Option Emergency Disconnect Switch

Introduction

For equipment that is Microprocessor Controlled and required to be Suitable for Use as Service Entrance Equipment, an Emergency Disconnect (ED) Switch will be installed on the outside of the Automatic Transfer Switch (ATS). This switch provides maintenance personnel with additional protection when servicing the ATS by forcing it to the neutral position.

When the ED switch is activated, the current control unit that is currently closed will be tripped open and the other control unit will be prevented from closing. Once the ED signal is removed and the ATS reset, automatic operation will resume.

Product Features

- Keyed ED Switch Located on Door
- Aux Switch, Bell Alarm and Shunt Trips Included in Both Control Units
- 12 or 24 Vdc Required for Operation (Guarantee's the Operator can Place the ATS in the Neutral Position even when AC Power is Lost)
- Included with all Microprocessor Controlled SE ATS Equipment

Operation Instructions

Follow the instructions below for proper operation of the emergency disconnect. This will place the ATS in the neutral position.

1. Operator must use all required PPE before operating the equipment.
2. Locate the ED key.
3. Insert the ED key into the ED switch and turn the key to the right. This will activate the ATS disconnect feature and place it into the neutral position. The operator should hear the control unit trip open. [CLANG!]
4. Verify that both control units have been tripped open by observing the ATS position lights. Both should be in the open/tripped position.
5. Once the ATS is in the neutral position, the operator may proceed with required maintenance.

Insulated Case Reset Instructions

Instructions to Reset the ATS for Automatic Operation.

1. ATS Operator must use all required PPE.
2. Turn the ED key to the left and remove the key from the ED switch. This will clear the ED signal to the ATS.

Microprocessor Controls

1. On the HMI screen, Depress "Enter".
2. The display will read "MAIN MENU / Reset Faults / Troubles".
3. Depress "Enter" again and the display will read "Reset Faults / Troubles Now? No".
4. The word "No" will be underlined.
5. Depress either "⇓" and "⇑" until "Yes", the desired value, is displayed.
6. Depress "Enter".
7. All faults / troubles will be reset and the display will show the operating mode again.

Insulated Case Reset Instructions Continued

Electromechanical Controls

1. No Further Action Required.

Molded Case Reset Instructions

Instructions to Physically Reset Control Units after the Emergency Disconnect was Activated

1. ATS Operator must use all required PPE.
2. Turn the ED key to the left and remove the key from the ED switch. This will clear the ED signal to the ATS.
3. Open the ATS enclosure. ATS will be in the Neutral position.
4. Depress the control handle on the Control Unit that was tripped until it is in the "OFF" position. [Solid CLICK sound.]
5. Close the ATS door.

Microprocessor Controls

The following instructions are to be performed using the keypad and HMI screen located on the front of the ATS.

1. Depress "Enter".
2. The display will read "MAIN MENU / Reset Faults / Troubles".
3. Depress "Enter" again and the display will read "Reset Faults / Troubles Now? No".
4. The word "No" will be underlined.
5. Depress either "⇓" and "⇑" until "Yes", the desired value, is displayed.
6. Depress "Enter".
7. All faults / troubles will be reset and the display will show the operating mode again.

Electromechanical Controls

1. No Further Action Required.

Order Guide

Part Number Examples:

1. ICFA32000BPSB**/SE/ED** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with Option SE and ED.
2. MCDA30400CESA**/32** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option 32.

LAKESHORE ELECTRIC CORPORATION

MBE CERTIFIED MINORITY BUSINESS ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Fire Pump Controls

Introduction

The Fire Pump Control option includes all features necessary for a Lake Shore Dual Motor Automatic Transfer Switch (ATS) to meet or exceed NFPA 20 (Chapter 10), U.L. 1008 and NEMA ICS 227-47 requirements for an ATS to be used in a Fire Pump Circuit.

NFPA 20 requires the Automatic Transfer Switch to be a self-contained power switching assembly, housed in a separate enclosure. The transfer switch is dedicated to the fire pump load exclusively and is both electrically or manually operable and mechanically held.

An Isolating Switch, located within the Transfer switch enclosure and externally operable, is provided ahead of the input terminals of the emergency side of the switch.

Product Features

Lake Shore Electric Option FPC, which is for a Utility (Normal) source and Generator (Alternate) source, includes all of the following LSEC accessories which comprise a fire pump control package that conforms to NFPA 20:

Time Delay Engine Start	Provides an adjustable delay after normal source failure before initiating engine start signal of emergency source.
Time Delay Return	Provides a delay after the return of normal power before retransferring the load from the emergency source.
Time Delay Transfer	Allows for a time delay in the neutral position between opening the contacts on one source and closing the contacts on the other source.
Under Voltage / Phase	Provided on the Normal source for close-differential monitoring of the Normal source Rotation Relay voltage to ensure that it is within acceptable limits and proper phase rotation.
Frequency-Voltage Relay	Provides protection against transferring to the emergency source until the generator has reached both operating frequency and voltage.
Start Contact	Starting Contact provides for starting an engine when initiated by the Transfer Switch.
Auxiliary Contacts	Provided on the emergency source to indicate remotely that the Transfer Switch has been transferred to the Alternate source.
Pilot Lights	Provide two indicating lights mounted on the exterior of the Transfer Switch enclosure showing to which source the load is connected.
Surge Suppression	Protection for the Transfer switch from transient voltage surges which may harm the control circuitry.
Load Test Switch	Provides engine starting plus transfer of the load to the emergency source. This switch is door mounted.
Special Devices	Other devices necessary to meet the requirements of NFPA 20, listed below: 1. Isolation Switch which is lockable in the open position Audible alarm on opening of the isolation switch Visual indication of isolation switch position. 2. Auxiliary contacts for remote annunciation of isolation switch position.
Labels & Markings	Transfer switch will be labeled as required by U.L. 1008 and NFPA 20 for use in a fire pump circuit.

The most common type of installation uses an onsite engine generator set as the emergency power source. The single line of this configuration is shown in

Figure 1.

The overcurrent protection shown on the normal side, (item A) can be incorporated in the Lake Shore Electric Fire Pump Transfer Switch by ordering it as service entrance rated.

The overcurrent protection shown on the emergency side, (item B) which is required in the event the alternative source is provided by a second utility, or the generator is larger than 225% of the fire pump motor's rated full load current, can also be incorporated into the Lake Shore Electric Fire Pump Transfer Switch by ordering it with overcurrent protection on emergency.

Order Guide

Part Number Examples:

1. MCDA30225CPSF**/FPC** - Molded Case ATS, 3 pole, 225 Amp, 277/480Vac, **Microprocessor Controls**, 35kAIC @ 480Vac, NEMA 3R Free Standing Enclosure with Fire Pump Controls.
2. MCDA30400CPSF**/FPC** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Microprocessor Controls**, 35kAIC @ 480Vac, NEMA 3R Free Standing Enclosure with Fire Pump Controls.
3. MCDA30800CPSF**/FPC** - Molded Case ATS, 3 pole, 800 Amp, 277/480Vac, **Microprocessor Controls**, 35kAIC @ 480Vac, NEMA 3R Free Standing Enclosure with Fire Pump Controls.

LAKESHORE
ELECTRIC CORPORATION

MBE CERTIFIED

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

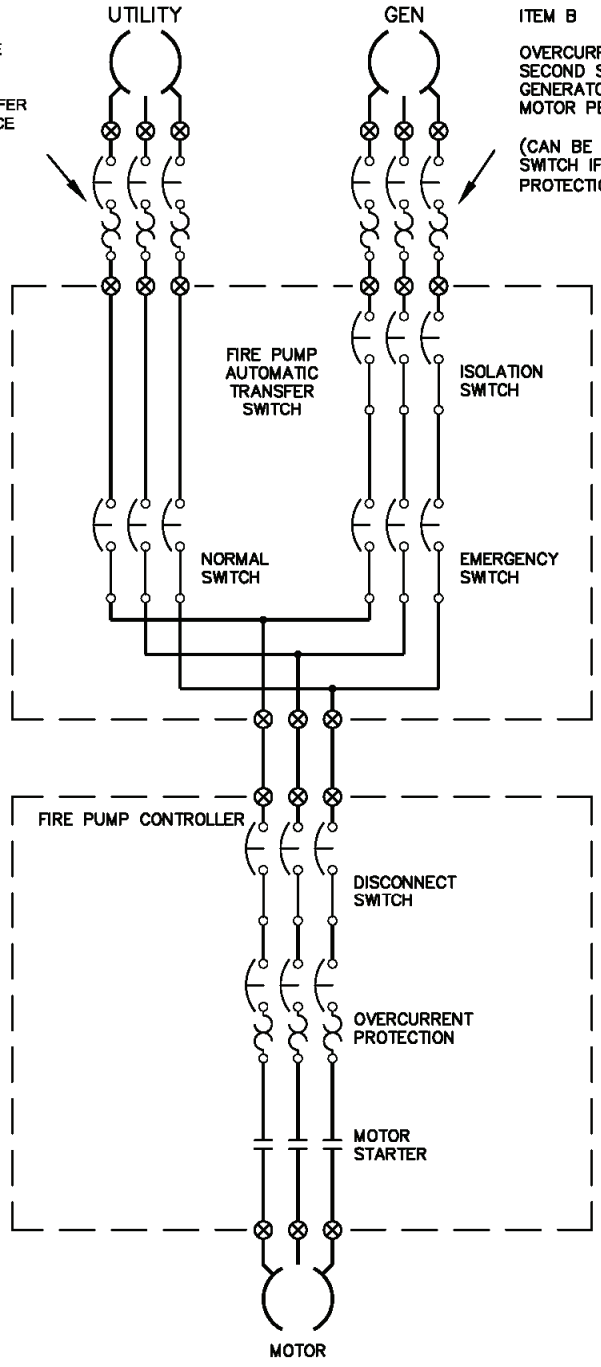
LAKESHORE
ELECTRIC CORPORATION

AUTOMATIC TRANSFER SWITCH / FIRE PUMP SCHEME

ITEM A

OVERCURRENT PROTECTION FOR SERVICE ENTRANCE AS REQUIRED BY CODE

(CAN BE PART OF THE LAKE SHORE TRANSFER SWITCH IF ORDERED AS SERVICE ENTRANCE EQUIPMENT)



ITEM B

OVERCURRENT PROTECTION REQUIRED WHEN SECOND SOURCE IS A UTILITY OR WHEN GENERATOR IS > 225% OF FIRE PUMP MOTOR PER PARAGRAPH 10.8.2.1.5.

(CAN BE PART OF LAKE SHORE TRANSFER SWITCH IF ORDERED WITH OVERCURRENT PROTECTION ON EMERGENCY)

Figure 1

LAKESHORE
ELECTRIC CORPORATION

MBE CERTIFIED MINORITY BUSINESS ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Ground Fault Indication

Introduction

Article 700-26 of the National Electric Code states “The alternate source for emergency systems shall not be required to have ground fault protection of equipment with automatic disconnecting means”. Although this is an exception to Article 230-95, it provides the designer of a system the ability to exercise judgment in the balance between risking damage to equipment verses loss of the emergency power source. This article does, however, require Ground Fault Indication be provided for the emergency source.

Article 700-6 of the National Electric Code states “Audible and visual signal devices shall be provided, where practicable, for Ground Fault. To indicate a ground fault in solidly grounded Wye emergency systems of 150 volts to ground and circuit protective devices rated 1,000 amperes or more. The sensor for the ground fault signal devices shall be located at, or ahead of the main system disconnecting means for the emergency source, and the maximum setting of the signal devices shall be for a ground fault current of 1200 amperes. Instruction on the course of action to be taken in event of indicated ground fault shall be located at or near the sensor location”.

Therefore the detection of a ground fault on an emergency service is desirable. However, Automatic Disconnect in the event of such a fault may not be appropriate.

Article 517 requires that any Ground Fault sensing for onsite generating units shall be indication only.

Article 517.17 (A) states, “where ground fault protection is provided for operation of the service disconnecting means or feeder disconnecting means as specified by 230.95 or 215.10, an additional step of ground fault protection shall be provided in the next level of feeder disconnecting means downstream toward the load. Such protection shall consist of overcurrent devices and current transformers or other equivalent protective equipment that shall cause the feeder disconnecting means to open. The additional levels of ground fault protection shall not be installed as follows:

1) On the load side of an essential electrical system transfer switch.
2) Between the onsite generating unit(s) described in 517.35(B) and the essential electrical system transfer switches.
3) On electrical systems that are not solidly grounded Wye systems with greater than 150 volts to ground but not exceeding 600 volts phase-to-phase.

When Ground Fault Indication is specified on a Lake Shore Electric Corporation Transfer Switch the fault will be annunciated, however the ATS will remain in the automatic mode and will allow the closing of either source to the known fault.

For Delta connected systems, please consult the factory.

Product Features

- UL 1008 Listed
- Monitors for Ground Fault, but the System will Not be Tripped in the Event of a Ground Fault Condition Detected
- Aux Contact Provided for the Customers Remote Controls or for an Indication Light Only

Operation

This option provides Ground Fault monitoring on the normal source. When a Ground Fault Condition is detected, the provided GFI aux contact will change states.

One use for this contact may be by the customer for remote monitoring of the system. Another use would be to provide a door light to indicate to the local personal of the ground fault condition and to proceed with Caution.

Recommendations

Lake Shore Electric Corporation highly recommends that the specifying engineer recommend where any and all ground fault indication should be placed within the facility.

If GFI has already been specified please consult the factory for ordering the appropriate equipment and further information.

Order Guide

Part Number Examples:

1. ICFA32000BPSB**/GFI** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with included option GFI.
2. MCDA31000CESA**/39B** - Molded Case ATS, 3 pole, 1000 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with option 39B, Ground Fault Indication Only.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Ground Fault Protection

Introduction

Ground faults in any power distribution system require special consideration. A ground fault occurs whenever a phase conductor develops an electrically conductive path to ground. This path may be caused by deteriorated insulation, mechanical damage, surges, heat, aging, presence of rodents, and the intrusion of foreign objects such as tools into bare bus compartments.

A ground fault may develop as a “bolted fault” and or “arcing fault.” Ground fault protection will protect against either type if properly set.

A “bolted fault” occurs when a phase conductor is solidly connected to ground. This produces a high fault current which dissipates energy throughout the distribution system.

An “arcing fault” occurs when a phase conductor develops an electrically conductive path to ground, but is not solidly connected to ground. This path develops an arcing fault which, if self-sustaining, is capable of releasing tremendous energy at the point of fault. This tremendous energy, released at low current levels over a period of time, creates devastating results sufficient to ignite fires.

The I.E.E.E. studies indicate that the typical arcing fault current is only 38% of the bolted fault current. It is this low current level that renders normal over current protection useless. The only recourse is to add supplemental relaying to secure adequate protection.

The National Electric Code requires in Article 230-95: “Ground fault protection of equipment shall be provided for solidly grounded Wye electrical services of more than 150 volts to ground, but not exceeding 600 volts phase to phase for each service disconnecting means rated 1,000 amperes or more”.

The voltage range for ground fault protection is specified since arcing faults in circuits less than 150 VAC to ground are usually self-extinguishing and arcing faults in circuits over 600 VAC line to line approach bolted fault levels which may be detected by ordinary phase over current devices if the system is solidly grounded.

When a ground fault is detected, the Normal and/or the Emergency source will be opened, isolating the ground fault from the external voltage source. To insure that the alternate source will not be closed to a known fault.

The Automatic Transfer Switch will be inhibited from transferring to the alternate source until:

1) The Fault is Cleared
2) Automatic Transfer Switch is Manually Reset
3) Ground Fault Relay is Reset by Pushing the Reset Pushbutton

The maximum setting of the ground fault protection shall be 1200 amperes, and the maximum time delay shall be one second for ground fault currents equal to or greater than 3000 amperes.

NOTE:

For Delta connected systems, please consult the factory. Ground Fault Protection is not required for a continuous industrial process where a non-orderly shutdown will introduce additional or increased hazards.

Product Features

- UL 1008 Listed
- Monitors for Ground Fault and the System will be Tripped in the Event of a Ground Fault Condition being Detected
- Aux Contact, TRBL, Provided for the Customers to Indicate a System Trouble (General Trouble Contact; Overcurrent, Ground Fault etc.)
- HMI will Display the Fault Condition

Operation

This option provides Ground Fault Protections on the normal source. When a Ground Fault Condition is detected, the system will trip open the normal side breaker to remove the ground fault from the load.

The Trouble contact, TRBL, will change state to indicate there is a problem with the power source. This will require operator intervention to remove the ground fault and reset the ATS for automatic operation.

Recommendations

Lake Shore Electric Corporation highly recommends that the specifying engineer recommend where any and all ground fault protection should be placed within the facility.

If GFP has already been specified please consult the factory for ordering the appropriate equipment and further information.

Order Guide

Part Number Examples:

1. ICFA32000BPSB**/GFP** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with option GFP.
2. MCDA31000CESA**/39A** - Molded Case ATS, 3 pole, 1000 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option 39A.
3. MCDM31000CESA**/39A** - Molded Case MTS, 3 pole, 1000 Amp, 277/480Vac, **Manual Transfer Switch**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option 39A.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Load Demand Inhibit

Introduction

Load Demand Inhibit, (LDI) provides an input to the transfer switch. The input is a two-wire connection on the Relay Interface Board and is marked “LDI”. It is pre-wired to the customer connection terminal blocks.

This option, when the input is active, will force the transfer switch from the emergency source and onto the normal source. If the normal source is not available, the transfer switch will be forced to the neutral position.

Once the transfer switch has been forced off of the emergency source and the LDI input is still active, the transfer switch will be prohibited from connecting to the Emergency Source.

Once that input has been removed, automatic operations will resume.

Product Features

- UL 1008 Listed
- Terminal Block Connection Point for Customer Wiring

Operation Instructions

Microprocessor Controls

The customer must wire in a normally open contact that they will close when LDI operation is required.

See Figure 1 for customer wiring terminals. The input to the Relay Interface Board is already pre-wired by Lake Shore Electric to terminal blocks 034 and 025.

When the customer contact has been closed, the ATS will be forced of emergency power. If normal power is not available, the ATS will be forced to the neutral position.

When automatic operation is required, remove the LDI input from the ATS and automatic operation will resume.

Electromechanical Controls

There is no standard option to include LDI with Electromechanical Controls. Please consult the factory to discuss the requirements for adding this feature.

Applications

Typical uses of the load demand inhibit function would be for load shedding applications.

Load Shedding Definition: The deliberate shutdown of electric power in a part or parts of a power-distribution system, generally to prevent the failure of the entire system when the demand strains the capacity of the system.

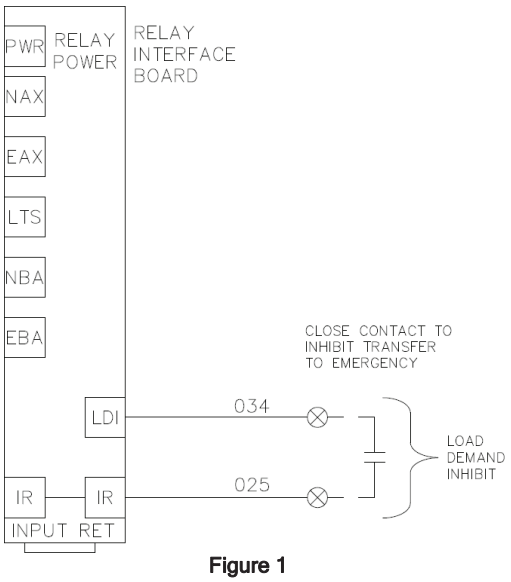


Figure 1

Order Guide

Part Number Examples:

1. ICFA32000BPSB**/LDI** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with Option LDI.
2. MCDA30400CPSA**/LDI** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **24Vdc Microprocessor Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option LDI.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Maintained Load Test Switch

Introduction

The standard load test switch in any automatic transfer switch (ATS), allows the operator to press/switch the load test switch (LTS) to perform a full load transfer test of the ATS.

Once the operator has pressed/switched the LTS, it will simulate a power outage on the normal source that will force the ATS to send the engine start (ES) signal to the attached generator. This is the same for either microprocessor or electromechanical controls. Once the generator is fully operational, the ATS will transfer the load to the emergency power. Once the transfer is complete, the ATS will return to automatic operation.

Product Features

- Maintained Load Test Switch (Manual Operation Required)

Standard Load Test Switch Operation

Microprocessor Controls – HMI Load Test

To ensure the Load Test software is operating correctly, the following explains how to perform a load test from the HMI panel directly.

All MP7650 controlled Transfer Switches have a "Load Test" operating mode which is menu selectable at the HMI panel. A test of the automatic circuitry can be initiated by placing the Transfer Switch in the load test mode. This will cause the normal control circuits to de-energize and give a signal to start the engine. After the generator is up to the required voltage and frequency, the transfer switch will transfer to the emergency source.

1. On the HMI screen, Depress "Enter".
2. The display will read "Select Mode (current mode displayed here)".
3. Depress "Enter" again.
4. Depress either "⇓" and "⇑". The following are the available selections.
   a. Automatic
   b. Hand Crank
   c. Load Test
   d. Off
5. Once the "Load Test" option is shown, depress "Enter" to proceed with load test. The following is an example of the HMI display.

MODE LOAD TEST
09:25 Thu 29 Sep, 2016

6. The display will then start to cycle through the appropriate timers to transfer the Load to the emergency source.

NOTE: At any time during this procedure you get lost, depress the "ESC" button unit you are back at the main screen to start over.

Place the transfer switch back into the 'AUTO' position at the HMI panel, using the instruction above, to allow the transfer switch to transfer back to normal and shut down the engine. After the appropriate time delays, the ATS will return the load to the normal source if normal power is available.

Microprocessor Controls – Load Test Switch

Entry into the ATS enclosure is required for this step. Be sure all the appropriate PPE required is being used.

To test the Load Test Cycle, press the momentary Load Test Cycle pushbutton inside the door for two seconds. The transfer switch will start the engine, transfer to emergency, and return to normal after the appropriate time delays.

Electromechanical Controls

Entry into the ATS enclosure is required for this step. Be sure all the appropriate PPE required is being used.

For the standard electromechanical controls, the Load Test switch is a maintained switch. A momentary version of this feature is available, but is mounted on the door (no enclosure entry required), and will work as described in the Microprocessor Controls – Load Test Switch section. See Electromechanical Controls Overview Datasheet for more information.

The operator has to be physically present during the entirety of the full load test in order to return the ATS to automatic operation after completion.

To perform a Load Test on the ATS, flip the toggle on the Load Test switch inside the door. The transfer switch will start the engine and transfer to emergency.

To return the ATS back to automatic operation, flip the toggle on the Load Test Switch inside the door back to its original position and the ATS will return to normal, if normal is available, after the appropriate time delays.

Maintained Load Test (MLT) Operation

Entry into the ATS enclosure is required for this step. Be sure all the appropriate PPE required is being used.

For the standard Maintained Load Test switch, the operator has to be physically present during the entirety of the full load test in order to return the ATS to automatic operation after completion. However, if this option is being used to force the ATS to emergency power, the switch may be set and the operator may leave.

To perform a Load Test on the ATS, flip the MLT switch located inside the door. The transfer switch will start the engine and transfer to emergency.

To return the ATS back to automatic operation, flip MLT switch inside the door back to its original position and the ATS will return to normal, if normal is available, after the appropriate time delays.

Once that input has been removed, automatic operations will resume.

Order Guide

Part Number Examples:

1. ICFA32000BPSB**/MLT** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with Option MLT.
2. MCDA30400CPSA**/MLT** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **24Vdc Microprocessor Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option MLT.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Manual Return to Normal

Introduction

The standard override TDR pushbutton, (ORPB), will override the time delay imposed by the TDR timer described below.

TDR Time Delay Return. This timer is adjustable from 0.0 to 60.0 minutes and is FACTORY SET AT 12 MINUTES. It is initiated upon the restoration of normal power and will inhibit the switch from retransferring to the normal source until it has timed out. If at any time during the timing cycle normal power is not maintained, this timer will be terminated and will be reinitiated when normal power returns.

The Manual Return to Normal (MRTN) option eliminates the "TDR" (Time Delay to Return) timer and a maintained switch replaces the momentary ORPB. In the standard operation of the automatic transfer switch (ATS) with a MRTN feature enabled, the ATS will never transfer to the normal power source unless this input is activated.

Product Features

- Manual Return to Normal (Manual Operation Required)

Standard MRTN Operation

Microprocessor Controls, MRTN

Entry into the ATS enclosure is required for this step. Be sure all the appropriate PPE required is being used.

To return the ATS to the normal source, flip the MRTN switch. The transfer switch will instantly transfer the load to the normal source, if available, and shut down the engine.

Figure 1 shows how the MRTN switch is wired into the microprocessor control circuit. If a remote MRTN input is required, simply wire a parallel control switch across the MRTN input. A terminal block is available for field wiring upon request.

Electromechanical Controls, 15

Entry into the ATS enclosure is required for this step. Be sure all the appropriate PPE required is being used.

To return the ATS to the normal source, flip the MRTN toggle switch. The transfer switch will instantly transfer the load to the normal source, if available, and shut down the engine.

If a remote MRTN input is required, a terminal block wired in parallel to the MRTN is available for field wiring upon request. This will allow a remote input to control the ATS.

See Electromechanical Controls Overview Datasheet for more information.

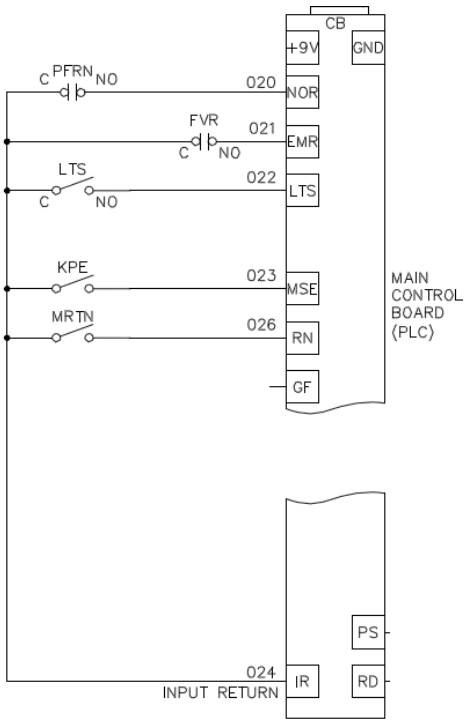


Figure 1

Order Guide

Part Number Examples:

1. ICFA32000BPSB**/MRTN** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with Option MRTN.
2. MCDA30400CESA**/15** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option 15.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Multifunction Metering

Introduction

This option provides a multifunction meter (MFM) on the load output that may be setup to monitor single or three phase systems and may be ordered on Automatic or Manual Transfer Switches. For three phase transfer switches, the unit can be setup to monitor delta or wye, 3-wire or 4-wire, systems.

The unit measures the following:

1. Phase Voltage (V)
2. Phase to Neutral Voltage (V)
3. Phase Current (I)
4. Frequency (Hz)
5. Active Power (W)
6. Active Energy (kWh)
7. Reactive Power (VAR)
8. Apparent Power (VA)
9. Reactive Energy (VARh)
10. Power Factor (PF)
11. Instantaneous Amp Demand
12. Instantaneous Watt Demand
13. Instantaneous VA Demand
14. Maximum Amp Demand
15. Maximum Watt Demand
16. Maximum VA Demand

Standard RS-485 MODBUS communications are included with the MFM option. Ethernet 10/100 base connectivity available upon request. If other communication types are required, a conversion module may be used convert the RS-485 to the appropriate protocol. Please consult the factory for the appropriate converter.

Product Features

- UL 1008 Listed
- Complete 1ϕ or 3ϕ Digital Metering System
- Continuous display of kW.h or kVAr.h
- THD option for Current and Voltage
- Front Access Keypad for MFM Controls
- RS-485 MODBUS Communication, Standard
- RS-485 Daisy Chain Capable with up to 32 Other Devices
- Programmable, Non-volatile Memory which retains:
  - CT Current Ratios
  - Demand Time Periods
  - Calibration Data in Power Down (Power Loss) Conditions
- Auxiliary Power Input will be One of the Following
  - 120Vac
  - 12Vdc
  - 24Vdc

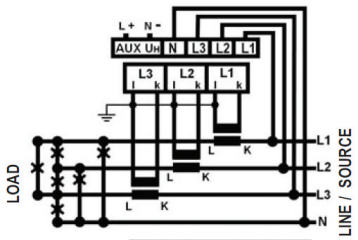
Operation Instructions

Currently, Lake Shore Electric utilizes the PC&S Power Monitor, mfg. part# M850-LCD, on transfer switches which this option has been ordered. Reference the user guide for operating this meter. This is subject to change without notice so be sure to consult the factory when ordering new equipment. If there are any technical questions for a multifunction meter provided with a Lake Shore Electric ATS, please give technical support a call.

Figure 1 shows the current wiring capabilities of the PC&S meter, mfg. part# M850-LCD.

Wiring Connections

k / K = X1 or H1 (Depending on CTs) = faces Source
l / L = X2 or H2 (Depending on CTs) = Grounded



	Voltage				Current		
	L1	L2	L3	N	L1	L2	L3
1ph	✓	×	×	✓	✓	×	×
1ph 3W	✓	✓	×	✓	✓	✓	×
3ph 3W	✓	✓	✓	×	✓	×	✓
3ph 4W	✓	✓	✓	✓	✓	✓	✓
3ph 3W BAL	✓	✓	✓	×	✓	×	×
3ph 4W BAL	✓	×	×	✓	✓	×	×

Unused Voltage terminals are internally connected
Secondary of CTs must be connected to earth

Figure 1

Order Guide

Part Number Examples:

1. ICFA32000BPSB**/MFM** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with Option LDI.
2. MCDA30400CESA**/25** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option 25.
3. MCDM30400CESA**/25** - Molded Case MTS, 3 pole, 400 Amp, 277/480Vac, **Manual Transfer Switch**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option 25.

Product Specifications

PC&S MULTIFUNCTION METER, M850-LCD	
DISPLAY	
Type	LCD
Screen Size	Blue, Green, White (User-Selectable)
Energy	1 line 99999999
Digit Size	6mm, 7 segment
Brightness	8 user-selectable levels
COMMUNICATIONS	
RS485	MODBUS Protocol
Pulsed Output	W.h, VAr.h
ENVIRONMENTAL	
Working Temperature	-20°C to +70°C [-4°F to 158°F]
Storage Temperature	-30°C to +80°C [-22°F to 176°F]
Relative Humidity	0 to 95% RH, no condensation
Shock	30G in 2 planes
APPROVAL	
UL	File No. E337752-1

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Peak Shave

Introduction

Peak Shave, (PS) provides an input to the transfer switch. The input is a two-wire connection on the Main Control Board and is marked “PS”. It is pre-wired to the customer connection terminal blocks.

This option, when the input is active, will force the transfer switch onto the emergency source. If the emergency source is not available, the transfer switch will return to the normal source.

As long as the PS input is active, the transfer switch will attempt to transfer to the emergency source. If that source is not available, it will return to the normal source.

Once that input has been removed, automatic operations will resume.

Product Features

- Terminal Block Connection Point for Customer Wiring

Operation Instructions

Microprocessor Controls, PS

The customer must wire in a normally open contact that they will close when PS operation is required.

See Figure 1 for customer wiring terminals. The input to the Main Control Board is already pre-wired by Lake Shore Electric to terminal blocks 035 and 024.

When the customer contact has been closed, the ATS will attempt to transfer to emergency power. If emergency power is not available, the ATS will return to normal power.

When automatic operation is required, remove the PS input from the ATS and automatic operation will resume.

Electromechanical Controls, 43

This feature will override the operation of a remote or local test switch that has been used to force the ATS to the Emergency position. If the emergency power fails, the ATS will automatically retransfer to the normal power if it is available.

Please consult the factory to discuss the requirements for adding this feature.

Applications

Typical uses of the peak save function are, for example, money saving applications. During peak hours of the day, when the Utility cost are at their highest, the facility will transfer their load to emergency power.

However, the facility can ill afford losing power. Therefore, if emergency power is unavailable for any reason, the ATS will return facility power to the normal (utility) power source until emergency power is available.

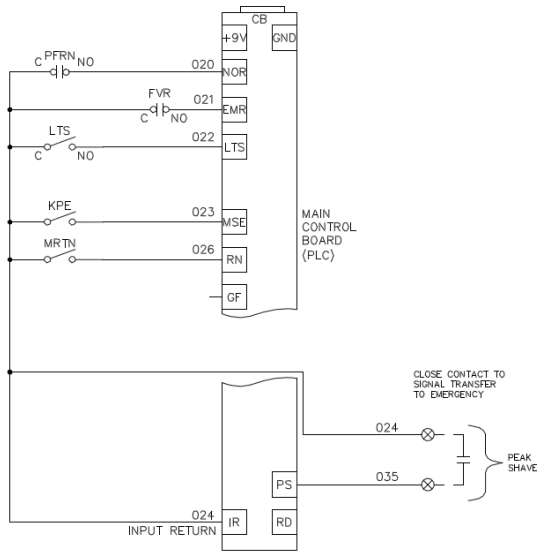


Figure 1

Order Guide

Part Number Examples:

1. ICFA32000BPSB**/LDI** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with Option LDI.
2. MCDA30400CESA**/43** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option 43.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Remote Disconnect

Introduction

Remote Disconnect, (RD); This option provides a shunt trip input to the transfer switch so that from a remote location either or both of the switches can be tripped and the transfer switch sent to the Fault mode. Customer interconnection can be made at a terminal block.

Product Features

- UL 1008 Listed
- Aux/Bell Alarm Combo Contact Included with Control Units
- 12 or 24 Vdc Shunt Trips Suppled for Remote Control of the Control Units
- Remote Disconnect Customer Connection Point

Standard Operation

When the RD signal is sent to the automatic transfer switch (ATS), both control units will be tripped open. While this signal is present, the ATS will be kept in the neutral position.

Microprocessor Controls, RD

The customer must wire in a normally open contact that they will close when RD operation is required.

See Figure 1 for customer wiring terminals. The input to the Main Control Board is already pre-wired by Lake Shore Electric to terminal blocks 036 and 024.

When the customer contact has been closed, the ATS will be forced off of both power sources and into the neutral position.

When automatic operation is required, remove the RD input from the ATS and follow the appropriate Reset instructions.

RD Reset - Molded Case Control Units

First, remove the RD signal forcing the ATS to the neutral position.

Next, entry into the ATS enclosure is required. Be sure all the appropriate PPE required is being used.

Both units will need to be physically reset. To reset the molded case units, depress the control handle on the normal unit until it is in the "OFF" position. Repeat this for the emergency unit.

Once the control units have been reset, close the enclosure door and follow the RESET instructions to resume automatic operation of the ATS.

Reset - Insulated Case Control Units

Remove the RD signal forcing the ATS to the neutral position. Then follow the RESET instructions to resume automatic operation of the ATS.

RESET Instruction

The following instructions are to be performed using the keypad and HMI screen located on the front of the ATS.

1. Depress "Enter".
2. The display will read "MAIN MENU / Reset Faults / Troubles".
3. Depress "Enter" again and the display will read "Reset Faults / Troubles Now? No".
4. The word "No" will be underlined.
5. Depress either "⇩" and "⇧" until "Yes", the desired value, is displayed.
6. Depress "Enter".
7. All faults / troubles will be reset and the display will show the operating mode again.

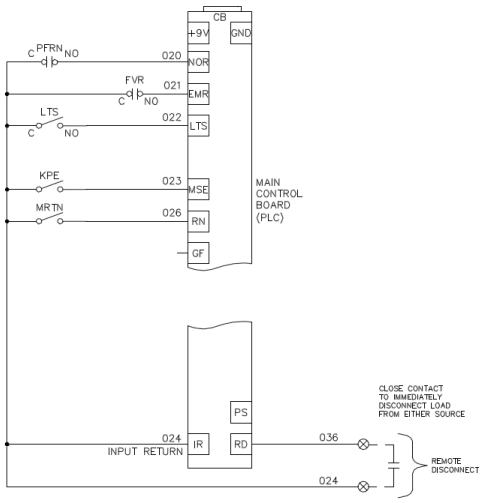


Figure 1

Electromechanical Controls, 30

The customer must wire in 12 or 24Vdc with a control contact to remote trip the control units. See Figure 2 for customer wiring terminals.

30 Reset - Molded Case Control Units

First, remove the RD signal forcing the ATS to the neutral position.

Next, entry into the ATS enclosure is required. Be sure all the appropriate PPE required is being used.

Both units will need to be physically reset. To reset the molded case units, depress the control handle on the normal unit until it is in the "OFF" position. Repeat this for the emergency unit. Once the control units have been reset, the ATS will resume automatic operation.

30 Reset - Insulated Case Control Units

Remove the RD signal forcing the ATS to the neutral position. Once the control units have been reset, the ATS will resume automatic operation.

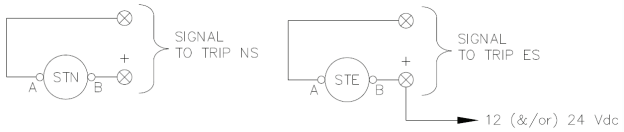


Figure 2

Order Guide

Part Number Examples:

1. ICFA32000BPSB**/RD** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with Option RD.
2. MCDA30400CESA**/30** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option 30 (Specify Available DC Voltage).

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Service Entrance Equipment

Introduction

Lake Shore Electric Corporations' Service Entrance Option provides for the Automatic or Manual Transfer Switch (UL 1008 Listed) to be labeled as Suitable for Use as Service Entrance Equipment (SE).

When a Lake Shore Electric Corporation Transfer Switch is connected to the load end of service conductors to a building or other structure it can be rated and listed as Service Equipment. This allows a great deal of flexibility to the design engineer in creating an efficient and economical electrical power system.

The Service Entrance Rated Transfer Switch is manufactured with the traditional high quality offered by Lake Shore Electric Corporation and in addition to the accessories requested:

- Provides a service disconnecting means.
- Provides permanent marking identifying it as a service disconnect suitable for the prevailing conditions.
- Provides over current protection for each ungrounded service conductor.
- Provides a means of disconnecting the grounding of the grounded conductor.
- Provides clear indication of the position of disconnect.

This dual application allows for the elimination of separate service equipment in series with the transfer switch. The cost savings can be significant.

- Additional equipment is not needed.
- Interposing cable and conduit are eliminated.
- Labor for equipment mounting is reduced.
- Labor for interposing cable and conduit is eliminated.

The logical application of service entrance equipment is where the alternate power supply is capable of accepting the entire service load and/or the placement of the Automatic Transfer Switch is installed in a readily accessible location consistent with Article 230 of the National Electric Code.

Section 230-2 of the National Electric Code clearly identifies emergency systems, legally required standby systems, optional standby systems and parallel power production systems as separate services.

Therefore, there is a requirement to provide additional SE for these sources of power. Since SE must be provided for the on-site power plant, the same benefits that apply when the Lake Shore Service Entrance Rated Transfer Switch is used as the Utility Service Equipment.

Product Features

- UL 1008 Listed
- Provides a Service Disconnecting Means
- Provides Permanent Marking as SE
- Provides Solid Neutral-to-Ground Bonding, Single Point

Operation

This option provides both overcurrent protection on the service entrance side of the equipment and fused protection ahead of all controls for the transfer switch. A neutral-to-ground bonding link is provided, as required by code, but shipped disconnected in the transfer switch.

When ordering this equipment, be sure to indicate which side of the transfer switch is being used for the service entrance, either normal or emergency side. Otherwise, the transfer switch will be constructed with the service entrance coming into the normal, top entry, side of the transfer switch.

Note: When service entrance is ordered on a transfer switch, then the neutral-to-ground bonding must be done within that piece of equipment, per code.

When a Delta system is indicated when ordering a transfer switch, 3ϕ, 3W, the neutral bus and a single lug will also be provided along with the bonding link. This allows the installer to pull in the delta neutral point to the transfer switch to perform the neutral-to-ground bonding in that location, per code requirements.

Recommendations

Lake Shore Electric Corporation highly recommends that the specifying engineer recommend where any and all service entrance equipment should be placed within the facility.

If SE has already been specified please consult the factory for ordering the appropriate equipment and further information.

Order Guide

Part Number Examples:

1. ICFA32000BPSB**/SE** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with included option SE.
2. MCDA30400CESA**/31** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option 31.
3. MCDM30400CESA**/31** - Molded Case MTS, 3 pole, 400 Amp, 277/480Vac, **Manual Transfer Switch**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option 31.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Single Phase Protection

Introduction

A balanced system means that each phase of the three-phase (3ϕ) power source are equal in voltage magnitude and are 120° apart. Since there are three phases, or "legs", of power available from the source, it is possible to lose one of them during normal operation.

The loss of a single phase, or "leg", can happen anywhere and is sometimes very difficult to detect. The following section will discuss the condition where "Single Phasing" is very difficult to detect simply by monitoring the voltage.

Induction Motors

The main reason that it may be difficult to detect is due to a condition known as "regeneration". This occurs on loads that have 3ϕ induction motors installed.

When a single phase condition occurs and a motor is running, the motor will continue to run if there is no single phase detection present. When this happens, the two good "legs" of power continue to run the motor. The third "leg" acts as a generator and regenerates the lost phase. The regenerated "leg" in this condition could potentially be equal to the other phases of power. Therefore, monitoring the power source 3ϕ voltage will result in findings of, "The power source is good", and the single phase condition will go undetected.

Generally speaking, most of the newer motors will have their own form of single phase detection equipment installed on them that monitors both "current" and "voltage" to help detect a single phase condition. If a single phasing condition is detected, they will automatically disconnect the motor from the power source until the single phase condition has been corrected.

On induction motors where there is no monitoring of "current" and "voltage" is typically where a regeneration condition will be seen. When a single phase condition occurs, it can affect multiple customers on that faulted line. Even if your facility does not have large motors, other customers on this line might, which affects your facilities ability to sense a power outage.

When an induction motor ends up being run as a generator, it puts great strain on the motor windings and the insulation covering them. The insulation keeps the motor windings from shorting out to the motor casing, potentially causing a "ground fault" condition; a direct path of a phase "leg" of power to ground. Ground faults are very dangerous; often accompanied by an "arc flash". Lean more in the Ground Fault Protection cutsheet.

If the single phase condition is not caught in a reasonable amount of time, the insulation will eventually fail and the winding will short out. This will result in significant damage to the motor and potentially any loads that may be connected to the same power feed; worst of all, people may be seriously hurt or killed.

Phase Loss Sensitivity

Even when adding in a more sensitive voltage and phase sensing relay, there is no guarantee in this situation that the single phase loss will be detected.

However, with the exception of lightly loaded motors, enough change is detected by the Phase Sequence Relay (PSR) supplied with the ATS for the Single Phase Protection (SPP) option to provide the required protection when properly adjusted. The PSR will monitor for an undervoltage condition, improper phase rotation and a phase loss condition.

The specifying engineer should be contacted to determine if additional detection equipment is required to safely detect any "Single Phasing" conditions at the site of installation.

Product Features

- Rated for up to 600 VAC
- True Three Phase Sensing
- Phase Rotation Sensing
- Undervoltage Sensing
- Phase Loss Sensing
- Adjustable Pick-Up Range - Factory set to 90%

Microprocessor Description of Operation Molded Case Units (Option SPP)

In the event that a phase has been lost, this should be corrected before any work on the ATS is performed.

When the PSR drops out, the Single Phase Protection Timer, (SPPT), begins timing. IF the transfer to emergency begins before this timer times out, this timer is turned off. If this timer times out before the transfer to emergency begins, an output is sent to trip the normal breaker. This is to prevent damage to the load in case the system is on a utility single phase condition.

SPPT: Single Phase Protection Timer - This timer is adjustable from 0 to 300 seconds and is factory set at 60 seconds.

The Normal side molded case unit will be tripped open in this event and will require operator intervention to reset the ATS for automatic operation. This unit will need to be physically reset, so a trained operator will be required to perform this maintenance because entry into the ATS enclosure is required. Be sure that all required PPE is used.

To reset the molded case unit, depress the control handle on the normal unit until it is in the "OFF" position.

Once the molded case unit has been physically reset, the microprocessor will need to be reset also. The faults seen will be displayed on the HMI screen. Follow the **RESET Instructions** in this cutsheet to clear the faults and resume automatic operation of the ATS.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Microprocessor Description of Operation Insulated Case Units (Option SPP)

When the PSR drops out, the Single Phase Protection Timer, (SPPT), begins timing. IF the transfer to emergency begins before this timer times out, this timer is turned off. If this timer times out before the transfer to emergency begins, an output is sent to open the normal breaker. This is to prevent damage to the load in case the system is on a utility single phase condition.

SPPT: Single Phase Protection Timer - This timer is adjustable from 0 to 300 seconds and is factory set at 10 seconds.

The ATS is capable of continuing automatic operation without an operator's intervention because opening and tripping the breaker are the same mechanism and the breaker does not need to be reset, but the HMI will display the Trouble fault. Follow the **RESET Instructions** to clear the trouble condition. A trained operator is required to perform this maintenance. Be sure that all required PPE is used.

However, until the SPP condition has been cleared, the ATS will remain on emergency power.

NOTE: If, during this time, something "Trips" the breaker, they will have to be physically reset. To do this, locate the red button that has popped out on the face of the breaker. There will be some form of identification saying that the "Breaker Tripped" near it. Push this red button back in to reset the breaker. Do this for both units.

RESET Instructions

The following instructions are to be performed using the keypad and HMI screen located on the front of the ATS.

1. Depress "Enter".
2. The display will read "MAIN MENU / Reset Faults / Troubles".
3. Depress "Enter" again and the display will read "Reset Faults / Troubles, Clear all now? No".
4. The word "No" will be underlined.
5. Depress either "⇓" or "⇑" until "Yes", the desired value, is displayed.
6. Depress "Enter" to clear or "ESC" to cancel.
7. All faults / troubles will be reset and the display will show the operating mode again.

Electromechanical Description of Operation – Molded or Insulated Case Units (Option 24A)

Single phase protection is not available as a standard option on ATS with electromechanical controls.

However, Lake Shore Electric Corp. does have the PSR as an option to be added to these controls, but the ATS logic will treat it the same way it would the standard Phase Failure Relay (PFR). When the PSR signals the loss of power on the power source it is monitoring, the ATS will not trip the breaker open. It will simply see it as a source failure and operate accordingly.

Order Guide

Part Number Examples:

1. ICFA32000BPSB**/SPP** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with included option ACSP.
2. MCDA31200CPSB**/SPP** - Molded Case ATS, 3 pole, 1200 Amp, 277/480Vac, **24Vdc Microprocessor Controls**, 50kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with included option SPP.
3. MCDA30400CESA**/24A** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with option 24A by description; (SPP Required).

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Space Heaters

Introduction

Condensation within a manual or automatic transfer switch is one of the main problem for component(s) operation and life expectancy. It will also create additional hazardous conditions that did not exist before the condensation was present.

Water is a good conductor of electricity and will significantly reduce the insulating dielectric value between current carrying conductors.

> **Rule of Thumb:** Over dry, insulating surfaces, 2" min required between current carrying conductors. Through Air, 1" min required between current carrying conductors.
>
> These dimensions may vary depending on the magnitude of the current and voltage being applied to the system, but will vary in accordance with the NEC.

Water is also a corrosive agent to any metals and will cause rusting / corrosion buildup on the equipment.

With water sitting within the ATS, the potential for it to create a current path (electrical short) is high. To help prevent these conditions, all outdoor ATS equipment will come standard with the space heater option.

The main purpose of the space heaters is not to heat the enclosure to a comfortable level for humans, but to prevent condensation on the internal controls and equipment.

This will help eliminate or reduce this dangerous condition which will make the ATS much safer for maintenance personnel.

NOTE: If the switch is located near the ocean, corrosion is a given factor to dropping the life expectancy of the ATS from the normal 15 to 20 year span down to 5 to 10; possibly less depending on the environment. The space heaters will help extend the life expectancy, but not guaranteed.

Features

- Molded Case ATS
  - 100 – 400 A, W/M or F/S Enclosures
  - 600 A, W/M Enclosure
  - Qty (1) Space Heater, 81 Watt Power Consumption
  - 600 A, F/S Enclosure
  - 800 – 1200 A, F/S Enclosure,
  - Qty (2) Space Heaters, 160 Watt Power Consumption
- Insulated Case ATS
  - All Amperage and Sizes,
  - Qty (4) Space Heaters, 350Watt Power Consumption
- Permanently Installed, Adjustable Thermostat
- Finger Safe Fuse Protection that May Be Used as a Circuit Disconnect for Maintenance

Product Description (Option: MP [SH], EM [44])

This option provides 350 Watt, 250 Volt strip heater, or heaters depending on the enclosure size, run at 120Vac.

Total power consumption per heater is 81W. These are used in conjunction with a wall mount style thermostat to help eliminate moisture build-up in the enclosure and to help prevent the controls from freezing.

Recommendations

Lake Shore Electric Corporation believes in providing the customer with a full turnkey solution to their needs. If the equipment does not fully meet your needs, please consult the factory for further information.

Standard Product Specifications

HEATER CIRCUIT SPECIFICATIONS	
Operating Voltage	120 Vac Heater Operation Power Transformer may by Required
Power Consumption	81 Watts per Heater
Heater Power Rating	350 Watt Heater, 250 Volt (Derated for Half Power Operation)
Ambient Temperature: Operating	-20°C to +60°C [-4°F to 140°F]
Ambient Temperature: Storage	-40°C to +80°C [-40°F to 176°F]
Relative Humidity	0 to 95% non-condensing

Order Guide

Part Number Examples:

1. ICFA32000BPSF - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 3R Free Standing Enclosure; Unit is an Outdoor Unit, so Space Heaters will automatically come installed.
2. ICFA32000BPSB**/SH** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure, with Option SH included.
3. MCDA30400CESA**/44** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option 44 included.
4. MCDM30400CESA**/44** - Molded Case MTS, 3 pole, 400 Amp, 277/480Vac, **Manual Transfer Switch**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option 44 included.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Surge Protection Devices

Introduction

The 2014 National Electric Code (NEC), Article [285] covers general, installation and connection requirements for surge-protective devices (SPDs) permanently installed on systems of 1000 volts or less.

- **Surges (Transients)** – a surge is a transient wave of current, voltage or power in an electric circuit.

  These are brief overvoltage spikes or disturbances on a power waveform that can damage, degrade, or destroy electronic equipment within any home, commercial building, industrial, or manufacturing facility.

  Transients can reach amplitudes of tens of thousands of volts depending on the source.

- The NEMA Surge Protection Institute says that, "*a surge, or transient, is a subcycle overvoltage with a duration of less than a half-cycle of the normal voltage waveform. A surge can be either positive or negative polarity, can be additive or subtractive from the normal voltage waveform, and is often oscillatory and decaying over time.*"

Electrical equipment is designed to operate at a specified nominal voltage such as 120 Vac, 240 Vac, 480 Vac, and so on with built in tolerances to slight variations in the supply voltage. Surges go outside of the designed tolerances which cause the equipment damage. To protect valuable equipment, SPDs are used as a cost effective solution.

One of the most commons terms for an SPD is a Transient Voltage Surge Suppressor (TVSS), the purpose of which is to eliminate or reduce damage to equipment. This in turn will reduce total down time and any repair cost.

Features

- Peak Current Rating per Phase
  - Standard Rating for SPD on Normal and Emergency (Protects ATS Controls)
    - 40kA
  - Optional Ratings for SPDs on Load Only (Protects Load Equipment)
    - 120kA
    - 160kA
    - 240kA
    - 320kA
    - 480kA
    - Display Readout Available Upon Request
- Short Circuit Withstand of 200kA
- Available for Single or Three Phase Systems

Product Description (Option: MP [SPD], EM [38A or 38B])

The standard version of this option provides two SPDs; one on the normal source and one on the emergency source. It will also provide a secondary MOV across the ATS controls.

For the SPD required for load equipment protection, please specify the required protection current and display readout is required.

Recommendations

Lake Shore Electric Corporation believes in providing the customer with a full turnkey solution to their needs. If the equipment does not fully meet your needs, please consult the factory for further information.

Standard Product Specifications

ELECTRICAL – STANDARD SPD – 40KA	
Minimum Life	2500 operations (for 1.5 kA 8/20µs wave for each line-to-ground)
Varistor surge current rating per phase	40kA peak (8/20µs wave)
Power Consumption per Phase	Less than 600mW
Ambient Temperature: Operating	-40°C to +70°C [-40°F to 160°F]
Relative Humidity	0 to 95% non-condensing
Surge energy capability per phase	2100 Joules (8/20µs wave)
Short Circuit Current Rating	200kA
Typical Clamping Voltage: for 8/20µs combination wave surge current for each phase-to-ground. (Lead Length 18")	
1,500 A Surge Current	1825 Vac
5,000 A Surge Current	2425 Vac
10,000 A Surge Current	3000 Vac

Order Guide

Part Number Examples:

1. ICFA32000BPSB/SPD - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure, with the Standard Surge Protection Device Option.
2. MCDA30400CESA/**38B** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with the Standard Surge Protection Device Option 38B.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Load Product Specifications

ELECTRICAL RATINGS					
Surge Capacity/Phase	120kA peak (8/20µs wave)				
L-N	**L-G**	**N-G**	**L-L**		
60kA	60kA	120kA	90kA		
Surge Capacity/Phase	160kA peak (8/20µs wave)				
L-N	**L-G**	**N-G**	**L-L**		
80kA	80kA	120kA	90kA		
Surge Capacity/Phase	240kA peak (8/20µs wave)				
L-N	**L-G**	**N-G**	**L-L**		
120kA	120kA	120kA	90kA		
Surge Capacity/Phase	320kA peak (8/20µs wave)				
L-N	**L-G**	**N-G**	**L-L**		
160kA	160kA	240kA	180kA		
Surge Capacity/Phase	480kA peak (8/20µs wave)				
L-N	**L-G**	**N-G**	**L-L**		
240kA	240kA	240kA	180kA		
COMMON RATINGS					
Minimum Life	Duty cycle tested (ANSI C62.41 C3, 10 kA, 20 kV) minimum 5000 impulses				
EMI/RFI Filtering	Up to -30 dB (100 kHz to 100 MHz)				
Ambient Temperature: Operating	0°C to +50°C [-32°F to 122°F]				
Ambient Temperature: Storage	-40°C to +65°C [-40°F to 149°F] -				
Relative Humidity	0 to 95% non-condensing				
Short Circuit Current Rating	200kA - Individually - Fused Suppression Modes				
Industrial Control Equipment	UL 1449 Listed and UL 1283 Listed				
UL Suppression Voltage Rating (SVR)*, 1ϕ					
Voltage	**L-N**	**L-G**	**N-G**	**L-L**	**MCOV[1]**
120/240	400 V	400V	400V	800 V	150 V
UL Suppression Voltage Rating (SVR)*, 3ϕ high-leg delta					
Voltage	**L-N**	**L-G**	**N-G**	**L-L**	**MCOV[1]**
120/240	800 / 400 V	400V	400V	1500 / 800 V	275 / 150 V
UL Suppression Voltage Rating (SVR)*, 3ϕ, 4W					
Voltage	**L-N**	**L-G**	**N-G**	**L-L**	**MCOV[1]**
120/208	400V	400V	400V	800V	150V
277/480	800V	800V	800V	1500V	320V
220/380	800V	800V	800V	1500V	320V
347/600	1200V	1200V	1200V	2000V	420V

[1] MCOV = Maximum Continuous Operating Voltage.

* For every foot of wire length, approximately 175 volts (6 kV / 3 kA, 8/20µs) is added to the suppressed voltage.)

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Electromechanical Controls - Overview

Standard Automatic Transfer Switch Features

P8	TDR	Time Delay Return
5	TDT	Time Delay to Transfer **
8x	PFRN	Phase Failure Relay Normal, 1ϕ or 3ϕ
17	SC	Engine Start Contacts
34A	LTS	Load Test Switch, Maintained

** Dual Motor & Insulated Case Automatic Transfer Switch

Positive Control System Configurations

The following configurations are available for ease of ordering the most common timer groups utilized on transfer switches.

P1 TDR, ODR, TDE, EMT

P2 TDR, ODR, EMT

P3 TDR, ODR, TDE

P4 TDR, TDE, EMT

P5 TDR, ODR

P6 TDR, TDE

P7 TDR, EMT

P8 TDR

Control Accessory Descriptions

1. TDR - Time Delay to Return

Provides a delay after the return of Normal power before retransferring the load from the Emergency source. This feature allows Normal voltage to stabilize and ensures against the premature return when the Normal power grid is potentially unbalanced. Provided in a five-range model 0.02-0.3 sec., 0.07-3 sec., 0.6-30 sec., 3.5 sec.-3 min., and 35 sec.-30 min., the timing ranges are field adjust- able. This time delay is standard on all electro- mechanical automatic transfer switches.

2. TDE - Time Delay to Emergency

Provides a delay after the engine has started before transferring the load to the Emergency source. This feature allows voltage to stabilize at the Emergency source to protect against initial wide fluctuations and can provide a brief warm-up period before loading the engine. Provided in a five-range model 0.02-0.3 sec., 0.07-3 sec., 0.6-30 sec., 3.5 sec.-3 min., 35 sec.-30 min., the timing ranges are field adjustable.

3. ODR – Outage Delay Relay

Provides an adjustable delay after failure of the Normal source before initiating an Engine-Start signal to allow for temporary short-duration fluctuations in voltage. This feature prevents unnecessary starting of the engine, and is usually supplied with an adjustable range of 1 to 300 seconds although other delay times are available.

4. EMT – Engine Maintained Timer

Provides a time delay after retransferring the load to the Normal source before shutting down the engine. This feature allows the engine to run under no- load conditions for cooling before shut-down to prevent against thermal and mechanical shocks. Provided in a five-range model 0.02-0.3 sec., 0.07-3 sec., 0.6-30 sec., 3.5 sec.-3 min., 35 sec.-30 min., the timing ranges are field adjust- able.

5. TDT – Time Delay to Transfer (For Dual Motor & Insulated Case Transfer Switches)

Provides a time delay between opening the contacts on one source and closing the contacts on the other source. This feature is recommended where there are high inductive loads, since with both sources open the residual field currents are allowed to decay to acceptable limits preventing electrical and mechanical overloads. This time delay functions in both directions (Normal to Emergency and Emergency to Normal) provided in a five-range model 0.02-0.3 sec., 0.07-3 sec., 0.6-30 sec., 3.5 sec.-3 min., 35 sec.-30 min., the timing ranges are field adjustable.

6. PE – Plant Exerciser / Switchable Load

Provides for regular automatic exercising of the Emergency Power System on a pre-selected schedule. The basic timer provides for a flexible period (in 15-minute increments) of exercise, and the periods can be scheduled for any specific day (or days) within a 7-day cycle. In the event of engine-generator failure, when operating in the plant exerciser mode, the Automatic Transfer Switch will immediately return to the Normal source, if available. A selector switch is included allowing exercising under either “load” or “no-load” conditions.

6A Always transfers the load to emergency power during the “Plant Exerciser Test”. **“**No Load Test Switch” is not included.

6C **“**No Load Test Switch” included which will allow the “Plant Exerciser Test” to run the emergency power source w/o transferring the load to emergency power or allow for load testing on emergency power.

7. FPC – Fire Pump Control

Provides necessary features required by NFPA 20 for the automatic transfer switch to be used with centrifugal fire pump controllers. For Dual Motor and Insulated Case Transfer Switches only. Two configurations are available:

7A Utility to Generator

7B Not Available

8. PFRN – Phase Failure Relay Normal

Provides for close differential monitoring of the Normal Source voltage to ensure that it is within acceptable limits. The factory setting for the PFRN is 90% Pickup and 80% Dropout of the nominal voltage. The 3 phase units can be adjusted to guard against long term reduced voltage conditions (“brownouts”) to as close a differential as 2% (i.e. 89% Pickup and 87% Dropout). This relay is standard on all automatic transfer switches.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

8 Continued . . .

8A Single Phase, 1ϕ

8B Three Phase, 3ϕ

9. PFRN/O – Phase Failure Relay Normal / Overvoltage

Provides for close differential monitoring of the Normal source to ensure that it is within acceptable limits with respect to overvoltage. The usual setting for the PFRN/O is 115% Pickup and 110% Dropout. This relay can also be adjusted to as close a differential as 2% (i.e. 116% Pickup and 114% Dropout), and is available as follows:

9A Single Phase, 1ϕ

9B Three Phase, 3ϕ

10. PFRE – Phase Failure Relay Emergency

Provides protection against transferring the load to the Emergency source until voltage has reached acceptable limits. In the event the relay drops out when Normal power is available, the TDR will be bypassed and retransfer to Normal will be initiated immediately. This relay is available as follows:

10A Single Phase, 1ϕ

10B Three Phase, 3ϕ

11. PFRE/0 – Phase Failure Relay Emergency / Overvoltage

Provides for close differential monitoring of the Emergency source to ensure that it is within acceptable limits with respect to overvoltage. The usual setting for the PFRE/O is 115% Pickup and 110% Dropout. This relay can also be adjusted to as close a differential as 2% (i.e. 116% Pickup and 114% Dropout), and is available as follows:

11A Single Phase, 1ϕ

11B Three Phase, 3ϕ

12. FR – Frequency Relay (Single Phase Monitoring)

Provides Protection against transferring to the Emergency Source until the generator has reached operating frequency.

13. FVR – Frequency / Voltage Relay (Single Phase Monitoring)

Provides Protection against transferring to the Emergency Source until the generator has reached operating frequency and voltage.

14. SS – Selector Switch

Provides selection of four modes of operation of the Transfer Switch:

- **AUTOMATIC -** The transfer switch is in the fully Automatic mode.
- **MANUAL -** Provides engine start signal only. The transfer switch will not operate and the load will not be transferred.
- **TEST -** Provides engine start signal plus transfer of the load to Emergency source.
- **OFF -** Disables the control logic, ensuring that the transfer switch will remain in the same position regardless of Normal or Emergency source conditions.

Options Available:

14A **SS** Selector Switch Only

14B **SSWL** Selector Switch plus 12Vdc light to indicate transfer switch not in automatic

14C **SS-WL** Selector Switch plus 24Vdc light to indicate transfer switch not in automatic

15. MRTN – Manual Return to Normal Push Button (This option may not be selected in conjunction with option 16.)

Provides immediate return to the Normal source when Normal voltage is present, by **Manual operation only** (TDR is not present). Dual Motor application allows for time delay (TDT) between Emergency source Open and Normal source Closed. Transfer to Normal will automatically take place when there is loss of Emergency source and the Normal source is present.

16. ORPB – Override Push Button (This option may not be selected in conjunction with option 15.)

Provides for immediate return to Normal position by manual operation when Normal source voltage is present bypassing the TDR timer. Dual Motor application allows for time delay (TDT) between Emergency source Open and Normal source Closed.

17. SC – Starting Contact

Provides dry (no voltage) contact for starting an engine when initiated by the transfer switch. This is standard on all automatic transfer switches.

18. ACRN – Auxiliary Contacts Relay for Normal (Energized when the Transfer Switch Load is fed from the Normal Source)

Provides for two auxiliary form “C” (Common + Normally Open + Normally Closed) 10 ampere contacts to indicate the transfer switch load is being fed from the normal source.

19. ACRE – Auxiliary Contacts Relay for Emergency (Energized when the Transfer Switch Load is fed from the Emergency Source)

Provides for two auxiliary form “C” (Common + Normally Open + Normally Closed) 10 ampere contacts to indicate the transfer switch load is being fed from the emergency source.

20. Option No Longer Available

21. Option No Longer Available

22. PL – Transfer Switch Indication Pilot Lights

Provides two LED indicating lights mounted on the exterior of the transfer switch enclosure, showing the position of the switch or the available sources. Pilot Lights may also be mounted at any remote location.

22A Switch Position
(GREEN = Normal, RED = Emergency)

22B Source Available
(WHITE Light for Both)

22C System Trouble
(AMBER Light)

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

23. CBT – Circuit Breaker Trips for Overcurrent Protection

Provides overcurrent protection within the transfer switch. This feature may eliminate the requirement to install separate overcurrent protective devices on either the Normal or Emergency source (or both sources). Trips will be of the following configurations and will be installed on the **Normal** or **Emergency** side molded case switch:

Thermal Magnetic - Providing both overload and short circuit protection, the thermal magnetic type will not trip under momentary overloads, but will trip instantly on heavy short circuit currents (against a definite current/time curve).

Magnetic Only - Providing short circuit protection only, the magnetic only type will trip instantly (within one cycle, or approximately 0.017 seconds) when current reaches the selected setting.

23A **Normal Source –** Provides trip on Normal Source Circuit Breaker.

23B **Emergency Source –** Provides trip on Emergency Source Circuit Breaker.

24. SCPD – Special Circuit Protection Devices

Provides for the many special additions specified by the customer that can be added to the transfer switch.

24J **ACSA –** Provides (2) sets of form "C" contacts (Common + Normally Open + Normally Closed) for each source to indicate when the source is available. This is done via relays NSAR and ESAR for the normal and emergency source respectively.

24M **Special Circuit Protection by Description –** See below for some standards for this option.

1. ITC - Trouble Circuit Built using the ACRN and ACRE relay contacts.
2. Georgia Transmission – This calls for a PSR on normal, emergency and load for 3ϕ equipment.
3. Foster Farms – Lug Barrier.
4. Single Phase Protection on Normal Source.

25. MFM – Multifunction Metering

This option provides a multifunction meter on the load output that may be setup to monitor single or three phase systems. For three phase transfer switches, the unit can be setup to monitor delta or wye, 3-wire or 4-wire, systems. The unit measures the following:

1. Phase Voltage (V)
2. Phase to Neutral Voltage (V)
3. Phase Current (I)
4. Frequency (Hz)
5. Active Power (W)
6. Active Energy (kWh)
7. Reactive Power (VAR)
8. Apparent Power (VA)
9. Reactive Energy (VARh)
10. Power Factor (PF)
11. Instantaneous Amp Demand
12. Instantaneous Watt Demand

25 MFM – Multifunction Metering Continued. . .

13. Instantaneous VA Demand
14. Maximum Amp Demand
15. Maximum Watt Demand
16. Maximum VA Demand

RS-485 (Modbus) communication is the standard output from this option. Ethernet 10/100 Base-T connectivity is available upon request. If other communications protocols are needed, please consult the factory for the appropriate converter.

26. Option No Longer Available

27. Option No Longer Available

28. SL – Special Lugs

Provides for connection of both sources and the load (as well as the neutral when specified) to the Transfer Switch. Shall be furnished as supplied by the manufacturer of the molded case switch. Standard lugs are supplied on all Lake Shore Transfer Switches. Special lug arrangements must be specified when order is placed.

29. MD – Maintenance Disconnect

Disconnects control circuitry from line for maintenance purposes. Reference a units schematic diagrams for specific controls disconnected.

30. ST – Shunt Trips for Remote Disconnect

Electrically trips switches from a remote location (not a protective type trip).

31. SE – Suitable for Use as Service Entrance

Provides for transfer switch (Dual Motor & Insulated Case only) to be approved for service entrance. Includes thermal magnetic overcurrent trip on Service Source switch, selector switch, neutral bus bar, lugs, bonding jumper and strap, and special nameplate.

32. ED – Emergency Disconnect Switch

Provides shunt trips in both control units to electrically trip the closed unit and place the ATS in the neutral position. This is done from a selector switch located on the ATS door.

33. DPS – Dual Prime Source

Provides for selection between two generators or two utilities. For Dual Prime Power consult factory for details.

33A Manual, Generator to Generator

33B Automatic, Generator to Generator

33C Manual, Utility to Utility

33D Automatic, Utility to Utility

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

34. LTS – Load Test Switch

Provides engine starting plus transfer of the load to the Emergency source without having to fail the Normal Source.

34A Mounted inside the enclosure, maintained switch. This switch is standard on all electromechanical automatic transfer switches.

34C Mounted inside the enclosure, momentary pushbutton.

34D Mounted outside the enclosure on the door, momentary pushbutton.

35. EC – Elevator Control

Provides 2 sets of dry (no voltage) contacts, 1 set N.O. and 1 set N.C., which change state prior to transfer in either direction. Time delay between initiation of these contacts and switch transfer is field adjustable .03 seconds to 30 minutes.

36. CTT – Closed Transition Transfer

Provides transfer of power from one source to another without interruption of power to the load. Applicable to Dual Motor and Insulated Case switches only.

37. Option No Longer Available

38. SPD – Surge Protection Devices

Provides for protection of transfer switch from voltage surges which may damage control circuitry. Protection includes surge suppressors on both power sources and MOV's on the control circuitry.

38A Single Phase, 1ϕ

38B Three Phase, 3ϕ

39. GFP – Ground Fault Protection

When a ground fault is detected, the Normal and Emergency source will be opened isolating the ground fault from external voltage sources.

39A Ground Fault Protection (Normal Source)

39B Ground Fault Indication (provides indication only with no isolating action.)

39C Ground Fault Protection (Emergency Source)

39D Ground Fault Protection on Load

40. ELA – Electrical Assist

This option is for manual transfer switches and provides the operator with electrical assistance to operate the control units without entering the transfer switch enclosure.

This option includes four push buttons for external breaker operation. The buttons are as follows:

1. Open Normal
2. Open Emergency
3. Close Normal
4. Close Emergency

NOTE: The Normal and Emergency breakers may not be closed at the same time, but they may both be open at the same time; Neutral Position.

This option will also provide a Control Enable Switch (CES), keyed, to enable/disable the circuit controls.

Pilot light options for source available, PLSA, and switch position, PLSP, are included with this option. (Options 22A and 22B)

If ground fault protection is order with this transfer switch, the PLST Amber trouble light will also be included. (Option 22C)

41. Option No Longer Available

42. Option No Longer Available

43. PS – Peak Shave

Overrides the operation of a remote or local test switch that has been used to force the ATS to the Emergency position. If the Emergency power fails the ATS will automatically retransfer to the Normal position if normal power is available.

44. HTR – Strip Heater (Standard Accessory on all Outdoor Equipment)

This option provides 350 Watt, 250 Volt strip heater(s) run at 120Vac. Total power consumption per heater is 81W. These are used in conjunction with a wall mount style thermostat to help eliminate moisture build-up in the enclosure and to help prevent the controls from freezing.

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Electromechanical Controls
Positive Control System Board

Introduction

The Positive Control System (PCS) is a sophisticated time delay network that provides highly dependable & adjustable control of automatic transfer switches and switchgear. Four plug-in solid-state and/or pneumatic controlled time delay relays provide any combination of four time delay functions; TDR, Time Delay to Return (Normal); TDE, Time Delay to Emergency; ODR, Outage Delay Relay; and EMT, Engine Maintained Timer.

Starting contacts are rated 10 amperes. Each ON DELAY timer includes two colored indicating lights which display the operation of the timer. Time Delays are available over a wide selection of ranges.

Product Features

- UL 1008 Listed
- Components are mounted on a printed circuit board to provide a compact, rugged design.
- Solid state time delay timers and sealed control relays assure dependable operation even in severe operating environments.
- UL-listed components have average projected electrical life of over 1,000,000 cycles.
- Plug-in components simplify maintenance and reduce downtime.
- The PCS provides optimum flexibility of transfer switch control.
- All adjustments are easily accessible.
- The normally open dry start contact provides a convenient interface to almost any engine starting control.

Time Delay Functions

TDR Time Delay to Return - Provides a delay after the return of Normal power before retransferring the load from the Emergency source. This feature allows Normal voltage to stabilize and ensures against the premature return when the Normal power grid is potentially unbalanced.

TDE Time Delay to Emergency - Provides a delay after the engine has started before transferring the load to the Emergency source. This feature allows voltage to stabilize at the Emergency source to protect against initial wide fluctuations and can provide a brief warm-up period before loading the engine.

ODR Outage Delay Relay - Provides an adjustable delay after a failure of the Normal source before initiating an Engine-Start signal to allow for temporary short duration fluctuations in voltage. This feature prevents unnecessary starting of the engine.

EMT Engine Maintained Timer - Provides a time delay after retransferring the load to the Normal source before shutting down the engine. This feature allows the engine to run under no-load conditions for cooling before shutdown to prevent against thermal and mechanical shocks.

Time Delay Ranges

Each time on delay relay (TDR, TDE and EMT) contains five selectable range settings. This allows the relay to be set accurately from .02 seconds to 30 minutes.

The off delay relay (ODR) is supplied with an adjustable range of 0 to 10 seconds, as standard, although other delays are available.

System Configurations

The Positive Control System is available in the following configurations:

Configuration	Ordering Number
TDR + ODR + TDE + EMT	P1
TDR + ODR + EMT	P2
TDR + ODR + TDE	P3
TDR + TDE + EMT	P4
TDR + ODR	P5
TDR + TDE	P6
TDR + EMT	P7
TDR	P8
No time delay relays	P9

Figure 1

LAKESHORE
ELECTRIC CORPORATION

MBE CERTIFIED

LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

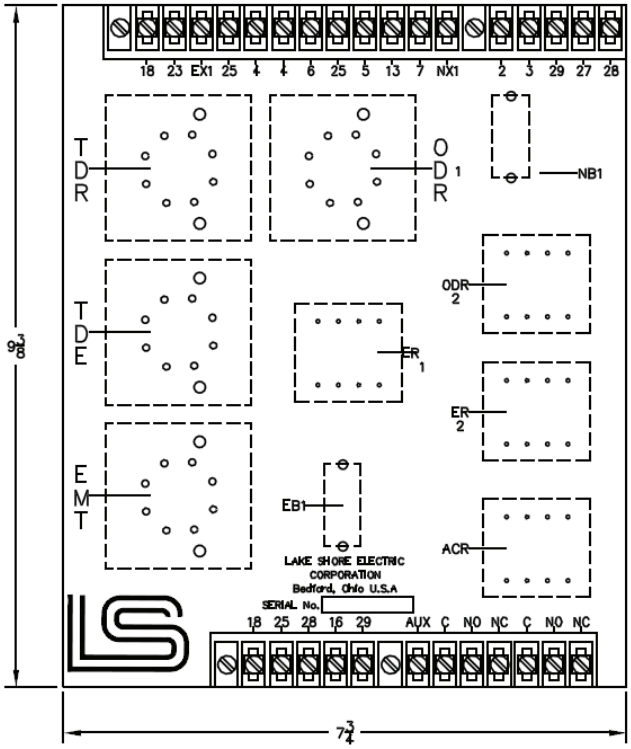


Figure 2

Product Specifications

NOMINAL INPUT VOLTAGE	110 ~ 130Vac
FREQUENCY	50/60 Hertz
POWER CONSUMPTION	30 VA maximum (Fully Populated Board)
AMBIENT TEMPERATURE: OPERATING	-20°C to +60°C [-4°F to 140°F]
AMBIENT TEMPERATURE: STORAGE	-40°C to +80°C [-40°F to 176°F]
HUMIDITY	5 to 85% RH, no condensation
CONTACT TYPE	Form "C" dry contacts
CONTACT RATING	10 amp @ 120Vac
WEIGHT	≅ 40.64 oz., 2.54 lbs. (Fully Populated Board)
INDUSTRIAL CONTROL EQUIPMENT	UL 1008 Listed
CONSTRUCTION	Solid state timers and relays installed on a PCB for
DIMENSIONS (W x H x D)*	7 ¾" x 9 3/8 " x 4"

* Reference Figure 2.

PCB Order Guide

Part Number Examples:

1. MCDA30400CESA**/P1** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with PCB P1 Controls.
2. MCDA30400CESA**/P6** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with PCB P6 Controls.

Recommendations

Please consult the factory for further information.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Auxiliary Contact Before Transfer

Introduction

This option provides two (2) sets of form "C" Contacts, which change state prior to transfer in either direction. The time delay between initiation of these contacts and switch transfer is field adjustable.

Product Description for Microprocessor Controls (Option ACBT)

For this option, the automatic transfer switch (ATS) provides a pre-transfer signal called Time Delay Before Transfer (**TDBT**) and two sets of form "C" contacts called **EC**.

- **EC** - Two form "C" contacts are provided on the Relay Interface Board and labeled EC (Elevator Control).
- **Time Delay Before Transfer -** This timer is adjustable from 0 to 300 seconds and is FACTORY SET AT 10 SECONDS. It is initiated when the switch is ready to transfer and upon its completion the transfer will take place. This is typically used in elevator circuits.

When the controller is ready to begin a transfer in either direction, it picks up a relay (EC) and starts timer TDBT. Upon completion of timer TDBT, the controller actually starts the transfer. Upon completion of the transfer, the output relay (EC) is dropped out.

While this timer is timing out, its status will be displayed on the HMI LCD display. (See Example Below)

AUTO - EXERCISE W/LOAD Awaiting TDBT: 4 sec

NOTE: This timer is not initiated wherever there is a failure of either power source, since its implementation would only serve to delay a transfer to the available source.

Product Description for Electromechanical Controls (Option 35)

a. Single Motor Operation

For this option, the automatic transfer switch (ATS) provides pre-transfer signals called Elevator Control Timer on Normal **ECTN** and Elevator Control Timer on Emergency **ECTE** and two sets of form "C" contacts are provided; one is **ECRN** and one is **ECRE**.

When the transfer switch senses that the preferred power source is out of acceptable limits, a signal is sent by the transfer switch to start the on-site engine generator set. When the output of the engine generator set has attained an acceptable level, the automatic transfer switch energizes relay ECRE and timer ECTE.

When ECRE is energized, a set of dry contacts, one normally open and one normally closed, immediately change state. This sends a signal to the elevator controller that a transfer is about to occur.

The time delay between the change in state of these contacts and actual transfer of the switch is field adjustable through timer ECTE. Once this timer has timed out, the automatic transfer switch transfers the load from the normal to the emergency power source, and ECRE and ECTE are de-energized allowing the set of dry contacts to revert to their original state.

Once the normal source has returned to within acceptable limits and associated time delays have been timed out to prepare for a return of the load to the normal source, relay ECRN and timer ECTN are energized. When ECRN is energized, a set of dry contacts, one normally open and one normally closed, change state signaling the elevator controller that a transfer of the power source is about to occur. When ECTN times out, the ATS transfers the load from the emergency source to the normal source. Once the transfer is complete, ECRN and ECTN are de-energized and revert to their original state. Please note that the engine maintain timer (EMT) is necessary for this option to function.

- **ECTN and ECTE** - These timers are field adjustable from .03 seconds to 30 minutes
- **ECRN and ECRE** - Two form "C" contacts are provided in the controls section; one is labeled ECRN and one is ECRE (Elevator Control Relay for Normal and Emergency).

b. Dual Motor Operation

Operation of the Elevator Control, Option 35, when applied on a Lake Shore Electric Corporation Dual Motor transfer switch is similar to that as described in section [a Single Motor Operation]. However, instead of transferring to the Normal or Emergency positions after the ECT timers have timed out, the transfer switch transfers to a neutral position, which starts the Time Delay to Transfer (TDT) timer.

At this time the ECRN and ECRE relays and the ECTN and ECTE timers are de-energized and revert to their original state. Once the TDT timer has timed out, the transfer switch completes the transfer operation.

Order Guide

Part Number Examples:

1. ICFA32000BPSB**/ACBT** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with Option ACBT.
2. MCDA30400CESA**/35** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option ACBT.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Auxiliary Contact Source Available

Introduction

This option provides two (2) sets of form "C" Contacts for each source. These contacts will change state dependent on their sources being available and within proper operating parameters required by the ATS.

Product Description for Microprocessor Controls (Option ACSA)

For this option, the automatic transfer switch (ATS) provides two (2) sets of form "C" Contacts for each source called NOR and EMR.

- **NOR** - Normal Relay - This relay changes state when the normal source power is available. When the normal source power is not available, the contact is in the "de-energized" state.
- **EMR** - Emergency Relay - This relay changes state when the normal unit closes or opens. When the normal unit is open, the contact is in the "de-energized" state.

This contacts provided immediate indication once the source is within operating parameters.

NOTE: Depending on other accessories that have been order with the transfer switch, one of the EMR contacts may be used for the transfer switch controls. Please refer to unit specific drawings to determine if only one (1) set of form "C" contacts is available for the emergency source.

This feature is available on all firmware versions for the microprocessor controller.

Reference Figure 1 when connecting into the aux contacts on the Relay Interface Board.

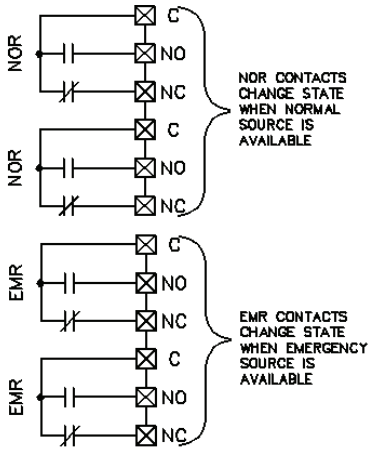


Figure 1

Product Description for Electromechanical Controls (Option 24J), Available for Automatic or Manual Transfer Switches

For this option, the automatic transfer switch (ATS) provides two (2) sets of form "C" Contacts for each source called NSAR and ESAR.

- **NSAR** - Normal Source Available Relay - This relay changes state when the normal source power is available. When the normal source power is not available, the contact is in the "de-energized" state.
- **ESAR** - Emergency Source Available Relay - This relay changes state when the normal unit closes or opens. When the normal unit is open, the contact is in the "de-energized" state.

This contacts provided immediate indication once the source is within operating parameters.

Reference Figure 2 when connecting into the aux contacts on the Electromechanical Control Panel

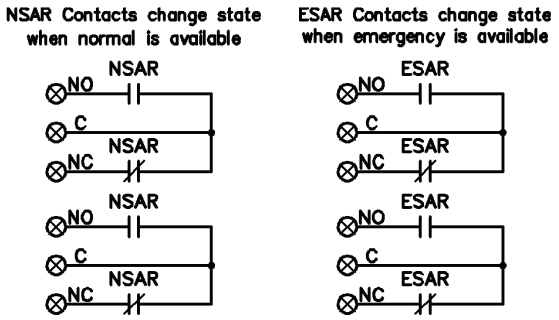


Figure 2

Order Guide

Part Number Examples:

1. ICFA32000BPSB**/ACSA** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with Option ACSA.
2. MCDA30400CESA**/24J** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option 24J.
3. MCDM30400CESA**/24J** - Molded Case MTS, 3 pole, 400 Amp, 277/480Vac, **Manual Transfer Switch**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option 24J.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Auxiliary Contact Switch Position

Introduction

This option provides two (2) sets of form "C" Contacts for each sources control unit (either a molded case or insulated case switch/breaker unit). These contacts will change state dependent on the position of their control unit.

Product Description for Microprocessor Controls (Option ACSP)

For this option, the automatic transfer switch (ATS) provides two (2) sets of form "C" Contacts for each control unit called SIN and SIE.

- **SIN** - Switch in Normal - This relay changes state when the switch is in the normal position. When the switch is not on the normal source, the contact is in the "de-energized" state.
- **SIE** - Switch in Emergency - This relay changes state when the switch is in the emergency position. When the switch is not on the emergency source, the contact is in the "de-energized" state.

These contacts provided immediate indication when the switch changes position.

This feature is available on all firmware versions for the microprocessor controller.

NOTES:

Automatic Transfer Switches with Microprocessor Controls - this is a standard feature.

Reference Figure 1 when connecting into the aux contacts on the Relay Interface Board.

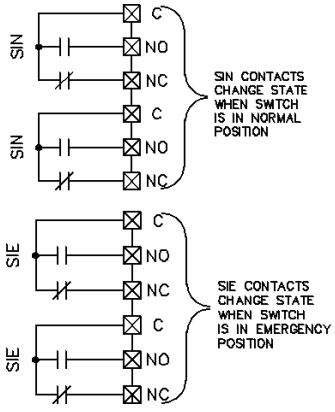


Figure 1

Product Description for Electromechanical Controls (Option 18 & 19), Available for Automatic or Manual Transfer Switches

For this option, the automatic transfer switch (ATS) provides two (2) sets of form "C" Contacts for each control unit called ACRN and ACRE.

- **ACRN (18)** - Aux Contact Relay on Normal - This relay changes state when the switch is in the normal position. When the switch is not on the normal source, the contact is in the "de-energized" state.
- **ACRE (19)** - Aux Contact Relay on Emergency - This relay changes state when the switch is in the emergency position. When the switch is not on the emergency source, the contact is in the "de-energized" state.

These contacts provided immediate indication when the switch changes position.

Reference Figure 2 when connecting into the aux contacts on the Electromechanical Control Panel.

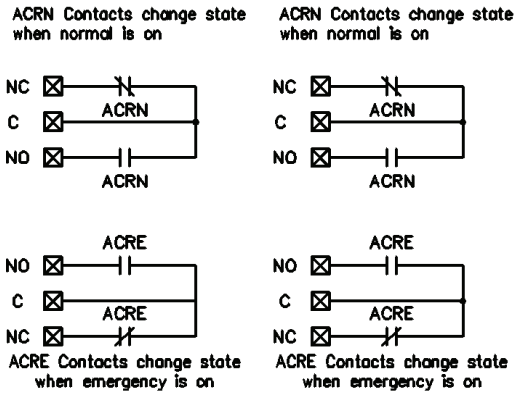


Figure 2

Order Guide

Part Number Examples:

1. ICFA32000BPSB - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with included option ACSP.
2. MCDA30400CESA**/18/19** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Options 18 and 19.
3. MCDM30400CESA**/18/19** - Molded Case MTS, 3 pole, 400 Amp, 277/480Vac, **Manual Transfer Switch**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Options 18 and 19.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Circuit Breaker Trip - Normal and/or Emergency

Introduction

The 2014 National Electric Code (NEC), Article [240] provides the requirements for selecting and installing overcurrent protection devices (OCPDs).

An overcurrent exists when current exceeds the rating of conductors or equipment. It can result from overload, short circuit, or ground fault.

- **Overload** - A condition in which equipment or conductors carry current exceeding their rated ampacity.
- **Short Circuit** - The unintentional electrical connection between any two normal current-carrying conductors of a circuit; (i.e.: line-to-line (L-L) or line-to-neutral (L-N)).
- **Instantaneous** - The inrush current created when a load is initially connected to the power source. The over current protection must be sized to accommodate the expected inrush values of connected loads. It must also be sized to accommodate the total amount of fault, short circuit, current available to the load, if the breaker is closed on a fault.
- **Ground Fault** - An unintentional, electrically conducting connection between a current carrying, ungrounded conductor of a circuit and ground; either equipment or earth ground. During a ground fault, dangerous voltages and abnormally large currents exist.

An example of one of the potential outcomes of any of the faults mentioned above is an Arc Flash, shown in Figure 1.

Figure 1 - Arc Flash Example

This situation is very dangerous for the workers and any other people in the vicinity. It is important that every precaution that can be made to eliminate potential hazards be taken.

Over Current Protection Devices, (OCPDs)

OCPDs protect circuits and equipment, but they protect circuits in one way and equipment in another.

An OCPD protects a circuit by opening when current reaches a value that would cause an excessive temperature rise in the conductors.

The interrupting rating must be sufficient for the maximum possible fault / inrush current available on the line-side terminals of the equipment.

An OCPD protects equipment by physically opening when it detects a short circuit, to high of an instantaneous inrush current, or ground fault. Every piece of electrical equipment must have short-circuit current ratings that permit the OCPDs (for that equipment) to clear the faults without extensive damage to the electrical components of the load.

Conductor overload protection is not required where circuit interruption would create a hazard (i.e., a fire pump transfer switch). Short-circuit protection is still required.

Circuit breakers must be capable of being opened and closed by hand. Non-manual means of operating a circuit breaker, such as electrical shunt trip or pneumatic operation, are permitted only if the circuit breaker can also be manually operated.

Product Description (Option: MP [CBTN / CBTE], EM [23A / 23B])

This option provides standard circuit breaker trips within either, or both, control units of the transfer switch. When automatic controls are utilized in the ATS, the control units will come complete with bell alarms. Bell alarms will only change state when the breaker is tripped due to an overcurrent/fault event, not every time the breakers changes states. When tripped, the bell alarm provides the appropriate input to the controls and the appropriate light will be illuminated on the HMI.

At any point during normal operation, in the event that one, or both, control units are tripped open from an overcurrent/fault event, the trouble (TRBL) contacts will switch states. There are two (2) sets of form "C" Contacts provided for the TRBL signal to indicate a trouble condition.

Please note that these contacts will change state in any trouble event, not just an overcurrent condition.

Also note this option is available for manual transfer switches as options 23A or 23B.

Order Guide

Part Number Examples:

1. ICFA32000BPSB/CBTN/CBTE - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure, with Options Circuit Breaker on Normal and Emergency.
2. MCDA30400CESA**/23A/23B** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Options 23A and 23B.
3. MCDM30400CESA**/23A/23B** - Molded Case MTS, 3 pole, 400 Amp, 277/480Vac, **Manual Transfer Switch**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Options 23A and 23B.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Closed Transition Transfer (CTT)

Introduction

Closed Transition Transfer allows the automatic transfer switch to transfer between sources without interruption of power to the load. This is accomplished by synchronizing the two sources prior to transfer; performing a "**make before break**" transfer.

Upon closure of the oncoming source, the source from which power is being transferred is disconnected; the actual time the sources are paralleled is typically less than 100 milliseconds.

The closed transition or "**make before break**" transfer is possible only if both power sources are available and synchronized. If either of the sources are not available, the transfer switch reverts to an open transition or "**break before make**" transfer arrangement. Closed Transition Transfer is available on Dual Motor Operator and Insulated Case automatic transfer switches.

Features

Closed Transition Automatic Transfer Switches are provided with the following features regardless of the selected transfer mode:

- Electrical Interlock Only
- Millisecond timers to ensure paralleling time is minimal
- Cross Tripping devices as backup to normal transfer means
- Reverse Power Relays for both sources to prevent back feeding Synchronizing relay
- Synchronize Fail Timer (SFT) – This timer is adjustable from 0.0 to 60.0 minutes and is FACTORY SET to 10 sec.
- Sync Check Relay (SCR)
- Reverse Power Relays - (RPRN) for Normal Power and (RPRE) for Emergency Power

Microprocessor Operation (Option CTT)

Closed Transition Transfer passively monitors and compares the frequency and phase angle of the power sources. When the alternate source's frequency and phase angle are within preset limits of the normal source, the sources will be paralleled and the alternate source will be disconnected within acceptable time limits. Again, the average time that the two sources are paralleled is under 100 milliseconds.

When offering closed transition transfer as an automatic transfer switch option, we feel that additional protective features should be added to ensure safety to the operator and equipment. Without exception, we provide all closed transition transfer switches with Reverse Power Relays on both sources. In addition, we provide an internal timer, which will trip the emergency source if both sources are paralleled for more than an acceptable time. As further redundant protection we will cross trip the normal switch if the emergency switch fails to properly open.

The Synchronize Fail Timer (SFT) timer is initiated once the closed transition is called for and will be reset upon completion of the transfer. The HMI Screen will display the following while waiting for the source to synchronize.

AUTO – EXERCISE w/LOAD Awaiting Synchronization

Should the timer time out before the transfer is made, the HMI display will show the following and the trouble contacts will change state.

AUTO – EXERCISE w/LOAD TROUBLE: SFT Timed Out

This is not considered a fault mode; therefore the automatic operation of the transfer switch will not be terminated. However, as long as both sources are available, and the sync check relay has detected a match in the phase angles of those two sources, the transfer will not be completed.

The operator can clear this message by using the following instructions on the HMI input.

1. Press "Enter"
2. Select "Clear Trouble"
3. Press "Enter" to finalize the selection.
4. Microprocessor controller will then resume normal operation.

The operator can also program the MP7650 to continue to try for a closed transition transfer or to do an open transition transfer when this timer times out. This also "Drops Out" the trouble relay to annunciate that this transfer switch requires attention.

As a safeguard, the Closed Transition Transfer Option provides a sync check relay (SCR) and a reverse power relays (RPRN and RPRE) for each source. In the event that both sources might be left in the closed position due to some form of a malfunction, the reverse power relays will sense a reverse power flow condition, if present, and trip/cross trip both sources. This will energize the trouble relay. The HMI panels will then display the following message along with the appropriate reverse power pilot light.

TROUBLE – Revers Power 08:24 Fri APR, 2016

If this is a molded case ATS that is tripped open by the Reverse Power Relays, the electromechanical controls will then be locked out. After this point, operator intervention is required to resume automatic operation.

If this is an insulated case ATS that has been instructed to "OPEN" by the Reverse Power Relays, the transfer switch will continue to operate as an open transition transfer switch.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Electromechanical Operation (Option 36)

Closed Transition Transfer passively monitors and compares the frequency and phase angle of the power sources. When the alternate source's frequency and phase angle are within preset limits of the normal source, the sources will be paralleled and the alternate source will be disconnected within pre-set time limits.

As a safeguard, the Closed Transition Transfer Option provides a sync check relay (SCR) and a reverse power relays (RPRN and RPRE) for each source. In the event that both sources might be left in the closed position due to some form of a malfunction, the reverse power relays will sense a reverse power flow condition, if present, and trip/cross trip both sources. In the event that the ATS is tripped open by the Reverse Power Relays, the electromechanical controls will then be locked out. After this point, regardless of the style of the ATS, operator intervention is required to resume automatic operation.

Recommendations

Where applications require extended or active paralleling operation, soft loading/unloading, utility peak shaving or distributed generation, Lake Shore Automatic Transfer Switches and Switchgear can be tailored to meet those needs. Please consult the factory for further information.

As in all applications which involve parallel operation with a utility grid, it is advised that the specific utility be consulted for prior approval on this type of application. Each utility has its own requirements and guidelines to be followed, such as additional protective relays. Please contact the Lake Shore Electric factory for products to meet such additional needs.

Order Guide

Part Number Examples:

1. MCDA30400CMSA**/CTT** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **12Vdc Microprocessor Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option CTT.
2. MCDA30400CESA**/36** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option 36.
3. ICFA32000CMSF**/CTT** - Insulated Case ATS, 3 pole, 2000 Amp, 277/480Vac, **12Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 3R Free Standing Enclosure with Option CTT.
4. ICFA32000CESF**/36** - Insulated Case ATS, 3 pole, 2000 Amp, 277/480Vac, **Electromechanical Controls**, 65kAIC @ 480Vac, NEMA 3R Free Standing Enclosure with Option 36.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Dual Prime Source

Introduction

The Dual Prime Source option provides the operator with the ability to select the Preferred Source input to the automatic transfer switch (ATS). The power sources can be two generators or two utilities.

As in a conventional transfer switch, the Dual Prime Source transfer switch is designed to transfer a load between two power sources with one power source designated as the Preferred Source while the other is designated as the Alternate Source.

This control is done one of two ways, with the microprocessor controls or electromechanical controls.

Product Features

- PFR1 – Standard Undervoltage Relay on Source 1
- PFR2 – Standard Undervoltage Relay on Source 2
- PSS – Preferred Source Selector Switch, (U1 or U2) or (G1 or G2)

Operation Instructions

General operation of a DPS ATS will depend on the power source type.

If the DPS is Utility to Utility, the ATS will monitor both sources for standard automatic operation. No engine start signal is required.

If the DPS is Generator to Generator, the ATS will monitor both sources for standard automatic operation and provide an engine start signal for the alternate source. The preferred source must have its own controls for standard operation.

Microprocessor Controls, DPS

Microprocessor controls provide diversity of operation for the DPS option, with the basic configuration code of the ATS. Ease of programing the microprocessor is a key feature.

The selection of the preferred source is done with the HMI panel. The units' plant exerciser may then be programmed for specific times the operator requires the ATS to transfer from the preferred source to the alternate source. With the microprocessor controls, the plant exerciser is a fixed feature on the ATS and offers diversity for Dual Prime Source ATS operation.

If a failure of the preferred source occurs, the transfer switch will transfer to alternate source. When the faulted Preferred Source is returned to service, the transfer switch will then retransfer the load back to the preferred source power.

There are other key features available with this option. Please see the Microprocessor Standard and Factory Options Overview datasheet to determine all required features for the ATS.

Electromechanical Controls, 33

Electromechanical controls provide the ATS with operational stability when installed in a noise prone area; i.e.: prone to many electromagnetic fields (EMF) that could potentially interrupt the microprocessor operation.

The selection of the preferred source is done with a selector switch; location may be on the door or internal to the ATS enclosure. The basic controls will allow for automatic selection of a preferred source.

In the event that the preferred source is lost, the unit will then transfer to the alternate source. Basic controls will not include a plant exerciser. When the faulted Preferred Source is returned to service, the transfer switch will then retransfer the load back to the Preferred Source power.

If a plant exerciser option is order with this option, a programmable time clock will alternate which power source the Load is feed from on a set time, or multiple times, during a seven day period.

Please review the Electromechanical Overview datasheet to determine all required features for the ATS. For Gen to Gen connection, Lake Shore Electric recommends P1 Control Board Selection, but P2, P4 and P7 are available for this option. For Utility to Utility connection, any version of the Positive Control Board may be used.

Typical Application of DPS for Redundant Onsite Power Systems

Specifying engineers may require two on-site power generation plants to insure that an alternate power source will be available. In Figure 1 below, ATS-1 is a standard Utility to Emergency ATS. ATS-2 is a Dual Prime Source automatic transfer switch, Gen to Gen connection.

Upon a Utility power outage, ATS-1 will signal ATS-2 to start the Preferred Source generator. ATS-2 will start the generator and provide power to ATS-1 which will transfer the load to the generator. If a failure occurs on the Preferred Source generator, the Alternate Source generator will be started by ATS-2 and its load transferred to the alternate source. ATS-2 will continue to supply power to the load through ATS-1.

When Utility power returns, ATS-1 will return to the utility position and the load transferred to the utility.

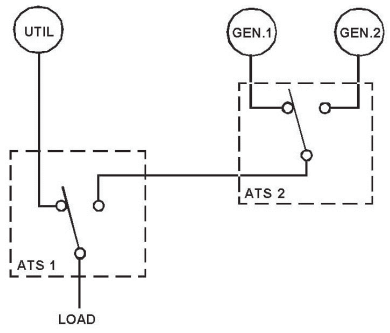


Figure 1

Order Guide

Part Number Examples:

1. ICFA32000BPSB**/DPS** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with Option Dual Prime Source.
2. MCDA30400CESA**/33** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option Dual Prime Source.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Manual Transfer Switch Option
Electrical Assist

Introduction

This option is for Manual Transfer Switches, (MTS), and provides the operator with electrical assistance to control the unit without entering the transfer switch enclosure.

Included with this option are four push buttons for external breaker operation. The buttons are as follows:

1. Open Normal
2. Open Emergency
3. Close Normal
4. Close Emergency

NOTE: The Normal and Emergency breakers may not be closed at the same time, but they may both be open at the same time; Neutral Position. This is done via a mechanical and electrical interlock built into the unit.

This option will also provide a Keyed Control Enable Switch (CES), to enable/disable the circuit controls. This will allow only authorized operators to control the units' position.

Pilot light options for source available and switch position are included with this option. (Options 22A and 22B) This will provide the operator with the required information to operator the MTS effectively.

If the unit is ordered as Suitable for Use as Service Entrance Equipment and/or has Ground Fault Protection included, the pilot light for system trouble detected will also be included. (Option 22C) This will let the operator know that a fault has occurred and that operator intervention is required.

Figure 1 shows an example of what to expect on the door when this option is ordered. Please note that this is a customized version of the door. The amber light is being utilized for "Switch in Neutral" notification. "Source Available" lights are normally white, "Switch in Normal" light is normally green and "Switch in Emergency" light is normally red. Were the "Control Selector Switch" is shown, this is typically the local "Control Enable" keyed switch only.

Figure 1

Description of Operation

Operation of the MTS is very straight forward and the same between the molded case, and insulated case, MTS.

Use the indicator lights to determine the current position of the MTS. Typically, the MTS load will be fed from the Normal Power Source. In this state, the white light for "Normal Source Available" and the green light for "Switch in Normal" will be lit.

To transfer the MTS load from the Normal Power Source to the Emergency Power Source, follow the instructions below.

1. Verify that the Emergency Power Source is available by checking to see if the "Emergency Power Source" white light is lit. If the light is off, start the Emergency Power Source per the facilities operating procedures.
2. The CES key is required to operate the MTS. Insert the key into the "Control Enable Switch" and turn it to the "Enabled" position.
3. Press the "Open Normal" pushbutton. There will be a type of "Clank" noise to indicate the normal side unit has been opened.
4. Verify the normal side unit has been opened by checking the "Switch in Normal" light has gone out.
5. Press the "Close Emergency" pushbutton. There will be another type of "Clank" noise to indicate the emergency side unit has been closed.
6. Provided the MTS functioned correctly, the MTS load will now be fed from the Emergency Power Source. Verify this by checking to see if the "Switch in Emergency" red light is lit.
7. Place the "Controls Enable Switch" key back in the "Disabled" position and remove to lock out unauthorized access.

To return the MTS load to the Normal Power Source, reverse the instructions above and return the unit to the normal operating position.

Hardware Reset Instructions (By MTS Type)

Continue with the "Reset Instructions" only after the cause of the fault has been cleared away.

Molded Case Units: The MTS must be physically reset to resume standard operation. To do this, push down on the lever bars over the normal and emergency molded case units, one at a time. This will place them solidly in the "OFF" position. Once that is completed, close the MTS door and resume normal operation.

Insulated Case Units: A physical reset is not required for this units. Once the fault has been cleared, they will resume normal operation.

Order Guide

Part Number Examples:

1. ICFM32000BESB**/40** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **Manual Transfer Switch**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with Option 40.
2. MCDM30400CESA**/31/40** - Molded Case MTS, 3 pole, 400 Amp, 277/480Vac, **Manual Transfer Switch**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Options 31, (Suitable for Use as Service Entrance Equipment) and 40.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE ELECTRIC CORPORATION

Automatic Transfer Switch Option Emergency Disconnect Switch

Introduction

For equipment that is Microprocessor Controlled and required to be Suitable for Use as Service Entrance Equipment, an Emergency Disconnect (ED) Switch will be installed on the outside of the Automatic Transfer Switch (ATS). This switch provides maintenance personnel with additional protection when servicing the ATS by forcing it to the neutral position.

When the ED switch is activated, the current control unit that is currently closed will be tripped open and the other control unit will be prevented from closing. Once the ED signal is removed and the ATS reset, automatic operation will resume.

Product Features

- Keyed ED Switch Located on Door
- Aux Switch, Bell Alarm and Shunt Trips Included in Both Control Units
- 12 or 24 Vdc Required for Operation (Guarantee's the Operator can Place the ATS in the Neutral Position even when AC Power is Lost)
- Included with all Microprocessor Controlled SE ATS Equipment

Operation Instructions

Follow the instructions below for proper operation of the emergency disconnect. This will place the ATS in the neutral position.

1. Operator must use all required PPE before operating the equipment.
2. Locate the ED key.
3. Insert the ED key into the ED switch and turn the key to the right. This will activate the ATS disconnect feature and place it into the neutral position. The operator should hear the control unit trip open. [CLANG!]
4. Verify that both control units have been tripped open by observing the ATS position lights. Both should be in the open/tripped position.
5. Once the ATS is in the neutral position, the operator may proceed with required maintenance.

Insulated Case Reset Instructions

Instructions to Reset the ATS for Automatic Operation.

1. ATS Operator must use all required PPE.
2. Turn the ED key to the left and remove the key from the ED switch. This will clear the ED signal to the ATS.

Microprocessor Controls

1. On the HMI screen, Depress "Enter".
2. The display will read "MAIN MENU / Reset Faults / Troubles".
3. Depress "Enter" again and the display will read "Reset Faults / Troubles Now? No".
4. The word "No" will be underlined.
5. Depress either "⇓" and "⇑" until "Yes", the desired value, is displayed.
6. Depress "Enter".
7. All faults / troubles will be reset and the display will show the operating mode again.

Insulated Case Reset Instructions Continued

Electromechanical Controls

1. No Further Action Required.

Molded Case Reset Instructions

Instructions to Physically Reset Control Units after the Emergency Disconnect was Activated

1. ATS Operator must use all required PPE.
2. Turn the ED key to the left and remove the key from the ED switch. This will clear the ED signal to the ATS.
3. Open the ATS enclosure. ATS will be in the Neutral position.
4. Depress the control handle on the Control Unit that was tripped until it is in the "OFF" position. [Solid CLICK sound.]
5. Close the ATS door.

Microprocessor Controls

The following instructions are to be performed using the keypad and HMI screen located on the front of the ATS.

1. Depress "Enter".
2. The display will read "MAIN MENU / Reset Faults / Troubles".
3. Depress "Enter" again and the display will read "Reset Faults / Troubles Now? No".
4. The word "No" will be underlined.
5. Depress either "⇓" and "⇑" until "Yes", the desired value, is displayed.
6. Depress "Enter".
7. All faults / troubles will be reset and the display will show the operating mode again.

Electromechanical Controls

1. No Further Action Required.

Order Guide

Part Number Examples:

1. ICFA32000BPSB**/SE/ED** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with Option SE and ED.
2. MCDA30400CESA**/32** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option 32.

LAKESHORE ELECTRIC CORPORATION

MBE CERTIFIED MINORITY BUSINESS ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Ground Fault Indication

Introduction

Article 700-26 of the National Electric Code states “The alternate source for emergency systems shall not be required to have ground fault protection of equipment with automatic disconnecting means”. Although this is an exception to Article 230-95, it provides the designer of a system the ability to exercise judgment in the balance between risking damage to equipment verses loss of the emergency power source. This article does, however, require Ground Fault Indication be provided for the emergency source.

Article 700-6 of the National Electric Code states “Audible and visual signal devices shall be provided, where practicable, for Ground Fault. To indicate a ground fault in solidly grounded Wye emergency systems of 150 volts to ground and circuit protective devices rated 1,000 amperes or more. The sensor for the ground fault signal devices shall be located at, or ahead of the main system disconnecting means for the emergency source, and the maximum setting of the signal devices shall be for a ground fault current of 1200 amperes. Instruction on the course of action to be taken in event of indicated ground fault shall be located at or near the sensor location”.

Therefore the detection of a ground fault on an emergency service is desirable. However, Automatic Disconnect in the event of such a fault may not be appropriate.

Article 517 requires that any Ground Fault sensing for onsite generating units shall be indication only.

Article 517.17 (A) states, “where ground fault protection is provided for operation of the service disconnecting means or feeder disconnecting means as specified by 230.95 or 215.10, an additional step of ground fault protection shall be provided in the next level of feeder disconnecting means downstream toward the load. Such protection shall consist of overcurrent devices and current transformers or other equivalent protective equipment that shall cause the feeder disconnecting means to open. The additional levels of ground fault protection shall not be installed as follows:

1) On the load side of an essential electrical system transfer switch.
2) Between the onsite generating unit(s) described in 517.35(B) and the essential electrical system transfer switches.
3) On electrical systems that are not solidly grounded Wye systems with greater than 150 volts to ground but not exceeding 600 volts phase-to-phase.

When Ground Fault Indication is specified on a Lake Shore Electric Corporation Transfer Switch the fault will be annunciated, however the ATS will remain in the automatic mode and will allow the closing of either source to the known fault.

For Delta connected systems, please consult the factory.

Product Features

- UL 1008 Listed
- Monitors for Ground Fault, but the System will Not be Tripped in the Event of a Ground Fault Condition Detected
- Aux Contact Provided for the Customers Remote Controls or for an Indication Light Only

Operation

This option provides Ground Fault monitoring on the normal source. When a Ground Fault Condition is detected, the provided GFI aux contact will change states.

One use for this contact may be by the customer for remote monitoring of the system. Another use would be to provide a door light to indicate to the local personal of the ground fault condition and to proceed with Caution.

Recommendations

Lake Shore Electric Corporation highly recommends that the specifying engineer recommend where any and all ground fault indication should be placed within the facility.

If GFI has already been specified please consult the factory for ordering the appropriate equipment and further information.

Order Guide

Part Number Examples:

1. ICFA32000BPSB**/GFI** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with included option GFI.
2. MCDA31000CESA**/39B** - Molded Case ATS, 3 pole, 1000 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with option 39B, Ground Fault Indication Only.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Ground Fault Protection

Introduction

Ground faults in any power distribution system require special consideration. A ground fault occurs whenever a phase conductor develops an electrically conductive path to ground. This path may be caused by deteriorated insulation, mechanical damage, surges, heat, aging, presence of rodents, and the intrusion of foreign objects such as tools into bare bus compartments.

A ground fault may develop as a “bolted fault” and or “arcing fault.” Ground fault protection will protect against either type if properly set.

A “bolted fault” occurs when a phase conductor is solidly connected to ground. This produces a high fault current which dissipates energy throughout the distribution system.

An “arcing fault” occurs when a phase conductor develops an electrically conductive path to ground, but is not solidly connected to ground. This path develops an arcing fault which, if self-sustaining, is capable of releasing tremendous energy at the point of fault. This tremendous energy, released at low current levels over a period of time, creates devastating results sufficient to ignite fires.

The I.E.E.E. studies indicate that the typical arcing fault current is only 38% of the bolted fault current. It is this low current level that renders normal over current protection useless. The only recourse is to add supplemental relaying to secure adequate protection.

The National Electric Code requires in Article 230-95: “Ground fault protection of equipment shall be provided for solidly grounded Wye electrical services of more than 150 volts to ground, but not exceeding 600 volts phase to phase for each service disconnecting means rated 1,000 amperes or more”.

The voltage range for ground fault protection is specified since arcing faults in circuits less than 150 VAC to ground are usually self-extinguishing and arcing faults in circuits over 600 VAC line to line approach bolted fault levels which may be detected by ordinary phase over current devices if the system is solidly grounded.

When a ground fault is detected, the Normal and/or the Emergency source will be opened, isolating the ground fault from the external voltage source. To insure that the alternate source will not be closed to a known fault.

The Automatic Transfer Switch will be inhibited from transferring to the alternate source until:

1) The Fault is Cleared
2) Automatic Transfer Switch is Manually Reset
3) Ground Fault Relay is Reset by Pushing the Reset Pushbutton

The maximum setting of the ground fault protection shall be 1200 amperes, and the maximum time delay shall be one second for ground fault currents equal to or greater than 3000 amperes.

NOTE:

For Delta connected systems, please consult the factory. Ground Fault Protection is not required for a continuous industrial process where a non-orderly shutdown will introduce additional or increased hazards.

Product Features

- UL 1008 Listed
- Monitors for Ground Fault and the System will be Tripped in the Event of a Ground Fault Condition being Detected
- Aux Contact, TRBL, Provided for the Customers to Indicate a System Trouble (General Trouble Contact; Overcurrent, Ground Fault etc.)
- HMI will Display the Fault Condition

Operation

This option provides Ground Fault Protections on the normal source. When a Ground Fault Condition is detected, the system will trip open the normal side breaker to remove the ground fault from the load.

The Trouble contact, TRBL, will change state to indicate there is a problem with the power source. This will require operator intervention to remove the ground fault and reset the ATS for automatic operation.

Recommendations

Lake Shore Electric Corporation highly recommends that the specifying engineer recommend where any and all ground fault protection should be placed within the facility.

If GFP has already been specified please consult the factory for ordering the appropriate equipment and further information.

Order Guide

Part Number Examples:

1. ICFA32000BPSB**/GFP** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with option GFP.
2. MCDA31000CESA**/39A** - Molded Case ATS, 3 pole, 1000 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option 39A.
3. MCDM31000CESA**/39A** - Molded Case MTS, 3 pole, 1000 Amp, 277/480Vac, **Manual Transfer Switch**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option 39A.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Manual Return to Normal

Introduction

The standard override TDR pushbutton, (ORPB), will override the time delay imposed by the TDR timer described below.

TDR Time Delay Return. This timer is adjustable from 0.0 to 60.0 minutes and is FACTORY SET AT 12 MINUTES. It is initiated upon the restoration of normal power and will inhibit the switch from retransferring to the normal source until it has timed out. If at any time during the timing cycle normal power is not maintained, this timer will be terminated and will be reinitiated when normal power returns.

The Manual Return to Normal (MRTN) option eliminates the "TDR" (Time Delay to Return) timer and a maintained switch replaces the momentary ORPB. In the standard operation of the automatic transfer switch (ATS) with a MRTN feature enabled, the ATS will never transfer to the normal power source unless this input is activated.

Product Features

- Manual Return to Normal (Manual Operation Required)

Standard MRTN Operation

Microprocessor Controls, MRTN

Entry into the ATS enclosure is required for this step. Be sure all the appropriate PPE required is being used.

To return the ATS to the normal source, flip the MRTN switch. The transfer switch will instantly transfer the load to the normal source, if available, and shut down the engine.

Figure 1 shows how the MRTN switch is wired into the microprocessor control circuit. If a remote MRTN input is required, simply wire a parallel control switch across the MRTN input. A terminal block is available for field wiring upon request.

Electromechanical Controls, 15

Entry into the ATS enclosure is required for this step. Be sure all the appropriate PPE required is being used.

To return the ATS to the normal source, flip the MRTN toggle switch. The transfer switch will instantly transfer the load to the normal source, if available, and shut down the engine.

If a remote MRTN input is required, a terminal block wired in parallel to the MRTN is available for field wiring upon request. This will allow a remote input to control the ATS.

See Electromechanical Controls Overview Datasheet for more information.

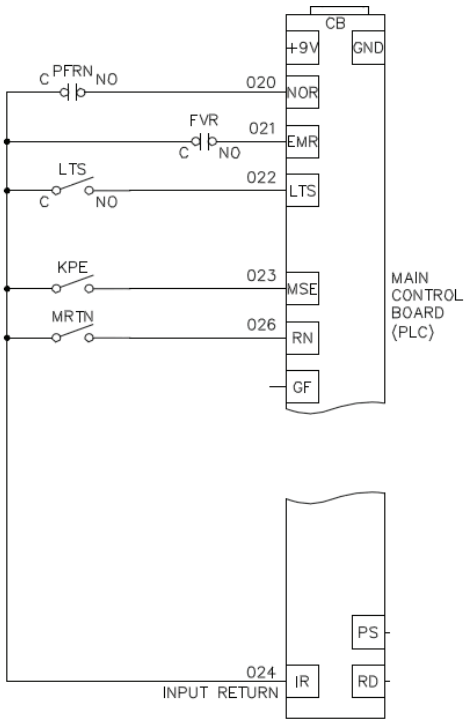


Figure 1

Order Guide

Part Number Examples:

1. ICFA32000BPSB**/MRTN** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with Option MRTN.
2. MCDA30400CESA**/15** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option 15.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Maintained Load Test Switch

Introduction

The standard load test switch in any automatic transfer switch (ATS), allows the operator to press/switch the load test switch (LTS) to perform a full load transfer test of the ATS.

Once the operator has pressed/switched the LTS, it will simulate a power outage on the normal source that will force the ATS to send the engine start (ES) signal to the attached generator. This is the same for either microprocessor or electromechanical controls. Once the generator is fully operational, the ATS will transfer the load to the emergency power. Once the transfer is complete, the ATS will return to automatic operation.

Product Features

- Maintained Load Test Switch (Manual Operation Required)

Standard Load Test Switch Operation

Microprocessor Controls – HMI Load Test

To ensure the Load Test software is operating correctly, the following explains how to perform a load test from the HMI panel directly.

All MP7650 controlled Transfer Switches have a "Load Test" operating mode which is menu selectable at the HMI panel. A test of the automatic circuitry can be initiated by placing the Transfer Switch in the load test mode. This will cause the normal control circuits to de-energize and give a signal to start the engine. After the generator is up to the required voltage and frequency, the transfer switch will transfer to the emergency source.

1. On the HMI screen, Depress "Enter".
2. The display will read "Select Mode (current mode displayed here)".
3. Depress "Enter" again.
4. Depress either "⇓" and "⇑". The following are the available selections.
   a. Automatic
   b. Hand Crank
   c. Load Test
   d. Off
5. Once the "Load Test" option is shown, depress "Enter" to proceed with load test. The following is an example of the HMI display.

MODE LOAD TEST
09:25 Thu 29 Sep, 2016

6. The display will then start to cycle through the appropriate timers to transfer the Load to the emergency source.

NOTE: At any time during this procedure you get lost, depress the "ESC" button unit you are back at the main screen to start over.

Place the transfer switch back into the 'AUTO' position at the HMI panel, using the instruction above, to allow the transfer switch to transfer back to normal and shut down the engine. After the appropriate time delays, the ATS will return the load to the normal source if normal power is available.

Microprocessor Controls – Load Test Switch

Entry into the ATS enclosure is required for this step. Be sure all the appropriate PPE required is being used.

To test the Load Test Cycle, press the momentary Load Test Cycle pushbutton inside the door for two seconds. The transfer switch will start the engine, transfer to emergency, and return to normal after the appropriate time delays.

Electromechanical Controls

Entry into the ATS enclosure is required for this step. Be sure all the appropriate PPE required is being used.

For the standard electromechanical controls, the Load Test switch is a maintained switch. A momentary version of this feature is available, but is mounted on the door (no enclosure entry required), and will work as described in the Microprocessor Controls – Load Test Switch section. See Electromechanical Controls Overview Datasheet for more information.

The operator has to be physically present during the entirety of the full load test in order to return the ATS to automatic operation after completion.

To perform a Load Test on the ATS, flip the toggle on the Load Test switch inside the door. The transfer switch will start the engine and transfer to emergency.

To return the ATS back to automatic operation, flip the toggle on the Load Test Switch inside the door back to its original position and the ATS will return to normal, if normal is available, after the appropriate time delays.

Maintained Load Test (MLT) Operation

Entry into the ATS enclosure is required for this step. Be sure all the appropriate PPE required is being used.

For the standard Maintained Load Test switch, the operator has to be physically present during the entirety of the full load test in order to return the ATS to automatic operation after completion. However, if this option is being used to force the ATS to emergency power, the switch may be set and the operator may leave.

To perform a Load Test on the ATS, flip the MLT switch located inside the door. The transfer switch will start the engine and transfer to emergency.

To return the ATS back to automatic operation, flip MLT switch inside the door back to its original position and the ATS will return to normal, if normal is available, after the appropriate time delays.

Once that input has been removed, automatic operations will resume.

Order Guide

Part Number Examples:

1. ICFA32000BPSB**/MLT** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with Option MLT.
2. MCDA30400CPSA**/MLT** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **24Vdc Microprocessor Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option MLT.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Multifunction Metering

Introduction

This option provides a multifunction meter (MFM) on the load output that may be setup to monitor single or three phase systems and may be ordered on Automatic or Manual Transfer Switches. For three phase transfer switches, the unit can be setup to monitor delta or wye, 3-wire or 4-wire, systems.

The unit measures the following:

1. Phase Voltage (V)
2. Phase to Neutral Voltage (V)
3. Phase Current (I)
4. Frequency (Hz)
5. Active Power (W)
6. Active Energy (kWh)
7. Reactive Power (VAR)
8. Apparent Power (VA)
9. Reactive Energy (VARh)
10. Power Factor (PF)
11. Instantaneous Amp Demand
12. Instantaneous Watt Demand
13. Instantaneous VA Demand
14. Maximum Amp Demand
15. Maximum Watt Demand
16. Maximum VA Demand

Standard RS-485 MODBUS communications are included with the MFM option. Ethernet 10/100 base connectivity available upon request. If other communication types are required, a conversion module may be used convert the RS-485 to the appropriate protocol. Please consult the factory for the appropriate converter.

Product Features

- UL 1008 Listed
- Complete 1ϕ or 3ϕ Digital Metering System
- Continuous display of kW.h or kVAr.h
- THD option for Current and Voltage
- Front Access Keypad for MFM Controls
- RS-485 MODBUS Communication, Standard
- RS-485 Daisy Chain Capable with up to 32 Other Devices
- Programmable, Non-volatile Memory which retains:
  - CT Current Ratios
  - Demand Time Periods
  - Calibration Data in Power Down (Power Loss) Conditions
- Auxiliary Power Input will be One of the Following
  - 120Vac
  - 12Vdc
  - 24Vdc

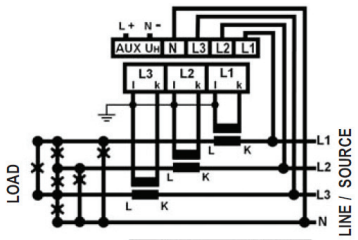
Operation Instructions

Currently, Lake Shore Electric utilizes the PC&S Power Monitor, mfg. part# M850-LCD, on transfer switches which this option has been ordered. Reference the user guide for operating this meter. This is subject to change without notice so be sure to consult the factory when ordering new equipment. If there are any technical questions for a multifunction meter provided with a Lake Shore Electric ATS, please give technical support a call.

Figure 1 shows the current wiring capabilities of the PC&S meter, mfg. part# M850-LCD.

Wiring Connections

k / K = X1 or H1 (Depending on CTs) = faces Source
l / L = X2 or H2 (Depending on CTs) = Grounded



	Voltage				Current		
	L1	L2	L3	N	L1	L2	L3
1ph	✓	×	×	✓	✓	×	×
1ph 3W	✓	✓	×	✓	✓	✓	×
3ph 3W	✓	✓	✓	×	✓	×	✓
3ph 4W	✓	✓	✓	✓	✓	✓	✓
3ph 3W BAL	✓	✓	✓	×	✓	×	×
3ph 4W BAL	✓	×	×	✓	✓	×	×

Unused Voltage terminals are internally connected
Secondary of CTs must be connected to earth

Figure 1

Order Guide

Part Number Examples:

1. ICFA32000BPSB**/MFM** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with Option LDI.
2. MCDA30400CESA**/25** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option 25.
3. MCDM30400CESA**/25** - Molded Case MTS, 3 pole, 400 Amp, 277/480Vac, **Manual Transfer Switch**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option 25.

Product Specifications

PC&S MULTIFUNCTION METER, M850-LCD	
DISPLAY	
Type	LCD
Screen Size	Blue, Green, White (User-Selectable)
Energy	1 line 99999999
Digit Size	6mm, 7 segment
Brightness	8 user-selectable levels
COMMUNICATIONS	
RS485	MODBUS Protocol
Pulsed Output	W.h, VAr.h
ENVIRONMENTAL	
Working Temperature	-20°C to +70°C [-4°F to 158°F]
Storage Temperature	-30°C to +80°C [-22°F to 176°F]
Relative Humidity	0 to 95% RH, no condensation
Shock	30G in 2 planes
APPROVAL	
UL	File No. E337752-1

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Peak Shave

Introduction

Peak Shave, (PS) provides an input to the transfer switch. The input is a two-wire connection on the Main Control Board and is marked “PS”. It is pre-wired to the customer connection terminal blocks.

This option, when the input is active, will force the transfer switch onto the emergency source. If the emergency source is not available, the transfer switch will return to the normal source.

As long as the PS input is active, the transfer switch will attempt to transfer to the emergency source. If that source is not available, it will return to the normal source.

Once that input has been removed, automatic operations will resume.

Product Features

- Terminal Block Connection Point for Customer Wiring

Operation Instructions

Microprocessor Controls, PS

The customer must wire in a normally open contact that they will close when PS operation is required.

See Figure 1 for customer wiring terminals. The input to the Main Control Board is already pre-wired by Lake Shore Electric to terminal blocks 035 and 024.

When the customer contact has been closed, the ATS will attempt to transfer to emergency power. If emergency power is not available, the ATS will return to normal power.

When automatic operation is required, remove the PS input from the ATS and automatic operation will resume.

Electromechanical Controls, 43

This feature will override the operation of a remote or local test switch that has been used to force the ATS to the Emergency position. If the emergency power fails, the ATS will automatically retransfer to the normal power if it is available.

Please consult the factory to discuss the requirements for adding this feature.

Applications

Typical uses of the peak save function are, for example, money saving applications. During peak hours of the day, when the Utility cost are at their highest, the facility will transfer their load to emergency power.

However, the facility can ill afford losing power. Therefore, if emergency power is unavailable for any reason, the ATS will return facility power to the normal (utility) power source until emergency power is available.

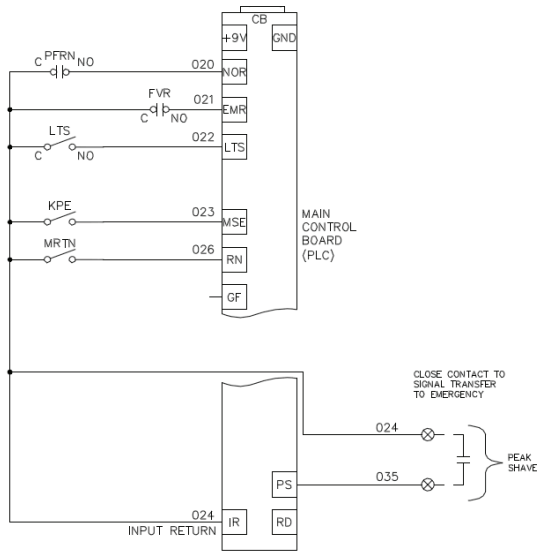


Figure 1

Order Guide

Part Number Examples:

1. ICFA32000BPSB**/LDI** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with Option LDI.
2. MCDA30400CESA**/43** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option 43.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Manual Transfer Switch Option
Pilot Lights - Switch Position, Source Available, System Trouble

Introduction

These options provide indicator lights mounted on the door of the Manual Transfer Switch (MTS) to provide the operator with information about the MTS state.

The Switch Position pilot lights will indicate which power source is currently feeding the load, if either.

The Source Available pilot lights will tell the operator which power sources are currently available to be loaded.

The System Trouble pilot light will indicate that one of two things have happened; an overcurrent or ground fault event.

Product Description – Pilot Lights for Switch Position (Option 22A)

The Switch Position pilot lights option will supply the MTS with two pilot lights, one red and one green.

The Green pilot light indicates the Normal Power Source is feeding the load.

The Red pilot light indicates the Emergency Power Source is feeding the load.

Both pilot lights will be marked with the appropriate engraved nameplates.

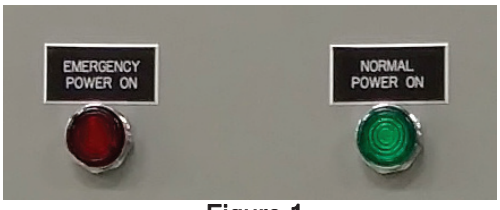


Figure 1

Please note Figure 1 shows and example of what to expect when the option for pilot lights for switch position is ordered. The end product may vary in position and nameplate wording depending on other options ordered. The colors may be customized by consulting the factory.

Order Guide

Part Number Examples:

1. ICFM32000BESB**/22A** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **Manual Transfer Switch**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with Option 22A.
2. MCDM30400CESA**/22A/22B** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Manual Transfer Switch**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Options 22A and 22B.

Product Description – Pilot Lights for Source Available (Option 22B)

The Source Available pilot lights option will supply the MTS with two white pilot lights.

When one or both of those pilot lights are lit, their respective sources are available and ready to be loaded.

Both pilot lights will be marked with the appropriate engraved nameplates.

Figure 2

Please note Figure 2 shows and example of what to expect when the option for pilot lights for source available is ordered. The end product may vary in position and nameplate wording depending on other options ordered. The colors may be customized by consulting the factory.

Product Description – Pilot Light for System Trouble (Option 22C)

The System Trouble pilot light option will supply the MTS with one Amber pilot light.

The pilot light will be marked with the appropriate engraved nameplate.

Please note that this option may be customized by consulting the factory.

3. MCDM30400CESA**/22C/31** - Molded Case MTS, 3 pole, 400 Amp, 277/480Vac, **Manual Transfer Switch**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Options 22C and 31, (Suitable for Use as Service Entrance Equipment).

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Remote Disconnect

Introduction

Remote Disconnect, (RD); This option provides a shunt trip input to the transfer switch so that from a remote location either or both of the switches can be tripped and the transfer switch sent to the Fault mode. Customer interconnection can be made at a terminal block.

Product Features

- UL 1008 Listed
- Aux/Bell Alarm Combo Contact Included with Control Units
- 12 or 24 Vdc Shunt Trips Suppled for Remote Control of the Control Units
- Remote Disconnect Customer Connection Point

Standard Operation

When the RD signal is sent to the automatic transfer switch (ATS), both control units will be tripped open. While this signal is present, the ATS will be kept in the neutral position.

Microprocessor Controls, RD

The customer must wire in a normally open contact that they will close when RD operation is required.

See Figure 1 for customer wiring terminals. The input to the Main Control Board is already pre-wired by Lake Shore Electric to terminal blocks 036 and 024.

When the customer contact has been closed, the ATS will be forced off of both power sources and into the neutral position.

When automatic operation is required, remove the RD input from the ATS and follow the appropriate Reset instructions.

RD Reset - Molded Case Control Units

First, remove the RD signal forcing the ATS to the neutral position.

Next, entry into the ATS enclosure is required. Be sure all the appropriate PPE required is being used.

Both units will need to be physically reset. To reset the molded case units, depress the control handle on the normal unit until it is in the "OFF" position. Repeat this for the emergency unit.

Once the control units have been reset, close the enclosure door and follow the RESET instructions to resume automatic operation of the ATS.

Reset - Insulated Case Control Units

Remove the RD signal forcing the ATS to the neutral position. Then follow the RESET instructions to resume automatic operation of the ATS.

RESET Instruction

The following instructions are to be performed using the keypad and HMI screen located on the front of the ATS.

1. Depress "Enter".
2. The display will read "MAIN MENU / Reset Faults / Troubles".
3. Depress "Enter" again and the display will read "Reset Faults / Troubles Now? No".
4. The word "No" will be underlined.
5. Depress either "⇩" and "⇧" until "Yes", the desired value, is displayed.
6. Depress "Enter".
7. All faults / troubles will be reset and the display will show the operating mode again.

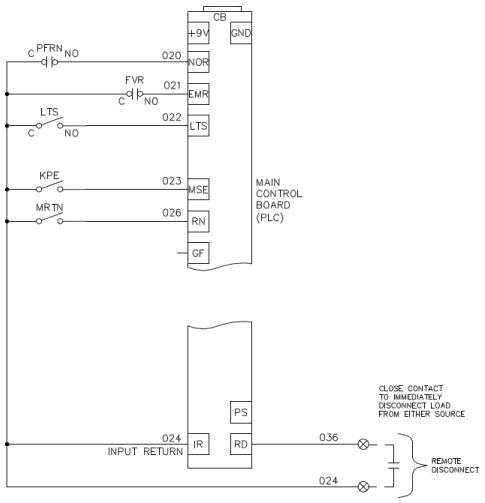


Figure 1

Electromechanical Controls, 30

The customer must wire in 12 or 24Vdc with a control contact to remote trip the control units. See Figure 2 for customer wiring terminals.

30 Reset - Molded Case Control Units

First, remove the RD signal forcing the ATS to the neutral position.

Next, entry into the ATS enclosure is required. Be sure all the appropriate PPE required is being used.

Both units will need to be physically reset. To reset the molded case units, depress the control handle on the normal unit until it is in the "OFF" position. Repeat this for the emergency unit. Once the control units have been reset, the ATS will resume automatic operation.

30 Reset - Insulated Case Control Units

Remove the RD signal forcing the ATS to the neutral position. Once the control units have been reset, the ATS will resume automatic operation.

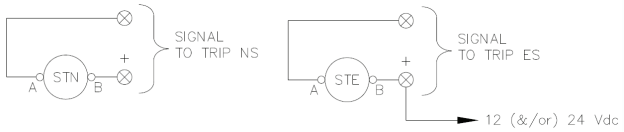


Figure 2

Order Guide

Part Number Examples:

1. ICFA32000BPSB**/RD** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with Option RD.
2. MCDA30400CESA**/30** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option 30 (Specify Available DC Voltage).

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Service Entrance Equipment

Introduction

Lake Shore Electric Corporations' Service Entrance Option provides for the Automatic or Manual Transfer Switch (UL 1008 Listed) to be labeled as Suitable for Use as Service Entrance Equipment (SE).

When a Lake Shore Electric Corporation Transfer Switch is connected to the load end of service conductors to a building or other structure it can be rated and listed as Service Equipment. This allows a great deal of flexibility to the design engineer in creating an efficient and economical electrical power system.

The Service Entrance Rated Transfer Switch is manufactured with the traditional high quality offered by Lake Shore Electric Corporation and in addition to the accessories requested:

- Provides a service disconnecting means.
- Provides permanent marking identifying it as a service disconnect suitable for the prevailing conditions.
- Provides over current protection for each ungrounded service conductor.
- Provides a means of disconnecting the grounding of the grounded conductor.
- Provides clear indication of the position of disconnect.

This dual application allows for the elimination of separate service equipment in series with the transfer switch. The cost savings can be significant.

- Additional equipment is not needed.
- Interposing cable and conduit are eliminated.
- Labor for equipment mounting is reduced.
- Labor for interposing cable and conduit is eliminated.

The logical application of service entrance equipment is where the alternate power supply is capable of accepting the entire service load and/or the placement of the Automatic Transfer Switch is installed in a readily accessible location consistent with Article 230 of the National Electric Code.

Section 230-2 of the National Electric Code clearly identifies emergency systems, legally required standby systems, optional standby systems and parallel power production systems as separate services.

Therefore, there is a requirement to provide additional SE for these sources of power. Since SE must be provided for the on-site power plant, the same benefits that apply when the Lake Shore Service Entrance Rated Transfer Switch is used as the Utility Service Equipment.

Product Features

- UL 1008 Listed
- Provides a Service Disconnecting Means
- Provides Permanent Marking as SE
- Provides Solid Neutral-to-Ground Bonding, Single Point

Operation

This option provides both overcurrent protection on the service entrance side of the equipment and fused protection ahead of all controls for the transfer switch. A neutral-to-ground bonding link is provided, as required by code, but shipped disconnected in the transfer switch.

When ordering this equipment, be sure to indicate which side of the transfer switch is being used for the service entrance, either normal or emergency side. Otherwise, the transfer switch will be constructed with the service entrance coming into the normal, top entry, side of the transfer switch.

Note: When service entrance is ordered on a transfer switch, then the neutral-to-ground bonding must be done within that piece of equipment, per code.

When a Delta system is indicated when ordering a transfer switch, 3ϕ, 3W, the neutral bus and a single lug will also be provided along with the bonding link. This allows the installer to pull in the delta neutral point to the transfer switch to perform the neutral-to-ground bonding in that location, per code requirements.

Recommendations

Lake Shore Electric Corporation highly recommends that the specifying engineer recommend where any and all service entrance equipment should be placed within the facility.

If SE has already been specified please consult the factory for ordering the appropriate equipment and further information.

Order Guide

Part Number Examples:

1. ICFA32000BPSB**/SE** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with included option SE.
2. MCDA30400CESA**/31** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option 31.
3. MCDM30400CESA**/31** - Molded Case MTS, 3 pole, 400 Amp, 277/480Vac, **Manual Transfer Switch**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option 31.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Single Phase Protection

Introduction

A balanced system means that each phase of the three-phase (3ϕ) power source are equal in voltage magnitude and are 120° apart. Since there are three phases, or "legs", of power available from the source, it is possible to lose one of them during normal operation.

The loss of a single phase, or "leg", can happen anywhere and is sometimes very difficult to detect. The following section will discuss the condition where "Single Phasing" is very difficult to detect simply by monitoring the voltage.

Induction Motors

The main reason that it may be difficult to detect is due to a condition known as "regeneration". This occurs on loads that have 3ϕ induction motors installed.

When a single phase condition occurs and a motor is running, the motor will continue to run if there is no single phase detection present. When this happens, the two good "legs" of power continue to run the motor. The third "leg" acts as a generator and regenerates the lost phase. The regenerated "leg" in this condition could potentially be equal to the other phases of power. Therefore, monitoring the power source 3ϕ voltage will result in findings of, "The power source is good", and the single phase condition will go undetected.

Generally speaking, most of the newer motors will have their own form of single phase detection equipment installed on them that monitors both "current" and "voltage" to help detect a single phase condition. If a single phasing condition is detected, they will automatically disconnect the motor from the power source until the single phase condition has been corrected.

On induction motors where there is no monitoring of "current" and "voltage" is typically where a regeneration condition will be seen. When a single phase condition occurs, it can affect multiple customers on that faulted line. Even if your facility does not have large motors, other customers on this line might, which affects your facilities ability to sense a power outage.

When an induction motor ends up being run as a generator, it puts great strain on the motor windings and the insulation covering them. The insulation keeps the motor windings from shorting out to the motor casing, potentially causing a "ground fault" condition; a direct path of a phase "leg" of power to ground. Ground faults are very dangerous; often accompanied by an "arc flash". Lean more in the Ground Fault Protection cutsheet.

If the single phase condition is not caught in a reasonable amount of time, the insulation will eventually fail and the winding will short out. This will result in significant damage to the motor and potentially any loads that may be connected to the same power feed; worst of all, people may be seriously hurt or killed.

Phase Loss Sensitivity

Even when adding in a more sensitive voltage and phase sensing relay, there is no guarantee in this situation that the single phase loss will be detected.

However, with the exception of lightly loaded motors, enough change is detected by the Phase Sequence Relay (PSR) supplied with the ATS for the Single Phase Protection (SPP) option to provide the required protection when properly adjusted. The PSR will monitor for an undervoltage condition, improper phase rotation and a phase loss condition.

The specifying engineer should be contacted to determine if additional detection equipment is required to safely detect any "Single Phasing" conditions at the site of installation.

Product Features

- Rated for up to 600 VAC
- True Three Phase Sensing
- Phase Rotation Sensing
- Undervoltage Sensing
- Phase Loss Sensing
- Adjustable Pick-Up Range - Factory set to 90%

Microprocessor Description of Operation Molded Case Units (Option SPP)

In the event that a phase has been lost, this should be corrected before any work on the ATS is performed.

When the PSR drops out, the Single Phase Protection Timer, (SPPT), begins timing. IF the transfer to emergency begins before this timer times out, this timer is turned off. If this timer times out before the transfer to emergency begins, an output is sent to trip the normal breaker. This is to prevent damage to the load in case the system is on a utility single phase condition.

SPPT: Single Phase Protection Timer - This timer is adjustable from 0 to 300 seconds and is factory set at 60 seconds.

The Normal side molded case unit will be tripped open in this event and will require operator intervention to reset the ATS for automatic operation. This unit will need to be physically reset, so a trained operator will be required to perform this maintenance because entry into the ATS enclosure is required. Be sure that all required PPE is used.

To reset the molded case unit, depress the control handle on the normal unit until it is in the "OFF" position.

Once the molded case unit has been physically reset, the microprocessor will need to be reset also. The faults seen will be displayed on the HMI screen. Follow the **RESET Instructions** in this cutsheet to clear the faults and resume automatic operation of the ATS.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Microprocessor Description of Operation Insulated Case Units (Option SPP)

When the PSR drops out, the Single Phase Protection Timer, (SPPT), begins timing. IF the transfer to emergency begins before this timer times out, this timer is turned off. If this timer times out before the transfer to emergency begins, an output is sent to open the normal breaker. This is to prevent damage to the load in case the system is on a utility single phase condition.

SPPT: Single Phase Protection Timer - This timer is adjustable from 0 to 300 seconds and is factory set at 10 seconds.

The ATS is capable of continuing automatic operation without an operator's intervention because opening and tripping the breaker are the same mechanism and the breaker does not need to be reset, but the HMI will display the Trouble fault. Follow the **RESET Instructions** to clear the trouble condition. A trained operator is required to perform this maintenance. Be sure that all required PPE is used.

However, until the SPP condition has been cleared, the ATS will remain on emergency power.

NOTE: If, during this time, something "Trips" the breaker, they will have to be physically reset. To do this, locate the red button that has popped out on the face of the breaker. There will be some form of identification saying that the "Breaker Tripped" near it. Push this red button back in to reset the breaker. Do this for both units.

RESET Instructions

The following instructions are to be performed using the keypad and HMI screen located on the front of the ATS.

1. Depress "Enter".
2. The display will read "MAIN MENU / Reset Faults / Troubles".
3. Depress "Enter" again and the display will read "Reset Faults / Troubles, Clear all now? No".
4. The word "No" will be underlined.
5. Depress either "⇓" or "⇑" until "Yes", the desired value, is displayed.
6. Depress "Enter" to clear or "ESC" to cancel.
7. All faults / troubles will be reset and the display will show the operating mode again.

Electromechanical Description of Operation – Molded or Insulated Case Units (Option 24A)

Single phase protection is not available as a standard option on ATS with electromechanical controls.

However, Lake Shore Electric Corp. does have the PSR as an option to be added to these controls, but the ATS logic will treat it the same way it would the standard Phase Failure Relay (PFR). When the PSR signals the loss of power on the power source it is monitoring, the ATS will not trip the breaker open. It will simply see it as a source failure and operate accordingly.

Order Guide

Part Number Examples:

1. ICFA32000BPSB**/SPP** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with included option ACSP.
2. MCDA31200CPSB**/SPP** - Molded Case ATS, 3 pole, 1200 Amp, 277/480Vac, **24Vdc Microprocessor Controls**, 50kAIC @ 480Vac, NEMA 1 Free Standing Enclosure with included option SPP.
3. MCDA30400CESA**/24A** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with option 24A by description; (SPP Required).

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Space Heaters

Introduction

Condensation within a manual or automatic transfer switch is one of the main problem for component(s) operation and life expectancy. It will also create additional hazardous conditions that did not exist before the condensation was present.

Water is a good conductor of electricity and will significantly reduce the insulating dielectric value between current carrying conductors.

> **Rule of Thumb:** Over dry, insulating surfaces, 2" min required between current carrying conductors. Through Air, 1" min required between current carrying conductors.
>
> These dimensions may vary depending on the magnitude of the current and voltage being applied to the system, but will vary in accordance with the NEC.

Water is also a corrosive agent to any metals and will cause rusting / corrosion buildup on the equipment.

With water sitting within the ATS, the potential for it to create a current path (electrical short) is high. To help prevent these conditions, all outdoor ATS equipment will come standard with the space heater option.

The main purpose of the space heaters is not to heat the enclosure to a comfortable level for humans, but to prevent condensation on the internal controls and equipment.

This will help eliminate or reduce this dangerous condition which will make the ATS much safer for maintenance personnel.

NOTE: If the switch is located near the ocean, corrosion is a given factor to dropping the life expectancy of the ATS from the normal 15 to 20 year span down to 5 to 10; possibly less depending on the environment. The space heaters will help extend the life expectancy, but not guaranteed.

Features

- Molded Case ATS
  - 100 – 400 A, W/M or F/S Enclosures
  - 600 A, W/M Enclosure
  - Qty (1) Space Heater, 81 Watt Power Consumption
  - 600 A, F/S Enclosure
  - 800 – 1200 A, F/S Enclosure,
  - Qty (2) Space Heaters, 160 Watt Power Consumption
- Insulated Case ATS
  - All Amperage and Sizes,
  - Qty (4) Space Heaters, 350Watt Power Consumption
- Permanently Installed, Adjustable Thermostat
- Finger Safe Fuse Protection that May Be Used as a Circuit Disconnect for Maintenance

Product Description (Option: MP [SH], EM [44])

This option provides 350 Watt, 250 Volt strip heater, or heaters depending on the enclosure size, run at 120Vac.

Total power consumption per heater is 81W. These are used in conjunction with a wall mount style thermostat to help eliminate moisture build-up in the enclosure and to help prevent the controls from freezing.

Recommendations

Lake Shore Electric Corporation believes in providing the customer with a full turnkey solution to their needs. If the equipment does not fully meet your needs, please consult the factory for further information.

Standard Product Specifications

HEATER CIRCUIT SPECIFICATIONS	
Operating Voltage	120 Vac Heater Operation Power Transformer may by Required
Power Consumption	81 Watts per Heater
Heater Power Rating	350 Watt Heater, 250 Volt (Derated for Half Power Operation)
Ambient Temperature: Operating	-20°C to +60°C [-4°F to 140°F]
Ambient Temperature: Storage	-40°C to +80°C [-40°F to 176°F]
Relative Humidity	0 to 95% non-condensing

Order Guide

Part Number Examples:

1. ICFA32000BPSF - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 3R Free Standing Enclosure; Unit is an Outdoor Unit, so Space Heaters will automatically come installed.
2. ICFA32000BPSB**/SH** - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure, with Option SH included.
3. MCDA30400CESA**/44** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option 44 included.
4. MCDM30400CESA**/44** - Molded Case MTS, 3 pole, 400 Amp, 277/480Vac, **Manual Transfer Switch**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with Option 44 included.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Surge Protection Devices

Introduction

The 2014 National Electric Code (NEC), Article [285] covers general, installation and connection requirements for surge-protective devices (SPDs) permanently installed on systems of 1000 volts or less.

- **Surges (Transients)** – a surge is a transient wave of current, voltage or power in an electric circuit.

  These are brief overvoltage spikes or disturbances on a power waveform that can damage, degrade, or destroy electronic equipment within any home, commercial building, industrial, or manufacturing facility.

  Transients can reach amplitudes of tens of thousands of volts depending on the source.

- The NEMA Surge Protection Institute says that, "*a surge, or transient, is a subcycle overvoltage with a duration of less than a half-cycle of the normal voltage waveform. A surge can be either positive or negative polarity, can be additive or subtractive from the normal voltage waveform, and is often oscillatory and decaying over time.*"

Electrical equipment is designed to operate at a specified nominal voltage such as 120 Vac, 240 Vac, 480 Vac, and so on with built in tolerances to slight variations in the supply voltage. Surges go outside of the designed tolerances which cause the equipment damage. To protect valuable equipment, SPDs are used as a cost effective solution.

One of the most commons terms for an SPD is a Transient Voltage Surge Suppressor (TVSS), the purpose of which is to eliminate or reduce damage to equipment. This in turn will reduce total down time and any repair cost.

Features

- Peak Current Rating per Phase
  - Standard Rating for SPD on Normal and Emergency (Protects ATS Controls)
    - 40kA
  - Optional Ratings for SPDs on Load Only (Protects Load Equipment)
    - 120kA
    - 160kA
    - 240kA
    - 320kA
    - 480kA
    - Display Readout Available Upon Request
- Short Circuit Withstand of 200kA
- Available for Single or Three Phase Systems

Product Description (Option: MP [SPD], EM [38A or 38B])

The standard version of this option provides two SPDs; one on the normal source and one on the emergency source. It will also provide a secondary MOV across the ATS controls.

For the SPD required for load equipment protection, please specify the required protection current and display readout is required.

Recommendations

Lake Shore Electric Corporation believes in providing the customer with a full turnkey solution to their needs. If the equipment does not fully meet your needs, please consult the factory for further information.

Standard Product Specifications

ELECTRICAL – STANDARD SPD – 40KA	
Minimum Life	2500 operations (for 1.5 kA 8/20µs wave for each line-to-ground)
Varistor surge current rating per phase	40kA peak (8/20µs wave)
Power Consumption per Phase	Less than 600mW
Ambient Temperature: Operating	-40°C to +70°C [-40°F to 160°F]
Relative Humidity	0 to 95% non-condensing
Surge energy capability per phase	2100 Joules (8/20µs wave)
Short Circuit Current Rating	200kA
Typical Clamping Voltage: for 8/20µs combination wave surge current for each phase-to-ground. (Lead Length 18")	
1,500 A Surge Current	1825 Vac
5,000 A Surge Current	2425 Vac
10,000 A Surge Current	3000 Vac

Order Guide

Part Number Examples:

1. ICFA32000BPSB/SPD - Insulated Case ATS, 3 pole, 2000 Amp, 120/208Vac, **24Vdc Microprocessor Controls**, 65kAIC @ 480Vac, NEMA 1 Free Standing Enclosure, with the Standard Surge Protection Device Option.
2. MCDA30400CESA/**38B** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with the Standard Surge Protection Device Option 38B.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Load Product Specifications

ELECTRICAL RATINGS					
Surge Capacity/Phase	120kA peak (8/20µs wave)				
L-N	**L-G**	**N-G**	**L-L**		
60kA	60kA	120kA	90kA		
Surge Capacity/Phase	160kA peak (8/20µs wave)				
L-N	**L-G**	**N-G**	**L-L**		
80kA	80kA	120kA	90kA		
Surge Capacity/Phase	240kA peak (8/20µs wave)				
L-N	**L-G**	**N-G**	**L-L**		
120kA	120kA	120kA	90kA		
Surge Capacity/Phase	320kA peak (8/20µs wave)				
L-N	**L-G**	**N-G**	**L-L**		
160kA	160kA	240kA	180kA		
Surge Capacity/Phase	480kA peak (8/20µs wave)				
L-N	**L-G**	**N-G**	**L-L**		
240kA	240kA	240kA	180kA		
COMMON RATINGS					
Minimum Life	Duty cycle tested (ANSI C62.41 C3, 10 kA, 20 kV) minimum 5000 impulses				
EMI/RFI Filtering	Up to -30 dB (100 kHz to 100 MHz)				
Ambient Temperature: Operating	0°C to +50°C [-32°F to 122°F]				
Ambient Temperature: Storage	-40°C to +65°C [-40°F to 149°F] -				
Relative Humidity	0 to 95% non-condensing				
Short Circuit Current Rating	200kA - Individually - Fused Suppression Modes				
Industrial Control Equipment	UL 1449 Listed and UL 1283 Listed				
UL Suppression Voltage Rating (SVR)*, 1ϕ					
Voltage	**L-N**	**L-G**	**N-G**	**L-L**	**MCOV[1]**
120/240	400 V	400V	400V	800 V	150 V
UL Suppression Voltage Rating (SVR)*, 3ϕ high-leg delta					
Voltage	**L-N**	**L-G**	**N-G**	**L-L**	**MCOV[1]**
120/240	800 / 400 V	400V	400V	1500 / 800 V	275 / 150 V
UL Suppression Voltage Rating (SVR)*, 3ϕ, 4W					
Voltage	**L-N**	**L-G**	**N-G**	**L-L**	**MCOV[1]**
120/208	400V	400V	400V	800V	150V
277/480	800V	800V	800V	1500V	320V
220/380	800V	800V	800V	1500V	320V
347/600	1200V	1200V	1200V	2000V	420V

[1] MCOV = Maximum Continuous Operating Voltage.

* For every foot of wire length, approximately 175 volts (6 kV / 3 kA, 8/20µs) is added to the suppressed voltage.)

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Close Differential Undervoltage Relay PFR

Introduction

The Close Differential Undervoltage Relay, or Phase Failure Relay (PFR), continuously monitors for **"Undervoltage"** and/or **"Phase Loss"** conditions of a three phase power source and provides dependable response to protect generators, transformers and motors from damage due to a continual undervoltage and/or phase loss condition.

Where most Undervoltage Relays are designed to measure the average voltage of all three phases and operate on the average voltage, the Lake Shore Undervoltage Relay measures each phase separately. It will not "pickup" until all three phases attain the value selected by the potentiometer setting. Correspondingly, the Relay will "dropout" as soon as any of the three phases show a drop in voltage below the value selected by the potentiometer setting.

Product Features

- UL 508 Listed
- Rated for up to 480 VAC
- True Three Phase Sensing
- Separate 70 - 100% Adjustable Pick-Up and Drop-Out Ranges
- Field Calibration Capable

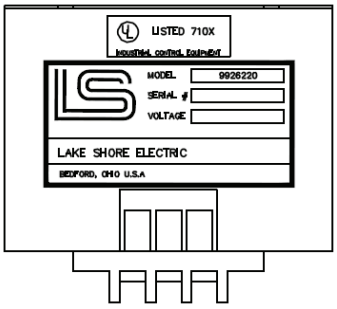


Figure 1

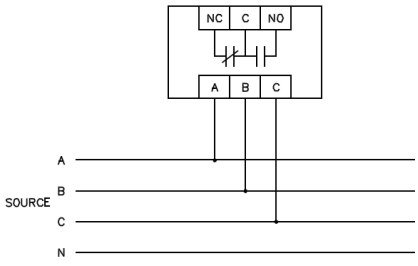


Figure 2

Operation and Adjustment

This Relay continuously monitors for undervoltage and/or phase loss conditions of a three phase power source.

When the voltage in each phase attains a value equal to or greater than the "pickup" setting, the output contacts change state and an LED is energized.

When the voltage of any phase fails below the "dropout" setting, the output contacts revert to their de-energized state and the LED is de-energized.

PICK-UP - When the voltage in each phase attains a value equal to or greater than the "PICK-UP" setting, the output contacts change state.

DROP-OUT - When the voltage of any phase falls below the "DROP-OUT" setting, the output contacts revert to their de-energized state and the "LED" turns off.

Both PICK-UP and DROP-OUT are easily field adjustable on all three phases by means of a single potentiometer accessible with a screwdriver from the front of the relay. The range of adjustment is 70 - 100% of nominal voltage.

Field Calibration Instructions

Reference Figure 2 and Figure 3 during instructions below.

1. Verify Base Voltage of PFR unit. This is fixed and will be either 240V or 480V depending on the model number. Check the model number on the unit to the order guide table on the back of this sheet for voltage verification.
2. Set the PICK-UP potentiometer to 100%.
3. Remove the nylon plug between the PICK-UP and DROP-OUT potentiometers, uncovering the calibration potentiometer.
4. Using a small screwdriver, turn the calibration potentiometer fully clockwise.
5. Apply nominal 3 phase input voltage from a known source to the PFR unit.
6. Slowly turn the calibration potentiometer counterclockwise until the unit picks up as indicated by the "Energized" light.
7. Reinsert the Nylon Plug above the calibration potentiometer.
8. Set PICK-UP and DROP-OUT potentiometers at desired settings.
9. Remove nominal 3 phase input voltage from the known source to the PFR Unit.
10. Unit is ready for operation.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

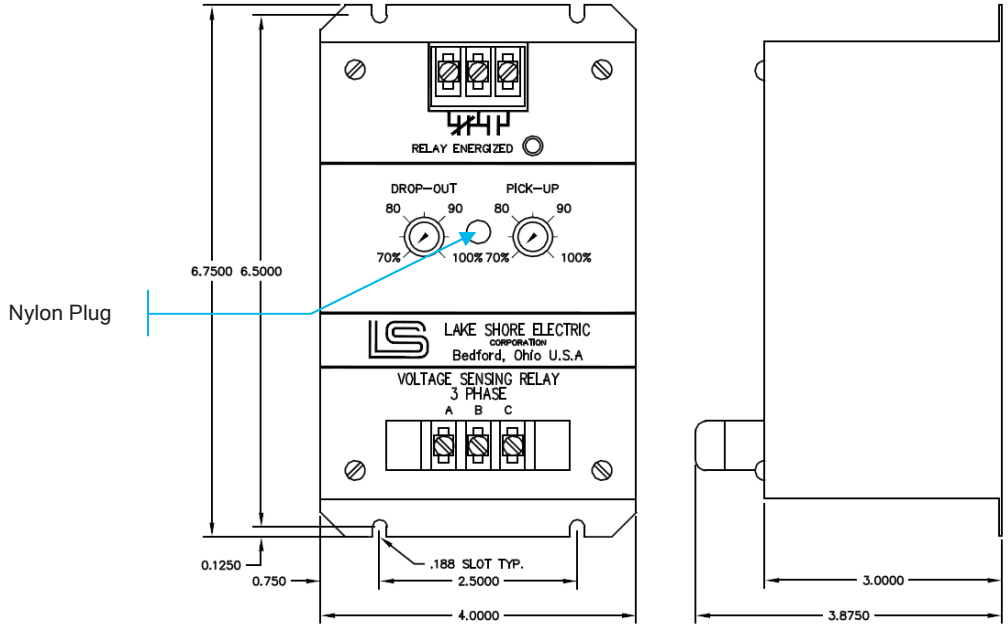


Figure 3

Product Specifications

NOMINAL INPUT VOLTAGE	208 - 480Vac (wide-range input)
ACCURACY	± 2% of nominal over operating temp. range
TRANSIENT	110% of nominal continuously 150% of nominal 10 seconds 200% of nominal 1 second
FREQUENCY	50/60 Hertz 40/70 Hertz ± 1% of normal
POWER CONSUMPTION	3 VA maximum
AMBIENT TEMPERATURE: OPERATING	-20°C to +60°C [-4°F to 140°F]
AMBIENT TEMPERATURE: STORAGE	-40°C to +80°C [-40°F to 176°F]
HUMIDITY	Up to 95% at +25°C (+77°F), no condensation
CONTACT TYPE	One form "C" dry contact
CONTACT RATING	5 amp @ 120VAC or 28VDC resistive
WEIGHT	30 oz., 1.9 lbs.
HIGH POT	Minimum of 2X's nominal voltage + 1,000 volts
VISUAL SETTING	±10% of nominal voltage
INDUSTRIAL CONTROL EQUIPMENT	UL 508 Listed
CONSTRUCTION	Solid state sensor with relay output housed in a steel enclosure
DIMENSIONS (W x H x D)*	4" x 6 ¾" x 3 $^{7}/_{8}$"
MOUNTING HOLES (W x H)*	2 ½" x 6 ½"

* Reference Figure 3.

PFR Order Guide

70LSEUV9926220	-

VOLTAGE CODE
B = 208 Vac
C = 480 Vac
E = 220 Vac
F = 240 Vac
I = 380 Vac
J = 440 Vac

Part Number Example: 70LSEUV9926220C (480 Vac Calibrated PFR)

Recommendations

Lake Shore Electric Corporation believes that a voltage relay that does not provide discrete monitoring of all three phases should never be relied upon in critical applications.

Please consult the factory for further information.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Automatic Transfer Switch Option
Closed Differential Undervoltage Protection
Technical Bulletin

Introduction

UL 1008, the standard under which almost all automatic transfer switches in the US are manufactured, states that an Automatic Transfer Switch (ATS) shall

> "initiate transfer from the normal supply to the alternate supply upon the interruption of any or all phases of the normal supply."

Lake Shore Electric Corporation accomplishes this by providing a Closed Differential Under Voltage and Voltage Unbalance sensing relay (Model 26220), on the normal supply, as a standard feature in all automatic transfer switches.

Undervoltage Protection

a. "Why is it Necessary?"

An improper voltage condition on a single or three phase power system may have several harmful effects, particularly when motor loads are involved. This article will refer to three phase systems since motor loads are predominantly used in such systems.

b. Effects of Undervoltage

During startup, a low voltage condition will produce a lower starting current and starting torque. Although a lower starting current may be desirable, a lower starting torque may not be acceptable. The torque produced by a motor is approximately proportional to the square of the voltage applied, that is, a motor that is started at 90% of rated voltage will produce 81% of rated torque; $(.90)^2$. This may not be capable of starting the load.

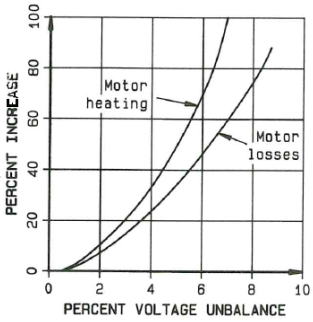
If the undervoltage condition occurs while the motor is running, the result is a lower running torque, as described above, and a higher line current. The reason for the increased line current is as follows: a lower line voltage at a given load produces an increased slip. The increased slip produces a higher line current. The reason the starting current is reduced with a lower line voltage is because the slip at starting is unity; it cannot get any worse, therefore the starting current is proportional to the starting voltage.

c. Effects of Voltage Unbalance

Another less mentioned and much more harmful condition to motors is voltage unbalance. Voltage unbalance creates a decrease in efficiency, decrease in power factor, large increase in current, large temperature increase and a decrease of insulation life.

Voltage unbalance is defined as a percentage equal to 100 times the maximum deviation from the average voltage divided by the average voltage. Therefore, a system with phase voltages of 205, 216, and 208 has an average voltage of 209.7 and a maximum deviation of 6.3 thus giving it a voltage unbalance of 3%.

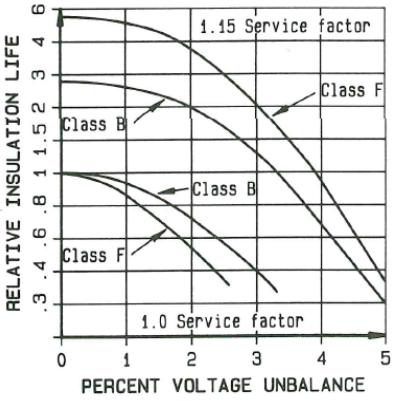
Unbalanced voltages applied to an induction motor will cause unbalanced currents to flow. The increase in temperature in the phase with the greatest current will be approximately two times the square of the percentage of voltage unbalance. The effects of voltage unbalance to increased motor temperature are shown in Figure 1.



EFFECT OF VOLTAGE UNBALANCE ON MOTOR HEATING AND LOSSES

Figure 1

This increase in temperature, created by the voltage unbalance, creates a decrease in insulation life as shown in Figure 2.



EFFECT OF VOLTAGE UNBALANCE ON MOTOR INSULATION LIFE

Figure 2

d. Protection

Undervoltage and voltage unbalance protection is necessary to prevent the harmful effects as described above.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

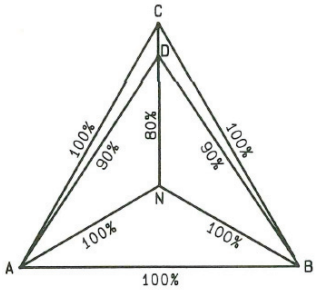
Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

Undervoltage relays are typically of the close-differential type, that is, all three phases of the three phase source must attain a value equal to, or greater than, the pickup setting of the undervoltage relay before it's contacts change state. This value is typically set at 90% of nominal voltage since the utility supply can stabilize at anywhere from ± 10% of nominal voltage. Once energized, the relay will not de-energize until any one of the three phases falls below the dropout setting of the undervoltage relay. This value is typically set at 80% of nominal voltage, however, this is where undervoltage relays differ. Many undervoltage relays strictly sense line to line voltage, while a Lake Shore Electric Corporation undervoltage relay generates an internal neutral, allowing it to sense a line to neutral voltage even in a three phase, three wire system.

This is important for detecting a voltage unbalance condition.



VECTOR DIAGRAM OF A
3 PHASE VOLTAGE SOURCE

Figure 3

Consider Figure 3. Triangle ABC represents a balanced voltage source. Triangle ABD represents a three phase system in which one phase has dropped to 80% of its nominal voltage, giving this system a 6.1% unbalance. A line to line sensing undervoltage relay set at 90% pickup and 80% dropout would monitor the following voltages:

AB = 100%; BD = 90%; DA = 90%

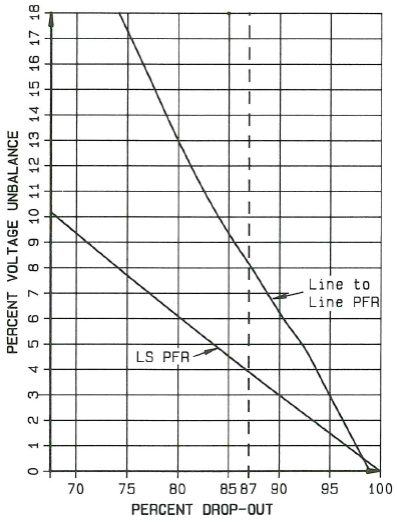
Since all three phases are equal to or greater than 90%, this relay would energize, indicating a proper voltage condition.

Now consider a Lake Shore Electric Corporation relay set at 90% pickup and 80% dropout. Since it generates its own neutral, it would monitor the following voltages:

NA = 100%; NB = 100%; ND = 80%

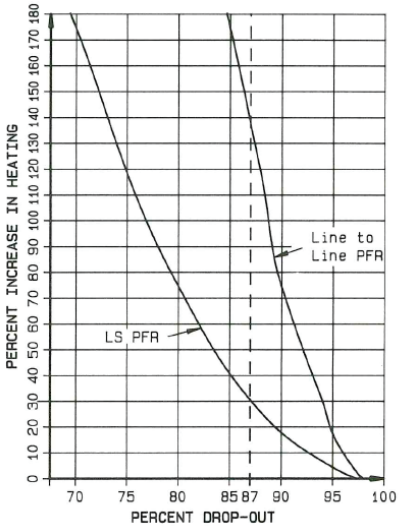
Since all three phases are not equal to or greater than 90%, this relay would not energize, indicating an improper voltage condition. If all three phases are reduced in a balanced manner, both types of relays will behave identically.

The dropout point of a Lake Shore Electric Corporation three phase voltage sensing relay can be set to protect a system for a given voltage unbalance as shown in Figure 4 and thereby protect the motors connected to this load from the severe overheating associated with this voltage unbalance as shown in Figure 5. A line to line type of voltage sensing relay (also shown in Figure 4) cannot accomplish this because the dropout point would have to be set so high it would cause nuisance undervoltage indications.



DROPOUT SETTING VERSUS PERCENT
VOLTAGE UNBALANCE

Figure 4



DROPOUT SETTING VERSUS PERCENT INCREASE
IN MOTOR HEATING

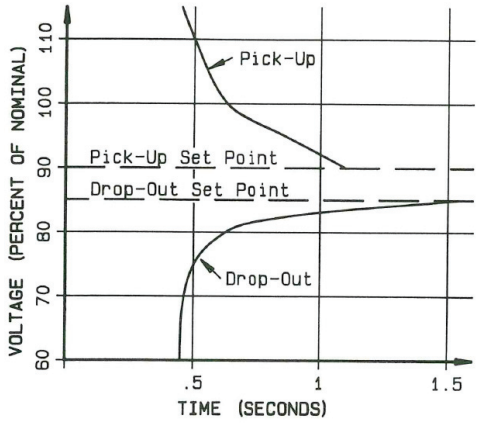
Figure 5

The vertical line in Figure 4 and Figure 5 indicates the protection undervoltage relays provide against voltage unbalance when it is calibrated for an 87% dropout. The Lake Shore Electric Corporation voltage sensing relay will dropout on a 4% voltage unbalance, thus limiting the motor overheating to 32% above normal. A line to line type voltage sensing relay with the same dropout point will not dropout until the system has an 8.5% voltage unbalance, thus allowing a 140% above normal temperature rise on any motors connected to this system.

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

The Lake Shore Electric Corporation undervoltage relay is also equipped with an inverse time delay on both “pickup” and “dropout”, as shown in Figure 6. This time delay helps avoid nuisance undervoltage indications as may occur during system transients. The inverse time characteristic allows a 1.5 second delay before the relay de-energizes when any phase falls just below the dropout setting. A .4 second delay occurs when any phase falls well below the dropout setting (20% or more).



TIME DELAY CHARACTERISTICS OF A LAKE SHORE 3 PHASE VOLTAGE SENSING RELAY

Figure 6

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Made in the USA

LAKESHORE
ELECTRIC CORPORATION

Frequency / Voltage Relay
FVR

Introduction

The Lake Shore Electric Frequency Voltage Relay (FVR), is a UL Listed Component. Its purpose is to monitor the required frequency and voltage of a 120Vac single phase source; typically a generator's output.

Product Features

- UL 508 Listed
- Rated for 120 VAC
- Pick up is 90% of Nominal Voltage
- 50 or 60Hz Calibrated Frequency
- Pick-up is 97% of the Calibrated Frequency
- Single Phase Voltage and Frequency Sensing
- Field Calibration Capable; (Please Call for Assistance)

The Lake Shore Electric Frequency / Voltage Relay utilizes solid-state sensing with a dry set of contacts for the customers use.

Additionally supplied is an LED, which is visible from the front of the unit, to indicate the output relay is energized. The unit can be adjusted in the field, but it is strongly recommended that the field service personnel contact the factory before any modifications are performed.

Operation

FVR's are used to accept a minimum value of a source voltage and frequency. The factory settings are 90% pick-up for the voltage and 97% pick-up for the frequency.

When the FVR's monitored input detects that the source is within proper operating range for both frequency and voltage, the output contacts will change state. The LED on the FVR enclosure face will then energize.

When the voltage falls below 50% of the nominal value, the output contacts revert to their de-energized state and the LED turns off.

Application

A typical application of a Frequency / Voltage Relay is to monitor the ascending voltage and frequency of an emergency generator and prevent application to the load until a minimum acceptable value of that generator's output is attained.

Additionally, the unit is designed to have a dropout setting of less than 50% of the nominal operating value. This enables the emergency source to remain online during load changes that may cause frequency and voltage to fluctuate.

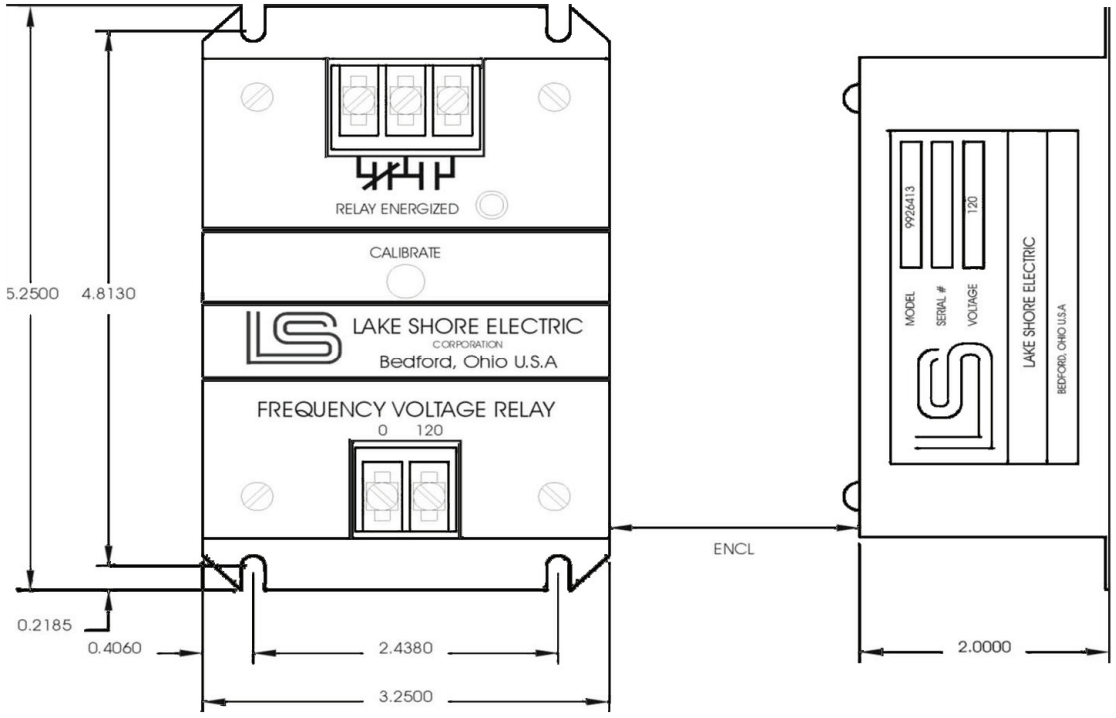


Figure 1

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS ENTERPRISE MBE CERTIFIED

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Product Specifications

NOMINAL INPUT VOLTAGE	120 volts A.C. ± 10%
INPUT FREQUENCY	0–100 hertz
ACCURACY	± 2% of nominal over operating temp. range
TRANSIENT	110% of nominal continuously 150% of nominal 10 seconds 200% of nominal 1 second
POWER CONSUMPTION	3 VA maximum
AMBIENT TEMPERATURE: OPERATING	-20°C to +60°C [-4°F to 140°F]
AMBIENT TEMPERATURE: STORAGE	-40°C to +80°C [-40°F to 176°F]
HUMIDITY	Up to 95% at +25°C (+77°F), no condensation
CONTACT TYPE	One form “C” dry contact
CONTACT RATING	5 amp @ 120VAC or 28VDC resistive
WEIGHT	20 oz., 1.25 lbs.
HIGH POT	Minimum of 2X’s nominal voltage + 1,000 volts
INDUSTRIAL CONTROL EQUIPMENT	UL 508 Listed
CONSTRUCTION	Solid state sensor with relay output housed in a steel enclosure.
FACTORY SETTINGS	50 Hz. - set for 48 Hz. and 108 VAC pickup 60 Hz. - set for 58 Hz. and 108 VAC pickup
DIMENSIONS (W x H x D)*	3 ¼" x 5 ¼" x 2"
MOUNTING HOLES (W x H)*	2 $^{7}/_{16}$" x 4 $^{13}/_{16}$"

* Reference Figure 1.

FVR Order Guide

PART NUMBER	70LSEFV9926413

Recommendations

Please consult the factory for further information.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Microprocessor Controls
MP7650 System

Introduction

The Lake Shore Electric Corporation MP7650 Control System is a sophisticated, state of the art, microprocessor based controller for automatic transfer switches. This system consists of five components:

- HMI (Human / Machine Interface) Panel
- Main Control Board
- Power Supply Board
- Relay Interface Board
- System Ribbon Cable

This powerful and versatile controller incorporates a full range of automatic transfer switch accessories, which are user selectable.

The MP7650 is fully programmable with four input keys and a two lines, 40 character, backlit LCD display.

All timer settings can be viewed on the LCD. Additionally, all timer values are displayed on the LCD during operation.

Diagnostic messages are displayed on the LCD.

System status is displayed by the diagnostic LED array.

Power can be supplied by either the engine battery system or an alternate power supply, 12 or 24 Vdc.

Components are mounted on printed circuit boards to provide a compact, rugged design. Solid-state devices assure dependable operation, even in severe environments, and have a projected electrical life of over one million cycles.

The MP7650 provides optimum flexibility of transfer switch controls. All adjustments are easily accessible at the HMI Panel.

The form "C", dry engine start contact provides a convenient interface to almost any engine starting control. Additional dry contacts from the Relay Interface Board provide a convenient interface for remotely monitoring the transfer switch as necessary.

The controller provides for five modes of operation:

- Off / Reset
- Automatic
- Hand Crank
- Load Test
- Fault

Note: The fault mode will display an explanation of the fault condition should one exist. Depending on the Fault, a trained operator will need to reset the transfer switch accordingly. All required PPE must be used for operator safety.

Product Features

- **UL 1008 Listed**
- **LCD Backlit Display, 2 Lines, 20 Characters Each, User Input Keypad - 4 Buttons (Membrane Style)**
- **MP7650 Control Inputs**
  - Key Pad Disable
  - Load Test (Cycled or Maintained*)
  - Override Pushbutton
  - Remote Load Test*
  - Synchronizer*
  - Load Demand Inhibit*
  - Ground Fault Protection Relay*
  - Reverse Power Condition* (Normal & Emergency)
  - Remote Disconnect*
  - Peak Shave*
- **System Status LED's**
  - System Not in Automatic
  - System Ground Fault*
  - Source Available (Normal & Emergency)
  - Switch Position (Normal & Emergency)
  - Reverse Power* (Normal & Emergency)
  - Switch Withdrawn* (Normal & Emergency)
  - Switch Tripped* (Normal & Emergency)
  - Switch in Test* (Normal & Emergency)
- **Maximum: 48 Diagnostic LED's for System Troubleshooting**
- **Dry, Form "C", Contacts for Customer Interface**
  - SIN Switch in Normal 2 Sets
  - SIE Switch in Emergency 2 Sets
  - NOR Normal Source Available* 2 Sets
  - EMR Emergency Source Available* 2 Sets
  - TBRL Trouble 2 Sets
  - ES Engine Start 1 Set
  - EC Pre-transfer Signal* 2 Sets
- **Dry, Form "C", Contacts for System Control**
  - TN Normal Tripped* 1 Set
  - TE Emergency Tripped* 1 Set
  - CE Close Emergency 1 Set
  - CN Close Normal 1 Set
  - OE Open Emergency* 1 Set
  - ON Open Normal* 1 Set
- **Up to 9 field programmable timers**
  - TDES Time Delay Engine Start
  - TDE Time Delay Emergency
  - TDN Time Delay Neutral*
  - TDR Time Delay Return
  - TDEC Time Delay Engine Cool Down
  - MRT Minimum Run Timer
  - TDBT Time Delay Before Transfer*
  - SFT Synchronize Fail Timer*
  - SPPT Single Phase Protection Timer*
- **Engine Exerciser Clock for weekly testing with or without load**
- **Available for open or closed transition**

*** Only available with certain accessories, consult factory for details.**

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE ELECTRIC CORPORATION

Operation Instructions

NOTE 1: All the following instructions are to be performed using the keypad and HMI screen located on the front of the ATS. Reference Figure 1.

NOTE 2: At any time throughout programming, the "ESC" pad may be pressed to return to the previous screen without accepting any new values.

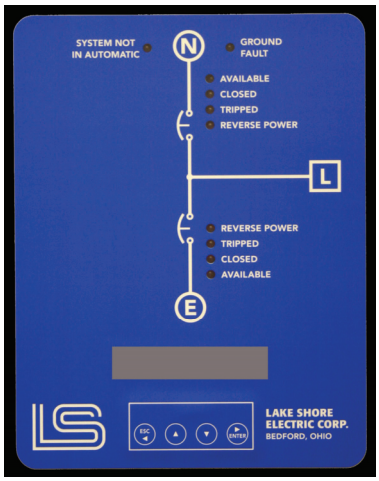


Figure 1

Operational Display Examples

During normal operation, the LCD on the HMI panel will display the mode selected, the status of the exerciser, time and date. Figure 2 shows a standard display of the controller in the automatic position with a programmed load test exerciser period. Also displayed is the time and date.

AUTO - EXERCISE W/LOAD
08:25 Fri 1 APR, 2016

Figure 2

Whenever the controller requires any action, the LCD displays the status of each timer. Figure 3 shows a standard display of the controller waiting for the TDES to time out before the engine is started.

AUTO - EXERCISE W/LOAD
Awaiting TDES: 3 sec

Figure 3

Whenever there is a fault, the operation of the switch is modified as described in Figure 4. The LCD displays the appropriate error message. Figure 4 shows a standard display of the controller displaying a Close Normal Failed fault.

FAULT - Close NOR failed
08:27 Fri 1 APR, 2016

Figure 4

FAULT RESET Instructions

1. Depress "Enter".
2. The display will read "MAIN MENU / Reset Faults / Troubles".
3. Depress "Enter" again and the display will read "Reset Faults / Troubles, Clear all now? No".
4. The word "No" will be underlined.
5. Depress either "⇓" or "⇑" until "Yes", the desired value, is displayed.
6. Depress "Enter" to clear or "ESC" to cancel.
7. All faults / troubles will be reset and the display will show the operating mode again.

RESET to Factory Defaults Instruction

1. Depress "Enter".
2. The display will read "MAIN MENU / Reset Faults / Troubles".
3. Depress "⇑" until "Restore Factory Defaults" is displayed.
4. Depress "Enter" again and the display will instruct operator to hold the "⇓" and "⇑" arrows for 5 seconds.
5. Continue to hold the "⇓" and "⇑" arrows until the countdown is complete.
6. The display will temporarily read "Factory Defaults Restored".
7. The display will show Main Menu/LED Test.
8. Depress "Escape" to complete or "ESC" to cancel.
9. The display will show the operating mode again.

Setting Mode of Operation

1. Depress the "Enter" key on the LCD pad.
2. The LCD displays "Main Menu/Select Mode".
3. Depress "Enter" and the LCD displays "MODE SELECT/AUTO".
   a. To select "Manual" mode, depress "⇓" and the display will advance to the next mode of operation.
4. Depress "Enter" once the appropriate mode of operation has been selected.
5. The display will return to the operating mode again.

Setting Date & Time

1. Depress the "Enter" key on the LCD pad.
2. The LCD displays "Main Menu/Select Mode".
3. Depress "⇓" and the LCD will display "Main Menu/Set Current Time & Date".
4. Depress "Enter" this will select that you wish to set the current time and/or date.
5. The display will show "Auto DST Changes? Yes". Default is "Yes" to update at Daylight Savings Time.
6. Depress either "⇓" or "⇑" until desired value is shown.
7. Depress "Enter" to store value or "ESC" to cancel.
8. The LCD will now display the current time and date stored.
9. A single character will be underlined.
10. Depress either "⇓" or "⇑" until the desired value is displayed.
11. Depress "Enter" to store value or "ESC" to cancel.
12. The curser will advance to the next character.
13. Repeat the process until the correct Time & Date values have been entered into the non-volatile memory.
14. Press "ESC" to have the display show the operating mode again.

LAKESHORE ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Setting Timers

NOTE: Timer settings can be reviewed by going through the SET UP TIMERS routine.

1. Depress the “Enter” key on the LCD pad.
2. The LCD will display “Main Menu/Select Mode”.
3. Depress “⇓” twice and the LCD will display “Main Menu/Set Timers”.
4. Depress “Enter” this will select that you wish to set any or all of the timers.
5. The LCD displays “SET UP TIMERS/Select Timer: TDES”.
6. To skip modifying a timer, depress “⇓” and the display will advance to the next timer.
7. Timers are displayed in the following order.

   NOTE: Several timers are optional. If the timer does not apply to your application, it will not be shown.

   a. TDES - Time Delay to Engine Start
   b. TDE - Time Delay to Emergency
   c. TDBT - Time Delay Before Transfer.
   d. SPPT - Single Phase Protection Timer
   e. TDN - Time Delay in Neutral
   f. TDR - Time Delay to Return
   g. TDEC - Time Delay for Engine Cool Down
   h. MRT - Minimum Run Timer
   i. SFT - Synchronize Fail Timer
8. To change the TDES timer, depress “Enter”.
9. The LCD displays “SET UP TIMERS/Set Time TDES: XXX sec”.
10. The first digit of the available time range will be underlined.
11. Depress either “⇓” or “⇑” until the desired value is displayed.
12. Depress “Enter” to store value or “ESC” to cancel.

    NOTE: The value for the timer will only be saved after hitting “Enter” after modifying the 3rd digit for the timer setting.
13. The LCD will sequence through all the timers in the same manner.
14. Repeat steps 8 thru 13 to modify other timers.

Plant Exerciser

When the exercise period is in effect, the first line of the display will read “Exerciser On”. The Plant Exerciser operates on a weekly, or monthly, basis and is configured as follows:

1. Disabled Mode
2. Enabled Mode: With or Without Load
3. 24 hr. Selectable for Start Time

   (Time of Day Plant Exercise Will Start)
4. Time Duration of Exercise Period: (hh:mm) from 00:01 through 24:00
5. Day(s) Available for Exercise Selection: (S M T W T F S)
6. Weeks of the month available for exercise selection:

   (1. 2. 3. 4. 5)

Setting Plant Exerciser

Note: If no days are selected (i.e. left in lower case), the exerciser will be disabled. This will be displayed in the operational display as “DO NOT EXERCISE”.

1. Depress the “Enter” key on the LCD pad.
2. The LCD displays “Main Menu/Select Mode”.
3. Depress “⇓” three times.
4. The LCD displays “Main Menu/Set Up Plant Exerciser”.
5. Depress “Enter”.
6. The LCD displays “SET UP EXERCISER/Load? Yes : Start: XX:XX.
7. The first Letter of “Yes or No” will be underlined.
8. Depress either “⇓” or “⇑” to change between “Yes” or “No”.
9. Depress “Enter”.
10. This will advance the underlined text to the first digit of the start time (XX:XX).
11. Depress either “⇓” or “⇑” until the desired value is displayed.
15. Depress “Enter” to store value or “ESC” to cancel.

    NOTE: The value for the time of day to start the plant exerciser will only be saved after hitting “Enter” after modifying the 4th digit.
12. The LCD displays “SET UP EXERCISER/Duration (hh:mm): XX:XX.
13. The first digit of the hour and minute duration timer is underlined.
14. Depress either “⇓” or “⇑” until the desired value is displayed.
16. Depress “Enter” to store value or “ESC” to cancel.

    NOTE: The value for the time duration will only be saved after hitting “Enter” after modifying the 4th digit.
15. Depress “Enter” until the LCD then displays “SET UP EXERCISER/Days (Caps = ON) : s m t w t f s”.
16. Notice that the first character will be underlined.
17. Depress “⇓” or “⇑” to change the selected days case.
    a. Capital - Exercise Performed
    b. Lower Case - No Exercise
18. Depress “Enter” to store value.
19. Depress “Enter” until the LCD then displays “SET UP WEEKS OF MONTH (NUMBER = ON; • = OFF) : 1 • 3 • 5”.

    (NOTE: If the “5th” week is selected and there is no 5th week in the month, the plant exerciser will not run.)
20. Notice that the first character will be underlined.
21. Depress “⇓” or “⇑” to change the selected number to a dot.
    a. Number - Exercise Performed
    b. Dot - No Exercise
22. Depress “Enter” to store value or “ESC” to cancel.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Standard Time Delays and Their Functions

TDES Time Delay Engine Start. This timer is adjustable from 0 to 300 seconds and is FACTORY SET AT 3 SECONDS. It is initiated upon sensing the loss of normal power and once timed out will initiate an engine start signal.

TDE Time Delay Emergency. This timer is adjustable from 0 to 300 seconds and is FACTORY SET AT 3 SECONDS. It is initiated upon the sensing of the emergency source and once timed out will initiate the transfer to the emergency source.

TDN Time Delay Neutral. This timer is adjustable from 0 to 300 seconds and is FACTORY SET AT 3 SECONDS. It is initiated upon the opening of one source and will inhibit the closing of the oncoming source until it has timed out.

TDR Time Delay Return. This timer is adjustable from 0.0 to 60.0 minutes and is FACTORY SET AT 12 MINUTES. It is initiated upon the restoration of normal power and will inhibit the switch from retransferring to the normal source until it has timed out. If at any time during the timing cycle normal power is not maintained, this timer will be terminated and will be reinitiated when normal power returns.

TDEC Time Delay Engine Cool down. This timer is adjustable from 0.0 to 60.0 minutes and is FACTORY SET AT 10 MINUTES. This timer is initiated upon the retransfer of the switch to the normal source and will keep the engine running until it has timed out.

MRT Minimum Run Timer. This timer is adjustable from 0.0 to 60.0 minutes and FACTORY SET AT 10 MINUTES. It is initiated upon the initiation of starting the engine generator set and will keep the engine running until it has timed out.

Optional Time Delays and Their Functions

SFT Synchronize Fail Timer. This timer is adjustable from 0.0 to 60.0 minutes and is FACTORY SET AT 10 SECONDS. It is only used for closed transition transfer switches. It is initiated at the time that actual transfer is permitted by the controller. If it times out prior to a transfer being complete, it will display “Trouble: SFT timed out”, but will not terminate operation of the transfer switch. This is to alert the operator that the system took longer to synchronize than expected. The operator can clear this message by pressing “Enter” and then select “Clear Trouble”. The operator can also program the MP7650 to continue to try for a closed transition transfer or to do an open transition transfer when this timer times out. This also drops out the trouble relay to annunciate that this transfer switch requires attention.

TDBT Time Delay Before Transfer. This timer is adjustable from 0 to 300 seconds and is FACTORY SET AT 10 SECONDS. It is initiated when the switch is ready to transfer and upon its completion the transfer will take place. This is typically used in elevator circuits.

SPPT Single Phase Protection Timer. This timer is adjustable from 0 to 300 seconds and is FACTORY SET AT 10 SECONDS. The SPPT timer begins timing when the under voltage relay drops out. IF the transfer to emergency begins before this timer times out, this timer is turned off. If this timer times out before the transfer to emergency begins, an output is sent to trip the normal breaker to trip it open. This is to prevent damage to the load in case the system is on a utility single phase condition. On insulated case breakers this operates without any operator intervention because opening and tripping the breaker are the same mechanism and the breaker does not need to be reset.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Relay Interface Board

The Relay Interface Board (RIB) is the electro mechanical interfacing device between the MP7650 microprocessor controls, the power panel and the user interfaces. When the transfer switch is ordered, 12-volt dc or 24-volt dc operation must be selected. Although the power supply will accept any voltage within its range, the relays that populate the Relay Interface Board must be either 12-volt dc or 24-volt dc. Please insure that the relay voltage agrees with your dc power source voltage.

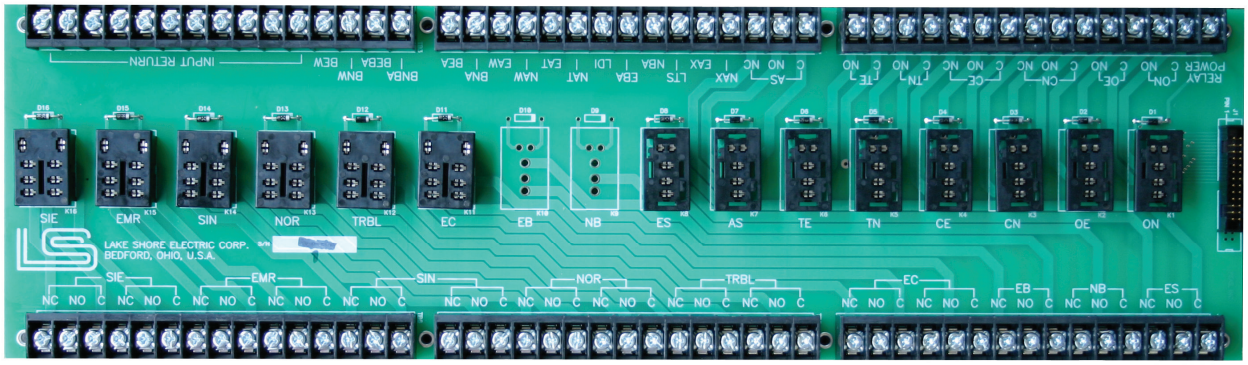


Figure 5 - Relay Interface Board

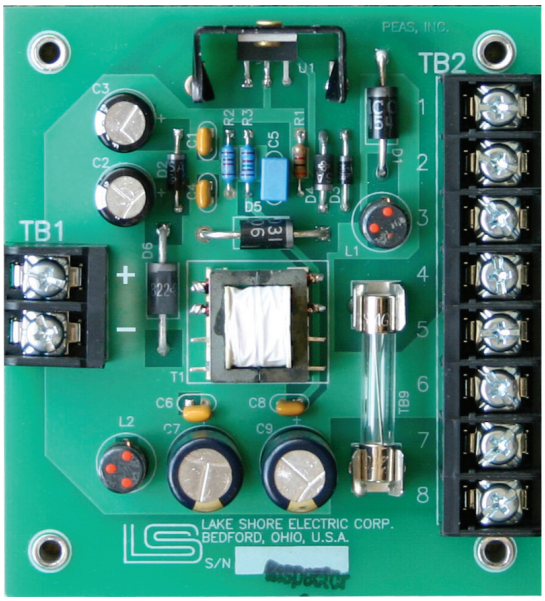


Figure 6 - Power Supply Board

Power Supply Board

The Power Supply (PS) unit accepts a 12-volt dc or 24-volt dc input. It is designed to function on the engine starting batteries. Voltage regulation for the power supply is within 2% from no load to full load. External voltage sources can vary from 7 volts dc to 36 volts dc without harm to the MP7650 or interruption of its operation.

This is a negative ground system. The board has provision to accommodate a large external “hold-up” capacitor for installations that may experience momentary input-voltage dropouts or reversals. For more information on the use of a “hold-up” capacitor in this circuit, please contact the factory.

TB1

1	+ Battery Input (Positive)
2	- Battery Input (Negative)

TB2

1	Battery Output to MDS, unfused
2	Battery Input from MDS, unfused
3	Battery Output to Relay Interface Board
4	Battery Output, spare
5	Battery Negative
6	Battery Negative
7	9VDC regulated Output
8	Capacitor Input

LAKESHORE
ELECTRIC CORPORATION

MBE CERTIFIED

LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

LAKESHORE
ELECTRIC CORPORATION

MP7650 – Field Replaceable Unit (F.R.U.)

Figure 7

Figure 8

Figure 9

Figure 10

Microprocessor System Specifications

MP7650 Microprocessor System	
Operating Voltage	12Vdc or 24Vdc
Power Consumption: Passive Monitoring	24 ~ 48 VA ≅ 2A @ Selected Voltage
Power Consumption: Operating MC Units	Max Inrush: 260 VA
Power Consumption: Operating IC Units	Max Inrush: 500 VA
Customer Connection Contact Type	Form "C" Dry Contacts [C, NO, NC]
Customer Connection Contact Rating	10 Amps Max Contacts
Ambient Temperature: Operating	-20°C to +60°C [-4°F to 140°F]
Ambient Temperature: Storage	-40°C to +80°C [-40°F to 176°F]
Humidity	5 to 85% RH, no condensation
Weight	51.5 oz., 3.2 lbs. (F.R.U.)
Industrial Control Equipment	UL 1008 Listed
Construction	Solid State Circuitry
Dimensions (W x H x D)*	7" x 10 3/8 " x 1 ½"
Mounting (W x H)*	7 ½" x 7"

* Reference Figure 10.

Microprocessor System Order Guide

MP7650 Microprocessor System Part Numbers	
Field Replaceable Unit, F.R.U.	70LSEMP1850000
HMI Overlay for Front of Door Fixed IC or MC Units Drawout IC Units	 58NPTOL7678000 58NPTOL7678001
Keypad	43XYMKP4408300
Relay Interface Board, RIB	70LSEMP1857400
ICE Cube Relays, 12Vdc 1 Pole 2 Pole Hold Down Spring	 32IDEDC1940001 32IDEDC1940002 43IDESP1940180
ICE Cube Relays, 24Vdc 1 Pole 2 Pole Hold Down Spring	 32IDEDC1940004 32IDEDC1940005 43IDESP1940180
Power Supply Board, PSB	70LSEMP1857301
Communication Ribbon Cable IC Units, 100" MC Units, 72"	 70LSEMP1858526 70LSEMP1857526
Standard Control Switches Keypad Enable, KPE Override Pushbutton, ORPB Load Test Switch, LTS	 02CASTS1673562, Maintained 02CASPB1673561, Momentary 02CASPB1673561, Momentary

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Electromechanical Controls
Positive Control System Board

Introduction

The Positive Control System (PCS) is a sophisticated time delay network that provides highly dependable & adjustable control of automatic transfer switches and switchgear. Four plug-in solid-state and/or pneumatic controlled time delay relays provide any combination of four time delay functions; TDR, Time Delay to Return (Normal); TDE, Time Delay to Emergency; ODR, Outage Delay Relay; and EMT, Engine Maintained Timer.

Starting contacts are rated 10 amperes. Each ON DELAY timer includes two colored indicating lights which display the operation of the timer. Time Delays are available over a wide selection of ranges.

Product Features

- UL 1008 Listed
- Components are mounted on a printed circuit board to provide a compact, rugged design.
- Solid state time delay timers and sealed control relays assure dependable operation even in severe operating environments.
- UL-listed components have average projected electrical life of over 1,000,000 cycles.
- Plug-in components simplify maintenance and reduce downtime.
- The PCS provides optimum flexibility of transfer switch control.
- All adjustments are easily accessible.
- The normally open dry start contact provides a convenient interface to almost any engine starting control.

Time Delay Functions

TDR Time Delay to Return - Provides a delay after the return of Normal power before retransferring the load from the Emergency source. This feature allows Normal voltage to stabilize and ensures against the premature return when the Normal power grid is potentially unbalanced.

TDE Time Delay to Emergency - Provides a delay after the engine has started before transferring the load to the Emergency source. This feature allows voltage to stabilize at the Emergency source to protect against initial wide fluctuations and can provide a brief warm-up period before loading the engine.

ODR Outage Delay Relay - Provides an adjustable delay after a failure of the Normal source before initiating an Engine-Start signal to allow for temporary short duration fluctuations in voltage. This feature prevents unnecessary starting of the engine.

EMT Engine Maintained Timer - Provides a time delay after retransferring the load to the Normal source before shutting down the engine. This feature allows the engine to run under no-load conditions for cooling before shutdown to prevent against thermal and mechanical shocks.

Time Delay Ranges

Each time on delay relay (TDR, TDE and EMT) contains five selectable range settings. This allows the relay to be set accurately from .02 seconds to 30 minutes.

The off delay relay (ODR) is supplied with an adjustable range of 0 to 10 seconds, as standard, although other delays are available.

System Configurations

The Positive Control System is available in the following configurations:

Configuration	Ordering Number
TDR + ODR + TDE + EMT	P1
TDR + ODR + EMT	P2
TDR + ODR + TDE	P3
TDR + TDE + EMT	P4
TDR + ODR	P5
TDR + TDE	P6
TDR + EMT	P7
TDR	P8
No time delay relays	P9

Figure 1

LAKESHORE
ELECTRIC CORPORATION

MBE CERTIFIED

LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

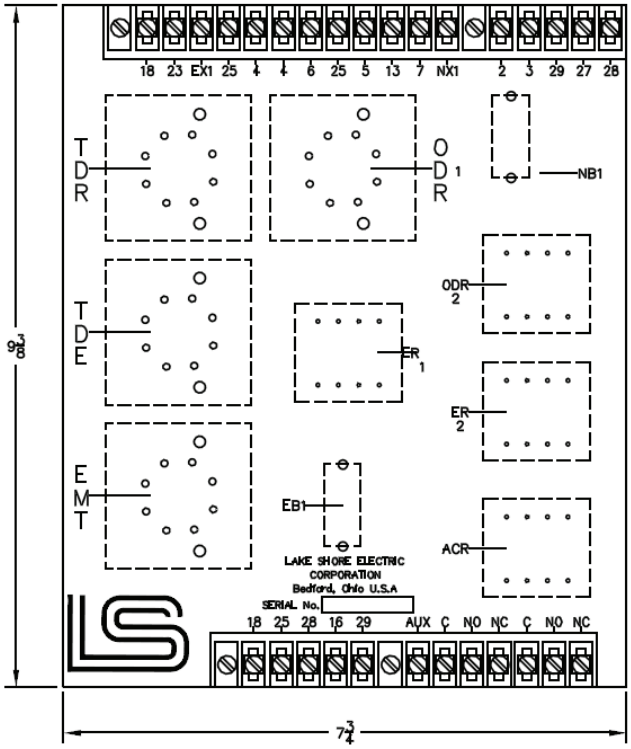


Figure 2

Product Specifications

NOMINAL INPUT VOLTAGE	110 ~ 130Vac
FREQUENCY	50/60 Hertz
POWER CONSUMPTION	30 VA maximum (Fully Populated Board)
AMBIENT TEMPERATURE: OPERATING	-20°C to +60°C [-4°F to 140°F]
AMBIENT TEMPERATURE: STORAGE	-40°C to +80°C [-40°F to 176°F]
HUMIDITY	5 to 85% RH, no condensation
CONTACT TYPE	Form "C" dry contacts
CONTACT RATING	10 amp @ 120Vac
WEIGHT	≅ 40.64 oz., 2.54 lbs. (Fully Populated Board)
INDUSTRIAL CONTROL EQUIPMENT	UL 1008 Listed
CONSTRUCTION	Solid state timers and relays installed on a PCB for
DIMENSIONS (W x H x D)*	7 ¾" x 9 3/8 " x 4"

* Reference Figure 2.

PCB Order Guide

Part Number Examples:

1. MCDA30400CESA**/P1** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with PCB P1 Controls.
2. MCDA30400CESA**/P6** - Molded Case ATS, 3 pole, 400 Amp, 277/480Vac, **Electromechanical Controls**, 35kAIC @ 480Vac, NEMA 1 Wall Mount Enclosure with PCB P6 Controls.

Recommendations

Please consult the factory for further information.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Bypass Isolation Automatic Transfer Switches

Introduction

The Bypass Isolation Automatic Transfer Switch (ATS) allows the MAIN Normal or Emergency Side Insulated Case units to be bypassed for service while still feeding the load via that side's source power. The most standard configuration of this ATS is via four Insulated Case, Draw-out Style, breakers / switches.

Each of these units are interlocked via mechanical interlocks; one set for the MAIN ATS units and one set for the BYPASS Manual Transfer Switch (MTS) units. They are also Kirk Key interlocked for the manual BYPASS MTS units to be operated safely. Due to the nature of this transfer switch, it is not recommended to order it with the Closed Transition Transfer (CTT) option. However, this option is available after engineering review.

Description of Operation

During normal operation on the MAIN ATS side of this transfer switch, the switch will operate as described in the standard Insulated Case Automatic Transfer Switch cutsheet. Either Microprocessor or Electromechanical Controls may be used.

Bypass Operation of this transfer switch requires MANUAL operation. There are four insulated case units present in this transfer switch.

The MAIN NS and ES units are used during automatic operation of the transfer switch.

During manual operation, the Bypass NSB and ESB units are used.

Normal Side Bypass Instructions

This is done when the transfer switch load is being fed via the Normal Power Source and the NS insulated case unit requires maintenance. To operate the manual portion of this transfer switch, remove the kirk key in the ES insulated case units and lock it in the open position. Then use that same kirk key to unlock the Normal Side Bypass (NSB) insulated case unit.

Pull down on the NSB charging handle until the unit is primed for operation. Press the "Push to Close" button on the NSB. This has now connected the load in parallel to the Normal Side Power Source.

Now push the "Push to Open" button on the NS insulated case unit. The NS unit has now been completely bypassed and the load is being fed via the Normal Source Power thru NSB.

The NS unit is now ready to be racked out for maintenance. Reverse these instructions to return the transfer switch to automatic operation.

Emergency Side Bypass Instructions

This is done when the transfer switch load is being fed via the Emergency Power Source and the ES insulated case unit requires maintenance. To operate the manual portion of this transfer switch, remove the kirk key in the NS insulated case units and lock it in the open position. Then use that same kirk key to unlock the Emergency Side Bypass (ESB) insulated case unit.

Pull down on the ESB charging handle until the unit is primed for operation. Press the "Push to Close" button on the ESB. This has now connected the load in parallel to the Emergency Side Power Source.

Now push the "Push to Open" button on the ES insulated case unit. The ES unit has now been completely bypassed and the load is being fed via the Emergency Source Power thru ESB.

The ES unit is now ready to be racked out for maintenance. Reverse these instructions to return the transfer switch to automatic operation.

Product Features

- Bypass Isolation
- 800 thru 4000 Ampere, 100% Rated Equipment
- Standard Operating Voltages (See Bypass Isolation ATS Order Guide)
- Electromechanical or Microprocessor Based Controls
- Phase Failure Relay on Normal (PFRN)
- Standard Features: MDS, LTS, ORPB, KPE and PE
- Keyed or Padlock Handle Provided
- Free Standing (F/S) Enclosure
- NEMA 1, 3R, 4, or 4X Std.; NEMA 3R or 4X Stainless Steel
- Front or Rear Accessible
- Safe Manual Transfer Under Load
- Aux Contacts for Switch Position, System Trouble and Engine Start
- Space Heaters Included with any Outdoor Equipment

Factory Options

- SE - Service Entrance
- ED - Emergency Disconnect Switch on Door
- GFP - Ground Fault Protection
- PFRE - Phase Failure & Undervoltage Relay on Emergency Source
- DPS - Dual Prime Source
- CBT(N or E)Circuit Breaker Trip on Normal and/or Emergency
- CTT - Closed Transition Transfer
- ACBT - Aux Contacts Before Transfer (Elevator Controls)
- ACSA - Aux Contacts for Source Available
- SPD - Surge Protection Devices by Description
- SPP - Single Phase Protection
- PS - Peak Shave
- LDI - Load Demand Inhibit
- RD - Remote Disconnect
- MLT - Maintained Load Test Switch
- MRTN - Manual Return to Normal
- MFM - Multifunction Metering
- BC - Battery Charger System, 12Vdc only
- SH - Space Heaters
- Custom Controls per Customer Spec

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Bypass Isolation ATS Order Guide

IC	-	-	-	----	-	-	-	-	/X	/X	/X	/X	/X	/X	/X	/X	/X	/X	/X	/X

OPERATOR
D = Draw Out
F = Fixed

CONTROL BASE
A = Automatic

NUMBER OF POLES
2 = Two Poles
3 = Three Poles
4 = Four Poles

AMPACITY
0800 = 800 Amps
1200 = 1200 Amps
1600 = 1600 Amps
2000 = 2000 Amps
2500 = 2500 Amps
3000 = 3000 Amps
4000 = 4000 Amps

VOLTAGE

A	=	120/240	1 ϕ	3 W	60 Hz
B	=	120/208	3 ϕ	4 W	60 Hz
C	=	277/480	3 ϕ	4 W	60 Hz
D	=	120	1 ϕ	2 W	60 Hz
E	=	127/220	3 ϕ	4 W	60 Hz
F	=	240	3 ϕ	3 W	60 Hz
G	=	120/240	3 ϕ	4 W	60 Hz
H	=	220/380	3 ϕ	4 W	60 Hz
I	=	380	3 ϕ	3 W	60 Hz
J	=	440	3 ϕ	3 W	60 Hz
K	=	480	3 ϕ	3 W	60 Hz
L	=	240/415	3 ϕ	4 W	60 Hz
S	=	Custom Voltage (Please Specify)			

CONTROLS
P = Microprocessor Controls 24Vdc
M = Microprocessor Controls 12Vdc
E = Electromechanical Controls

INTERRUPTING RATING
S = Standard Rating = 65kAIC @ 480VAC
H = High Rating = 100kAIC @ 480Vac
V = Very High Rating = 150kAIC @ 480Vac
** kAIC Ratings Higher @ 240VAC (Consult Factory Rep)**

ENCLOSURE
B = NEMA 1 Free Standing
D = NEMA 12 Free Standing
F = NEMA 3R Free Standing
H = NEMA 4 Free Standing
J = NEMA 4X Free Standing
L = NEMA 3R Free Standing (304 or 316 Stainless Steel)
O = Open Style (no enclosure)
X = Special (by description)

USE FOR REQUIRED FACTORY OPTIONS

Part Number Example: ICDA2000CPSF / BP / SE / ED / CBTE / ACSA / SH (Bypass Isolation, Insulated Case, Draw Out Style, Automatic Operation, 2000Amps, Microprocessor Controls 24Vdc, 277/480Vac, 65kAIC@480Vac, NEMA 3R Free Standing Enclosure. **Factory Options Requested:** Service Entrance Rated, Emergency Disconnect Switch on Door, Circuit Breaker Trip on Emergency, Aux Contacts for Source Available and Space Heaters.)

Recommendations

If the load does not have to be fed via the same source during maintenance, Lake Shore Electric recommends using the standard Draw-Out Style Insulated Case ATS in place of the Bypass Isolation ATS. The Standard IC ATS may be ordered with CTT to prevent interruption of power to the load if that is the only issue. Please consult the factory for further information on equipment outside the standard or other, more cost saving packages.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

DC Transfer Switches

Introduction

The Standard Direct Current (DC) Automatic Transfer Switches (ATS) utilize a single isolated motor to operate both the normal and emergency molded case units. Normally, the transfer switch operates on the preferred power source with the Normal molded case unit in the closed position and the Emergency molded case unit in the open position.

Electromechanical controls are used in the control of this ATS and consist of the following:

1. PFRN - Undervoltage relay on the normal power source; standard voltage 125Vdc. Will only pick-up when ATS normal voltage is within optimum operating range.
2. NSAR - Normal Source Available Relay - This is a mechanical relay used to pick up when the normal power is available. This determines which power source the ATS will remain on.
3. LTS - Load Test Switch - This will perform a load test on the ATS by transferring the load from normal power to emergency power.
4. TDE - Time Delay to Emergency Timer - This timer provides a short time delay before the system transfers the load to the emergency source. FACTORY SET TO 3 SEC.

The DC ATS is capable of other configurations outside the standard setup. Please consult the factory for further information.

Product Features

- UL 1008 Listed
- 125 VDC Standard
- Standard Electromechanical Controls
- Load Test Switch
- Keyed or Padlock Handle Provided
- Front Accessible
- Safe Manual Transfer Under Load

Available Options

- Enclosure Options: NEMA 1, 12 or 3R; Stainless Steel Available
- Standard Enclosure Color: ANSI-61 light gray.
- Automatic (A) or Manual (M) Control Options
  - Programmable Plant Exerciser (A)
  - Source Available & Switch Position Pilot Lights (A or M)
  - Space Heaters (A or M)
  - Electrical Assist (M)
- Custom Voltages; please contact the factory.

DC ATS Order Guide

MC	-	-	-	- - - -	-	-	-	-	0	0

OPERATOR
S = Single Motor

CONTROL BASE
A = Automatic
M = Manual

NUMBER OF POLES
2 = Two Poles
3 = Three Poles
4 = Four Poles

AMPACITY
0100 = 100 Amps
0225 = 225 Amps
0400 = 400 Amps

VOLTAGE
X = 125VDC
S = Custom Voltage

CONTROLS
E = Electromechanical Controls

INTERRUPTING RATING
S = Standard Rating = 10kAIC @ 250VDC

ENCLOSURE
A = NEMA 1 Wall Mount
B = NEMA 1 Free Standing
C = NEMA 12 Wall Mount
D = NEMA 12 Free Standing
E = NEMA 3R Wall Mount
F = NEMA 3R Free Standing
K = NEMA 3R Wall Mount (304 Stainless Steel)
L = NEMA 3R Free Standing (304 Stainless Steel)
O = Open (no enclosure)
X = Special (by description)

FOR FUTURE USE

Part Number Example: MCSA0225EXSA (Molded Case, Single Motor, Automatic Operation, 225Amps, Electromechanical Controls, 125Vdc, 10kAIC@250, NEMA 1 Wall Mount Enclosure)

LAKESHORE
ELECTRIC CORPORATION

MBE CERTIFIED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: March 2018

LAKESHORE
ELECTRIC CORPORATION

ATS INFORMATION									
AMPS	STYLE	APPROXIMATE DIMENSIONS			CABLE ENTRY AREA		APPROX. SHIPPING WEIGHTS	LUG RANGES AVAILABLE	
		HEIGHT	WIDTH	DEPTH	HEIGHT	WIDTH			
100	W/M	48"	28"	18"	15"	26"	285	STD	(1) #4 - 4/0
	F/S	66"	28"	18"	9"	26"	410	OPT	(1) #14 - 1/0
225	W/M	54"	28"	18"	15"	26"	340	STD	(225A) (1) 3/0 - 350
	F/S	66"	28"	18"	9"	26"	410	OPT	(225A) (2) 3/0 - 350
400	W/M	54"	28"	18"	15"	26"	340	STD	(400A) (1) 2/0 - 500*
	F/S	66"	28"	18"	9"	26"	410	OPT	(400A) (1) 500-600

* This Lug is also capable of accommodating (2) 2/0 – 250 MCM cables.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: March 2018

LAKESHORE
ELECTRIC CORPORATION

Insulated Case Automatic Transfer Switches

Introduction

The Insulated Case Automatic Transfer Switches (ATS) allows the load to be disconnected from both the Normal and Emergency power sources, essentially placing the load in a "Neutral" position.

The Standard Insulated Case ATS utilizes internal motors on both insulated case control units to operate the load connection to either the normal or emergency power source. Normally, the transfer switch operates on the preferred power source with the Normal insulated case unit in the closed position and the Emergency insulated case unit in the open position.

All ATS are protected by mechanical interlocking located to the right side of the insulated case units to prevent accidental paralleling of the sources except were temporary source paralleling is required; see Closed Transition Transfer (CTT).

Description of Operation: Microprocessor Controls

All phases of the Normal Power Source are continuously monitored by a Phase Failure Relay on Normal (PFRN) which is adjustable from 70% to 100% of the nominal voltage.

Assuming the ATS is feeding the load from the Normal Power Source, when the PFRN signal's the loss of Normal Power, the microprocessor starts the Time Delay to Engine Start (TDES). This helps to prevent nuisance tripping of the ATS and only start the generator when normal power is well and truly down.

After the TDES times out and normal power has still not returned, an Engine Start (ES) signal is sent to the generator. The ATS monitors a single phase of the generator voltage and frequency. When they are within the proper operating parameters, the microprocessor also starts the Minimum Run Timer (MRT) for the generator and the Time Delay to Emergency Timer (TDE). Once the TDE completes its counting cycle, the microprocessor operates the normal side motor and disconnects the load from the Normal Power Source.

At this time, the Time Delay in Neutral Timer (TDN) starts counting. Upon completion, the microprocessor operates the emergency side motor and connects the load to the Emergency Power Source.

The PFRN will continue to monitor the Normal Power Source and will signal the microprocessor when it is once again available for the ATS to use.

When PFRN signals the ATS Normal Power has returned, the Time Delay to Return (TDR) timer will start. This will keep the load of the ATS on the Emergency Power Source until the timer completes to verify that the Normal Power Source has returned.

Once the TDR completes its counting cycle, the microprocessor operates the emergency side motor and disconnects the load from the Emergency Power Source. At this time, the Engine Cool Down Timer (TDEC) and the TDN timer are started.

When the TDN timer completes its counting cycle, the microprocessor operates the normal side motor and connects the load to the Normal Power Source.

The generator will continue running until both the MRT and the TDEC timers have completed their counting cycles. After they are done, the microprocessor removes the ES signal and the generator is turned off. This completes the full sequence of the standard ATS transfer process.

Product Features

- UL 1008 Listed
- 800 thru 4000 Ampere, 100% Rated Equipment
- Standard Operating Voltages (See Insulated Case ATS Order Guide)
- Electromechanical or Microprocessor Based Controls
- Phase Failure Relay on Normal (PFRN)
- Standard Features: MDS, LTS, ORPB, KPE and PE
- Keyed or Padlock Handle Provided
- Free Standing (F/S) Enclosure
- NEMA 1, 3R, 4, or 4X Std.; NEMA 3R or 4X Stainless Steel
- Front or Rear Accessible
- Safe Manual Transfer Under Load
- Aux Contacts for Switch Position, System Trouble and Engine Start
- Space Heaters Included with any Outdoor Equipment

Factory Options

- SE - Service Entrance
- ED - Emergency Disconnect Switch on Door
- GFP - Ground Fault Protection
- PFRE - Phase Failure & Undervoltage Relay on Emergency Source
- DPS - Dual Prime Source
- CBT(N or E)Circuit Breaker Trip on Normal and/or Emergency
- CTT - Closed Transition Transfer
- ACBT - Aux Contacts Before Transfer (Elevator Controls)
- ACSA - Aux Contacts for Source Available
- SPD - Surge Protection Devices by Description
- SPP - Single Phase Protection
- PS - Peak Shave
- LDI - Load Demand Inhibit
- RD - Remote Disconnect
- MLT - Maintained Load Test Switch
- MRTN – Manual Return to Normal
- MFM – Multifunction Metering
- BC – Battery Charger System, 12Vdc only
- SH - Space Heaters

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Description of Operation: Electromechanical Controls – P8 Control Board

All phases of the Normal Power Source are continuously monitored by a Phase Failure Relay on Normal (PFRN) which is adjustable from 70% to 100% of the nominal voltage. In the event of a drop in any phase of the preferred voltage below the drop-out set point, the PFRN interrupts the voltage to a control relay coil which drops out, closing the engine start contact.

The ATS will continuously monitor a single phase of the Emergency Power Source. Once the engine has started, this generally takes from three to ten seconds, a signal will be sent to indicate the emergency power is within operating range.

When the Control Relay (CR) and Emergency Relay (ER) signals to transfer are received, the drive motor on the Normal side of the ATS, removes the load from the Normal Power Source, placing the ATS in the neutral position. The Time Delay to Transfer (TDT) timer is then energized.

After the TDT times out, the drive motor on the Emergency side is energized, transferring the load to the Emergency Power Source.

With the ATS load now operating on the Emergency Power Source, the PFRN continues to monitor the Normal Power Source. When all phases of the Normal Power Source return to the set pickup level of the PFRN, the Time Delay to Return Timer (TDR) is started. When it times out, the CR is again energized. NOTE: The TDR is bypassed completely if Emergency Power is no longer available.

The CR signal will disconnect the engine-start contact and turn off the generator. At the same time, the emergency side motor will disconnect the load from the Emergency Power Source, placing the ATS in the neutral position.

By utilizing the time delay (TDT) it is possible to regulate the length of time where the load is neither connected to the Normal or Emergency source. This is useful in allowing residual voltage in inductive loads to decay before reapplying power, thereby avoiding large and possibly damaging in-rush currents.

When the TDT Timer has timed out, the normal side motor connects the load to the Normal Power Source. This completes the full sequence of the standard ATS transfer process.

Other timers are available. For more information, see the Electromechanical Controls Overview.

Standard ATS Features

Along with the standard timers described, there are four standard switches included with all Microprocessor Controlled ATS. These are the momentary load test switch (LTS), the momentary override pushbutton (ORPB), the maintained key pad enable (KPE) and the maintained maintenance disconnect switch (MDS). ATS is also included with a plant exerciser (PE). See the MP7650 System datasheet.

NOTE: If using Electromechanical Controls, only the LTS switch is standard.

The LTS switch provides the ATS operator with a manual way to perform a load test of the transfer switch. When the MP76xx controller receives this input, it will mimic the loss of the Normal Power Source and go through the steps of transferring the load to the Emergency Power Source. This is one to perform a manual routine check of the equipment to ensure it is within proper working order.

The ORPB switch provides the ATS operator with a manual way to force the ATS back to the Normal Power Source without waiting for the timers to finish their timing sequence.

The KPE switch provides the ATS operator with a way to lockout the HMI controls from unauthorized tampering. This switch is located inside the ATS enclosure, which either has a key or padlock locking mechanism preventing entry.

The MDS switch provides the ATS operator with a manual way to disconnect power to the controls of the ATS for maintenance. It is highly recommended that any ATS operator have been properly trained on the unit and have the units control wiring diagrams present when performing any maintenance of the ATS. Be sure that all required PPE is utilized.

Recommendations

The Insulated Case ATS is capable of other configurations outside the standard setup. Please consult the factory for further information on equipment outside the standard packages.

ATS INFORMATION

AMPS	STYLE	APPROXIMATE DIMENSIONS			CABLE ENTRY AREA		APPROX. SHIPPING WEIGHTS (LBS)	LUG RANGES AVAILABLE	
		HEIGHT	WIDTH	DEPTH	WIDTH	DEPTH			
800 1200	Fixed	90"	36"	54"	26"	24"	1450	STD	(4) #2 - 600MCM
	D/O[1]	90"	36"	60"	26"	24"			
1600 2000	Fixed	90"	36"	54"	26"	24"	1450	STD	(6) #2 - 600MCM
	D/O[1]	90"	36"	60"	26"	24"			
2500 3000	Fixed	90"	42"	60"	32"	30"	1950	STD	(10) #2 - 600MCM
	D/O[1]	90"	42"	66"	32"	30"			
3200	Fixed	90"	42"	60"	32"	30"	2250	STD	(12) #2 - 600MCM
	D/O[1]	90"	42"	66"	32"	30"			
4000	Fixed	90"	60"	54"	50"	24"	3200	STD	(12) #2 - 600MCM
	D/O[1]	90"	60"	60"	50"	24"	3500		

[1] Draw Out Style Control Units

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Insulated Case ATS Order Guide

IC	-	-	-	----	-	-	-	-	/X	/X	/X	/X	/X	/X	/X	/X	/X	/X	/X	/X

OPERATOR
D = Draw Out
F = Fixed

CONTROL BASE
A = Automatic

NUMBER OF POLES
2 = Two Poles
3 = Three Poles
4 = Four Poles

AMPACITY
0800 = 800 Amps
1200 = 1200 Amps
1600 = 1600 Amps
2000 = 2000 Amps
2500 = 2500 Amps
3000 = 3000 Amps
3000 = 3000 Amps

VOLTAGE

A	=	120/240	1 ϕ	3 W	60 Hz
B	=	120/208	3 ϕ	4 W	60 Hz
C	=	277/480	3 ϕ	4 W	60 Hz
D	=	120	1 ϕ	2 W	60 Hz
E	=	127/220	3 ϕ	4 W	60 Hz
F	=	240	3 ϕ	3 W	60 Hz
G	=	120/240	3 ϕ	4 W	60 Hz
H	=	220/380	3 ϕ	4 W	60 Hz
I	=	380	3 ϕ	3 W	60 Hz
J	=	440	3 ϕ	3 W	60 Hz
K	=	480	3 ϕ	3 W	60 Hz
L	=	240/415	3 ϕ	4 W	60 Hz
S	=	Custom Voltage (Please Specify)			

CONTROLS
P = Microprocessor Controls 24Vdc
M = Microprocessor Controls 12Vdc
E = Electromechanical Controls

INTERRUPTING RATING
S = Standard Rating = 65kAIC @ 480VAC
H = High Rating = 100kAIC @ 480Vac
V = Very High Rating = 150kAIC @ 480Vac
** kAIC Ratings Higher @ 240VAC (Consult Factory Rep)**

ENCLOSURE
B = NEMA 1 Free Standing
D = NEMA 12 Free Standing
F = NEMA 3R Free Standing
H = NEMA 4 Free Standing
J = NEMA 4X Free Standing
L = NEMA 3R Free Standing (304 or 316 Stainless Steel)
O = Open Style (no enclosure)
X = Special (by description)

USE FOR REQUIRED FACTORY OPTIONS

Part Number Example: ICDA2000CPSF / SE / ED / CBTE / ACSA / SH (Insulated Case, Draw Out Style, Automatic Operation, 2000Amps, Microprocessor Controls 24Vdc, 277/480Vac, 65kAIC@480Vac, NEMA 3R Free Standing Enclosure. **Factory Options Requested:** Service Entrance Rated, Emergency Disconnect Switch on Door, Circuit Breaker Trip on Emergency, Aux Contacts for Source Available and Space Heaters.)

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

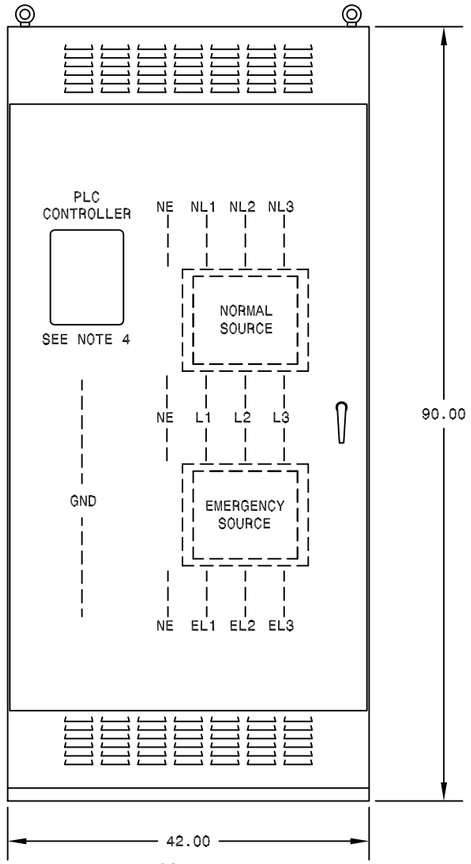
UL LISTED

Made in the USA

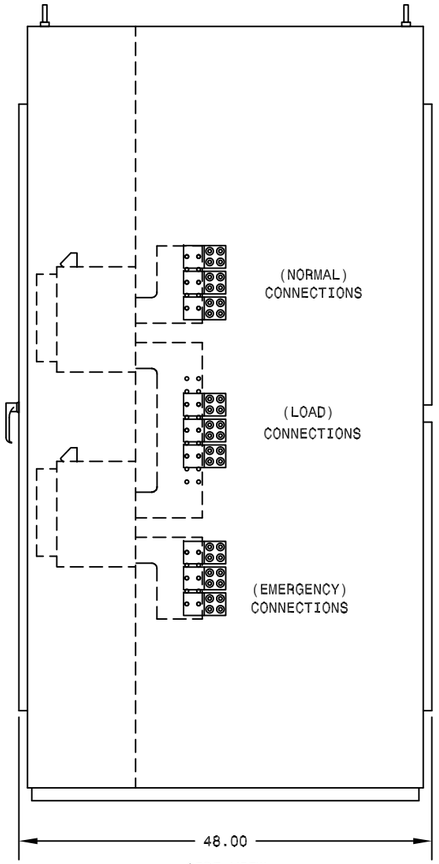
Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

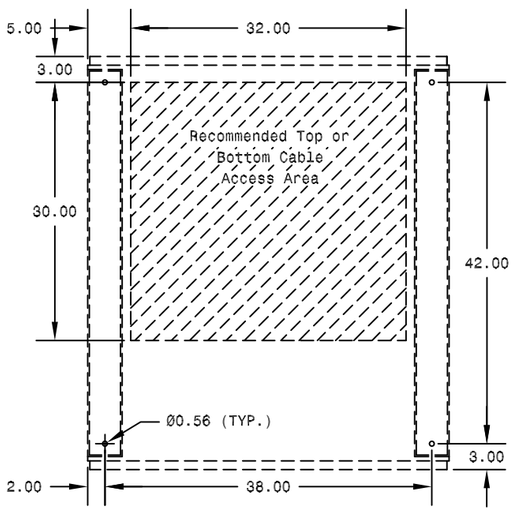
Rev: November 2016



FRONT VIEW



SIDE VIEW



PLAN VIEW
FRONT

OUTLINE NOTES

1) GENERAL ENCLOSURE CONSTRUCTION:
   A) FREESTANDING ENCLOSURE
   B) FABRICATED FROM 14 GA. STEEL
   C) HINGED FRONT DOOR
   D) REMOVABLE REAR PANELS
   E) FRONT & REAR ACCESS REQUIRED
   F) OPEN BOTTOM FOR CABLE ENTRY
   G) PAINTED ANSI-61 LIGHT GRAY
   H) ALL DIMENSIONS EXPRESSED IN INCHES
   I) NEMA 1 KEYLOCKABLE HANDLE

2) LUGS:

CURRENT RATING	STANDARD LUG
1200 AMP	(4)300-750MCM

3) .25 X 3.00 GROUND BUS

4) PLC CONTROLLER OR CONTROLS PROVIDED WITH MICROPROCESSOR OPTION.

REV	DESCRIPTION	BY	APV	DATE
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

LAKE SHORE ELECTRIC Corp
BEDFORD, OHIO U.S.A.

IC TRANSFER SWITCH OUTLINE
800-3000 AMP, FIXED, NEMA 1

SCALE: 1=12 | DRN: --- --/--/-- | CHK: --- --/--/-- | APV: --- --/--/--

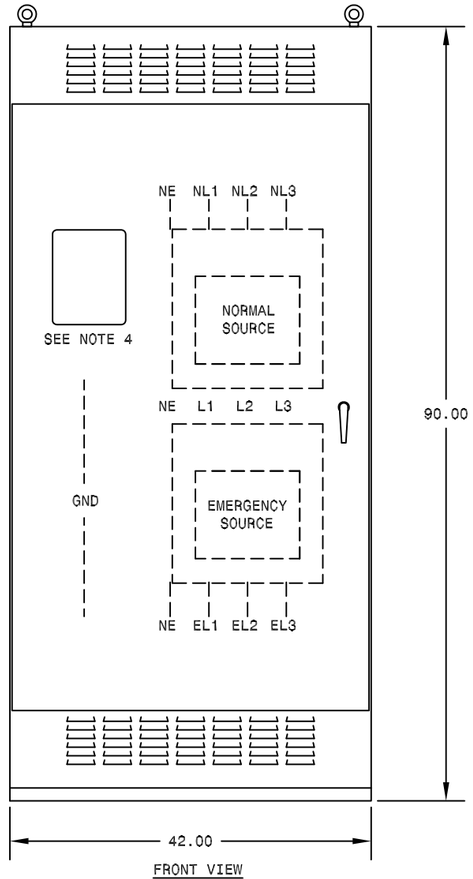
PROJ: -
-

CUSTOMER:
-
-
-

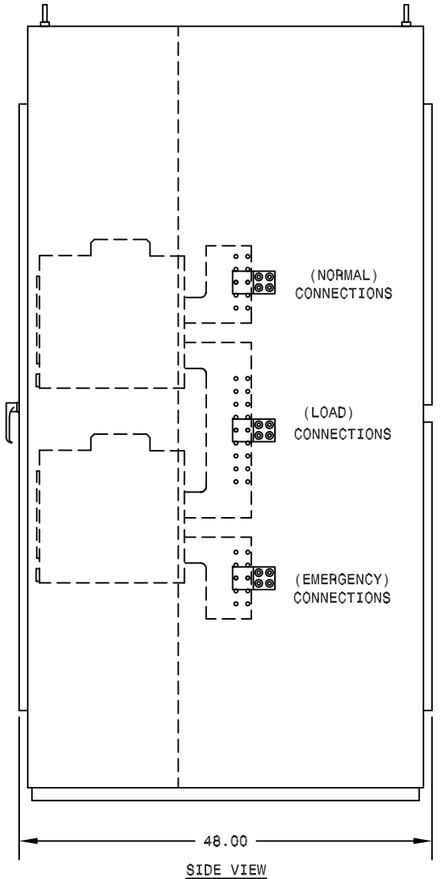
DWG NUMBER
1X1-XXXX-02 -

QUOTE/JOB#: -

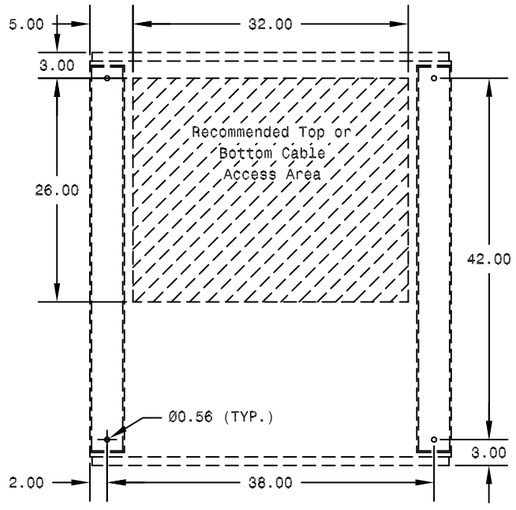
PG 1 OF 1



FRONT VIEW



SIDE VIEW



PLAN VIEW
FRONT

OUTLINE NOTES

1) GENERAL ENCLOSURE CONSTRUCTION:
   A) FREESTANDING ENCLOSURE
   B) FABRICATED FROM 14 GA. STEEL
   C) HINGED FRONT DOOR
   D) REMOVABLE REAR PANELS
   E) FRONT & REAR ACCESS REQUIRED
   F) OPEN BOTTOM FOR CABLE ENTRY
   G) PAINTED ANSI-61 LIGHT GRAY
   H) ALL DIMENSIONS EXPRESSED IN INCHES
   I) NEMA 1 KEYLOCKABLE HANDLE

2) LUGS:

CURRENT RATING	STANDARD LUG
1200 AMP	(4)300-750MCM

3) .25 X 3.00 GROUND BUS

4) PLC CONTROLLER OR CONTROLS PROVIDED WITH MICROPROCESSOR OPTION.

REV	DESCRIPTION	BY	APV	DATE
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

LAKE SHORE ELECTRIC Corp
BEDFORD, OHIO U.S.A.

IC TRANSFER SWITCH OUTLINE
800-1200 AMP, DRAW OUT, NEMA 1

SCALE: 1=12 | DRN: --- --/--/-- | CHK: --- --/--/-- | APV: --- --/--/--

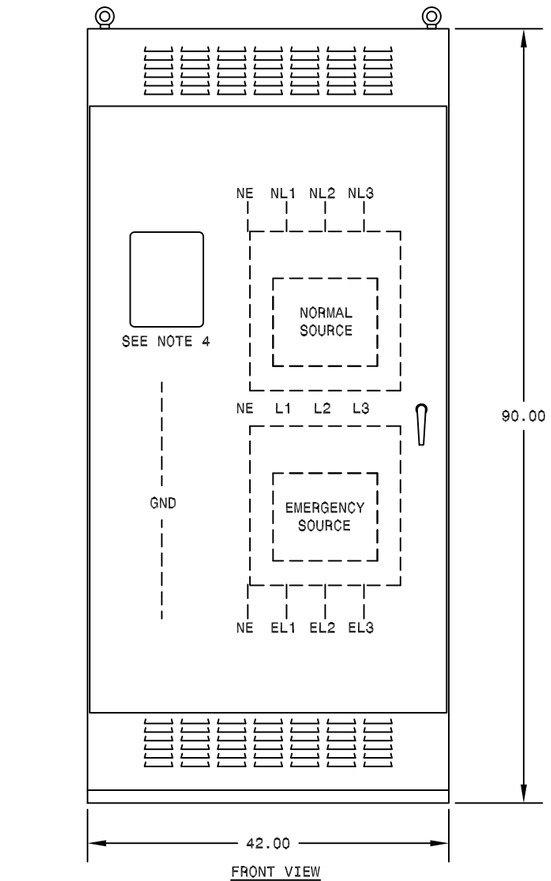
PROJ: -
-

CUSTOMER: -
-
-

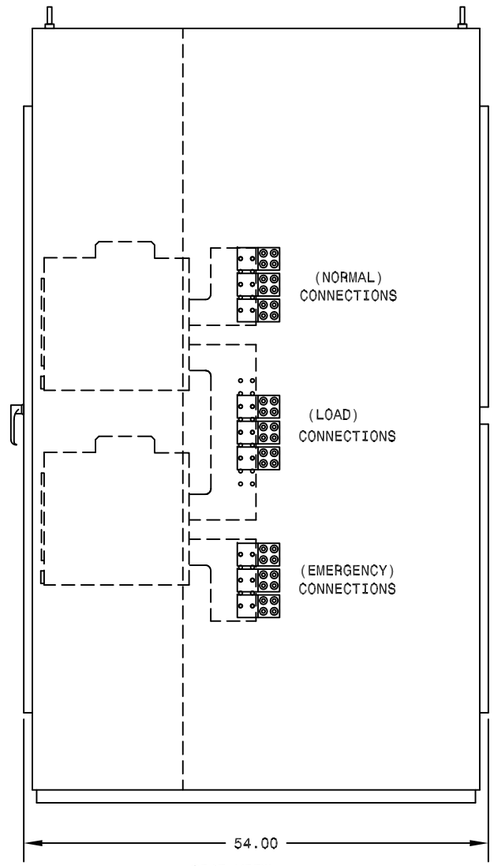
DWG NUMBER 1X1-XXXX-02 -

QUOTE/JOB#: -

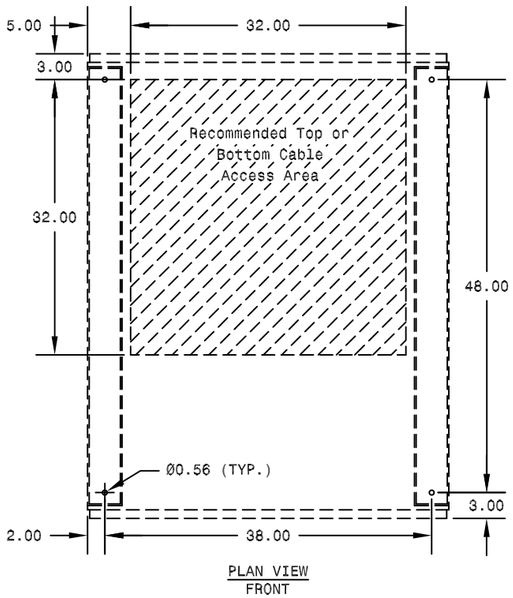
PG 1 OF 1



FRONT VIEW



SIDE VIEW



PLAN VIEW
FRONT

OUTLINE NOTES

1) GENERAL ENCLOSURE CONSTRUCTION:
   A) FREESTANDING ENCLOSURE
   B) FABRICATED FROM 14 GA. STEEL
   C) HINGED FRONT DOOR
   D) REMOVABLE REAR PANELS
   E) FRONT & REAR ACCESS REQUIRED
   F) OPEN BOTTOM FOR CABLE ENTRY
   G) PAINTED ANSI-61 LIGHT GRAY
   H) ALL DIMENSIONS EXPRESSED IN INCHES
   I) NEMA 1 KEYLOCKABLE HANDLE

2) LUGS:

CURRENT RATING	STANDARD LUG
3000 AMP	(12)300-750MCM

3) .25 X 3.00 GROUND BUS

4) PLC CONTROLLER OR CONTROLS PROVIDED WITH MICROPROCESSOR OPTION.

REV	DESCRIPTION	BY	APV	DATE
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

LAKE SHORE ELECTRIC Corp
BEDFORD, OHIO U.S.A.

IC TRANSFER SWITCH OUTLINE
1600-3000 AMP, DRAW OUT, NEMA 1

SCALE: 1=12 | DRN: --- --/--/-- | CHK: --- --/--/-- | APV: --- --/--/--

PROJ: -
-

CUSTOMER:
-
-
-

DWG NUMBER
1X1-XXXX-02 -

QUOTE/JOB#: -

PG 1 OF 1

LAKESHORE
ELECTRIC CORPORATION

Manual Transfer Switches

Introduction

The Standard Manual Transfer Switch (MTS) utilizes a manual operator to operate both the normal and emergency units. All Molded Case (MC) MTS are protected by a mechanical interlock located behind the molded case units and all Insulated Case (IC) MTS are protected by a mechanical interlock located to the right side of the insulated case units. The mechanical interlock provides additional safety to the operators by preventing them from paralleling the sources.

These switches are U.L. 1008 Listed (File No. E32008) approved as suitable for use in emergency systems, these transfer switches are rated for applications of 100 thru 4000 amperes, up to 600 Vac with short circuit ratings of 35kAIC@480Vac thru 150kAIC@480Vac available.

Description of Operation

The MTS is a manually operated transfer switch that is used to choose one of two sources of power to connect to the load. Depending on the ampacity and basic features required, there are a couple of styles available. There are the MC MTS, the IC MTS and a Service Entrance equivalent for both of these styles.

Molded Case

To operate the MC MTS, there are manual operating handles located on the front of each molded case unit. When the handle is in the "UP" position, the load is connected to that unit's power source. When both of the handles are in the "DOWN" position, the load is disconnected from both power sources and the MTS is in the "Neutral" position.

Remember, the mechanical interlock will prevent both units from being closed at the same time. If the unit being operated does not move, the opposite unit may be in the "UP" position preventing the closure of the unit. Place that unit in the "DOWN" position before continuing.

Insulated Case

To operate the IC MTS, there are charging handles located on each insulated case unit. Pull the handles down repeatedly, (there will be resistance felt here), until you hear a "Click" sound and there is no more resistance felt when pulling the handle down. The unit is now changed to handle a full operation; (one close and open function). Push the "Close" button on the insulated case unit whose power is to be connected to the load.

Remember, the mechanical interlock will prevent both units from being closed at the same time. If the "Close" button does not operate the required unit, push the "Open" button on the other unit to verify it is open first.

Featured Option, 40

Electrical Assist - This option will allow the operator to control the MTS from the door.

It will provide a Control Enable Keyed Switch, Pilot Lights for Switch Position and Source Available and pushbuttons to open and close each unit from the door.

If Service Entrance and Ground Fault are included with this order, the Pilot Light for System Trouble will be included also.

See the Electrical Assist cutsheet for a full description.

Product Features

- UL 1008 Listed
- Molded Case: 100 thru 1200 Ampere, 100% Rated Equipment
- Insulated Case: 800 thru 4000 Ampere, 100% Rated Equipment
- Max Operating Voltage of 600Vac
- Keyed or Padlock Handle Provided
- Wall Mount (W/M) or Free Standing (F/S) Enclosure Available
- NEMA 1, 3R, 4, or 4X Std.; NEMA 3R or 4X Stainless Steel
- MC's are Front Accessible
- IC's are Front and Rear Accessible
- Safe Manual Transfer Under Load
- Space Heaters Included with any Outdoor Equipment

Factory Options

- 18 - Aux Contacts for Switch Position; ACRN
- 19 - Aux Contacts for Switch Position; ACRE
- 22A - Pilot Lights for Switch Position
- 22B - Pilot Lights for Source Available
- 22C - Pilot Light for System Trouble (Overcurrent, Ground Fault, etc.)
- 23A - Circuit Breaker Trip on Normal
- 23B - Circuit Breaker Trip on Emergency
- 24J - Aux Contacts for Source Available
- 25 - Multifunction Metering
- 31 - Service Entrance
- 39 - Ground Fault Protection
- 40 - Electrical Assist (Allows Operator to Manually Control the MTS from the Door)
- 44 - Space Heaters
- External Door Operators Available - Consult Factory for Custom Configurations

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: April 2019

LAKESHORE
ELECTRIC CORPORATION

MOLDED CASE MTS INFORMATION

AMPS	STYLE	APPROXIMATE DIMENSIONS			CABLE ENTRY AREA		APPROX. SHIPPING WEIGHTS	LUG RANGES AVAILABLE	
		HEIGHT	WIDTH	DEPTH	HEIGHT	WIDTH			
100	W/M	48"	28"	18"	15"	26"	285	STD	(1) #4 - 4/0
	F/S	66"	28"	18"	9"	26"	410	OPT	(1) #14 - 1/0
225	W/M	54"	28"	18"	15"	26"	340	STD	(1) 3/0 - 350
	F/S	66"	28"	18"	9"	26"	410	OPT	(2) 3/0 - 350
400	W/M	54"	28"	18"	15"	26"	340	STD	(1) 2/0 - 500*
	F/S	66"	28"	18"	9"	26"	410	OPT	(1) 500 - 600
600	W/M	60"	37"	18"	15"	35"	415	STD	(2) 400 - 500
	F/S	84"	37"	20"	10"	35"	630	OPT	(2) 3/0 - 350
800 1000 1200	W/M	72"	37"	20"	18"	35"	570	STD	(3) 500 - 750**
	F/S	84"	37"	20"	10"	35"	630	OPT	(4) 4/0 - 500

* This Lug is also capable of accommodating (2) 2/0 - 250 MCM cables.
** Not recommended for 500 MCM Cables.

INSULATED CASE MTS INFORMATION

AMPS	STYLE	APPROXIMATE DIMENSIONS			CABLE ENTRY AREA		APPROX. SHIPPING WEIGHTS (LBS)	LUG RANGES AVAILABLE	
		HEIGHT	WIDTH	DEPTH	WIDTH	DEPTH			
800 1200	Fixed	90"	36"	54"	26"	24"	1450	STD	(4) #2 - 600MCM
	D/O[1]	90"	36"	60"	26"	24"			
1600 2000	Fixed	90"	36"	54"	26"	24"	1450	STD	(6) #2 - 600MCM
	D/O[1]	90"	36"	60"	26"	24"			
2500 3000	Fixed	90"	42"	60"	32"	30"	1950	STD	(10) #2 - 600MCM
	D/O[1]	90"	42"	66"	32"	30"			
3200	Fixed	90"	42"	60"	32"	30"	2250	STD	(12) #2 - 600MCM
	D/O[1]	90"	42"	66"	32"	30"			
4000	Fixed	90"	60"	54"	50"	24"	3200	STD	(12) #2 - 600MCM
	D/O[1]	90"	60"	60"	50"	24"	3500		

[1] Draw Out Style Control Units

Recommendations

The MTS are capable of other configurations outside the standard setup. Please consult the factory for further information on equipment outside the standard packages.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: April 2019

LAKESHORE
ELECTRIC CORPORATION

Manual Transfer Switch Order Guide

MC	-	-	-	----	-	-	-	-	/X	/X	/X	/X	/X	/X	/X	/X	/X	/X	/X	/X

TYPE
- MC[1]
- IC[2]

OPERATOR
- D = Dual[1] or D/O[2]
- F = Fixed[2]

CONTROL BASE
- M = Manual

NUMBER OF POLES
- 2 = Two Poles
- 3 = Three Poles
- 4 = Four Poles

AMPACITY
- 0100 = 100 Amps
- 0225 = 225 Amps
- 0400 = 400 Amps
- 0600 = 600 Amps
- 0800 = 800 Amps
- 1000 = 1000 Amps
- 1200 = 1200 Amps
- 1600 = 1600 Amps
- 2000 = 2000 Amps
- 2500 = 2500 Amps
- 3000 = 3000 Amps
- 4000 = 4000 Amps

VOLTAGE

A	=	120/240	1 ϕ	3 W	60 Hz
B	=	120/208	3 ϕ	4 W	60 Hz
C	=	277/480	3 ϕ	4 W	60 Hz
D	=	120	1 ϕ	2 W	60 Hz
E	=	127/220	3 ϕ	4 W	60 Hz
F	=	240	3 ϕ	3 W	60 Hz
G	=	120/240	3 ϕ	4 W	60 Hz
H	=	220/380	3 ϕ	4 W	60 Hz
I	=	380	3 ϕ	3 W	60 Hz
J	=	440	3 ϕ	3 W	60 Hz
K	=	480	3 ϕ	3 W	60 Hz
L	=	240/415	3 ϕ	4 W	60 Hz
S	=	Custom Voltage (Please Specify)			

CONTROLS
- E = Electromechanical Controls (Use for MTS)

INTERRUPTING RATING
- S[1] = Standard Rating = 35kAIC @ 480VAC, (100 - 600A)
- S[1] = Standard Rating = 50kAIC @ 480VAC (800 - 1200A)
- H[1] = High Rating = 65kAIC @ 480Vac (100 - 1200A)
- V[1] = Very High Rating = 100kAIC @ 480Vac (100 - 1200A)
- S[2] = Standard Rating = 65kAIC @ 480VAC (800 - 4000A)
- H[2] = High Rating = 100kAIC @ 480Vac (800 - 4000A)
- V[2] = Very High Rating = 150kAIC @ 480Vac (800 - 4000A)
- ** kAIC Ratings Higher @ 240VAC (Consult Factory Rep)**

ENCLOSURE
- A = NEMA 1 Wall Mount
- B = NEMA 1 Free Standing
- C = NEMA 12 Wall Mount
- D = NEMA 12 Free Standing
- E = NEMA 3R Wall Mount
- F = NEMA 3R Free Standing
- G = NEMA 4 Wall Mount
- H = NEMA 4 Free Standing
- I = NEMA 4X Wall Mount
- J = NEMA 4X Free Standing
- K = NEMA 3R Wall Mount (304 or 316 Stainless Steel)
- L = NEMA 3R Free Standing (304 or 316 Stainless Steel)
- O = Open Style (no enclosure)
- X = Special (by description)

USE FOR REQUIRED FACTORY OPTIONS

[1] Molded Case Style Unit
[2] Insulated Case Style Unit and D/O is Draw-Out

Part Number Example: MCDM0400CESE / ELA / SH (Molded Case, Dual Operator, Manual Operation, 400Amps, 277/480 Vac, 35kAIC @ 480Vac, NEMA 3R Wall Mount Enclosure. **Factory Options Requested:** Electrical Assist and Space Heaters)

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: April 2019

LAKESHORE
ELECTRIC CORPORATION

Medium Voltage Automatic Transfer Switches

Introduction

The Vacuum Breaker (VB) Medium Voltage (MV) Automatic Transfer Switches (ATS) allows the load to be disconnected from both the Normal and Emergency power sources essentially placing the load in a "Neutral" position.

The Standard VB MV ATS utilizes internal motors on both VB control units to operate the load connection to either the normal or emergency power source. Normally, the transfer switch operates on the preferred power source with the Normal VB unit in the closed position and the Emergency VB unit in the open position.

All VB MV ATS are protected by electrical interlocking. Some of these ATS incorporate mechanical interlocking also. This is subject to change based on the breaker manufacture. The provision of the interlock is to prevent accidental paralleling of the sources except were temporary source paralleling is required; see (CTT).

Description of Operation: Microprocessor Controls

All phases of the Normal and Emergency Power Source are continuously monitored by a Phase Sequence Relay on Normal (PSRN) and Emergency (PSRE) which have an adjustable pick-up from 70% to 100% of the nominal voltage. The factory set at 90%.

Assuming the ATS is feeding the load from the Normal Power Source, when the PSRN signal's the loss of Normal Power, the microprocessor starts the Time Delay to Engine Start (TDES). This helps to prevent nuisance tripping of the ATS and only start the generator when normal power is well and truly down.

After the TDES times out and normal power has still not returned, an Engine Start (ES) signal is sent to the generator. The ATS monitors the generators' output via the PSRE. When the generators' output is within the proper operating parameters, the microprocessor also starts the Minimum Run Timer (MRT) for the generator and the Time Delay to Emergency Timer (TDE). Once the TDE completes its counting cycle, the microprocessor operates the normal side motor and disconnects the load from the Normal Power Source.

At this time, the Time Delay in Neutral Timer (TDN) starts counting. Upon completion, the microprocessor operates the emergency side motor and connects the load to the Emergency Power Source.

The PSRN will continue to monitor the Normal Power Source and will signal the microprocessor when it is once again available for the ATS to use.

When PSRN signals the ATS Normal Power has returned, the Time Delay to Return (TDR) timer will start. This will keep the load of the ATS on the Emergency Power Source until the timer completes to verify that the Normal Power Source has returned.

Once the TDR completes its counting cycle, the microprocessor operates the emergency side motor and disconnects the load from the Emergency Power Source. At this time, the Engine Cool Down Timer (TDEC) and the TDN timer are started.

When the TDN timer completes its counting cycle, the microprocessor operates the normal side motor and connects the load to the Normal Power Source.

The generator will continue running until both the MRT and the TDEC timers have completed their counting cycles. After they are done, the microprocessor removes the ES signal and the generator is turned off. This completes the full sequence of the standard ATS transfer process.

Product Features

- 600,1200, 2000 & 2500 Ampere, 100% Rated Equipment
- Standard Operating Voltages (See VB MV ATS Order Guide)
- Electromechanical or Microprocessor Based Controls
- Phase Sequence Relay on Normal (PSRN)
- Phase Sequence Relay on Emergency (PSRE)
- SPP - Single Phase Protection
- Standard Features: MDS, LTS, ORPB, KPE and PE
- Keyed or Padlock Handle Provided
- Free Standing (F/S) Enclosure
- NEMA 1, 3R, 4, or 4X Std.; NEMA 3R or 4X Stainless Steel
- Front and Rear Accessible
- Safe Manual Transfer Under Load
- Aux Contacts for Switch Position, System Trouble and Engine Start
- Space Heaters Included with any Outdoor Equipment

Factory Options

- SE - Service Entrance
- ED - Emergency Disconnect Switch on Door
- GFP - Ground Fault Protection
- DPS - Dual Prime Source
- CBT(N or E)Circuit Breaker Trip on Normal and/or Emergency
- CTT - Closed Transition Transfer
- ACBT - Aux Contacts Before Transfer (Elevator Controls)
- ACSA - Aux Contacts for Source Available
- SPD - Surge Protection Devices by Description
- PS - Peak Shave
- LDI - Load Demand Inhibit
- RD - Remote Disconnect
- MLT - Maintained Load Test Switch
- MRTN – Manual Return to Normal
- MFM – Multifunction Metering
- BC – Battery Charger System, 12Vdc only
- SH - Space Heaters
- Custom Controls per Customer Spec
  (i.e: Generator Differential Protective Relays)

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Description of Operation: Electromechanical Controls – P1 Control Board

All phases of the Normal and Emergency Power Source are continuously monitored by a Phase Sequence Relay on Normal (PSRN) and Emergency (PSRE) which have an adjustable pick-up from 70% to 100% of the nominal voltage. This is factory set to 90%. In the event of a drop in any phase of the preferred voltage set-point, the PSRN interrupts the voltage to the ODR1, an off delay timer, and ODR2, a control relay coil. When ODR2 drops out, the Time Delay to Emergency Timer (TDE) is started.

Depending on which timer finishes first, ODR1 or TDE, once one finishes its' countdown, the Engine Start (ES) contact will close and start the generator. The PSRE will monitor the generators' output and connect power to the controls once the generators' output is within proper operating parameters.

Once TDE finishes its' countdown, two Emergency Control Relays (ER1 and ER2) will change state. ER1 will start the Engine Maintain Timer (EMT) and connect power to the normal side transfer motor (TMN) to open the Normal Side Unit.

The internal aux contacts in the Normal Side Unit will change back to their normal OFF state and remove power from the TMN. This will then apply power to the Time Delay to Transfer timer (TDT), keeping the ATS in the neutral position until it is finished its' countdown. Once the TDT has finished its countdown, it will then apply power to the emergency side transfer motor (TME).

This will close the Emergency Side Unit. The internal aux contacts in the Emergency Side Unit will change to their ON state and remove power from the TME. The ATS load is now being fed from the Emergency Power Source.

The EMT's contacts will stay in their current OFF state until the EMT's countdown finishes. Once the EMT timer finishes, the generator maintain signal, ER2, will be turned off. EMT's input power will be removed via ER1.

However, as long as normal power has not returned, the generator will continue running via ODR1.

The PSRN continuously monitors the normal side power and once it is back within proper operating parameters, will apply power to the normal side controls. This will start the Time Delay to Return Timer (TDR). When it is finished, power will be applied to ODR1, ODR2 and the Transfer Relay (TR).

ODR1's contacts will change state immediately, removing the ES signal and power from open normal side unit transfer motor. ODR2 will apply power to the TME and open the Emergency Side Unit and remove power from the emergency side controls.

With power to the TR, the TDT timer may be started from the normal side power. Once the TDT timer has finished its' countdown, power will be applied to the TMN, closing the Normal Side Unit. The ATS load is now fed from the Normal Power Source.

This completes a full sequence of the ATS via electromechanical controls.

NOTE: By utilizing the time delay (TDT) it is possible to regulate the length of time where the load is neither connected to the Normal or Emergency source. This is useful in allowing residual voltage in inductive loads to decay before reapplying power, thereby avoiding large and possibly damaging in-rush currents.

Standard Microprocessor ATS Features

Along with the standard timers described, there are four standard switches included with all Microprocessor Controlled ATS. These are the momentary load test switch (LTS), the momentary override pushbutton (ORPB), the maintained key pad enable (KPE) and the maintained maintenance disconnect switch (MDS). ATS is also included with a plant exerciser (PE). See the MP7650 System datasheet.

NOTE: If using Electromechanical Controls, only the LTS switch is standard.

The LTS switch provides the ATS operator with a manual way to perform a load test of the transfer switch. When the MP76xx controller receives this input, it will mimic the loss of the Normal Power Source and go through the steps of transferring the load to the Emergency Power Source. This is one to perform a manual routine check of the equipment to ensure it is within proper working order.

The ORPB switch provides the ATS operator with a manual way to force the ATS back to the Normal Power Source without waiting for the timers to finish their timing sequence.

The KPE switch provides the ATS operator with a way to lockout the HMI controls from unauthorized tampering. This switch is located inside the ATS enclosure, which either has a key or padlock locking mechanism preventing entry.

The MDS switch provides the ATS operator with a manual way to disconnect power to the controls of the ATS for maintenance. It is highly recommended that any ATS operator have been properly trained on the unit and have the units control wiring diagrams present when performing any maintenance of the ATS. Be sure that all required PPE is utilized.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

VB MV ATS Order Guide

VB	-	-	-	----	-	-	-	-	/X	/X	/X	/X	/X	/X	/X	/X	/X	/X	/X	/X

OPERATOR
D = Draw Out
F = Fixed

CONTROL BASE
A = Automatic
M = Manual

NUMBER OF POLES
2 = Two Poles
3 = Three Poles
4 = Four Poles

AMPACITY
0600 = 600 Amps
1200 = 1200 Amps
2000 = 2000 Amps
2500 = 2500 Amps
NOTE: Consult Factory for Higher Amperages

VOLTAGE

A	=	4160	3 ϕ 3 W	60 Hz
B	=	8250	3 ϕ 3 W	60 Hz
C	=	12470	3 ϕ 3 W	60 Hz
D	=	13800	3 ϕ 3 W	60 Hz

CONTROLS
P = Microprocessor Controls 24Vdc
M = Microprocessor Controls 12Vdc
E = Electromechanical Controls

INTERRUPTING RATING

S	=	Standard Rating	16kA rms
H	=	High Rating	20kA rms
V	=	Very High Rating	25kA rms
X	=	Extremely High Rating	40kA rms

NOTE: If MVA Ratings are specified, please contact the factory to discuss.

ENCLOSURE
B = NEMA 1 Free Standing
D = NEMA 12 Free Standing
F = NEMA 3R Free Standing
H = NEMA 4 Free Standing
J = NEMA 4X Free Standing
L = NEMA 3R Free Standing (304 or 316 Stainless Steel)
O = Open Style (no enclosure)
X = Special (by description)

USE FOR REQUIRED FACTORY OPTIONS

Part Number Example: VBDA0600APSF / SE / ED / CBTE / ACSA / SH (Vacuum Breaker, Draw Out Style, Automatic Operation, 600Amps, Microprocessor Controls 24Vdc, 4160Vac, 16kA rms, NEMA 3R Free Standing Enclosure. **Factory Options Requested:** Service Entrance Rated, Emergency Disconnect Switch on Door, Circuit Breaker Trip on Emergency, Aux Contacts for Source Available and Space Heaters.)

Recommendations

The VB MV ATS is capable of other configurations outside the standard setup. Please consult the factory for further information on equipment outside the standard packages.

LAKESHORE
ELECTRIC CORPORATION

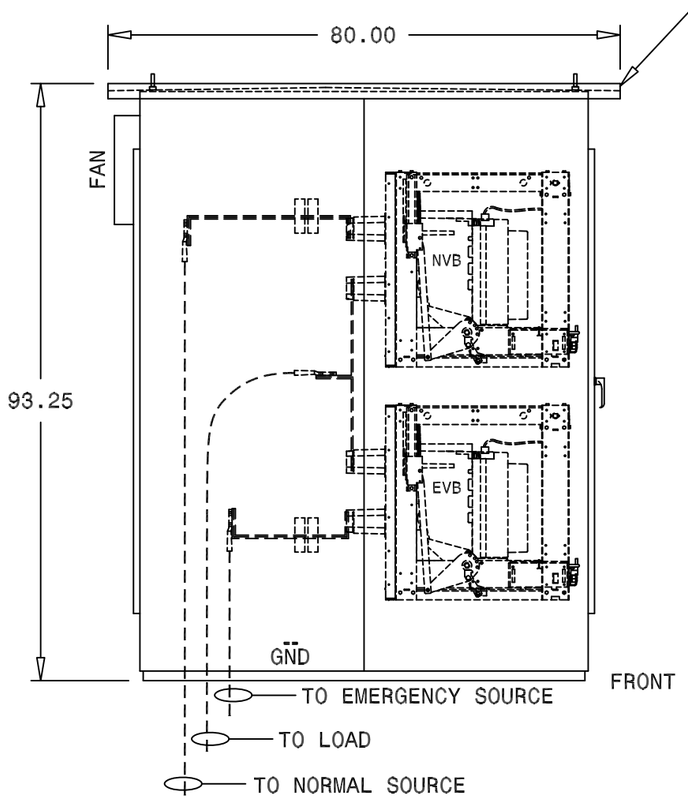
MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

Made in the USA

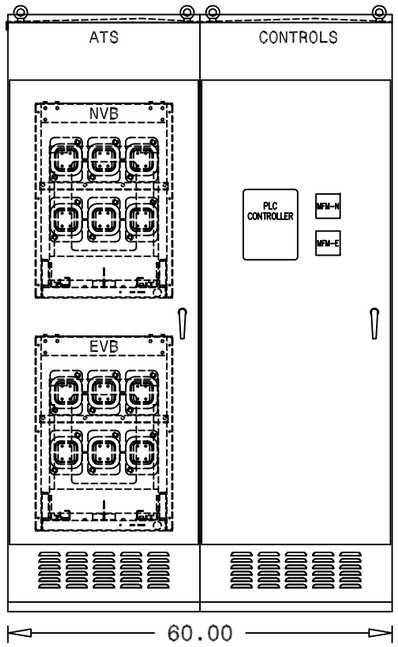
Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

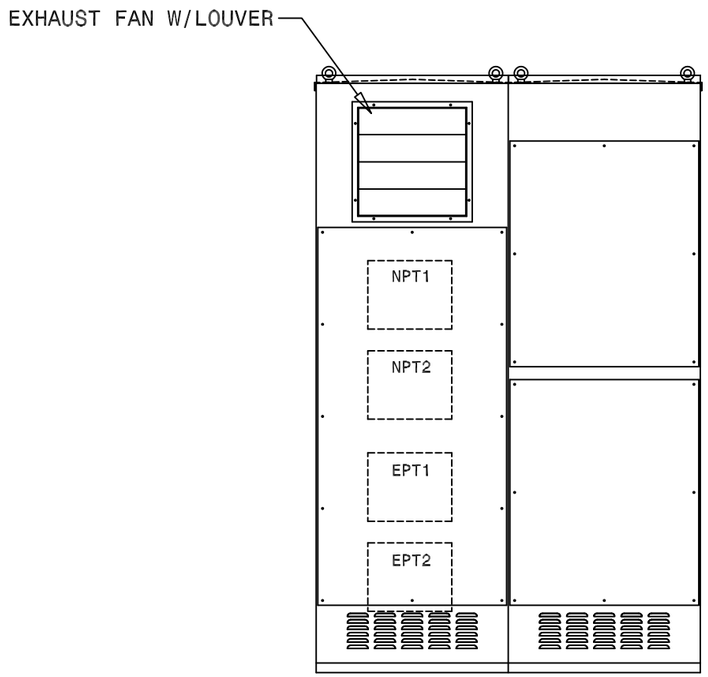
Rev: November 2016



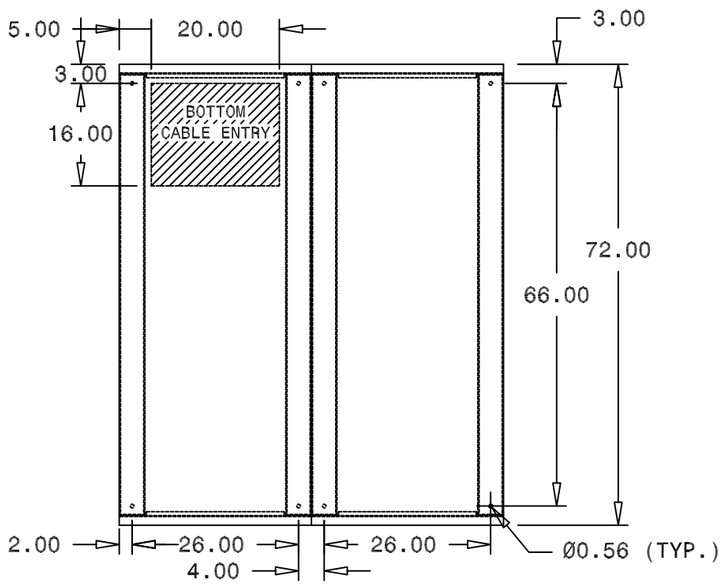
LEFT VIEW



FRONT VIEW



REAR VIEW



FLOOR PLAN
FRONT

OUTLINE NOTES

1) GENERAL ENCLOSURE CONSTRUCTION:
   A) FREE-STANDING NEMA 3R ENCLOSURE
   B) 14 GA. SHEET METAL
   C) 1.5"x4.0" 7 GA. CHANNEL BASE
   D) HINGED FRONT DOOR WITH 3 POINT LATCH
   E) PADLOCKABLE HANDLES
   F) BOLT-ON REAR COVERS
   G) MOUNTING DIMENSIONS ARE ± .063", ALL OTHER DIMENSIONS ARE APPROXIMATE

2) ENCLOSURE FINISH:
   A) ANSI-61 LIGHT GRAY

REV	DESCRIPTION	BY	APV	DATE
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

LAKE SHORE ELECTRIC Corp
BEDFORD, OHIO U.S.A.

MV TRANSFER SWITCH OUTLINE
NEMA 3R FREE STANDING

SCALE: 1=24 | DRN: --- --/--/-- | CHK: --- --/--/-- | APV: --- --/--/--

PROJ: -
-

CUSTOMER:
-
-
-

DWG NUMBER
1X1-XXXX-02
-

QUOTE/JOB#:
-

PG 1 OF 1

LAKESHORE
ELECTRIC CORPORATION

Dual Motor Automatic Transfer Switches

Introduction

The Standard Dual Motor Automatic Transfer Switches (ATS) utilizes isolated motors to operate both the normal and emergency molded case units. Normally, the transfer switch operates on the preferred power source with the Normal molded case unit in the closed position and the Emergency molded case unit in the open position. All ATS are protected by mechanical interlocking located behind the molded case units to prevent accidental paralleling of the sources except were temporary source paralleling is required; see Closed Transition Transfer (CTT).

Description of Operation: Microprocessor Controls

The Dual Motor ATS allows the load to be disconnected from both the Normal and Emergency power sources essentially placing the load in a "Neutral" position. All phases of the Normal Power Source are continuously monitored by a Phase Failure Relay on Normal (PFRN) which is adjustable from 70% to 100% of the nominal voltage.

Assuming the ATS is feeding the load from the Normal Power Source, when the PFRN signal's the loss of Normal Power, the microprocessor starts the Time Delay to Engine Start (TDES). This helps to prevent nuisance tripping of the ATS and only start the generator when normal power is well and truly down.

After the TDES times out and normal power has still not returned, an Engine Start (ES) signal is sent to the generator. The ATS monitors a single phase of the generator voltage and frequency. When they are within the proper operating parameters, the microprocessor also starts the Minimum Run Timer (MRT) for the generator and the Time Delay to Emergency Timer (TDE). Once the TDE completes its counting cycle, the microprocessor operates the normal side motor and disconnects the load from the Normal Power Source.

At this time, the Time Delay in Neutral Timer (TDN) starts counting. Upon completion, the microprocessor operates the emergency side motor and connects the load to the Emergency Power Source.

The PFRN will continue to monitor the Normal Power Source and will signal the microprocessor when it is once again available for the ATS to use.

When PFRN signals the ATS Normal Power has returned, the Time Delay to Return (TDR) timer will start. This will keep the load of the ATS on the Emergency Power Source until the timer completes to verify that the Normal Power Source has returned.

Once the TDR completes its counting cycle, the microprocessor operates the emergency side motor and disconnects the load from the Emergency Power Source. At this time, the Engine Cool Down Timer (TDEC) and the TDN timer are started.

When the TDN timer completes its counting cycle, the microprocessor operates the normal side motor and connects the load to the Normal Power Source.

The generator will continue running until both the MRT and the TDEC timers have completed their counting cycles. After they are done, the microprocessor removes the ES signal and the generator is turned off. This completes the full sequence of the standard ATS transfer process.

Product Features

- UL 1008 Listed
- 100 thru 1200 Ampere, 100% Rated Equipment
- Standard Operating Voltages (See Dual Motor ATS Order Guide)
- Electromechanical or Microprocessor Based Controls
- Phase Failure & Undervoltage Relay on Normal Source
- Standard Features: MDS, LTS, ORPB, KPE and PE
- Keyed or Padlock Handle Provided
- Wall Mount (W/M) or Free Standing (F/S) Enclosure Available
- NEMA 1, 3R, 4, or 4X Std.; NEMA 3R or 4X Stainless Steel
- Front Accessible
- Safe Manual Transfer Under Load
- Aux Contacts for Switch Position, System Trouble and Engine Start
- Space Heaters Included with any Outdoor Equipment

Factory Options

- SE - Service Entrance
- ED - Emergency Disconnect Switch on Door
- GFP - Ground Fault Protection
- PFRE - Phase Failure & Undervoltage Relay on Emergency Source
- DPS - Dual Prime Source
- CBT(N or E)Circuit Breaker Trip on Normal and/or Emergency
- CTT - Closed Transition Transfer
- ACBT - Aux Contacts Before Transfer (Elevator Controls)
- ACSA - Aux Contacts for Source Available
- SPD - Surge Protection Devices by Description
- SPP - Single Phase Protection
- PS - Peak Shave
- LDI - Load Demand Inhibit
- RD - Remote Disconnect
- MLT - Maintained Load Test Switch
- MRTN - Manual Return to Normal
- FPC - Fire Pump Controls
- MFM - Multifunction Metering
- BC - Battery Charger System, 12Vdc only
- SH - Space Heaters

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Description of Operation: Electromechanical Controls – P8 Control Board

All phases of the Normal Power Source are continuously monitored by a Phase Failure Relay on Normal (PFRN) which is adjustable from 70% to 100% of the nominal voltage. In the event of a drop in any phase of the preferred voltage below the drop-out set point, the PFRN interrupts the voltage to a control relay coil which drops out, closing the engine start contact.

The ATS will continuously monitor a single phase of the Emergency Power Source. Once the engine has started, this generally takes from three to ten seconds, a signal will be sent to indicate the emergency power is within operating range.

When the Control Relay (CR) and Emergency Relay (ER) signals to transfer are received, the drive motor on the Normal side of the ATS, removes the load from the Normal Power Source, placing the ATS in the neutral position. The Time Delay to Transfer (TDT) timer is then energized.

After the TDT times out, the drive motor on the Emergency side is energized, transferring the load to the Emergency Power Source.

With the ATS load now operating on the Emergency Power Source, the PFRN continues to monitor the Normal Power Source. When all phases of the Normal Power Source return to the set pickup level of the PFRN, the Time Delay to Return Timer (TDR) is started. When it times out, the CR is again energized. NOTE: The TDR is bypassed completely if Emergency Power is no longer available.

The CR signal will disconnect the engine-start contact and turn off the generator. At the same time, the emergency side motor will disconnect the load from the Emergency Power Source, placing the ATS in the neutral position.

By utilizing the time delay (TDT) it is possible to regulate the length of time where the load is neither connected to the Normal or Emergency source. This is useful in allowing residual voltage in inductive loads to decay before reapplying power, thereby avoiding large and possibly damaging in-rush currents.

When the TDT Timer has timed out, the normal side motor connects the load to the Normal Power Source. This completes the full sequence of the standard ATS transfer process.

Other timers are available. For more information, see the Electromechanical Controls Overview.

Standard Microprocessor ATS Features

Along with the standard timers described, there are four standard switches included with all Microprocessor Controlled ATS. These are the momentary load test switch (LTS), the momentary override pushbutton (ORPB), the maintained key pad enable (KPE) and the maintained maintenance disconnect switch (MDS). ATS is also included with a plant exerciser (PE). See the MP7650 System datasheet.

NOTE: If using Electromechanical Controls, only the LTS switch is standard.

The LTS switch provides the ATS operator with a manual way to perform a load test of the transfer switch. When the MP76xx controller receives this input, it will mimic the loss of the Normal Power Source and go through the steps of transferring the load to the Emergency Power Source. This is one to perform a manual routine check of the equipment to ensure it is within proper working order.

The ORPB switch provides the ATS operator with a manual way to force the ATS back to the Normal Power Source without waiting for the timers to finish their timing sequence.

The KPE switch provides the ATS operator with a way to lockout the HMI controls from unauthorized tampering. This switch is located inside the ATS enclosure, which either has a key or padlock locking mechanism preventing entry.

The MDS switch provides the ATS operator with a manual way to disconnect power to the controls of the ATS for maintenance. It is highly recommended that any ATS operator have been properly trained on the unit and have the units control wiring diagrams present when performing any maintenance of the ATS. Be sure that all required PPE is utilized.

Recommendations

The Molded Case Dual Motor ATS is capable of other configurations outside the standard setup. Please consult the factory for further information on equipment outside the standard packages.

ATS INFORMATION

AMPS	STYLE	APPROXIMATE DIMENSIONS			CABLE ENTRY AREA		APPROX. SHIPPING WEIGHTS	LUG RANGES AVAILABLE	
		HEIGHT	WIDTH	DEPTH	HEIGHT	WIDTH			
100	W/M	48"	28"	18"	15"	26"	285	STD	(1) #4 - 4/0
	F/S	66"	28"	18"	9"	26"	410	OPT	(1) #14 - 1/0
225	W/M	54"	28"	18"	15"	26"	340	STD	(1) 3/0 - 350
	F/S	66"	28"	18"	9"	26"	410	OPT	(2) 3/0 - 350
400	W/M	54"	28"	18"	15"	26"	340	STD	(1) 2/0 - 500*
	F/S	66"	28"	18"	9"	26"	410	OPT	(1) 500 - 600
600	W/M	60"	37"	18"	15"	35"	415	STD	(2) 400 - 500
	F/S	84"	37"	20"	10"	35"	630	OPT	(2) 3/0 - 350
800 1000 1200	W/M	72"	37"	20"	18"	35"	570	STD	(3) 500 - 750**
	F/S	84"	37"	20"	10"	35"	630	OPT	(4) 4/0 - 500

* This Lug is also capable of accommodating (2) 2/0 – 250 MCM cables.

** Not recommended for 500 MCM Cables.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Dual Motor ATS Order Guide

MC	-	-	-	----	-	-	-	-	/X	/X	/X	/X	/X	/X	/X	/X	/X	/X	/X	/X

OPERATOR
D = Dual Motor

CONTROL BASE
A = Automatic

NUMBER OF POLES
2 = Two Poles
3 = Three Poles
4 = Four Poles

AMPACITY
0100 = 100 Amps
0225 = 225 Amps
0400 = 400 Amps
0600 = 600 Amps
0800 = 800 Amps
1000 = 1000 Amps
1200 = 1200 Amps

VOLTAGE

A	=	120/240	1 ϕ	3 W	60 Hz
B	=	120/208	3 ϕ	4 W	60 Hz
C	=	277/480	3 ϕ	4 W	60 Hz
D	=	120	1 ϕ	2 W	60 Hz
E	=	127/220	3 ϕ	4 W	60 Hz
F	=	240	3 ϕ	3 W	60 Hz
G	=	120/240	3 ϕ	4 W	60 Hz
H	=	220/380	3 ϕ	4 W	60 Hz
I	=	380	3 ϕ	3 W	60 Hz
J	=	440	3 ϕ	3 W	60 Hz
K	=	480	3 ϕ	3 W	60 Hz
L	=	240/415	3 ϕ	4 W	60 Hz
S	=	Custom Voltage (Please Specify)			

CONTROLS
P = Microprocessor Controls 24Vdc
M = Microprocessor Controls 12Vdc
E = Electromechanical Controls

INTERRUPTING RATING
S = Standard Rating = 35kAIC @ 480VAC, (100 - 600A)
S = Standard Rating = 50kAIC @ 480VAC (800 - 1200A)
H = High Rating = 65kAIC @ 480Vac (All Amperages)
V = Very High Rating = 100kAIC @ 480Vac (All Amperages)
** kAIC Ratings Higher @ 240VAC (Consult Factory Rep)**

ENCLOSURE
A = NEMA 1 Wall Mount
B = NEMA 1 Free Standing
C = NEMA 12 Wall Mount
D = NEMA 12 Free Standing
E = NEMA 3R Wall Mount
F = NEMA 3R Free Standing
G = NEMA 4 Wall Mount
H = NEMA 4 Free Standing
I = NEMA 4X Wall Mount
J = NEMA 4X Free Standing
K = NEMA 3R Wall Mount (304 or 316 Stainless Steel)
L = NEMA 3R Free Standing (304 or 316 Stainless Steel)
O = Open Style (no enclosure)
X = Special (by description)

USE FOR REQUIRED FACTORY OPTIONS

Part Number Example: MCDA0400CPSE / SE / ED / CBTE / ACSA / SH (Molded Case, Dual Motor Operator, Automatic Operation, 400Amps, Microprocessor Controls 24Vdc, 277/480Vac, 35kAIC@480Vac, NEMA 3R Wall Mount Enclosure. **Factory Options Requested:** Service Entrance Rated, Emergency Disconnect Switch on Door, Circuit Breaker Trip on Emergency, Aux Contacts for Source Available and Space Heaters)

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Single Motor Automatic Transfer Switches

Introduction

The Standard Single Motor Automatic Transfer Switches (ATS) utilizes an isolated motor to operate both the normal and emergency molded case units. Normally, the transfer switch operates on the preferred power source with the Normal molded case unit in the closed position and the Emergency molded case unit in the open position. All ATS are protected by mechanical interlocking located behind the molded case units to prevent accidental paralleling of the sources.

Description of Operation: Microprocessor Controls

The Single Motor ATS allows the load to be connected to either the Normal or Emergency power source, but it will always be connected to one of them. For this unit, a “Neutral" or "OFF” position is not available and is not approved to be used as service entrance equipment. Normally, the transfer switch operates on the preferred power source with the Normal molded case unit in the closed position and the Emergency molded case unit in the open position.

All phases of the Normal Power Source are continuously monitored by a Phase Failure Relay on Normal (PFRN) which is adjustable from 70% to 100% of the nominal voltage.

Assuming the ATS is feeding the load from the Normal Power Source, when the PFRN signal’s the loss of Normal Power, the microprocessor starts the Time Delay to Engine Start (TDES). This helps to prevent nuisance tripping of the ATS and only start the generator when normal power is well and truly down.

After the TDES times out and normal power has still not returned, an Engine Start (ES) signal is sent to the generator. The ATS monitors a single phase of the generator voltage and frequency. When they are within the proper operating parameters, the microprocessor also starts the Minimum Run Timer (MRT) for the generator and the Time Delay to Emergency Timer (TDE). Once the TDE completes its counting cycle, the microprocessor operates the transfer motor and switches the load from the Normal Power Source to the Emergency Power Source.

The PFRN will continue to monitor the Normal Power Source and will signal the microprocessor when it is once again available for the ATS to use.

When PFRN signals the ATS Normal Power has returned, the Time Delay to Return (TDR) timer will start. This will keep the load of the ATS on the Emergency Power Source until the timer completes to verify that the Normal Power Source has returned.

Once the TDR completes its counting cycle, the microprocessor operates the transfer motor and switches the load from the Emergency Power Source back to the Normal Power Source. At this time, the Engine Cool Down Timer (TDEC) is started to keep the generator running for a pre-determined amount of time.

The generator will continue running until both the MRT and the TDEC timers have completed their counting cycles. After they are done, the microprocessor removes the ES signal and the generator is turned off. This completes the full sequence of the standard Single Motor ATS transfer process.

Product Features

- UL 1008 Listed
- 100 thru 600 Ampere, 100% Rated Equipment
- Standard Operating Voltages (See Single Motor ATS Order Guide)
- Electromechanical or Microprocessor Based Controls
- Phase Failure & Undervoltage Relay on Normal Source
- Standard Features: MDS, LTS, ORPB, KPE and PE
- Keyed or Padlock Handle Provided
- Wall Mount (W/M) or Free Standing (F/S) Enclosure Available
- NEMA 1, 3R, 4, or 4X Std.; NEMA 3R or 4X Stainless Steel
- Front Accessible
- Safe Manual Transfer Under Load
- Aux Contacts for Switch Position, System Trouble and Engine Start
- Space Heaters Included with any Outdoor Equipment

Factory Options

- GFP - Ground Fault Protection
- PFRE - Phase Failure & Undervoltage Relay on Emergency Source
- CBT(N or E)Circuit Breaker Trip on Normal and/or Emergency
- ACBT - Aux Contacts Before Transfer (Elevator Controls)
- ACSA - Aux Contacts for Source Available
- SPD - Surge Protection Devices by Description
- SPP - Single Phase Protection
- PS - Peak Shave
- LDI - Load Demand Inhibit
- RD - Remote Disconnect
- MLT - Maintained Load Test Switch
- MRTN - Manual Return to Normal
- MFM - Multifunction Metering
- BC - Battery Charger System, 12Vdc only
- SH - Space Heaters

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Description of Operation: Electromechanical Controls – P8 Control Board

All phases of the Normal Power Source are continuously monitored by a Phase Failure Relay on Normal (PFRN) which is adjustable from 70% to 100% of the nominal voltage. In the event of a drop in any phase of the preferred voltage below the drop-out set point, the PFRN interrupts the voltage to a control relay coil which drops out, closing the engine start contact.

The ATS will continuously monitor a single phase of the Emergency Power Source. Once the engine has started, this generally takes from three to ten seconds, a signal will be sent to indicate the emergency power is within operating range.

When the Control Relay (CR) and Emergency Relay (ER) signals to transfer are received, the transfer motor, connects the load to the Emergency Power Source and removes it from the Normal Power Source.

With the ATS load now operating on the Emergency Power Source, the PFRN continues to monitor the Normal Power Source. When all phases of the Normal Power Source return to the set pickup level of the PFRN, the Time Delay to Return Timer (TDR) is started. When it times out, the CR is again energized. NOTE: The TDR is bypassed completely if Emergency Power is no longer available.

The CR signal will disconnect the engine-start contact and turn off the generator. At the same time, the emergency side motor will disconnect the load from the Emergency Power Source, placing the ATS in the neutral position.

Please note that with this unit, there is no “Neutral” or “Off” position. Keep this in mind when choosing this ATS to feed loads that may have residual voltage in inductive loads that have not been drained away, potentially causing large and possibly damaging in-rush currents.

When the TDR Timer has timed out, the transfer motor connects the load to the Normal Power Source and disconnects the Emergency Power Source. This completes the full sequence of the standard ATS transfer process.

Other timers are available. For more information, see the Electromechanical Controls Overview.

Standard Microprocessor ATS Features

Along with the standard timers described, there are four standard switches included with all Microprocessor Controlled ATS. These are the momentary load test switch (LTS), the momentary override pushbutton (ORPB), the maintained key pad enable (KPE) and the maintained maintenance disconnect switch (MDS). ATS is also included with a plant exerciser (PE). See the MP7650 System datasheet.

NOTE: If using Electromechanical Controls, only the LTS switch is standard.

The LTS switch provides the ATS operator with a manual way to perform a load test of the transfer switch. When the MP76xx controller receives this input, it will mimic the loss of the Normal Power Source and go through the steps of transferring the load to the Emergency Power Source. This is one to perform a manual routine check of the equipment to ensure it is within proper working order.

The ORPB switch provides the ATS operator with a manual way to force the ATS back to the Normal Power Source without waiting for the timers to finish their timing sequence.

The KPE switch provides the ATS operator with a way to lockout the HMI controls from unauthorized tampering. This switch is located inside the ATS enclosure, which either has a key or padlock locking mechanism preventing entry.

The MDS switch provides the ATS operator with a manual way to disconnect power to the controls of the ATS for maintenance. It is highly recommended that any ATS operator have been properly trained on the unit and have the units control wiring diagrams present when performing any maintenance of the ATS. Be sure that all required PPE is utilized.

Recommendations

The Molded Case Single Motor ATS is capable of other configurations outside the standard setup. Please consult the factory for further information on equipment outside the standard packages.

ATS INFORMATION

AMPS	STYLE	APPROXIMATE DIMENSIONS			CABLE ENTRY AREA		APPROX. SHIPPING WEIGHTS	LUG RANGES AVAILABLE	
		HEIGHT	WIDTH	DEPTH	HEIGHT	WIDTH			
100	W/M	48"	28"	18"	15"	26"	285	STD	(1) #4 - 4/0
	F/S	66"	28"	18"	9"	26"	410	OPT	(1) #14 - 1/0
225	W/M	54"	28"	18"	15"	26"	340	STD	(1) 3/0 - 350
	F/S	66"	28"	18"	9"	26"	410	OPT	(2) 3/0 - 350
400	W/M	54"	28"	18"	15"	26"	340	STD	(1) 2/0 - 500*
	F/S	66"	28"	18"	9"	26"	410	OPT	(1) 500 - 600
600	W/M	60"	37"	18"	15"	35"	415	STD	(2) 400 - 500
	F/S	84"	37"	20"	10"	35"	630	OPT	(2) 3/0 - 350

* This Lug is also capable of accommodating (2) 2/0 – 250 MCM cables.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Single Motor ATS Order Guide

MC	-	-	-	----	-	-	-	-	/X	/X	/X	/X	/X	/X	/X	/X	/X	/X	/X	/X

OPERATOR
S = Single Motor

CONTROL BASE
A = Automatic

NUMBER OF POLES
2 = Two Poles
3 = Three Poles
4 = Four Poles

AMPACITY
0100 = 100 Amps
0225 = 225 Amps
0400 = 400 Amps
0600 = 600 Amps

VOLTAGE

A	=	120/240	1 ϕ	3 W	60 Hz
B	=	120/208	3 ϕ	4 W	60 Hz
C	=	277/480	3 ϕ	4 W	60 Hz
D	=	120	1 ϕ	2 W	60 Hz
E	=	127/220	3 ϕ	4 W	60 Hz
F	=	240	3 ϕ	3 W	60 Hz
G	=	120/240	3 ϕ	4 W	60 Hz
H	=	220/380	3 ϕ	4 W	60 Hz
I	=	380	3 ϕ	3 W	60 Hz
J	=	440	3 ϕ	3 W	60 Hz
K	=	480	3 ϕ	3 W	60 Hz
L	=	240/415	3 ϕ	4 W	60 Hz
S	=	Custom Voltage (Please Specify)			

CONTROLS
P = Microprocessor Controls 24Vdc
M = Microprocessor Controls 12Vdc
E = Electromechanical Controls

INTERRUPTING RATING
S = Standard Rating = 35kAIC @ 480VAC
H = High Rating = 65kAIC @ 480Vac
V = Very High Rating = 100kAIC @ 480Vac
** kAIC Ratings Higher @ 240VAC (Consult Factory Rep)**

ENCLOSURE
A = NEMA 1 Wall Mount
B = NEMA 1 Free Standing
C = NEMA 12 Wall Mount
D = NEMA 12 Free Standing
E = NEMA 3R Wall Mount
F = NEMA 3R Free Standing
G = NEMA 4 Wall Mount
H = NEMA 4 Free Standing
I = NEMA 4X Wall Mount
J = NEMA 4X Free Standing
K = NEMA 3R Wall Mount (304 or 316 Stainless Steel)
L = NEMA 3R Free Standing (304 or 316 Stainless Steel)
O = Open Style (no enclosure)
X = Special (by description)

USE FOR REQUIRED FACTORY OPTIONS

Part Number Example: MCSA0400CPSE / CBTN / ACSA / SH (Molded Case, Single Motor Operator, Automatic Operation, 400Amps, Microprocessor Controls 24Vdc, 277/480Vac, 35kAIC@480Vac, NEMA 3R Wall Mount Enclosure. **Factory Options Requested:** Circuit Breaker Trip on Normal, Aux Contacts for Source Available and Space Heaters)

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

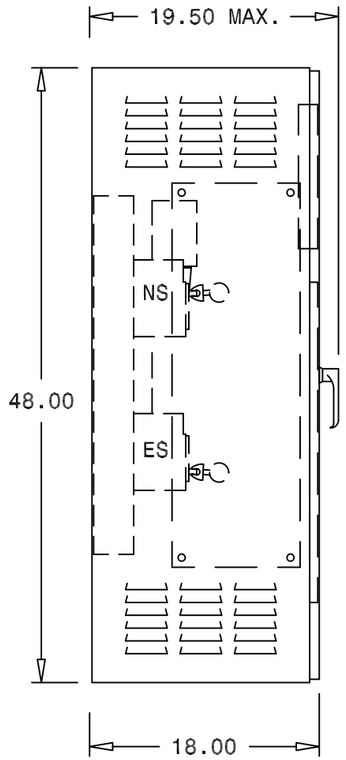
UL LISTED

Made in the USA

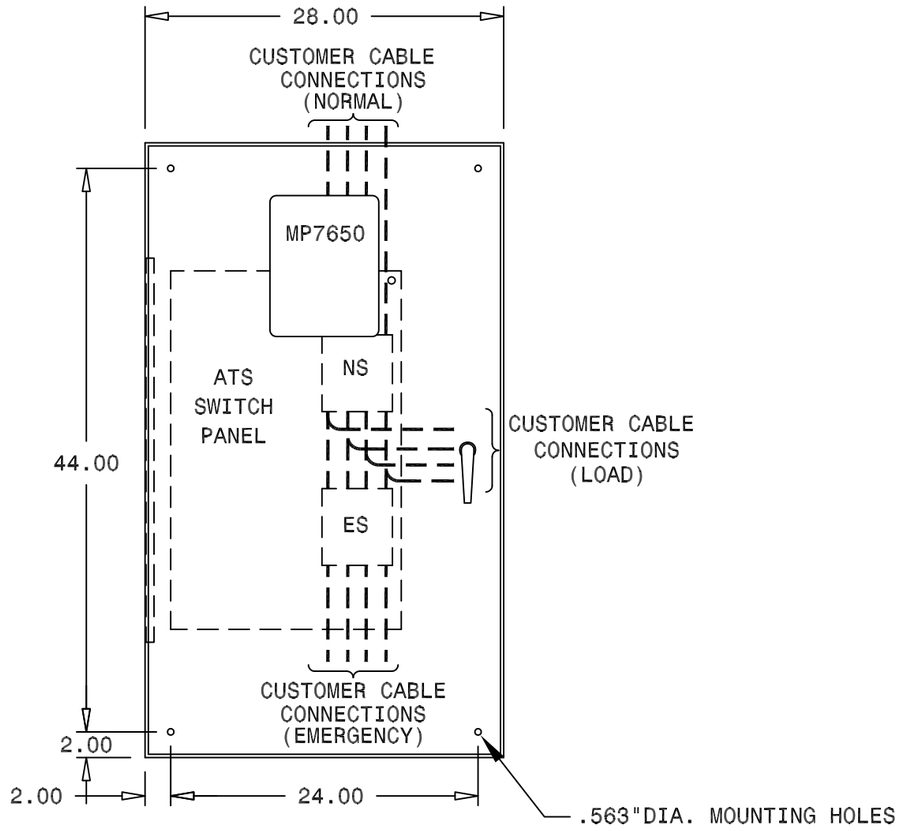
Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

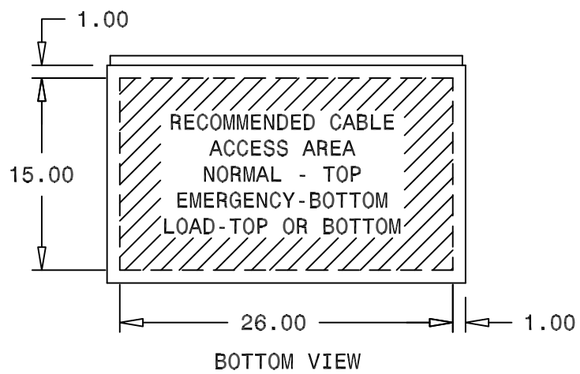
Rev: November 2016



SIDE VIEW



FRONT VIEW



BOTTOM VIEW

OUTLINE NOTES

1) GENERAL ENCLOSURE CONSTRUCTION:
   A) WALL MOUNTED ENCLOSURE
   B) HINGED FRONT DOOR
   C) ESTIMATED SYSTEM WEIGHT: 285 LBS
   D) ALL DIMENSIONS EXPRESSED IN INCHES
   E) FABRICATED FROM 14 GA. STEEL
   F) PAINTED ANSI-61 LIGHT GRAY
   G) KEYLOCKABLE HANDLE
   H) 3-POINT LATCHING
   I) NEMA 1 ENCLOSURE

2) LUG/CONNECTION DATA:
   A) (1) #6-4/0
   B) .25 X 3.00 GROUND BUS WITH (1) #14-1/0

REV	DESCRIPTION	BY	APV	DATE
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

LAKE SHORE ELECTRIC Corp
BEDFORD, OHIO U.S.A.

MC TRANSFER SWITCH OUTLINE
100 AMP WALL MOUNTED

SCALE: 1-12	DRN: --- --/--/--	CHK: --- --/--/--	APV: --- --/--/--

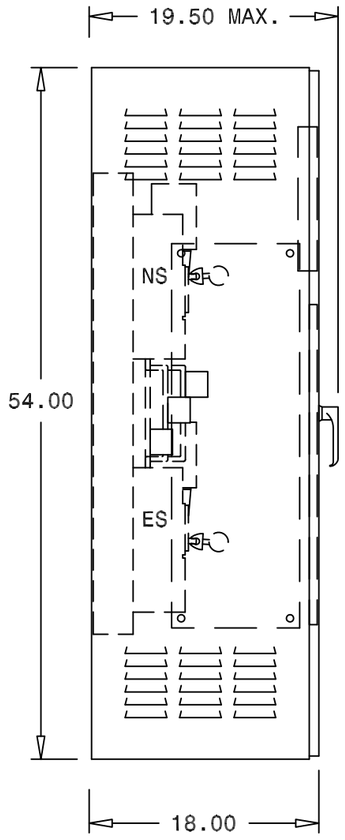
PROJ: -
-

CUSTOMER: -
-
-

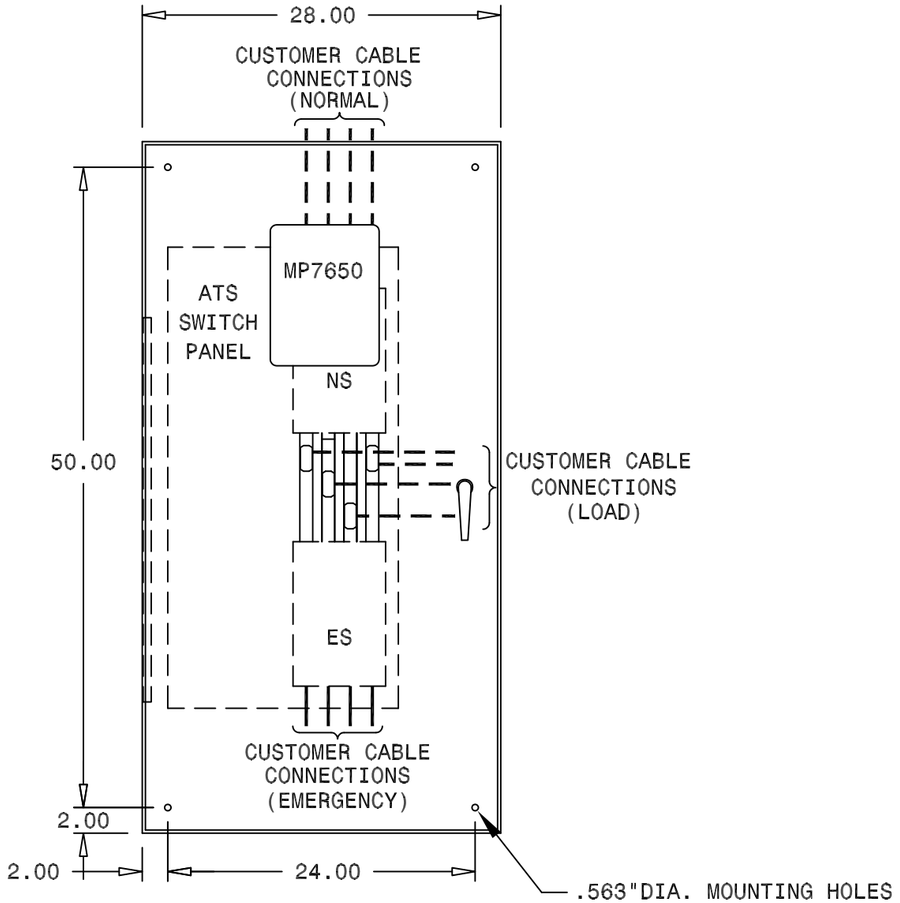
DWG NUMBER 1X1-XXXX-02 -

QUOTE/JOB#: -

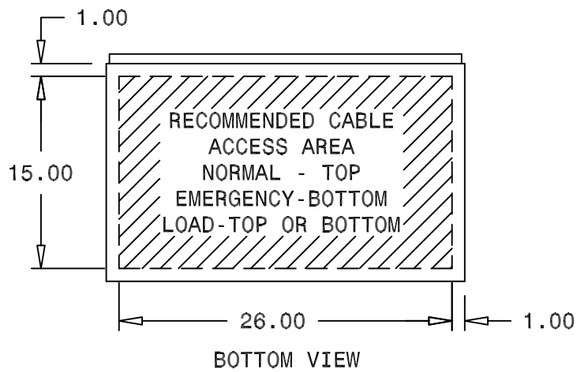
PG 1 OF 1



SIDE VIEW



FRONT VIEW



BOTTOM VIEW

OUTLINE NOTES

1) GENERAL ENCLOSURE CONSTRUCTION:
   A) WALL MOUNTED ENCLOSURE
   B) HINGED FRONT DOOR
   C) ESTIMATED SYSTEM WEIGHT: 340 LBS
   D) ALL DIMENSIONS EXPRESSED IN INCHES
   E) FABRICATED FROM 14 GA. STEEL
   F) PAINTED ANSI-61 LIGHT GRAY
   G) KEYLOCKABLE HANDLE
   H) 3-POINT LATCHING
   I) NEMA 1 ENCLOSURE

2) LUG/CONNECTION DATA:
   A) (1) 2/0-500MCM OR (2) 2/0-250MCM
   B) .25 X 3.00 GROUND BUS WITH (1) #14-1/0

REV	DESCRIPTION	BY	APV	DATE
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

LAKE SHORE ELECTRIC Corp
BEDFORD, OHIO U.S.A.

MC TRANSFER SWITCH OUTLINE
225-400 AMP WALL MOUNT

SCALE: 1-12 | DRN: --- --/--/-- | CHK: --- --/--/-- | APV: --- --/--/--

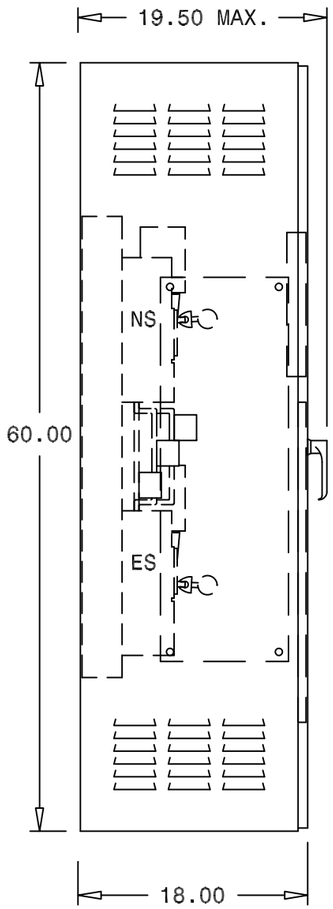
PROJ: -
-

CUSTOMER: -
-
-

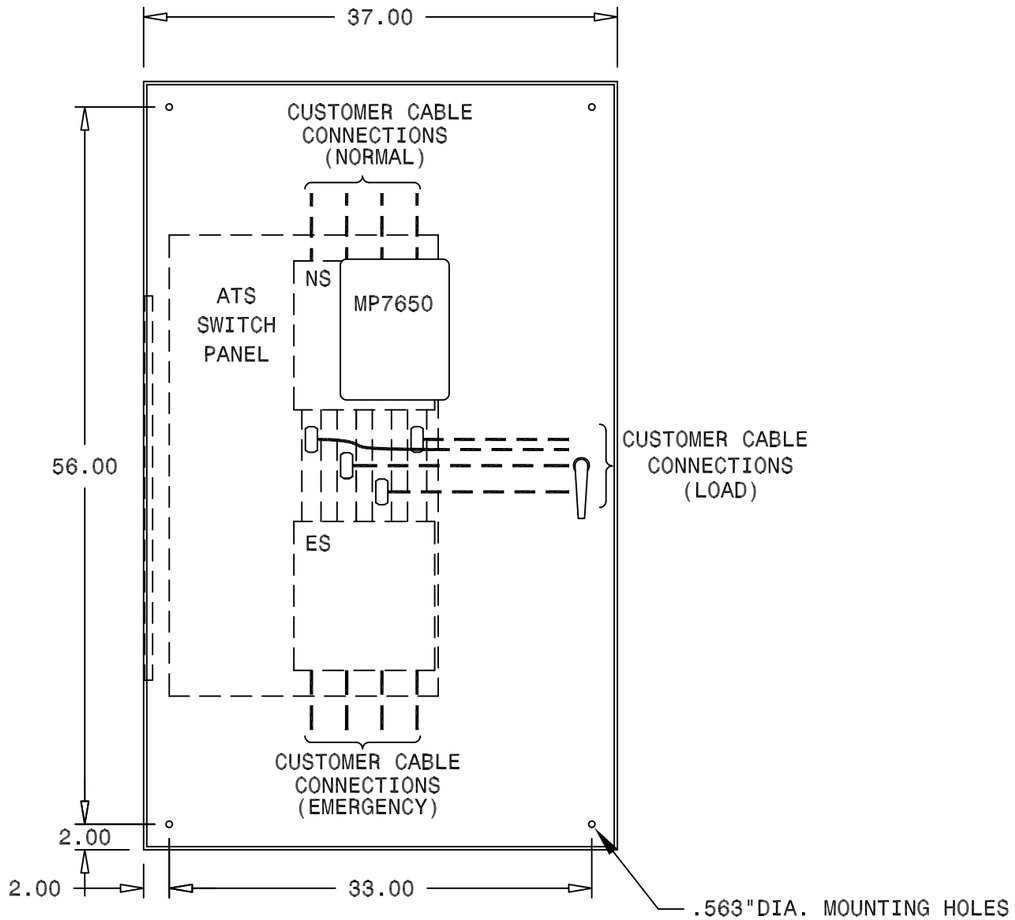
DWG NUMBER 1X1-XXXX-02 -

QUOTE/JOB#: -

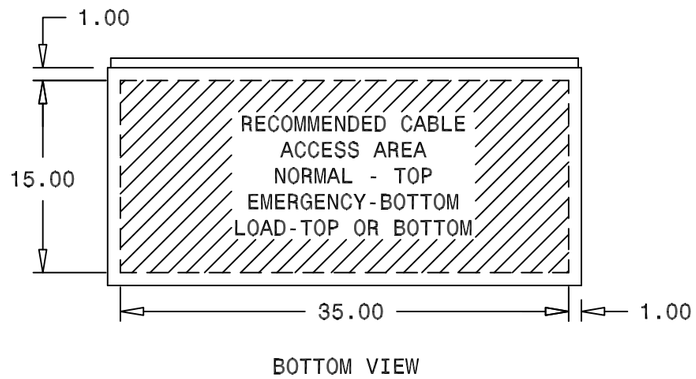
PG 1 OF 1



SIDE VIEW



FRONT VIEW



BOTTOM VIEW

OUTLINE NOTES

1) GENERAL ENCLOSURE CONSTRUCTION:
   A) WALL MOUNTED ENCLOSURE
   B) HINGED FRONT DOOR
   C) ESTIMATED SYSTEM WEIGHT: 415 LBS
   D) ALL DIMENSIONS EXPRESSED IN INCHES
   E) FABRICATED FROM 14 GA. STEEL
   F) PAINTED ANSI-61 LIGHT GRAY
   G) KEYLOCKABLE HANDLE
   H) 3-POINT LATCHING
   I) NEMA 1 ENCLOSURE

2) LUG/CONNECTION DATA:
   A) (2) 400-500MCM
   B) .25 X 3.00 GROUND BUS WITH (1) #14-1/0

REV	DESCRIPTION	BY	APV	DATE
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

LAKE SHORE ELECTRIC Corp
BEDFORD, OHIO U.S.A.

MC TRANSFER SWITCH OUTLINE
600 AMP WALL MOUNT

SCALE: 1-12 | DRN: --- --/--/-- | CHK: --- --/--/-- | APV: --- --/--/--

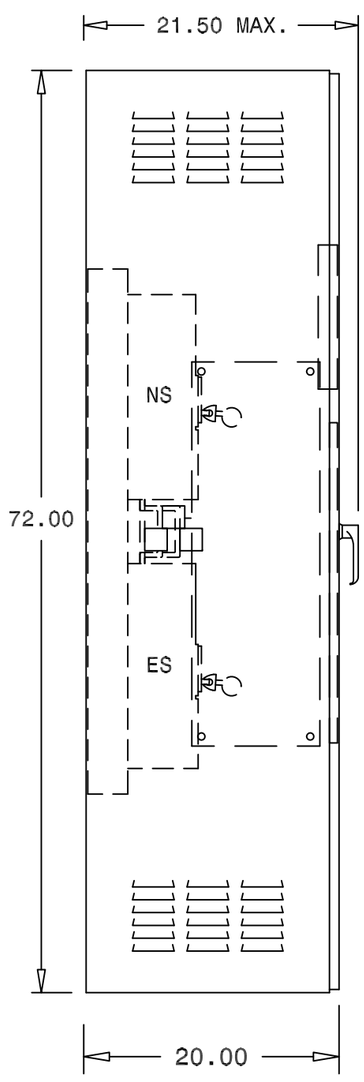
PROJ: -
-

CUSTOMER: -
-
-

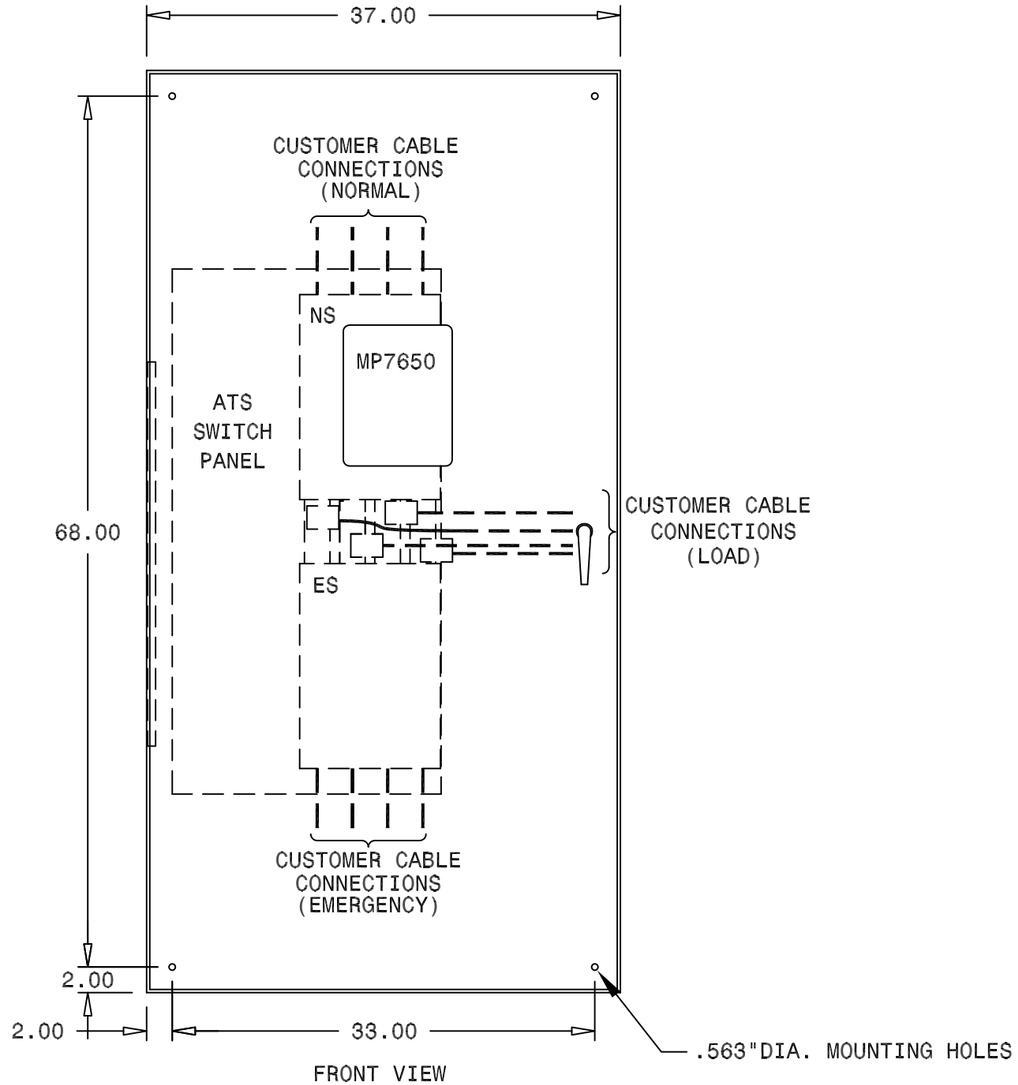
DWG NUMBER 1X1-XXXX-02 -

QUOTE/JOB#: -

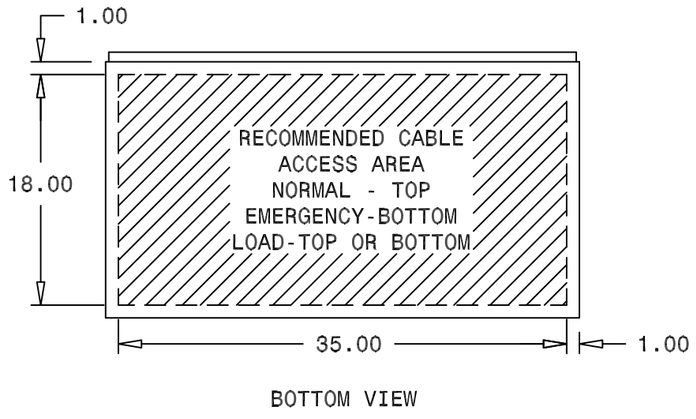
PG 1 OF 1



SIDE VIEW



FRONT VIEW



BOTTOM VIEW

OUTLINE NOTES

1) GENERAL ENCLOSURE CONSTRUCTION:
   A) WALL MOUNTED ENCLOSURE
   B) HINGED FRONT DOOR
   C) ESTIMATED SYSTEM WEIGHT: 570 LBS
   D) ALL DIMENSIONS EXPRESSED IN INCHES
   E) FABRICATED FROM 14 GA. STEEL
   F) PAINTED ANSI-61 LIGHT GRAY
   G) KEYLOCKABLE HANDLE
   H) 3-POINT LATCHING
   I) NEMA 1 ENCLOSURE

2) LUG/CONNECTION DATA:
   A) (3) 500-750MCM
   B) .25 X 3.00 GROUND BUS WITH (1) #14-1/0

REV	DESCRIPTION	BY	APV	DATE
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

LAKE SHORE ELECTRIC Corp
BEDFORD, OHIO U.S.A.

MC TRANSFER SWITCH OUTLINE
800-1200 AMP WALL MOUNT

SCALE: 1-12 | DRN: --- --/--/-- | CHK: --- --/--/-- | APV: --- --/--/--

PROJ: -
-

CUSTOMER: -
-
-

DWG NUMBER 1X1-XXXX-02 -

QUOTE/JOB#: -

PG 1 OF 1

LAKESHORE
ELECTRIC CORPORATION

ENGINEER'S GUIDEBOOK

SWITCHGEAR

LAKESHORE ELECTRIC CORPORATION

Custom Switchgear

Introduction

Lake Shore Electric Corporation has been manufacturing Switchgear since we started business in 1922. No two jobs are ever the same when it comes to Switchgear, which is why we can accommodate most types of generator control applications with both UL and non-UL listed solutions.

We are dedicated to providing our customers with the communication and control solutions they have chosen to work with. From simple single engine solutions to more complex switchgear for emergency standby or prime power applications incorporating multiple engine generators and various options such as import/export control, cogeneration, base loading, peak shaving, and/or soft loading and unloading.

The control logic may be programmed into the customized HMI touch screens, or done completely through electromechanical controls. This is truly dependent on the customer preference and requirements. There are examples of some of our software screens on our website page for Custom Switchgear available for review.

Other companies who offer "Off the Shelf" switchgear will not always provide the required solution. And sometimes this solution doesn't always add up to the required cost savings a customer needs to see. Modifying an off-the-shelf product, as opposed to building a custom product is not always the most cost effective option.

Lake Shore Electric offers competitively priced custom switchgear that works with any generator manufacture. Send us your specifications or drawings and we will provide a detailed quote on the customized equipment required. We work with our customers to build to their requirements, not ours.

Lake Shore Electric has decades of successful installations. Here are a few examples…TAKE A LOOK FOR YOURSELF

Description of Operation

Each Switchgear unit is unique and will have a custom description of operation. Wither it be from controlling one, or multiple, generator(s), the switchgear will operate per the customer specifications and not based off of a pre-programmed, "Off the Shelf" unit.

Examples

On the reverse side of this informational sheet, there are several pictorial examples of switchgear Lake Shore Electric has built in the past. This is to offer additional information to our customers on our capabilities and what we may provide for you.

Recommendations

Please consult the factory for further information on the custom equipment required for your project. We offer free consultations and quotes for all custom equipment.

Product Overview

- Custom Built Switchgear per Customer Specifications
- UL 891 Listed or Non-Listed
- Custom Amperage per Customer Specifications
- 100% Rated Equipment
- 100% Rated Copper Bus
- Low or Medium Operating Voltages
- Electromechanical or Programmable Based Controls
- Custom Controls
- Custom Metering
- NEMA 1, 3R, 4, or 4X Enclosures
- Metal Clad Enclosures
- Front and/or Rear Accessible
- Safe Manual Transfer Under Load

Software Product Options

- Setting Up the Automatic Exerciser Controls
- Read / Log Alarm and Event Histories
- Adjust Timer Settings
- Perform Automatic Load Shed Functions
- Read / Log Metering Data
- Basic Operator Login Security
- Custom Controls
- Revenue Metering

LAKESHORE ELECTRIC CORPORATION

MBE CERTIFIED

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: November 2016

LAKESHORE ELECTRIC CORPORATION

LAKESHORE ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

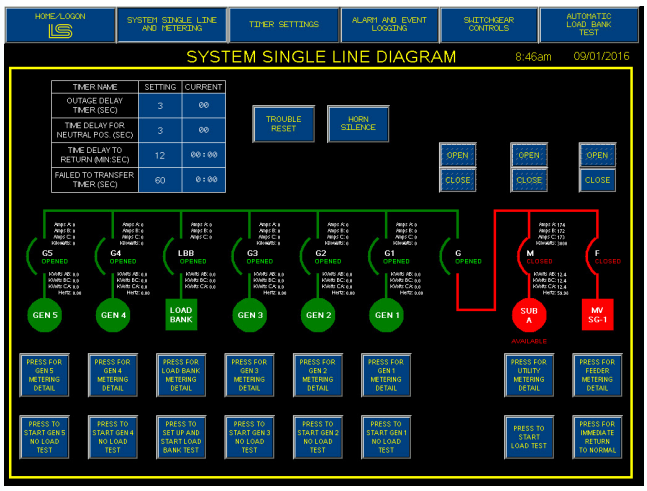
Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Advanced Control System

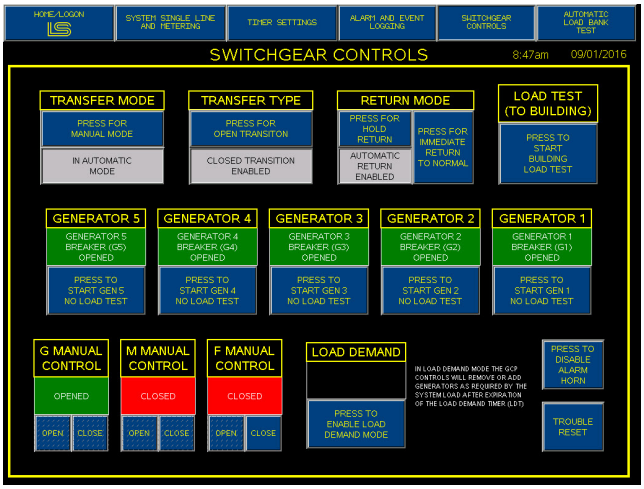
Endless Options of Controls and Data at Your Fingertips

- Interactive Single Lines - Switchgear Controls - Generator Controls - Breaker Controls - Alarm and Event History - Automatic Exerciser - Metering Information - Timer Adjustments - Automatic Load Shedding - Security - Protection - Engine Monitoring - Load Bank- Custom Screen Designs for All Applications

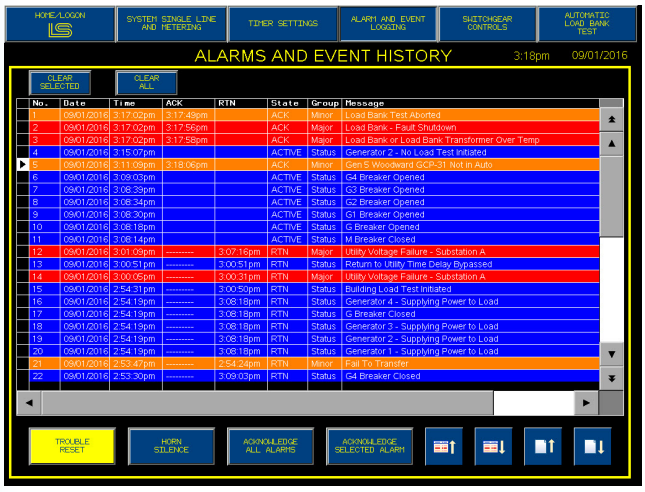


Interactive Single Line

(Showing Standby Generator Application)



Switchgear Controls



Alarms and Event History

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

Made in the USA

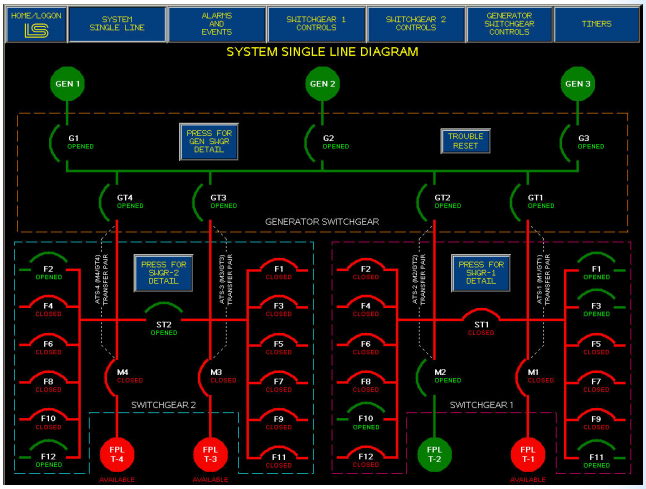
Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

LAKESHORE
ELECTRIC CORPORATION

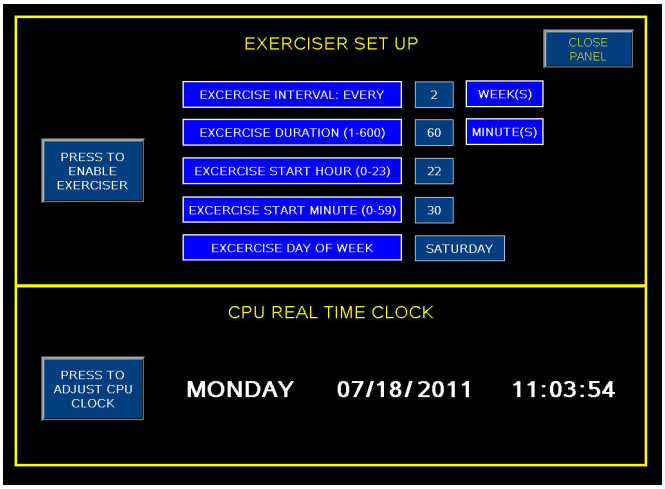
Single Line

(Showing Main-Tie-Main Application)



Timer Adjustment

Automatic Exerciser



LAKESHORE
ELECTRIC CORPORATION

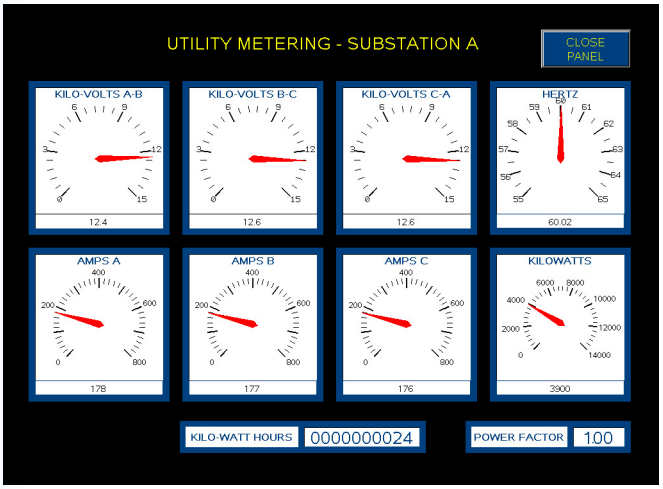
MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

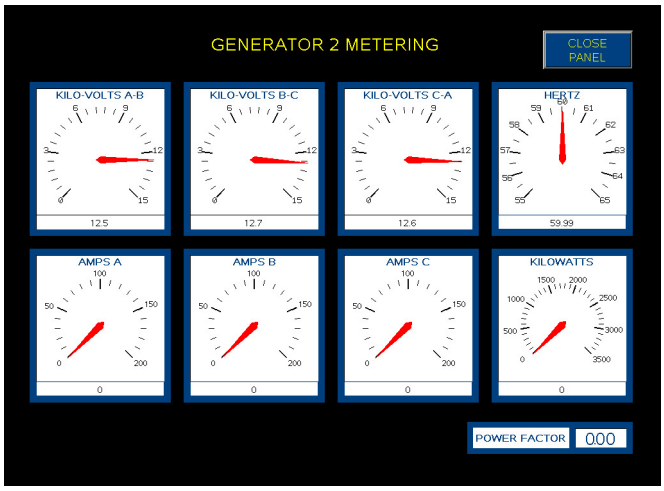
Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

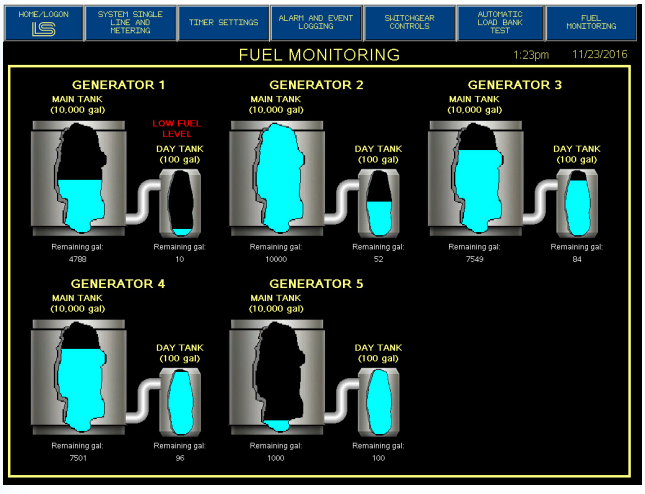
LAKESHORE
ELECTRIC CORPORATION



Utility Metering

Generator Metering





Engine Parameters

(Showing Fuel Monitoring)

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

Made in the USA

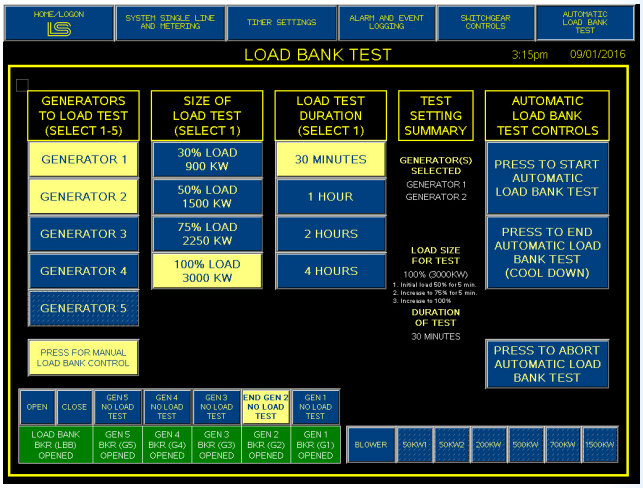
Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

LAKESHORE
ELECTRIC CORPORATION

Load Bank Controls

(Manual or Automatic Testing)



Security Logon

(Configurable for Multiple Levels)

IO Summary Screen

(Real Time PLC I/O Monitoring)

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

LAKESHORE
ELECTRIC CORPORATION

ENGINEER'S GUIDEBOOK

UTILITY METERING TRANSFORMER CABINET

LAKESHORE
ELECTRIC CORPORATION

Utility Metering Transformer Cabinet

Introduction

Lake Shore Electric Metering Transformer Cabinets are UL Listed and Utility Company Compliant. They provide a safe, convenient and standardized method to install, test and maintain the following equipment:

- Current Transformers
- Potential (Voltage) Transformers

Typically, services over 400 Amps are required to have a conforming enclosure to house Utility provided metering current transformers. The Lake Shore Electric Utility Metering Transformer Cabinet provides the solution.

Product Features

- UL 414 Listed
- 100% Rated Copper Bus
- Ampacity Range: 800 thru 4000A
- Top or Bottom Entry/Exit
- NEMA 1, 3R, & 3R Stainless Enclosures Available
- Standardized bus bar arrangement with removable center link. (4" Width Standard) For use with donut type current transformers.
- Bar Type Current Transformers are Installed in Place of Removable Links
- Standard cabinets have split, hinged doors with removable center post.

Factory Options

- Utility Compliance: Specify When Ordering
- Custom Mechanical Lugs: Specify When Ordering
  - Wire Range
  - # of Cables
  - Line or Load Side or Both

Accessories

- 18" Floor Stands for JCTC & MCTC Model Wall Mount Enclosures

Recommendations

The CT Cabinets are capable of other configurations outside the standard setup. Please consult the factory for further information on equipment outside the standard packages.

Here are Some Customized Examples

- Mounting Panel
- Z-Brackets
- Channel Style
- Enclosure Only

CT Cabinet Order Guide

JCTC	- - - -	-	-	0	0	0	0

MODEL SERIES	CURRENT RATING
JCTC	0800 = 800 Amps
MCTC	1000 = 1000 Amps 1200 = 1200 Amps
SCTC	2000 = 2000 Amps 3000 = 3000 Amps 4000 = 4000 Amps

CUSTOMER CONNECTIONS
M = Mechanical Lugs
N = NEMA Hole Pattern

ENCLOSURE TYPE
A = NEMA 1 Wall Mount
B = NEMA 1 Freestanding[2]
E = NEMA 3R Wall Mount
F = NEMA 3R Freestanding[2]
K = NEMA 3R Wall Mount Stainless
L = NEMA 3R Freestanding Stainless[2]

FOR FUTURE USE

[2] For SCTC Models Only

Part Number Example: MCTC1200NA0000 (Model MCTC, 1200 Amps, NEMA 2 Hole Pattern, in a NEMA 1 Wall Mount Enclosure; No Options Selected)

CT CABINET SPECIFICATIONS

Model Prefix	Ampacity Rating	kAIC Rating 480V	Dimensions H x W x D (inches)	Customer Connections	
				Mechanical Lugs (MCM)	NEMA 2 Hole
JCTC	800A	50	60x42x12	(2) #2-500	2
MCTC	1200A		66x48x18	(4) 4/0-500	4
SCTC	2000A	50	84x48x18	(8) 300-600	6
	3000A			(12) 300-600	10
	4000A	100*			

* 100kAIC Rating Applies to SCTC 4000 Amp Model Only

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

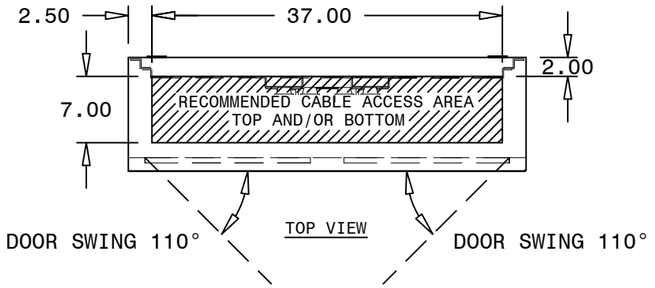
UL LISTED

Made in the USA

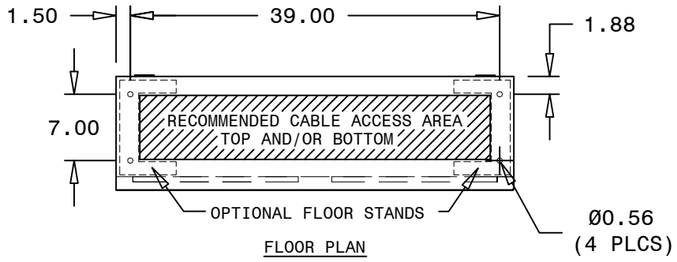
Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: December 2016



TOP VIEW



FLOOR PLAN

NOTES:

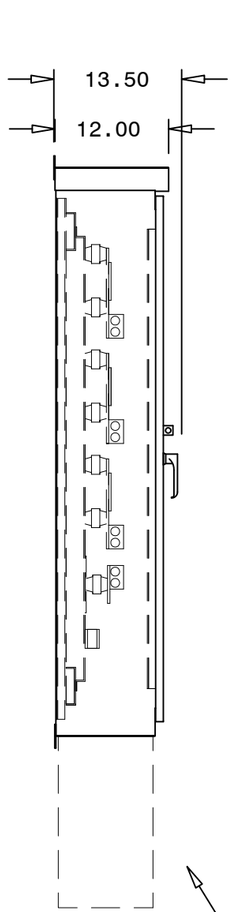
1. WALL MOUNTED ENCLOSURE (14 GA STEEL)
   FREE STANDING WITH OPTIONAL FLOOR STANDS
2. FINISH: ANSI 61 LIGHT GRAY (EXCEPT STAINLESS)
3. DOUBLE FRONT DOORS WITH STAINLESS STEEL HINGES
4. DOOR STOPS PROVIDED ON EACH DOOR
5. 3-POINT LATCHING PADLOCKABLE DOOR HANDLE
6. GASKETED DOOR (3R ONLY)
7. UTILITY SEAL PROVISION
8. ESTIMATED SYSTEM WEIGHT: 400 LBS
9. ALL DIMENSIONS EXPRESSED IN INCHES
10. SHORT CIRCUIT CURRENT RATING: 50kAIC (480V)
11. UL414 LISTED "METERING TRANSFORMER CABINET"
12. FIRST ENERGY FORM 115 (REV 2007) COMPLIANT

MECHANICAL LUGS:

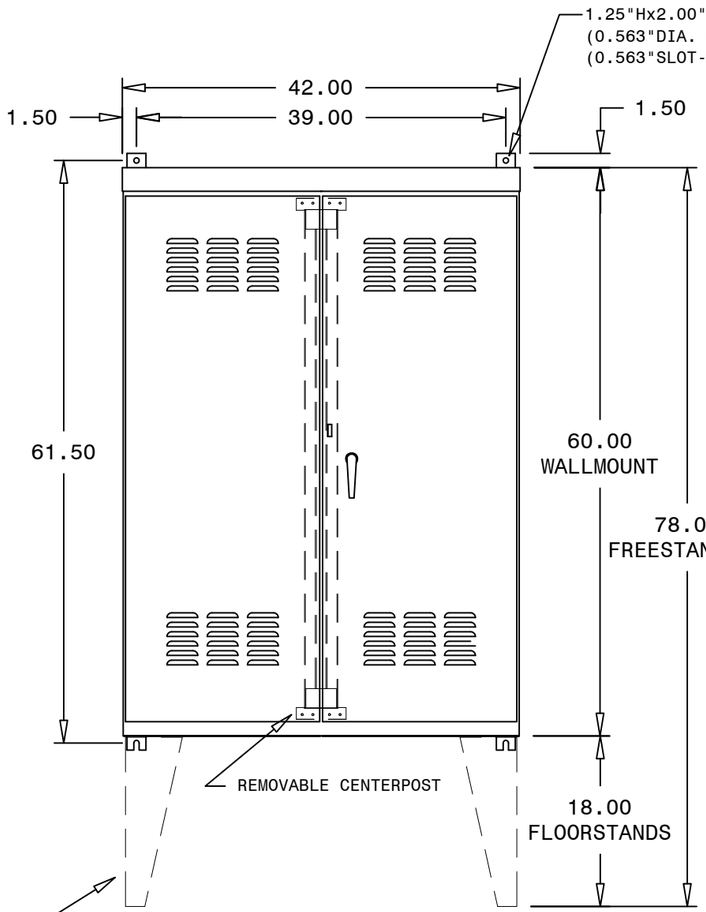
1. (2) #2-600MCM PER PHASE AND NEUTRAL

OPTIONAL NEMA 2 HOLE PATTERN:

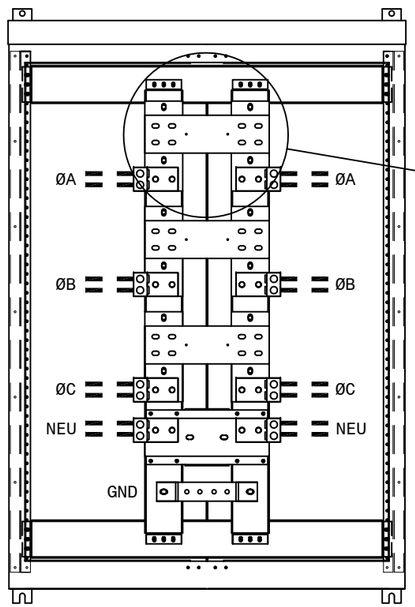
1. (2) CABLES PER PHASE AND NEUTRAL



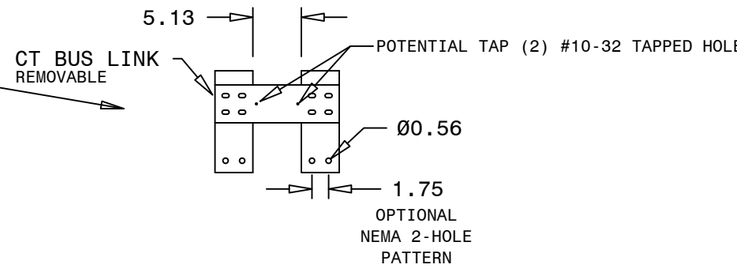
LEFT SIDE VIEW



FRONT VIEW



FRONT VIEW
DOORS AND CENTERPOST REMOVED



REV	DESCRIPTION	BY	APV	DATE
C	CORRECTED NEMA 2-HOLE DIM'S,WIRE RANGE #2-600MCM WAS #2-500MCM	BW	Bjw	06/02/15
B	WIRE RANGE LIMIT WAS 4/0-600MCM	Bjw	Bjw	11/18/10
A	PRODUCT RELEASE	JC	Bjw	04/28/08

LAKE SHORE ELECTRIC Corp
BEDFORD, OHIO U.S.A.

OUTLINE DWG, UTILITY METERING CABINET
MODEL SERIES JCTC, 800 AMPS

SCALE: 1:16 | DRN: JC 7/25/2012 | CHK: CC 7/25/2012 | APV: BJW 7/25/2012

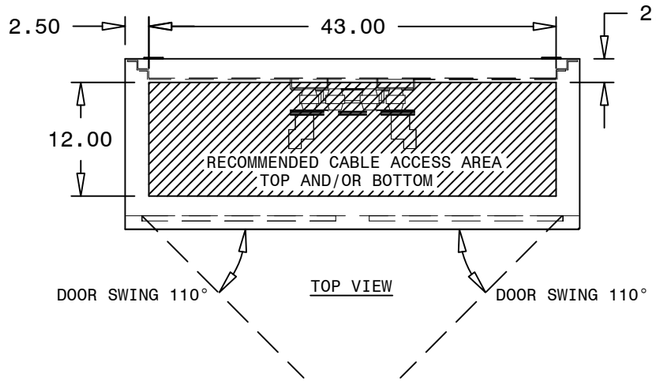
PROJ: -
-

CUSTOMER:
-
-
-

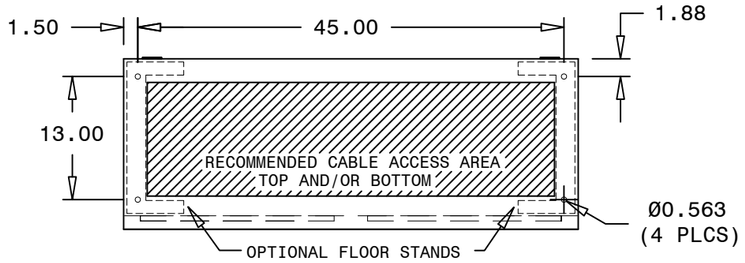
DWG NUMBER: UMC-JCTC0000-0 -

QUOTE/JOB#: -

PG 1 OF 1



TOP VIEW



FLOOR PLAN

NOTES:

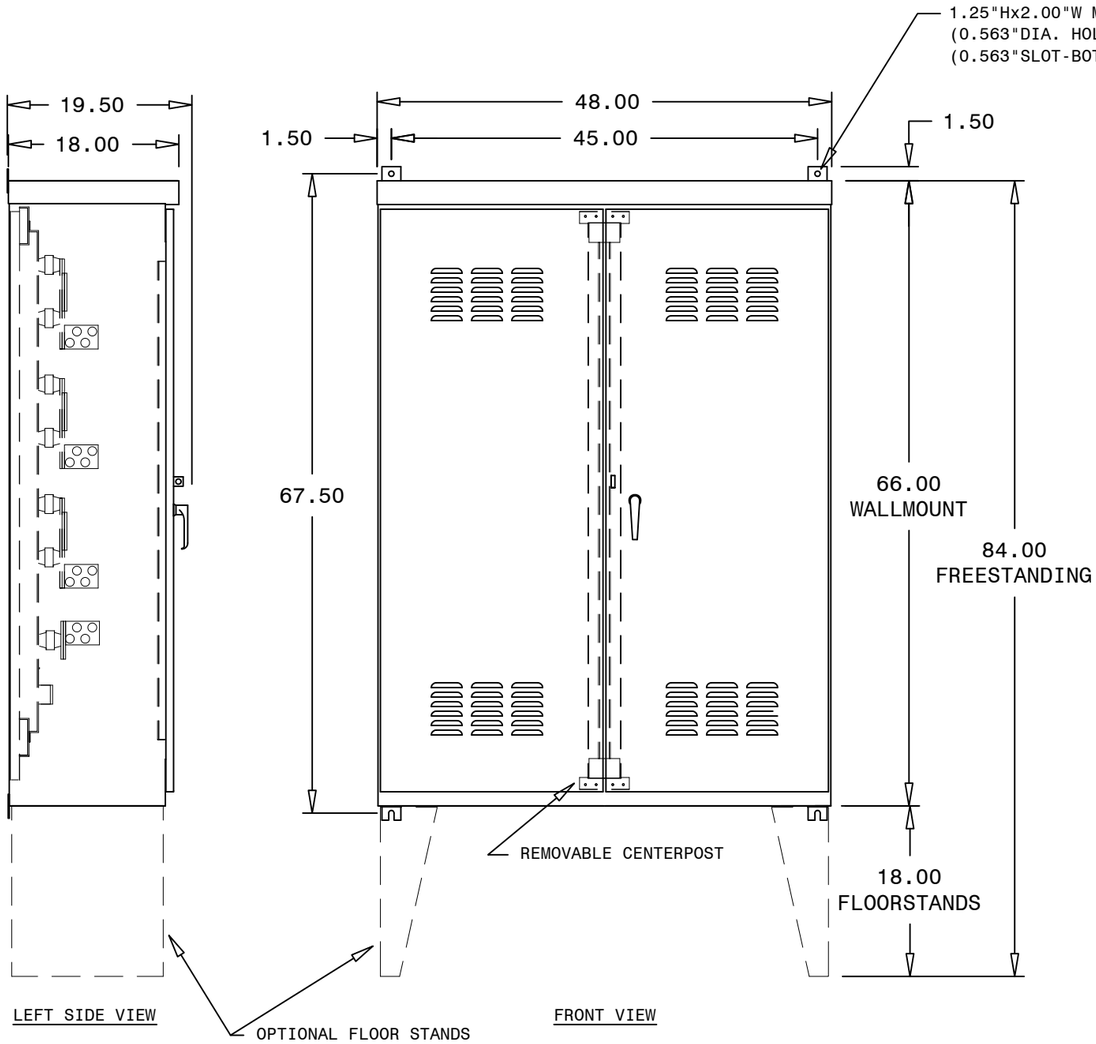
1. WALL MOUNTED ENCLOSURE (14 GA STEEL)
   FREE STANDING WITH OPTIONAL FLOOR STANDS
2. FINISH: ANSI 61 LIGHT GRAY (EXCEPT STAINLESS)
3. DOUBLE FRONT DOORS WITH STAINLESS STEEL HINGES
4. DOOR STOPS PROVIDED ON EACH DOOR
5. 3-POINT LATCHING PADLOCKABLE DOOR HANDLE
6. GASKETED DOOR (3R ONLY)
7. UTILITY SEAL PROVISION
8. ESTIMATED SYSTEM WEIGHT: 500 LBS
9. ALL DIMENSIONS EXPRESSED IN INCHES
10. SHORT CIRCUIT CURRENT RATING: 50kAIC (480V)
11. UL414 LISTED "METERING TRANSFORMER CABINET"
12. FIRST ENERGY FORM 115 (REV 2007) COMPLIANT

MECHANICAL LUGS:

1. (4) 4/0 - 500 MCM PER PHASE AND NEUTRAL

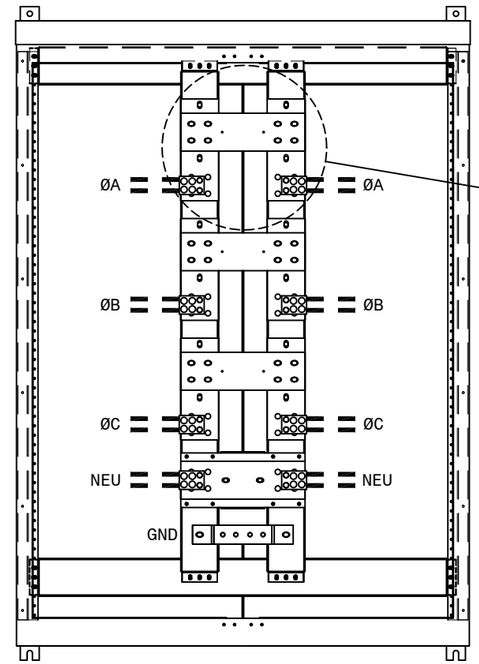
OPTIONAL NEMA 2 HOLE PATTERN:

1. (4) CABLES PER PHASE AND NEUTRAL

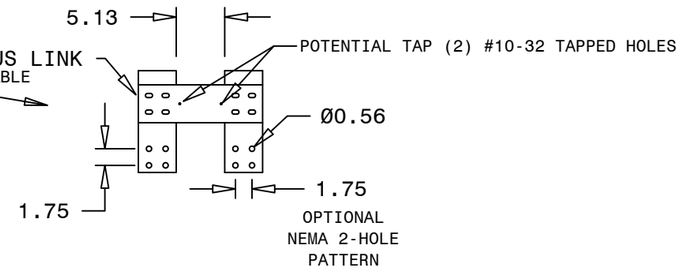


LEFT SIDE VIEW

FRONT VIEW



FRONT VIEW
DOORS AND CENTERPOST REMOVED



REV	DESCRIPTION	BY	APV	DATE
C	MECH LUG CABLE RANGE WAS 4/0-600MCM	BW	Bjw	02/19/15
B	WIRE RANGE LIMIT WAS 4/0-500MCM	Bjw	Bjw	11/18/10
A	PRODUCT RELEASE	JC	Bjw	04/28/08

LAKE SHORE ELECTRIC Corp
BEDFORD, OHIO U.S.A.

OUTLINE DWG, UTILITY METERING CABINET
MODEL SERIES MCTC, 1000-1200 AMPS

SCALE: 1:16 | DRN: JC 7/25/2012 | CHK: CC 7/25/2012 | APV: BJW 7/25/2012

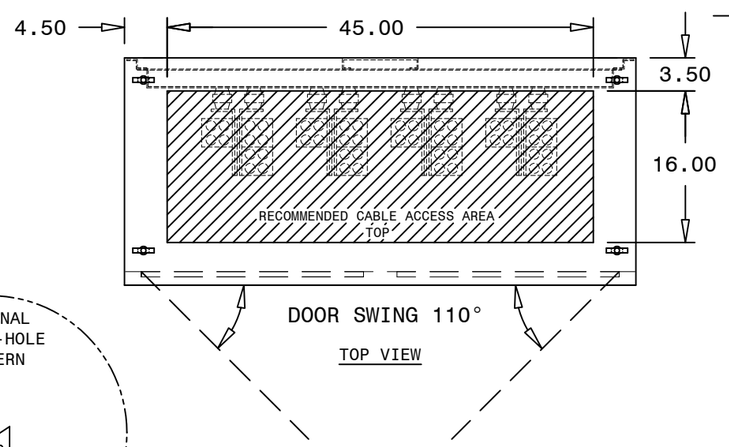
PROJ: -
-

CUSTOMER:
-
-
-

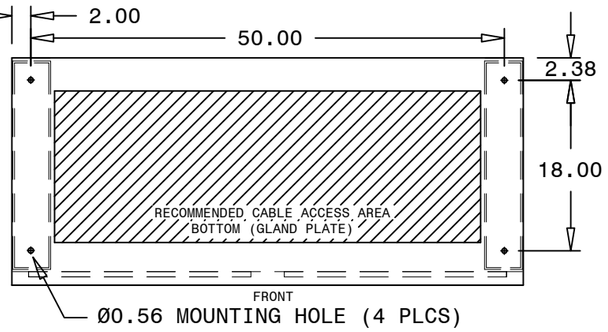
DWG NUMBER: UMC-MCTC0000-0 -

QUOTE/JOB#: -

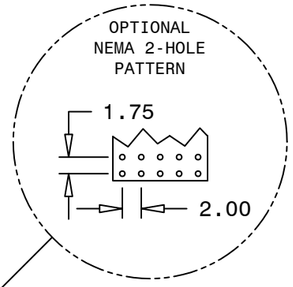
PG 1 OF 1

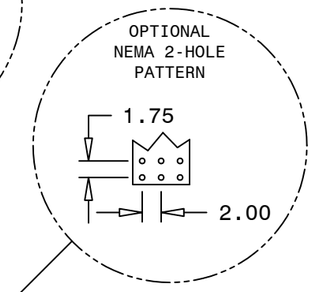


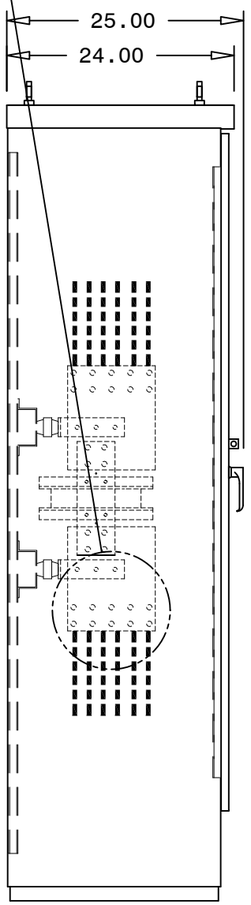
TOP VIEW



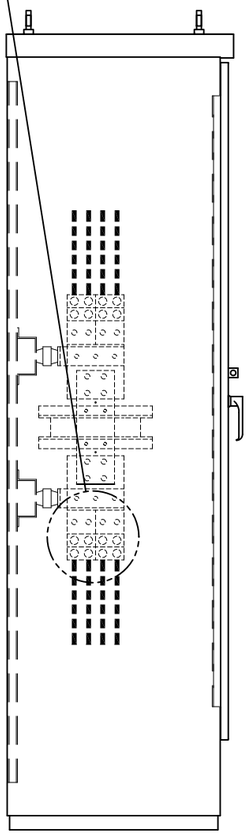
FLOOR PLAN



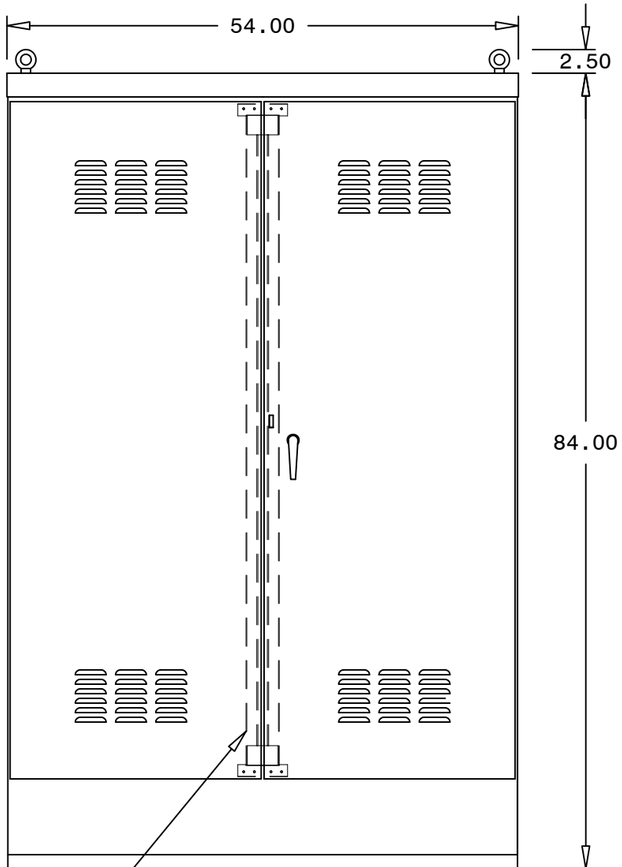




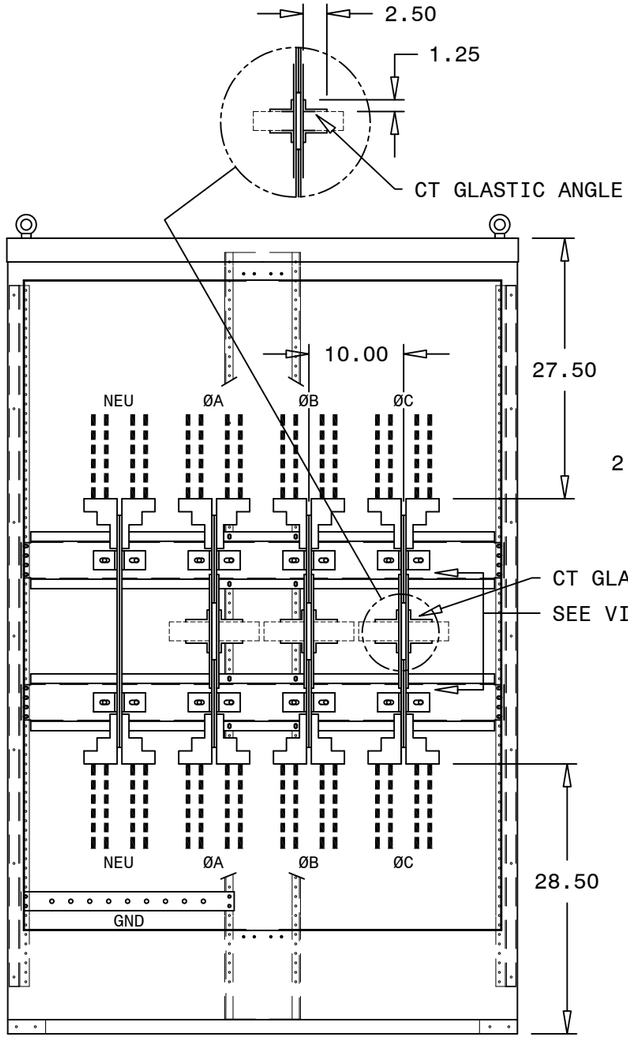
LEFT SIDE VIEW
2500-4000 AMPS
NEMA 2 HOLE ONLY



LEFT SIDE VIEW
1600-2000 AMPS
2500-4000 AMPS W/ LUGS ONLY



FRONT VIEW



FRONT VIEW
FRONT DOORS AND CENTERPOST REMOVED
(3000 AMP W/ LUGS SHOWN ABOVE)

NOTES:

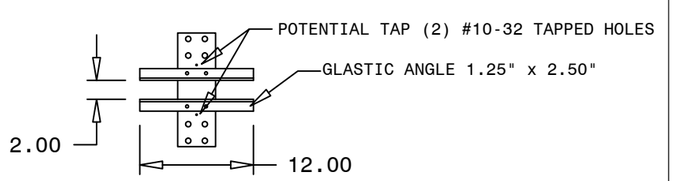
1. FREE STANDING ENCLOSURE (14 GA STEEL)
2. FINISH: ANSI 61 LIGHT GRAY (EXCEPT STAINLESS)
3. DOUBLE FRONT DOORS WITH STAINLESS STEEL HINGES
4. DOOR STOPS PROVIDED ON EACH DOOR
5. 3-POINT LATCHING PADLOCKABLE DOOR HANDLE
6. GASKETED DOOR (3R ONLY)
7. UTILITY SEAL PROVISION
8. ESTIMATED SYSTEM WEIGHT: 600 LBS
9. ALL DIMENSIONS EXPRESSED IN INCHES
10. SHORT CIRCUIT CURRENT RATING:
    1600-3000 AMPS: 50 KAIC (480V)
    4000 AMPS: 100 KAIC (480V)
11. UL 414 LISTED "METERING TRANSFORMER CABINET"
12. FIRST ENERGY FORM 115 (REV 2007) COMPLIANT

MECHANICAL LUGS:

1. 1600 - 2000A
   (8) 300 - 800 MCM PER PHASE AND NEUTRAL
2. 2500 - 4000A
   (12) 300 - 800 MCM PER PHASE AND NEUTRAL

OPTIONAL NEMA 2 HOLE PATTERN:

1. 1600 - 2000A
   (6) CABLES PER PHASE AND NEUTRAL
2. 2500 - 4000A
   (10) CABLES PER PHASE AND NEUTRAL



CT BUS LINK
REMOVABLE

REV	DESCRIPTION	BY	APV	DATE
E	CORRECTED LUG RANGE, WAS 300-600mcm	BW	Bjw	06/01/15
D	REVISED PER SHEETMETAL CHANGES, NOTE CABLE ACCESS AREA (GLAND PLATE)	LM	CC	04/08/11
C	CORRECTED NOTE 10 KAIC RATING, NOTE WIRE RANGE LIMIT WAS 300-800MCM	Bjw	Bjw	11/18/10
B	REVISED PER BUS CHANGE	JC	Bjw	09/09/08
A	PRODUCT RELEASE	JC	Bjw	04/28/08

LAKE SHORE ELECTRIC Corp
BEDFORD, OHIO U.S.A.

OUTLINE DWG, UTILITY METERING CABINET
MODEL SERIES SCTC, 1600-4000 AMPS

SCALE: 1:16	DRN: CC 03/13/08	CHK: JC 03/14/08	APV: BJW 03/14/08

PROJ: -
-

CUSTOMER:
-
-
-

DWG NUMBER
UMC-SCTC0000-0 -

QUOTE/JOB#: -

PG 1 OF 1

LAKESHORE
ELECTRIC CORPORATION

ENGINEER'S GUIDEBOOK

QUICK CONNECTION CABINET

LAKESHORE
ELECTRIC CORPORATION

Quick Connection Cabinet (QCC)

Introduction

The Lake Shore Electric Corporation Quick Connection Cabinets offer a safe and simple solution to connect a portable generator to a facility distribution system.

Product Features

- ETL Listed to UL 1008 for 400 thru 1200 Amp Models, Pending for Others
- 100% Rated Copper Bus
- Robust Design from 14 Gauge Steel
- NEMA 2 Hole Pattern for Load Connections
- Color Coded Cam-Lok Connections by Voltage
- Padlockable Door Latches
- Powder Coated Enclosure (except SS), ANSI 61 Gray
- Silver Flashed Copper Bus with a Minimum Current Density of 1000 (Amps / In^2)
- Cooper-Crouse-Hinds E1015/16 Series Cam-Loks, Male or Female
- NEMA 3R, 4, 4X & 12 Enclosures in Steel or Stainless ALL Models Only Rated NEMA 3R When in USE

Factory Options

- Custom Design

Accessories

- Floor Stand - QCC0400 thru QCC1200 Series Only
- Mating Cam-Lok Plug & Cable Kits
- Compression Lug Kits
- Cam-Lok Snap Caps

Recommendations

QCC Cabinets are highly customizable. Please consult factory with your specific requirements.

Examples

- Circuit Breaker or Disconnect
- Bus Flanges
- Phase Rotation Monitor
- Kirk Key Interlocks
- Mechanical Lugs

Images show QCC0400 thru QCC1200

QCC Order Guide

QCC	----	-	-	-	0	0	0	0

AMPERAGE
0150 = 150 Amps
0400 = 400 Amps
0800 = 800 Amps
1200 = 1200 Amps
2000 = 2000 Amps
3200 = 3200 Amps
4000 = 4000 Amps

VOLTAGE
A = 120/240 Vac, 1ϕ, 3W, 60Hz
B = 120/208 Vac, 3ϕ, 4W, 60Hz
C = 277/480 Vac, 3ϕ, 4W, 60Hz
D = 120 Vac, 1ϕ, 2W, 60Hz
E = 127/220 Vac, 3ϕ, 4W, 60Hz
F = 240 Vac, 3ϕ, 3W, 60Hz
G = 120/240 Vac, 3ϕ, 4W, 60Hz
J = 440 Vac, 3ϕ, 3W, 60Hz
K = 480 Vac, 3ϕ, 3W, 60Hz
L = 240/415 Vac, 3ϕ, 3W, 60Hz

ENVIRONMENTAL
E = NEMA 3R WALLMOUNT [1]
F = NEMA 3R FREESTANDING [2]
G = NEMA 4, 12 WALLMOUNT [1]
H = NEMA 4, 12 FREESTANDING [2]
I = NEMA 4X WALLMOUNT, 304 STAINLESS [1]
J = NEMA 4X FREESTANDING, 304 STAINLESS [2]
K = NEMA 3R WALLMOUNT, 304 STAINLESS [1]
L = NEMA 3R FREESTANDING, 304 STAINLESS [2]
M = NEMA 4X WALLMOUNT, 316 STAINLESS [1]
N = NEMA 4X FREESTANDING, 316 STAINLESS [2]
P = NEMA 3R WALLMOUNT, 316 STAINLESS [1]
Q = NEMA 3R FREESTANDING, 316 STAINLESS [2]

CAM-LOK GENDER
M = MALE (STANDARD)
F = FEMALE

FOR FUTURE USE

1. QCC0150 thru QCC1200 Series, Wallmount Only
2. QCC2000 thru QCC4000 Series, Freestanding Only

Part Number Example: QCC0400CEM000 (400 Amps, 277/480 Vac, 3ϕ, 4W, 60Hz, NEMA 3R WALLMOUNT, w/Male Cam-Lok Connectors.)

LAKESHORE
ELECTRIC CORPORATION

ETL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

LAKESHORE
ELECTRIC CORPORATION

QCC CABINET SPECIFICATIONS						
Model Prefix	Amp Rating	Enclosure Type	MAX RMS kAIC Rating @ 480V	Dimensions H x W x D (inches)	Permanent Customer Connections	Temporary Connections
					Type	(Qty) per ϕ and Neutral (Neu.), (Qty) per Ground
QCC0150	150A	Wallmount[1]	50	24 x 18 x 12	ME[4] Lugs	(1) #14AWG - 2/0, (1) #14AWG - 2/0	(1) #8AWG - #4AWG, (1) #8AWG - #4AWG
QCC0400	400A	Wallmount[2] Padmounted[2]		36 x 26 x 20 71.75 x 28.38 x 23.50	Nema 2-Hole	(2) 4/0, (1) #3AWG	(1) 4/0 per ϕ and Neu. (1) 4/0 per Ground
QCC0800	800A					(3) 350MCM, (1) 1/0	(2) 4/0 per ϕ and Neu. (1) 4/0 per Ground
QCC1200	1200A					(4) 350MCM, (1) 3/0	(3) 4/0 per ϕ and Neu. (1) 4/0 per Ground
QCC2000	2000A	Freestanding[3]	65	71.75 x 36.00 x 38.00	Nema 2-Hole	(14) 600MCM, (14) 1/0	(5) 4/0 per ϕ and Neu. (2) 4/0 per Ground
QCC3200	3200A						(8) 4/0 per ϕ and Neu. (2) 4/0 per Ground
QCC4000	4000A						(10) 4/0 per ϕ and Neu. (2) 4/0 per Ground

1. QCC0150 Models are Wallmount Only.
2. QCC0400-1200 Models are Wallmount Only. Order Accessory “18" Floor Stand” when Pad Mounting is required.
3. QCC2000-4000 Models are Freestanding Only.
4. Mechanical Lugs Abbreviation.

Examples

Optional 4000 Amp QCC Box

4000 Amp QCC Box with Custom Bus Connections

Clear Snap Cap

Custom QCC w/Integral Breaker

Bottom Cam-Lok Connections

Standard 400 Amp QCC

LAKESHORE
ELECTRIC CORPORATION

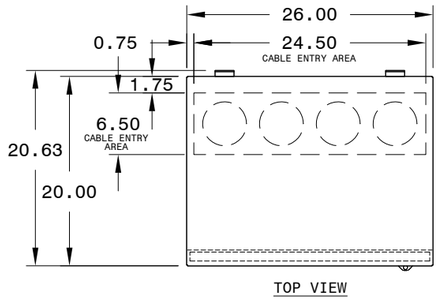
ETL LISTED

Made in the USA

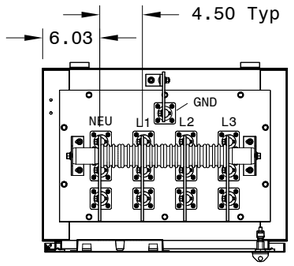
Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

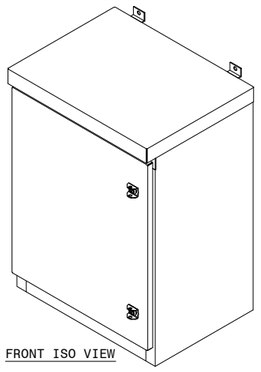
Rev: December 2016



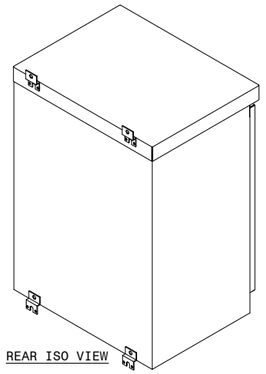
TOP VIEW



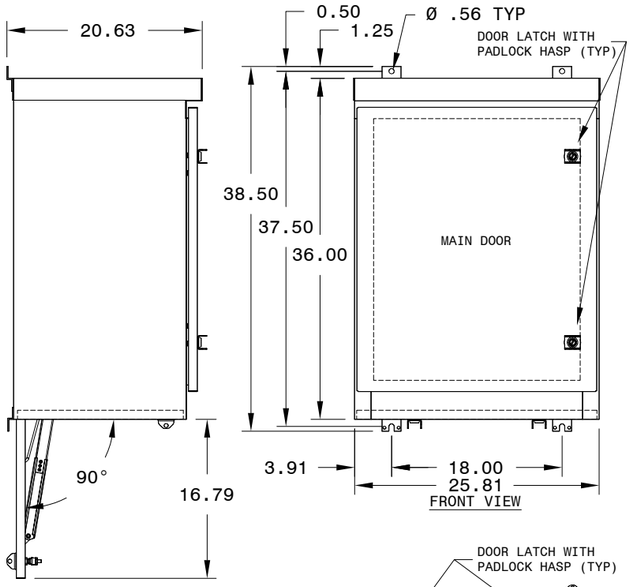
SECTION VIEW D-D



FRONT ISO VIEW

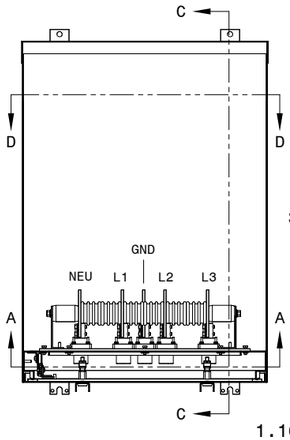


REAR ISO VIEW

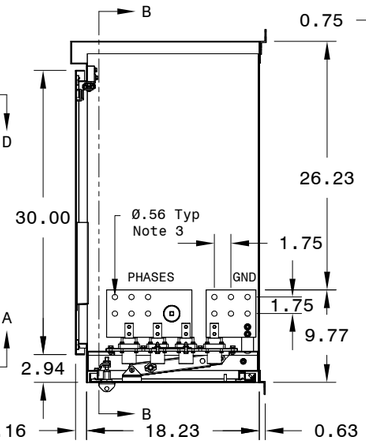


FRONT VIEW

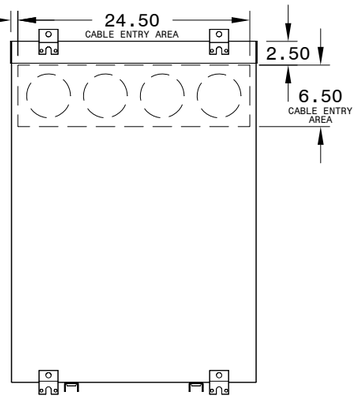
LEFT VIEW
CAM-LOK ACCESS DOOR OPEN



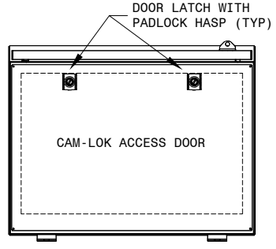
SECTION VIEW B-B



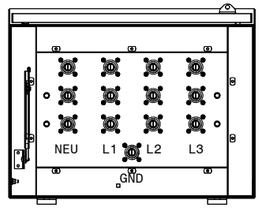
SECTION VIEW C-C



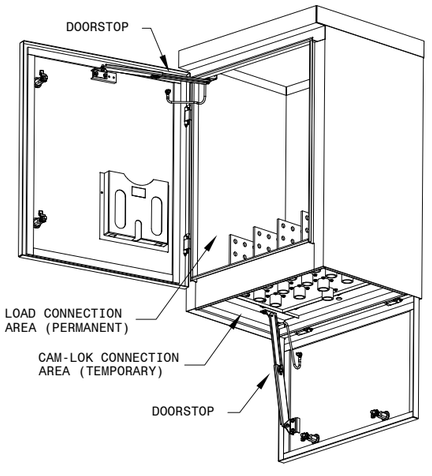
REAR VIEW



BOTTOM VIEW



SECTION VIEW A-A
1200A 3PH 4W CAM-LOK CONFIGURATION SHOWN
Note 4



FRONT ISO VIEW
MAIN AND CAM-LOK
DOORS OPEN

GENERAL SPECIFICATIONS:

1. CABINET: 14 GA BODY, SEAM WELDED, POWDER COATED ANSI 61 LIGHT GRAY (NOT STAINLESS).
   DOORS: FULLY GASKETED, WITH SLOTTED HEAD COMPRESSION LATCHES, DOOR STOPS, AND PROVISIONS FOR PADLOCKING.
2. ENVIRONMENTAL RATING: APPLIES WHEN ALL DOORS LATCHED CLOSED (UNIT NOT IN USE). THE RATING IS NEMA 3R WHEN IN USE (FRONT DOOR LATCHED CLOSED, BOTTOM DOOR OPEN AND MATING CAM-LOKS CONNECTED).
3. OUTPUT BUS: RATED MINIMUM 1000 AMPS/SQ.IN. CURRENT DENSITY. ACCEPTS UP TO (6) 500MCM (MAX) NEMA 2-HOLE COMPRESSION LUGS PER LINE, NEU & GND.
4. CAM-LOKS: COOPER E1016 SERIES, INDIVIDUALLY RATED:
   400 AMPS @600VAC 60Hz WITH MATING CAM-LOK CABLES RATED 105°C MIN
   COLOR CODED PER VOLTAGE CODE SPECIFIED IN MODEL NUMBER DEFINITION.
   QTY PROVIDED PER LINE & NEU: 400A: (1) 800A: (2) 1200A: (3)
   GND: ALL UNITS (1)
5. UNIT WEIGHT: 400LBS
6. SHORT CIRCUIT RATING: 50 kAIC @480VAC 60Hz
7. DIMENSIONS IN INCHES
8. ETL LISTED TO UL1008 (NEMA 4X PENDING)

MODEL NUMBER DEFINITION

Q	C	C								Ø	Ø	Ø	Ø

AMPERAGE

Ø400	400 AMPS
Ø800	800 AMPS
1200	1200 AMPS

VOLTAGE

		CAM-LOCK COLOR	L1	L2	L3	NEU	GND
A	120/240 1PH 3W 60HZ	BLK	RED	-		WHT	GRN
B	120/208 3PH 4W 60HZ	BLK	RED	BLU		WHT	GRN
C	277/480 3PH 4W 60HZ	BRN	ORG	YEL		WHT	GRN
D	120 1PH 2W 60HZ	BLK	RED	-		WHT	GRN
E	127/220 3PH 4W 60HZ	BLK	RED	BLU		WHT	GRN
F	240 3PH 3W 60HZ	BLK	RED	BLU		-	GRN
G	120/240 3PH 4W 60HZ	BLK	RED	BLU		WHT	GRN
J	440 3PH 3W 60HZ	BRN	ORG	YEL		-	GRN
K	480 3PH 3W 60HZ	BRN	ORG	YEL		-	GRN
L	240/415 3PH 4W 60HZ	BRN	ORG	YEL		WHT	GRN

ENVIRONMENTAL [Note 2]

E	NEMA 3R WALLMOUNT
G	NEMA 4,12 WALLMOUNT
I	NEMA 4X WALLMOUNT,304 STAINLESS [Note 8]
K	NEMA 3R WALLMOUNT,304 STAINLESS
M	NEMA 4X WALLMOUNT,316 STAINLESS [Note 8]
P	NEMA 3R WALLMOUNT,316 STAINLESS

CAM-LOK GENDER

M	MALE [STANDARD]
F	FEMALE

FACTORY OPTIONS — See Product Data Sheet for all Available Options

None	0
None	0
None	0
None	0

REV	DESCRIPTION	BY	APV	DATE
.	.	.	.	.

LAKE SHORE ELECTRIC Corp
BEDFORD, OHIO U.S.A.

OUTLINE DWG, QUICK CONNECTION CABINET
MODEL SERIES QCC0400 - QCC1200

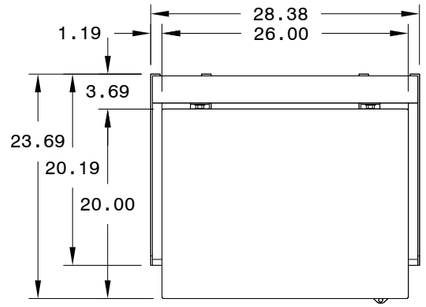
SCALE: 1:16	DRN: BW 10/20/15	CHK: Bjw 10/21/15	APV: Bjw 10/21/15

PROJ: .

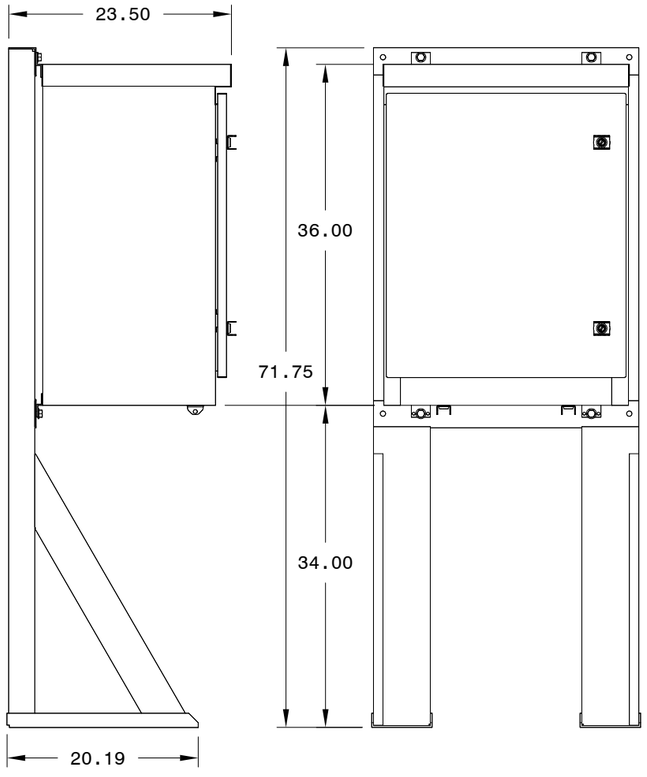
CUSTOMER: .

DWG NUMBER: QCC-0000000-01 A

QUOTE/JOB#: .

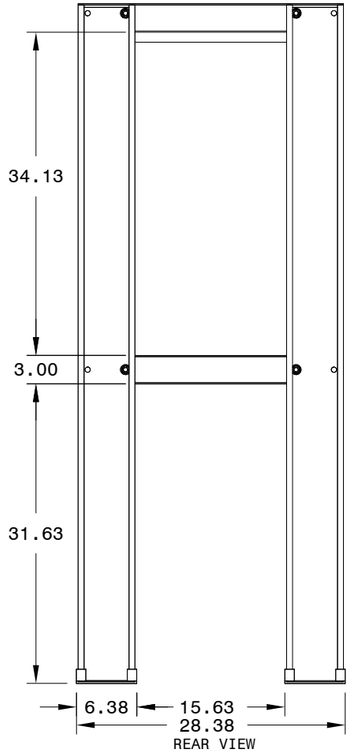


TOP VIEW

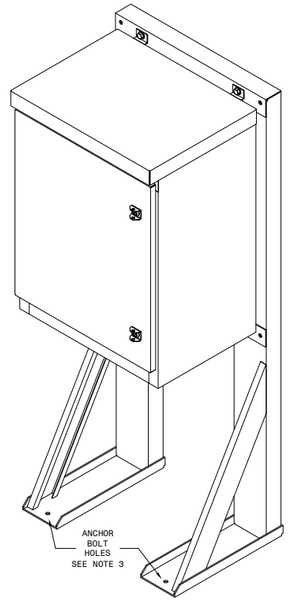


LEFT SIDE VIEW

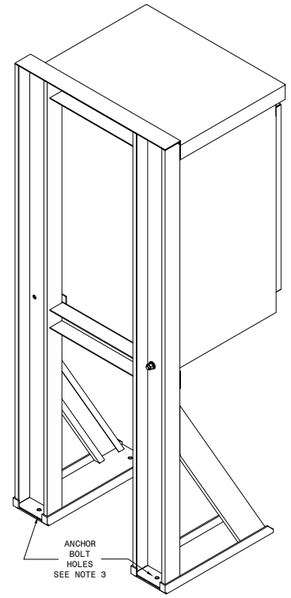
FRONT VIEW



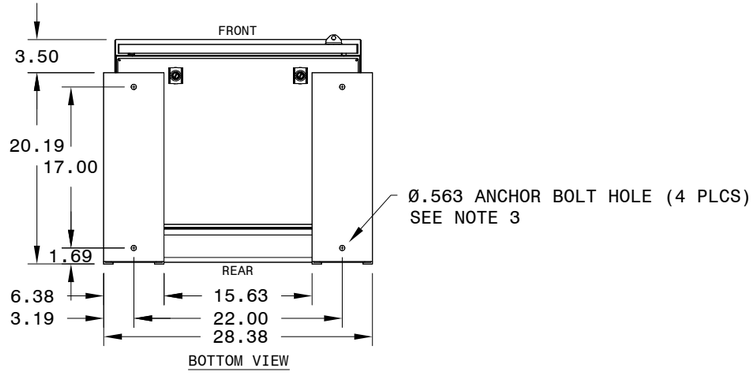
REAR VIEW



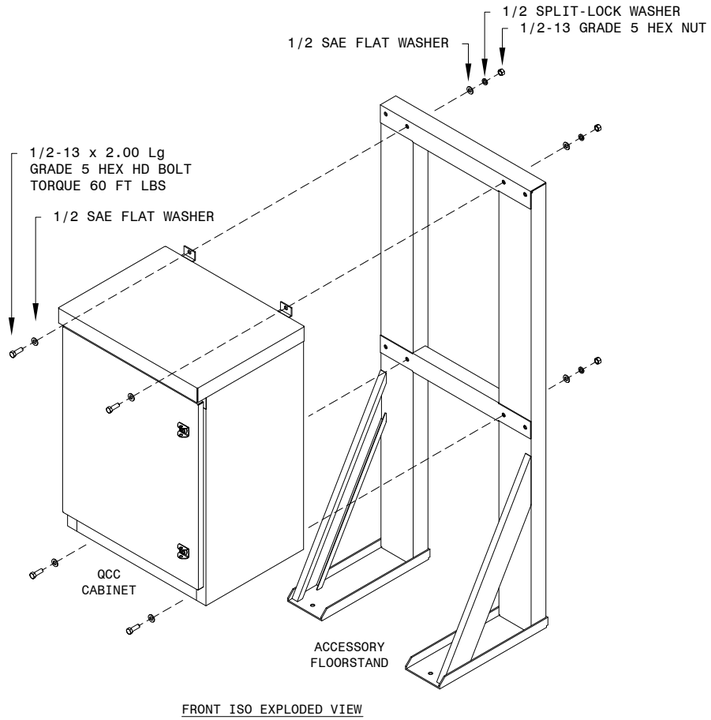
FRONT ISO VIEW



REAR ISO VIEW



BOTTOM VIEW



FRONT ISO EXPLODED VIEW

MODEL NUMBER DEFINITION

Q	C	C								0	0	0	0

MATERIAL MODIFIER

10	STEEL, ANSI 61 GREY
20	304 STAINLESS
21	316 STAINLESS

GENERAL SPECIFICATIONS:

1. CONSTRUCTION: 11 GA WELDED FRAME, POWDER COATED ANSI 61 LIGHT GRAY (NOT STAINLESS)
2. QCC0400-1200 MODEL SERIES CABINET SHOWN FOR ILLUSTRATIVE PURPOSES ONLY AND MUST BE ORDERED SEPERATELY. HARDWARE TO MOUNT THE QCC CABINET TO THE STAND INCLUDED.
3. THIS FLOORSTAND IS NOT INTENDED TO BE FREE-STANDING AND MUST BE SECURED TO THE FLOOR VIA ANCHOR BOLT HOLES AT THE BASE (HARDWARE NOT SUPPLIED).
4. DIMENSIONS IN INCHES
5. UNIT WEIGHT: 100LBS

REV	DESCRIPTION	BY	APV	DATE
.	.	.	.	.

LAKE SHORE ELECTRIC Corp
BEDFORD, OHIO U.S.A.

OUTLINE DWG, ACCESSORY FLOORSTAND
MODEL SERIES QCC0400 - QCC1200

SCALE: 1:16	DRN: BW 11/01/16	CHK: Bjw 11/01/16	APV: Bjw 11/01/16

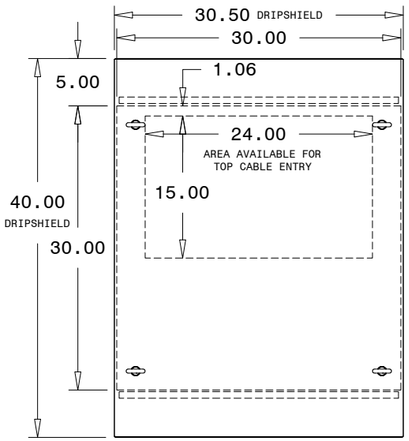
PROJ: .

CUSTOMER: .

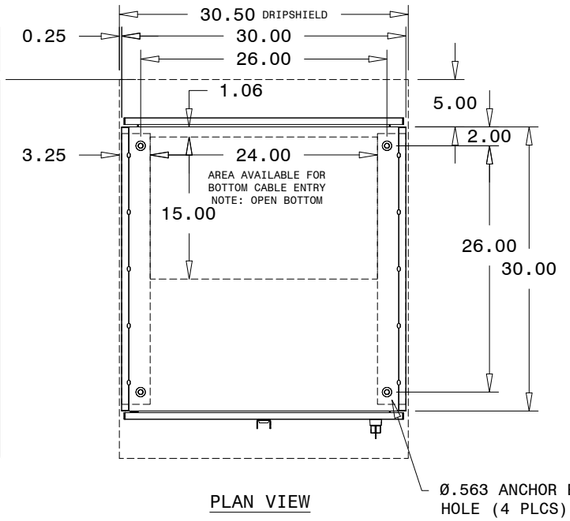
DWG NUMBER: QCA-0000000-01 .

QUOTE/JOB#: .

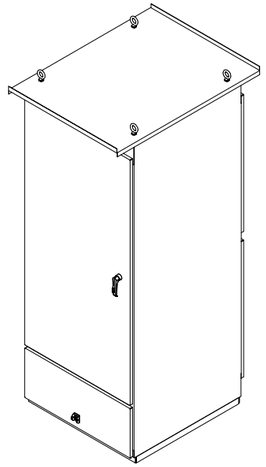
PG 1 OF 1



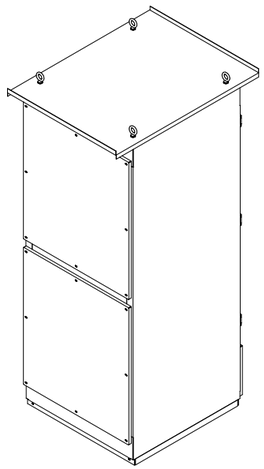
TOP VIEW



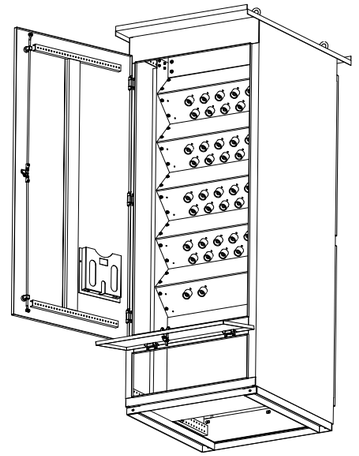
PLAN VIEW



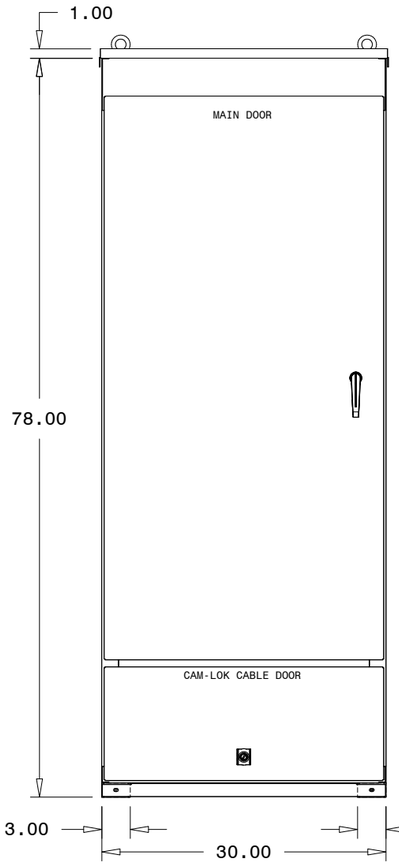
FRONT ISO VIEW



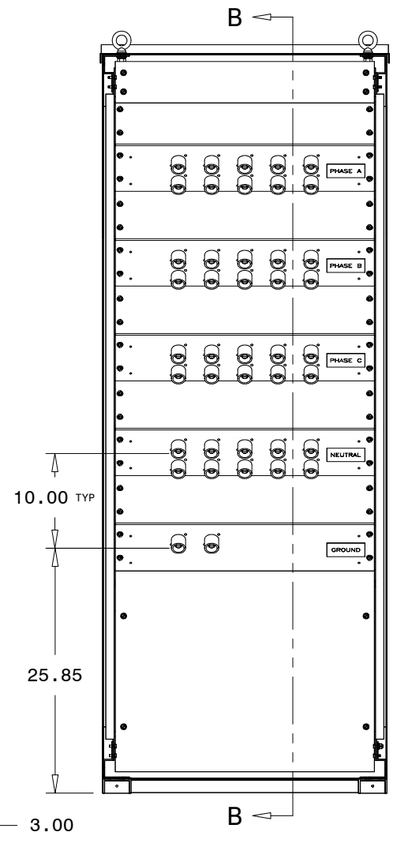
REAR ISO VIEW



FRONT ISO VIEW

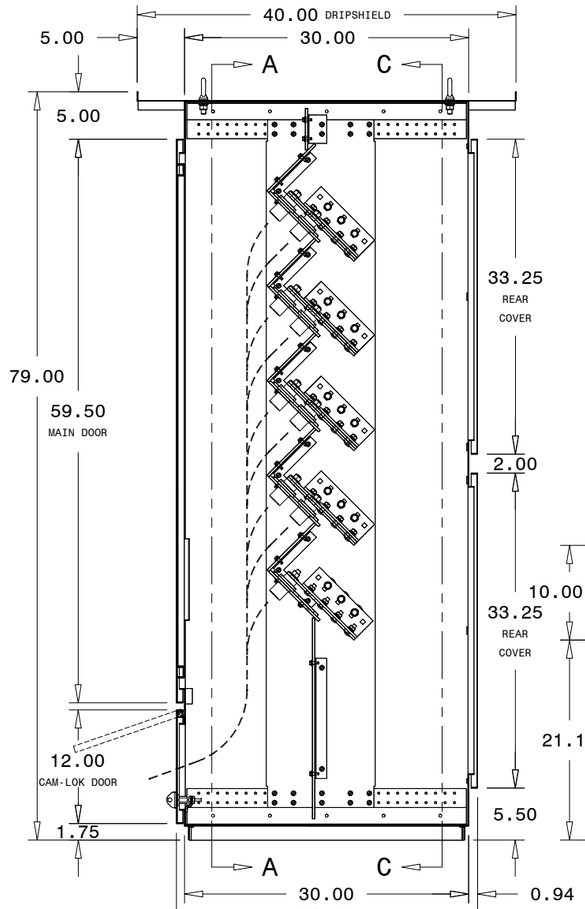


FRONT VIEW

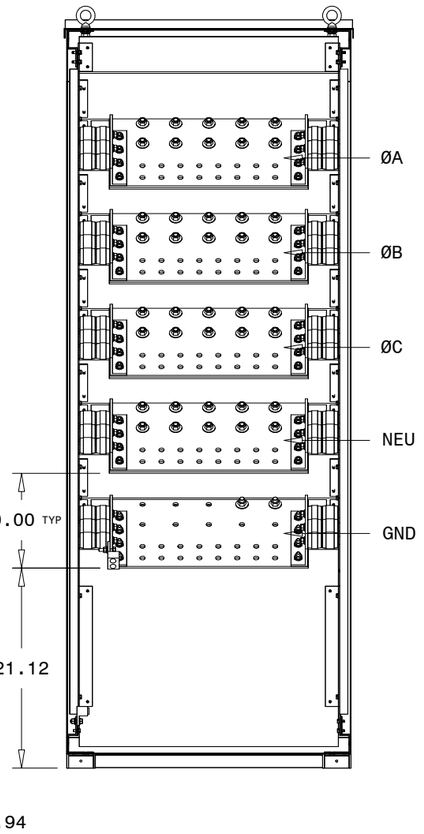


FRONT SECTION VIEW A-A

SECTION VIEW A-A



SIDE SECTION VIEW B-B



REAR SECTION VIEW C-C

MODEL NUMBER DEFINITION

Q	C	C	-	0	0	0	-	-	-	0	0	0	0

AMPERAGE

2000	2000 AMPS
3000	3000 AMPS
4000	4000 AMPS

VOLTAGE

		CAM-LOCK COLOR	L1	L2	L3	NEU	GND
A	120/240 1PH 3W 60HZ	BLK	RED	-	-	WHT	GRN
B	120/208 3PH 4W 60HZ	BLK	RED	BLU	WHT	GRN	
C	277/480 3PH 4W 60HZ	BRN	ORG	YEL	WHT	GRN	
D	120 1PH 2W 60HZ	BLK	RED	-	-	WHT	GRN
E	127/220 3PH 4W 60HZ	BLK	RED	BLU	WHT	GRN	
F	240 3PH 3W 60HZ	BLK	RED	BLU	-	-	GRN
G	120/240 3PH 4W 60HZ	BLK	RED	BLU	WHT	GRN	
J	440 3PH 3W 60HZ	BRN	ORG	YEL	-	-	GRN
K	480 3PH 3W 60HZ	BRN	ORG	YEL	-	-	GRN
L	240/415 3PH 4W 60HZ	BRN	ORG	YEL	WHT	GRN	

ENVIRONMENTAL [Note 2]

D	NEMA 12 FREESTANDING
F	NEMA 3R FREESTANDING
H	NEMA 4 FREESTANDING
J	NEMA 4X FREESTANDING,304 SS
L	NEMA 3R FREESTANDING,304 SS

CAM-LOK GENDER

M	MALE [STANDARD]
F	FEMALE

NOTES:

1. CABINET: 14 GA STEEL ENCLOSURE BODY, SEAM WELDED, POWDER COATED ANSI 61 LIGHT GRAY.
   DOORS: FULLY GASKETED, WITH SLOTTED HEAD COMPRESSION LATCHES, DOOR STOPS, AND PROVISIONS FOR PADLOCKING

2. ENVIRONMENTAL RATING: APPLIES WHEN ALL DOORS ARE LATCHED CLOSED ALL MODELS RATED NEMA 3R WITH THE BOTTOM CAM-LOK DOOR OPEN.

3. OUTPUT BUS: RATED MINIMUM 1000 AMPS/SQ.IN. CURRENT DENSITY. ACCEPTS UP TO (8) 750MCM (MAX) NEMA 2-HOLE COMPRESSION LUGS PER LINE, NEU & GND.

4. CAM-LOKS: COOPER E1016 SERIES, EACH RATED 400 AMPS @600VAC 60H WITH MATING CABLES RATED 105°C, 360 AMPS WHEN <105°C CAM-LOKS COLOR CODED PER VOLTAGE CODE TABLE. QTY PE LINE/NEU: 2000A(5), 3000A(8), 4000A(10), ALL(2) GND

5. UNIT WEIGHT: 750LBS

REV	DESCRIPTION	BY	APV	DATE
-	-	-	-	-

LAKE SHORE ELECTRIC Corp
BEDFORD, OHIO U.S.A.

OUTLINE DRAWING, QCC_000___0000
___/___VAC _Ø _W __HZ ____A

SCALE: -	DRN: --- --/--/--	CHK: . .	APV: . .

PROJ: . .

CUSTOMER: - - -

DWG NUMBER: XXX-XXXX-02

QUOTE/JOB#: -

PG 1 OF 1

LAKESHORE
ELECTRIC CORPORATION

ENGINEER'S GUIDEBOOK

SERVICE PEDESTAL

LAKESHORE
ELECTRIC CORPORATION

Service Pedestals

Introduction

Lake Shore Electric Service Pedestals are designed to provide electrical power distribution to various areas such as parking lots, street lighting, traffic signal control, pump stations, cellular applications, recreational fields, pavilions, etc. These pedestals typically contain a main circuit breaker and a utility meter socket to meter the electrical power usage. They also may contain photocells and/or time clocks and power contactors to automatically control any outdoor lighting panels, power distribution circuits for outdoor receptacles, and other loads as required by the area it is serving.

Please contacts us today for a free consultation

Trust your Service Pedestals and Streetscapes Panels to Lake Shore Electric Corporation, in business since 1922. Our custom configured pedestals offer the following:

Recommendations

The Service Pedestals are capable of other configurations outside of the shown examples. Please consult the factory for further information on this custom equipment.

Product Features and Options

- Custom Built Service Pedestals per Customer Specifications
- UL 508 Listed
- NEMA 1, 3R Stainless Steel or Aluminum Enclosures Available
- All Enclosures Pad Lockable and Gasketed
- Al Pedestals are Dead Front Constructed
- Front and/or Rear Accessible
- Electromechanical Based Custom Controls
- Pedestals are custom configured to your specifications and may include: Disconnects, Panelboards, Contactors, Selector Switch, GFI Receptacle, Photocell Controls, Time Clock Controls, Meter Socket, Space Heater with Thermostat Control, Interior Light with Control Switch, Power Transformer, etc.
- Safe Manual Transfer Under Load
- Custom Amperage per Customer Specifications
- 100% Rated Equipment
- 100% Rated Copper Bus
- 120Vac, 120/208Vac,120/240Vac, 277/480Vac Operating Voltages Available
- Send specifications and/or drawings to the factory for any inquires.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

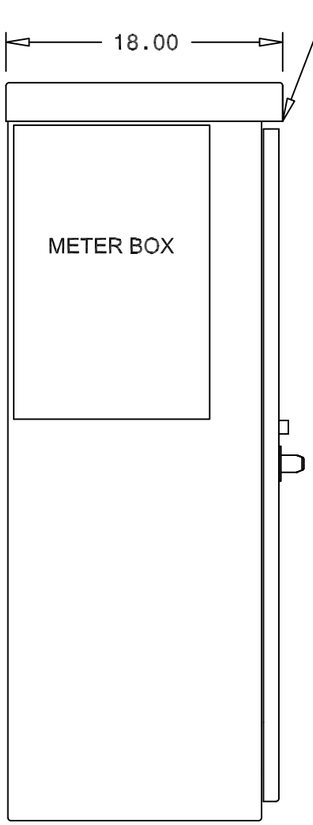
UL LISTED

Made in the USA

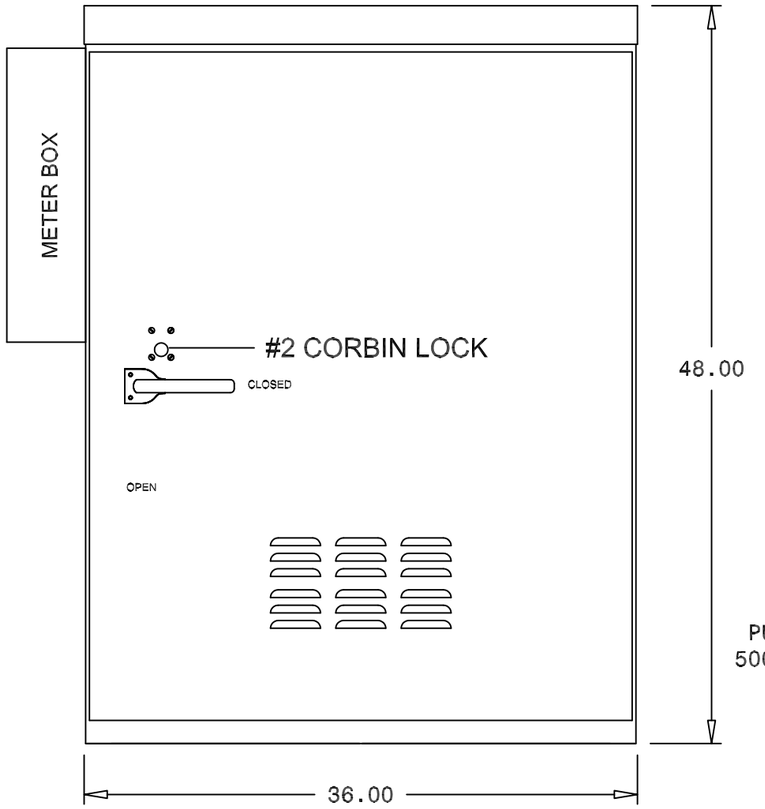
Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

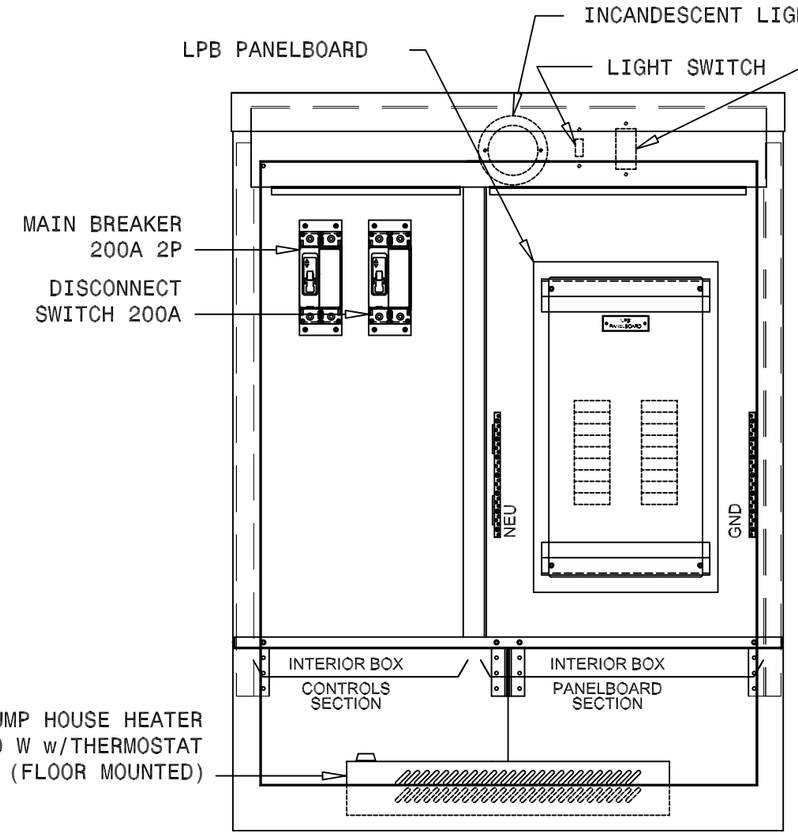
Rev: November 2016



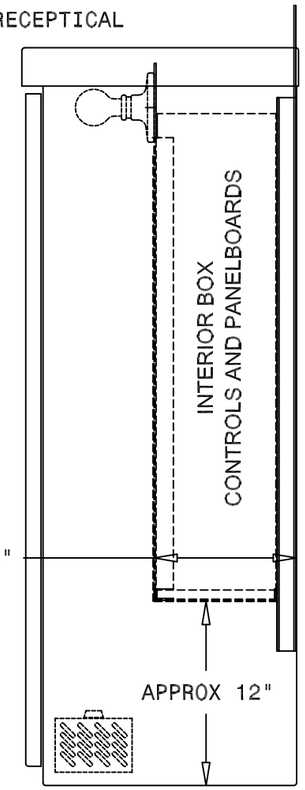
LEFT VIEW



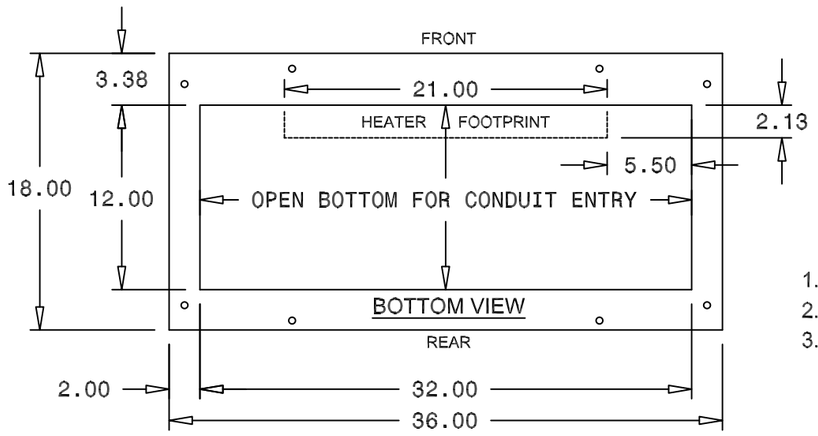
FRONT VIEW



FRONT VIEW
INTERIOR HIDDEN LINE



RIGHT VIEW
INTERIOR HIDDEN LINE



1. NEMA 3R, STAINLESS STEEL ENCLOSURE (PAINTED BLACK)
2. METER BOX PAINTED BLACK
3. SINGLE FRONT DOOR WITH PADLOCKABLE HANDLE

REV	DESCRIPTION	BY	APV	DATE
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

LAKE SHORE ELECTRIC Corp
BEDFORD, OHIO U.S.A.

OUTLINE DRAWING
SERVICE PEDESTAL

SCALE: 1:10 | DRN: --- --/--/-- | CHK: --- --/--/-- | APV: --- --/--/--

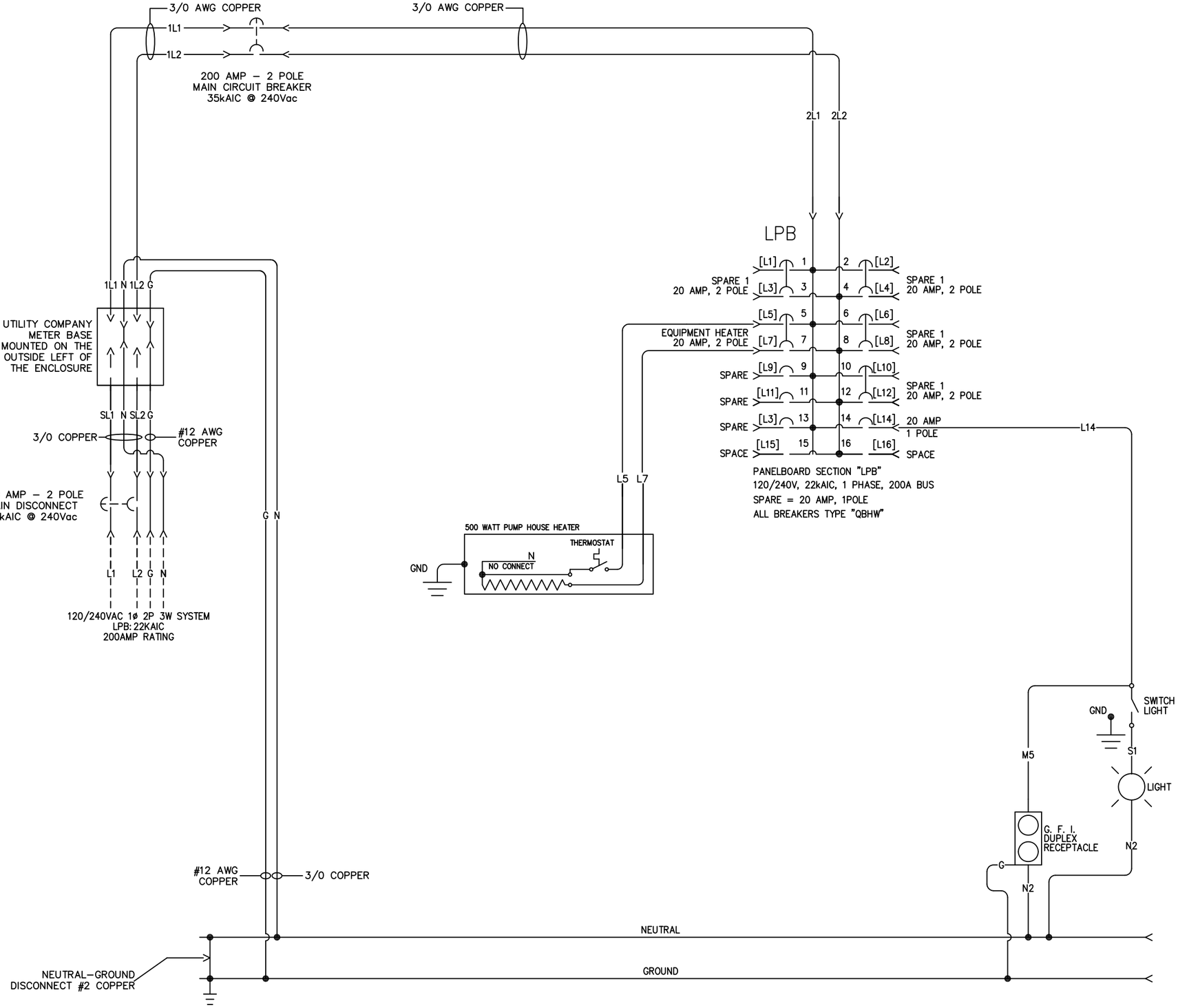
PROJ: -
-

CUSTOMER:
-
-
-

DWG NUMBER
XX2-XXXX-01
1

QUOTE/JOB#:
-

PG 1 OF 1



NOTE: ALL WIRE TO BE #12 GAGE SIS WIRE UNLESS OTHERWISE NOTED.

REV	DESCRIPTION	BY	APV	DATE
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

LAKE SHORE ELECTRIC Corp
BEDFORD, OHIO U.S.A.

WIRING DIAGRAM
SERVICE PEDESTAL

SCALE: 1:32 | DRN: --- --/--/-- | CHK: --- --/--/-- | APV: --- --/--/--

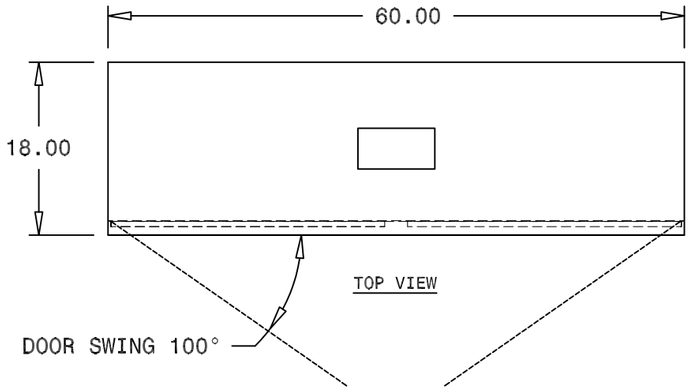
PROJ: -
-

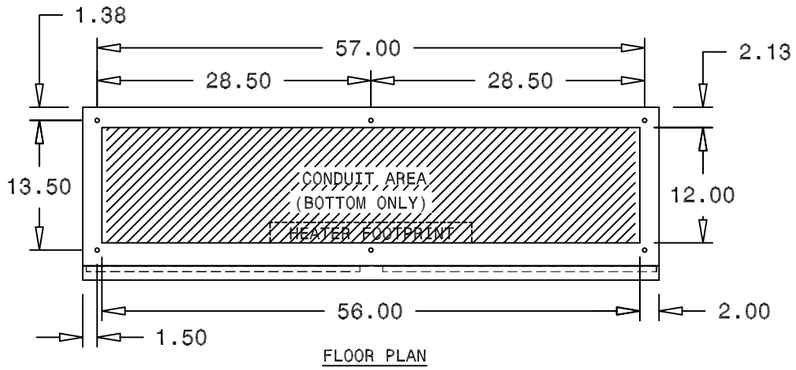
CUSTOMER:
-
-
-

DWG NUMBER
XX2-XXXX-02
-

QUOTE/JOB#:
-

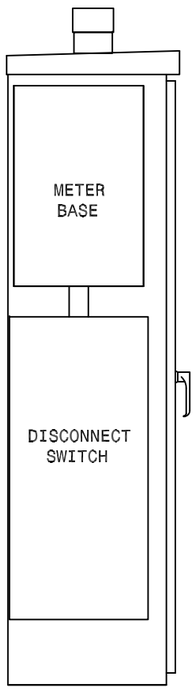
PG 1 OF 1



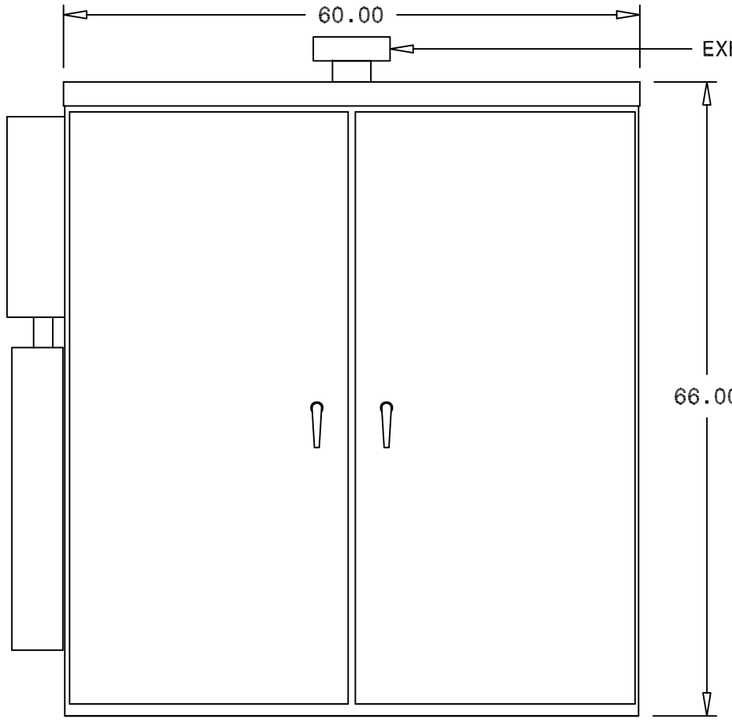


NOTES:

1. NEMA 3R, STAINLESS STEEL. (NATURAL FINISH)
2. DOUBLE FRONT DOORS WITH PADLOCKABLE HANDLES.

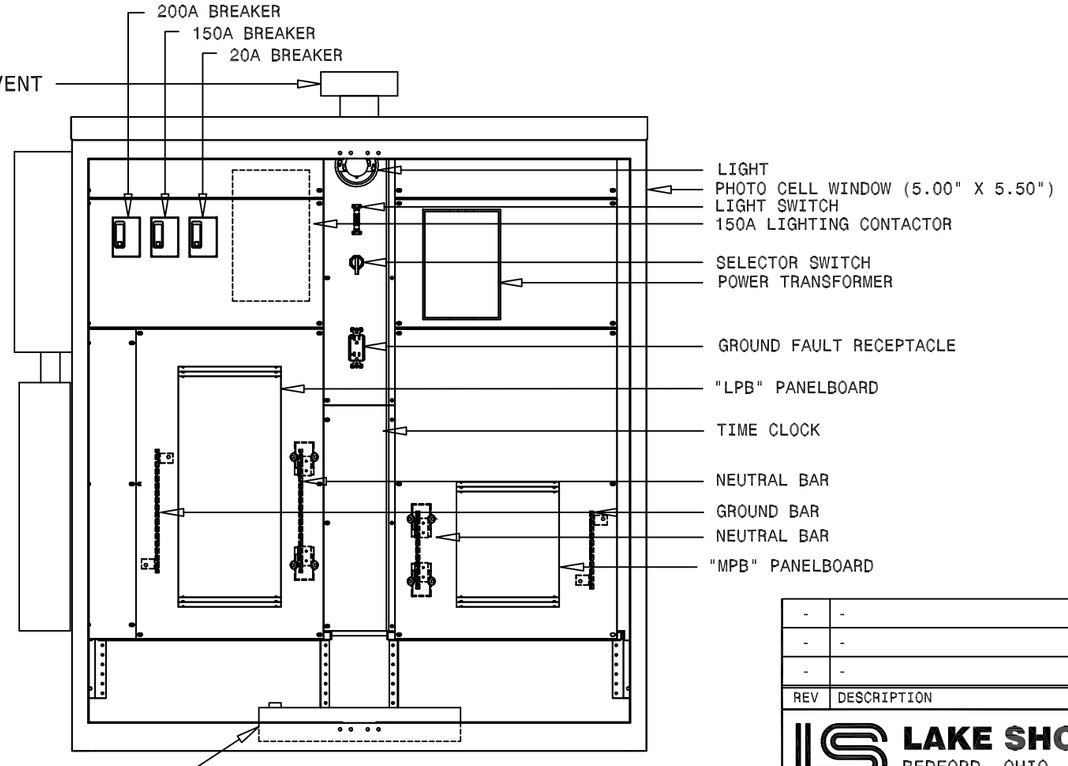


LEFT SIDE VIEW



FRONT VIEW
(SHOWN WITH DOORS)

500 WATT PUMP HOUSE HEATER



FRONT VIEW
(SHOWN WITHOUT DOORS AND CENTER POST)

REV	DESCRIPTION	BY	APV	DATE
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

LAKE SHORE ELECTRIC Corp
BEDFORD, OHIO U.S.A.

SERVICE PEDESTAL
OUTLINE

SCALE: 1:16	DRN: --- --/--/--	CHK: --- --/--/--	APV: --- --/--/--

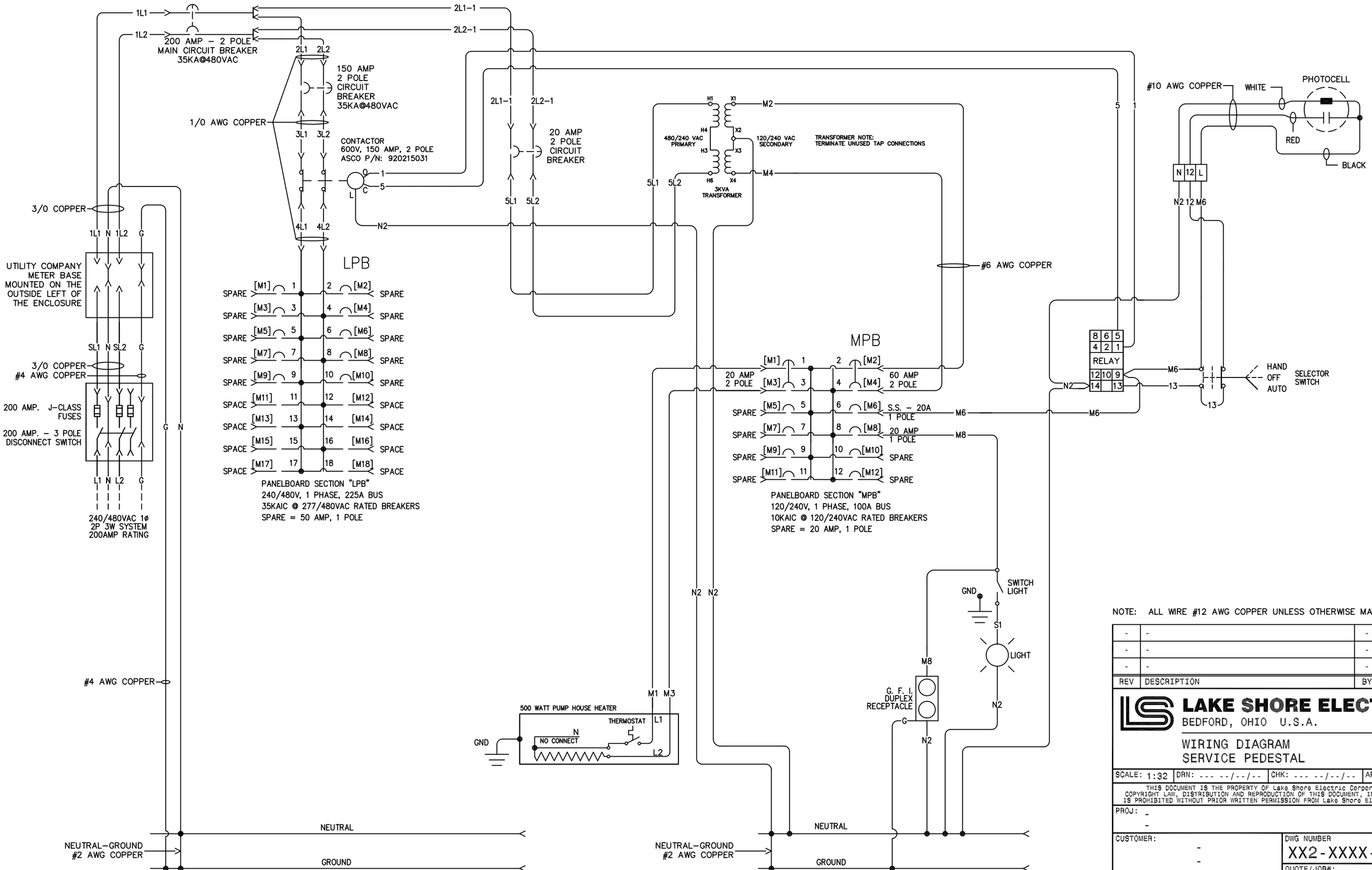
PROJ: -
-

CUSTOMER:
-
-
-

DWG NUMBER
XX2-XXXX-01 -

QUOTE/JOB#:
-

PG 1 OF 1



NOTE: ALL WIRE #12 AWG COPPER UNLESS OTHERWISE MARKED

REV	DESCRIPTION	BY	APV	DATE
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

LAKE SHORE ELECTRIC Corp
BEDFORD, OHIO U.S.A.

WIRING DIAGRAM
SERVICE PEDESTAL

SCALE: 1:32	DRN: --- --/--/--	CHK: --- --/--/--	APV: --- --/--/--

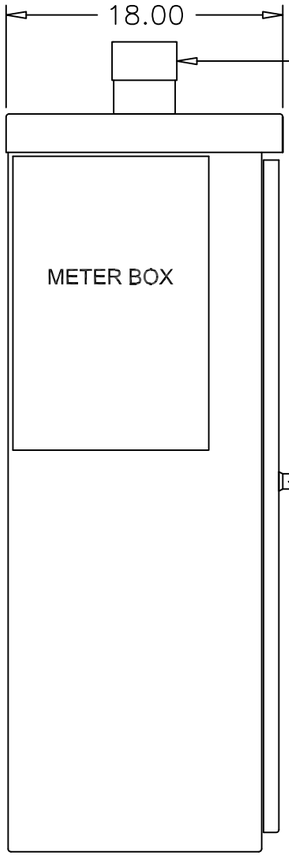
PROJ: -
-

CUSTOMER: - - -

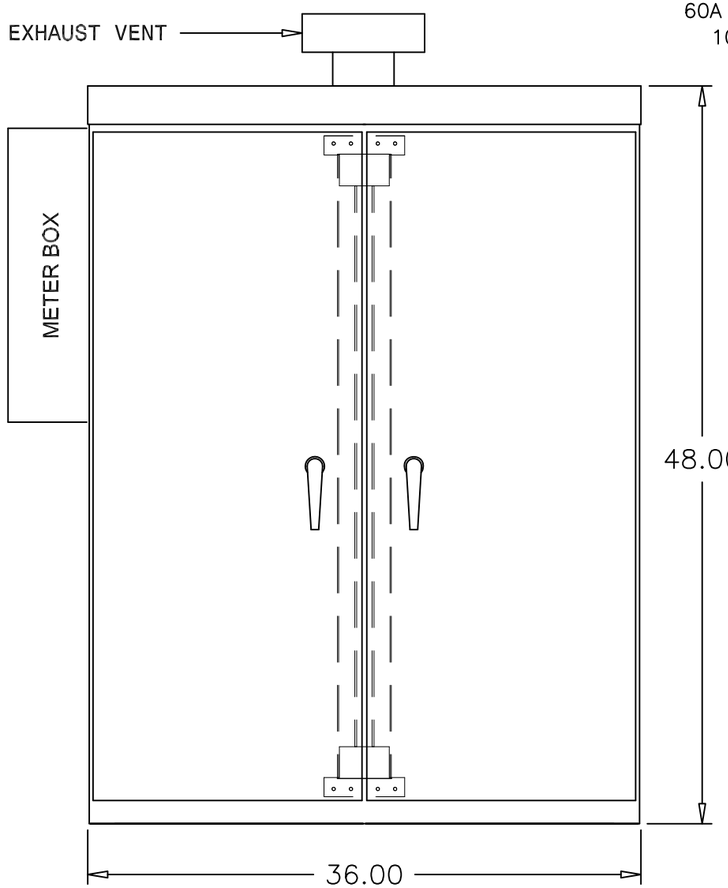
DWG NUMBER: XX2-XXXX-02 -

QUOTE/JOB#: -

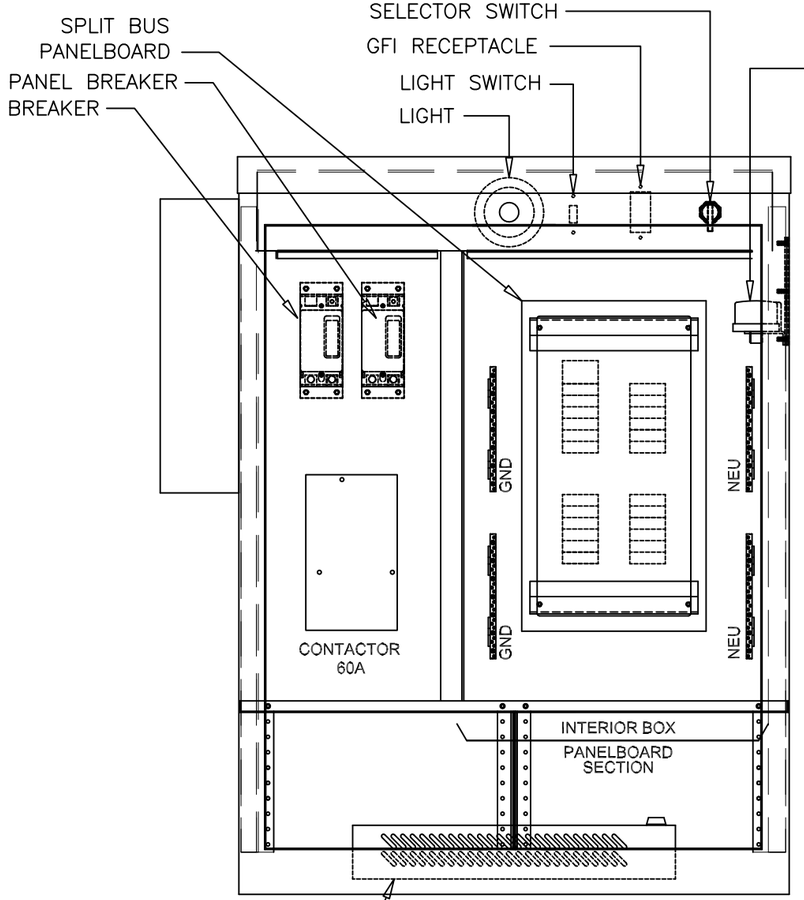
PG 1 OF 1



LEFT VIEW

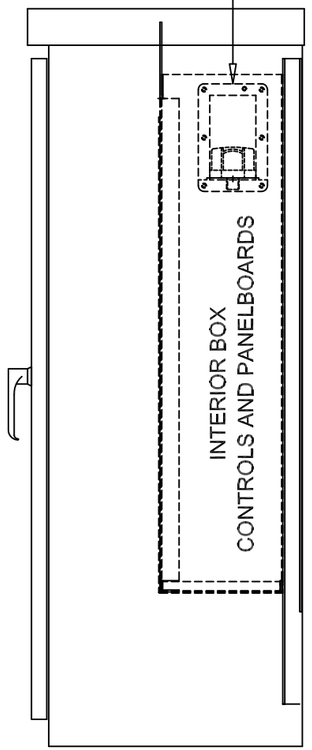


FRONT VIEW

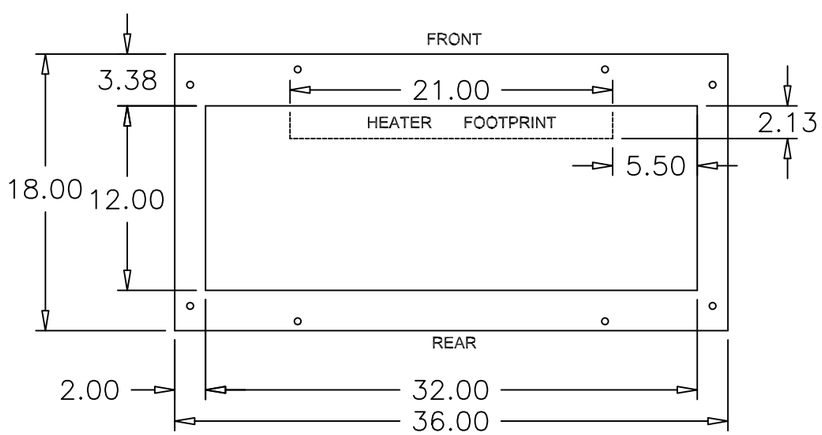


FRONT VIEW
INTERIOR HIDDEN LINE

PUMP HOUSE HEATER
500 W w/THERMOSTAT
(FLOOR MOUNTED)



RIGHT VIEW
INTERIOR HIDDEN LINE



BOTTOM VIEW

NOTES:

1. NEMA 3R, FREE STANDING ENCLOSURE
2. STAINLESS STEEL
3. DOUBLE FRONT DOOR WITH STAINLESS HINGE AND PIN
4. DOOR STOP PROVIDED ON DOORS
5. 3-POINT LATCHING PADLOCKABLE DOOR HANDLE
6. GASKETED DOOR
7. ALL DIMENSIONS EXPRESSED IN INCHES

REV	DESCRIPTION	BY	APV	DATE
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

LAKE SHORE ELECTRIC Corp
BEDFORD, OHIO U.S.A.

OUTLINE DRAWING
SERVICE PEDESTAL

SCALE: 1:10 | DRN: --- --/--/-- | CHK: --- --/--/-- | APV: --- --/--/--

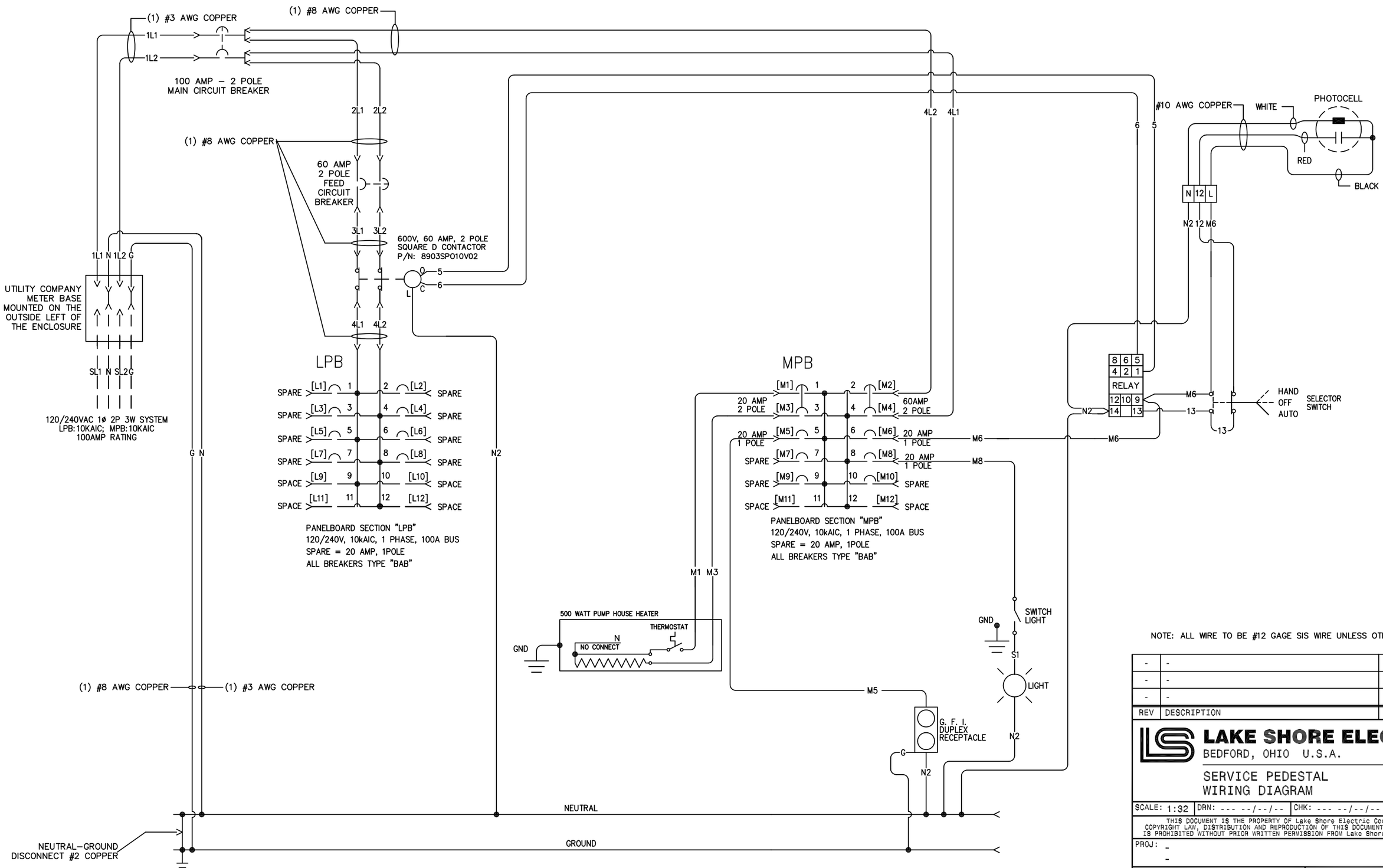
PROJ: -
-

CUSTOMER: -
-
-

DWG NUMBER: XX2-XXXX-01 -

QUOTE/JOB#: -

PG 1 OF 1



NOTE: ALL WIRE TO BE #12 GAGE SIS WIRE UNLESS OTHERWISE NOTED.

REV	DESCRIPTION	BY	APV	DATE
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

LAKE SHORE ELECTRIC Corp
BEDFORD, OHIO U.S.A.

SERVICE PEDESTAL
WIRING DIAGRAM

SCALE: 1:32 | DRN: --- --/--/-- | CHK: --- --/--/-- | APV: --- --/--/--

PROJ: -
-

CUSTOMER: -
-
-

DWG NUMBER: XX2-XXXX-02 -

QUOTE/JOB#: -

PG 1 OF 1

LAKESHORE
ELECTRIC CORPORATION

ENGINEER'S GUIDEBOOK

GENERATOR SURGE PROTECTOR

LAKESHORE
ELECTRIC CORPORATION

Generator Surge Protector

Medium Voltage Surge Pack Introduction

The Lake Shore Electric Corporation Generator Surge Protectors (GSP) provides surge protection for Medium Voltage rotating machines operating at voltages from 2400 VAC to 24,000VAC. They are typically installed directly at the generator output terminals.

Overvoltage conditions in electrical systems can reduce the useful life of insulation, which will appear as insulation failures, resulting in circuit faults. In rotating electrical machines such as generators, insulation space is limited. This creates a design balance and conflict between voltage stress and size which has an acute impact on useful life. To help reduce the electrical stress on a medium voltage generator caused by overvoltage, lightning, ground faults, switching surges, static, etc., Lake Shore Electric Corporation recommends that the use of Generator Surge Protection, as outlined in IEEE Standard 142, be considered.

The GSP integrates the combination of a station class arrester with a protective capacitor to limit voltage peaks which can commonly stress the generator beyond its impulse rating. The arrester helps protect the generator insulation by limiting the amplitude of applied impulse waves or reflections within the machine windings, shunting these high voltages to ground. The protective capacitors reduce the slope of the voltage peak by shunting the high rate of voltage change, (dv/dt), to ground.

It has been shown that the protection of rotating machinery from overvoltage conditions has resulted in increased reliability and decreased downtime.

Product Features

- NEMA 3R Enclosures
- Suitable for Indoor & Outdoor Applications
- Protection from Damaging Overvoltage Conditions
- Includes Station Class Arrester to Shunt High Voltage to Ground
- Includes Protective Capacitor to Shunt the High Rate of Voltage Change, (dv/dt), to Ground
- Increased Reliability of Rotating Machinery
- Decreases Down Time of Rotating Machinery
- All cabinets feature 100% rated Copper Bus

Generator Surge Protector Order Guide

60	-	- - - -

SYSTEM TYPE
F = Delta or Ungrounded Neutral System
G = Grounded Neutral Systems

SYSTEM VOLTAGE IN RMS (L-to-L)
2400
4160
4800
6900
7200
12800
13800
24000

Part Number Example: 60F4160 (Generator Surge Protector for a Delta or Ungrounded Neutral System, System Voltage is 4160V (L-to-L))

NOTES: Determine the configuration of the generator output connections (i.e. delta or wye, grounded or ungrounded) and then select the model number from the table above based on the lint to line voltage. Also reference the tables on the next page for standard part numbers and enclosure sizes.

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

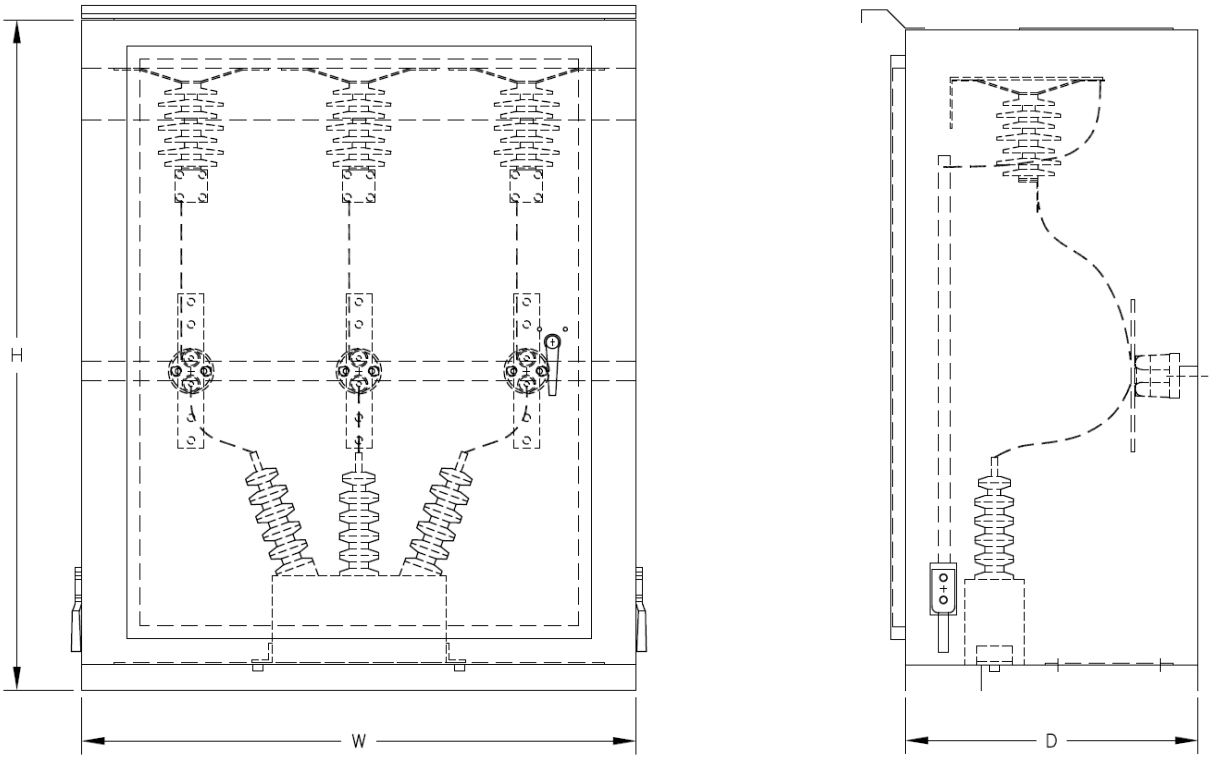
Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

Rev: July 2018

LAKESHORE
ELECTRIC CORPORATION



DELTA & UNGROUNDED NEUTRAL SYSTEMS (STANDARD PART NUMBERS)							
VOLTAGE RATING VOLTS RMS (L-L)	MODEL NUMBER	ARRESTER RATING KV RMS	ARRESTER MCOV KV RMS	CAPACITOR MICROFARADS PER POLE	"H" HEIGHT	"W" WIDTH	"D" DEPTH
2400	60F2400	3.00	2.55	0.50	52	42	23
4160	60F4160	6.00	5.10	0.50	52	43	23
4800	60F4800	6.00	5.10	0.50	52	43	36
6900	60F6900	8.50	6.90	0.50	52	43	36
7200	60F7200	9.00	7.85	0.50	52	43	36
13800	60F13800	18.00	15.30	0.25	52	43	36
24000	60F24000	30.00	24.40	0.125	52	43	36

GROUNDED NEUTRAL SYSTEM (STANDARD PART NUMBERS)							
VOLTAGE RATING VOLTS RMS (L-L)	MODEL NUMBER	ARRESTER RATING KV RMS	ARRESTER MCOV KV RMS	CAPACITOR MICROFARADS PER POLE	"H" HEIGHT	"W" WIDTH	"D" DEPTH
4160	60G4160	3.00	2.55	0.50	52	43	23
13800	60G13800	12.00	10.20	0.25	52	43	36
24000	60G24000	21.00	17.00	0.125	52	43	36

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

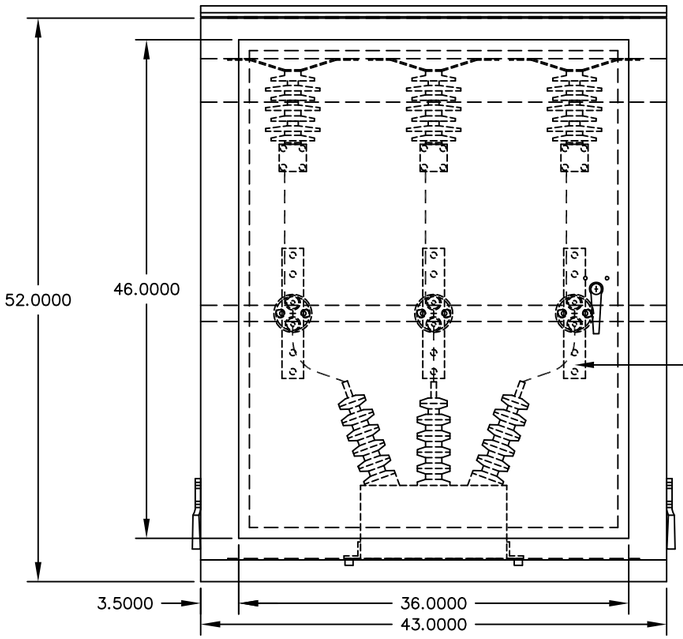
Rev: July 2018

OUTLINE NOTES

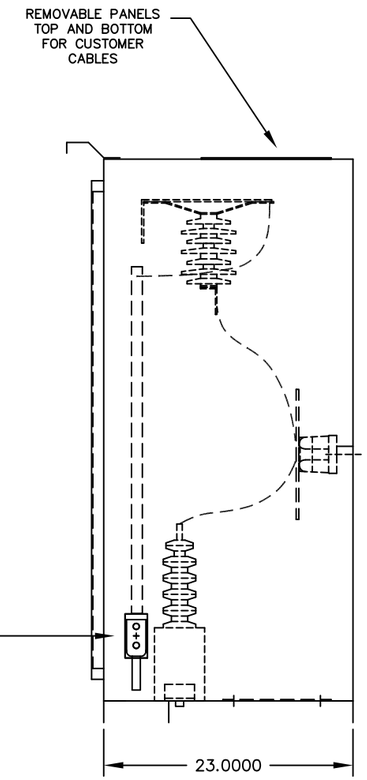
1) SPECIFICATIONS:
   A) SURGE PROTECTOR IS FOR USE WITH (1) GENERATOR SET AT 2400 VAC 3PHASE LINE TO LINE. WITH UNGROUNDED NEUTRAL.
   B) NOMENCLATURE DISCRIPTIONS, IF NOT ON THIS DRAWING (REFER TO LAKE SHORE STANDARD NOMENCLATURE.
   C) * = CUSTOMER SUPPLIED EQUIPMENT.

2) ENCLOSURE CONSTRUCTION:
   A) NEMA 3R, FREE-STANDING, 11 GA. SHEET METAL WITH 1.5"x4" 7 GA. CHANNEL BASE.
   B) (1) HINGED FRONT DOOR AND (2) REMOVABLE PANEL(S) IN TOP AND BOTTOM.
   C) MOUNTING DIMENSIONS ARE ±.125" ALL OTHER DIMENSIONS ARE APPROXIMATE.

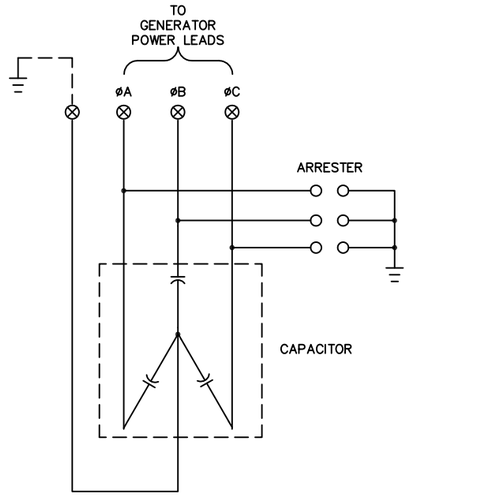
3) ENCLOSURE FINISH:
   A) PRIMED AND PAINTED ANSI-61 LIGHT GRAY.



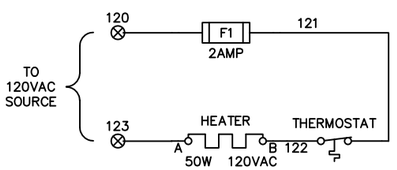
FRONT VIEW



SIDE VIEW



CONNECTION DIAGRAM



CUSTOMER

LAKE SHORE ELECTRIC CORPORATION
Bedford, Ohio U.S.A.

SCALE .1=1	REVISIONS	BY	DATE
DATE 040199			
DR'N DJA CK'D			
AP'VD			

TITLE: GENERATOR SURGE PROTECTOR OUTLINE

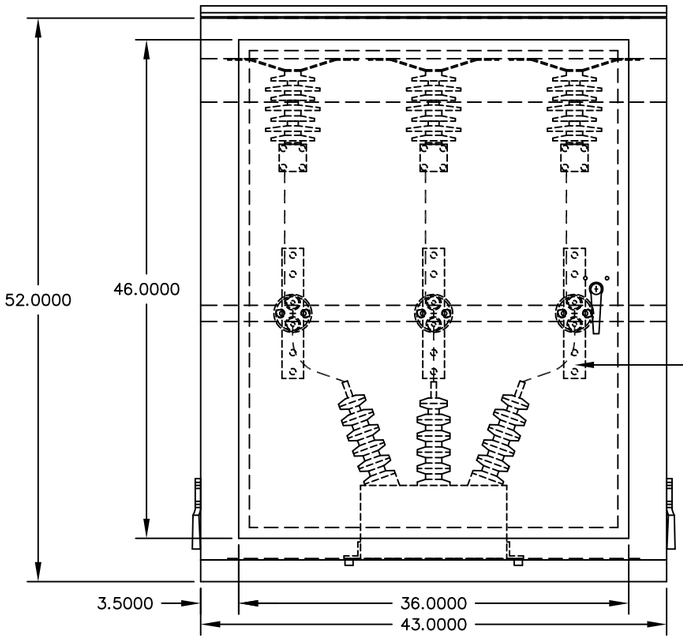
NO. 60F2400

OUTLINE NOTES

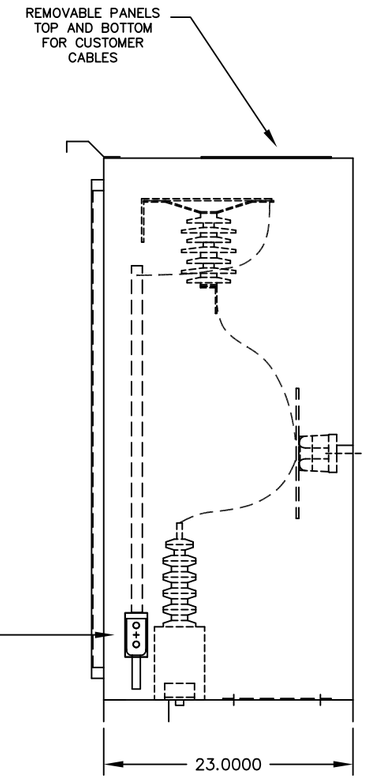
1) SPECIFICATIONS:
   A) SURGE PROTECTOR IS FOR USE WITH (1) GENERATOR SET AT 4160 VAC 3PHASE LINE TO LINE. WITH UNGROUNDED NEUTRAL.
   B) NOMENCLATURE DISCRIPTIONS, IF NOT ON THIS DRAWING (REFER TO LAKE SHORE STANDARD NOMENCLATURE.
   C) * = CUSTOMER SUPPLIED EQUIPMENT.

2) ENCLOSURE CONSTRUCTION:
   A) NEMA 3R, FREE-STANDING, 11 GA. SHEET METAL WITH 1.5"x4" 7 GA. CHANNEL BASE.
   B) (1) HINGED FRONT DOOR AND (2) REMOVABLE PANEL(S) IN TOP AND BOTTOM.
   C) MOUNTING DIMENSIONS ARE ±.125" ALL OTHER DIMENSIONS ARE APPROXIMATE.

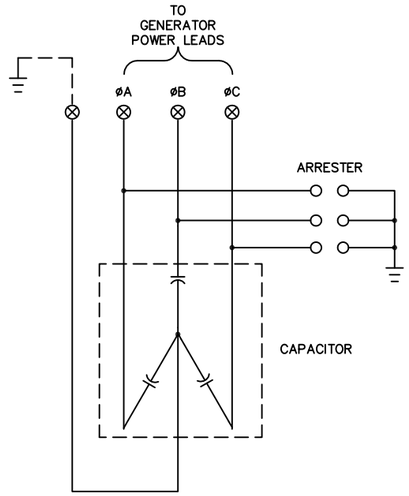
3) ENCLOSURE FINISH:
   A) PRIMED AND PAINTED ANSI-61 LIGHT GRAY.



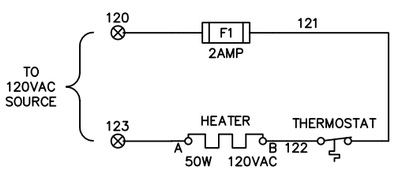
FRONT VIEW



SIDE VIEW



CONNECTION DIAGRAM



CUSTOMER

LAKE SHORE ELECTRIC CORPORATION
Bedford, Ohio U.S.A.

SCALE .1=1	REVISIONS	BY	DATE
DATE 040199			
DR'N DJA CK'D			
AP'VD			

TITLE: GENERATOR SURGE PROTECTOR OUTLINE

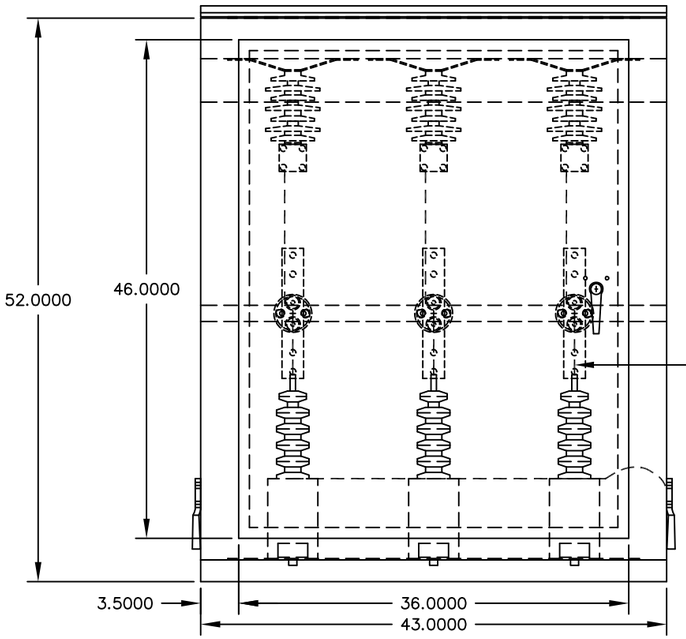
NO. 60F4160

OUTLINE NOTES

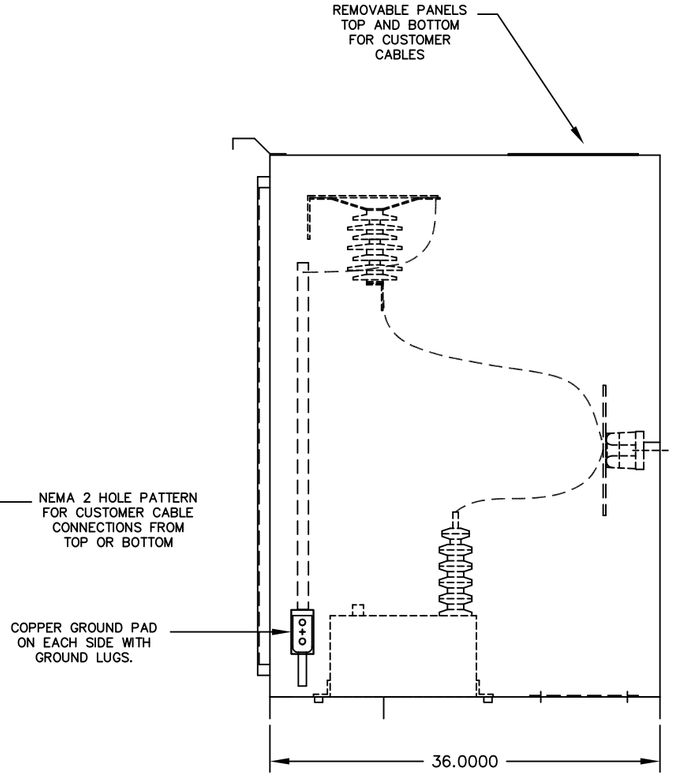
1) SPECIFICATIONS:
   A) SURGE PROTECTOR IS FOR USE WITH (1) GENERATOR SET AT 4800 VAC 3PHASE LINE TO LINE. WITH UNGROUNDED NEUTRAL.
   B) NOMENCLATURE DISCRIPTIONS, IF NOT ON THIS DRAWING (REFER TO LAKE SHORE STANDARD NOMENCLATURE.
   C) * = CUSTOMER SUPPLIED EQUIPMENT.

2) ENCLOSURE CONSTRUCTION:
   A) NEMA 3R, FREE-STANDING, 11 GA. SHEET METAL WITH 1.5"x4" 7 GA. CHANNEL BASE.
   B) (1) HINGED FRONT DOOR AND (2) REMOVABLE PANEL(S) IN TOP AND BOTTOM.
   C) MOUNTING DIMENSIONS ARE ±.125" ALL OTHER DIMENSIONS ARE APPROXIMATE.

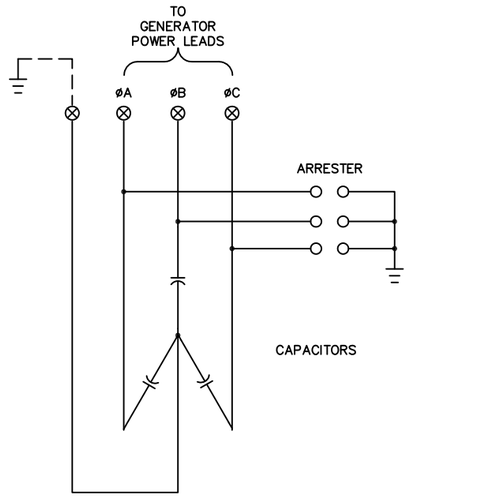
3) ENCLOSURE FINISH:
   A) PRIMED AND PAINTED ANSI-61 LIGHT GRAY.



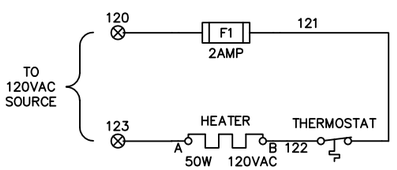
FRONT VIEW



SIDE VIEW



CONNECTION DIAGRAM



CUSTOMER

LAKE SHORE ELECTRIC CORPORATION
Bedford, Ohio U.S.A.

SCALE .1=1	REVISIONS	BY	DATE
DATE 040199			
DR'N DJA CK'D			
AP'VD			

TITLE: GENERATOR SURGE PROTECTOR OUTLINE

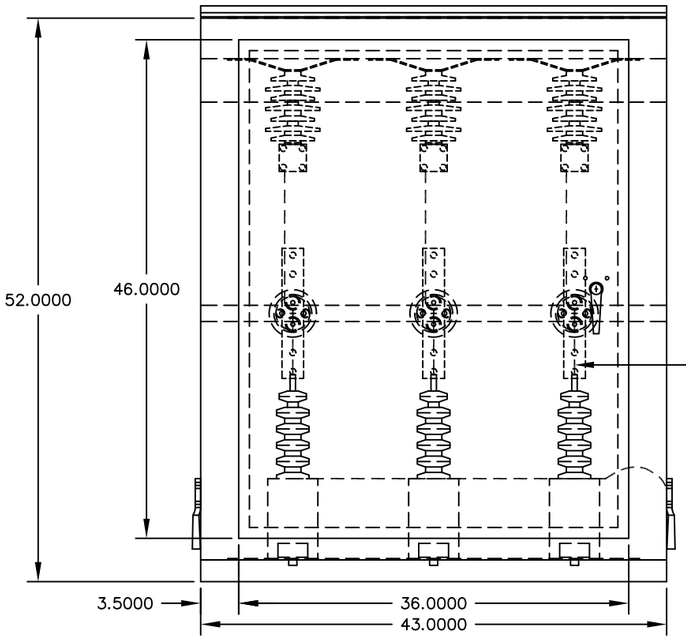
NO. 60F4800

OUTLINE NOTES

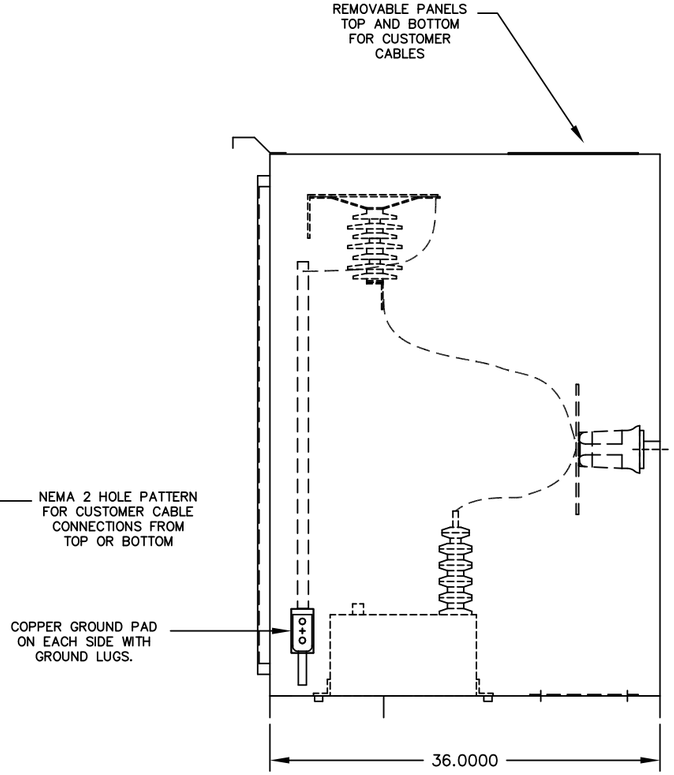
1) SPECIFICATIONS:
   A) SURGE PROTECTOR IS FOR USE WITH (1) GENERATOR SET AT 6900 VAC 3PHASE LINE TO LINE. WITH UNGROUNDED NEUTRAL.
   B) NOMENCLATURE DISCRIPTIONS, IF NOT ON THIS DRAWING (REFER TO LAKE SHORE STANDARD NOMENCLATURE.
   C) * = CUSTOMER SUPPLIED EQUIPMENT.

2) ENCLOSURE CONSTRUCTION:
   A) NEMA 3R, FREE-STANDING, 11 GA. SHEET METAL WITH 1.5"x4" 7 GA. CHANNEL BASE.
   B) (1) HINGED FRONT DOOR AND (2) REMOVABLE PANEL(S) IN TOP AND BOTTOM.
   C) MOUNTING DIMENSIONS ARE ±.125" ALL OTHER DIMENSIONS ARE APPROXIMATE.

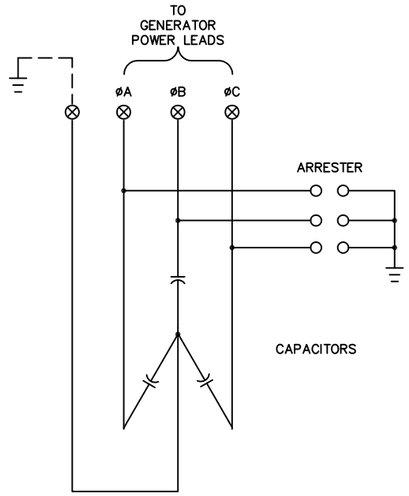
3) ENCLOSURE FINISH:
   A) PRIMED AND PAINTED ANSI-61 LIGHT GRAY.



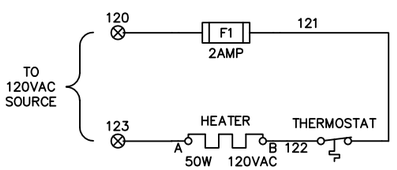
FRONT VIEW



SIDE VIEW



CONNECTION DIAGRAM



LAKE SHORE ELECTRIC CORPORATION
Bedford, Ohio U.S.A.

SCALE .1=1	REVISIONS	BY	DATE
DATE 040199			
DR'N DJA CK'D			
AP'VD			

CUSTOMER

TITLE: GENERATOR SURGE PROTECTOR OUTLINE

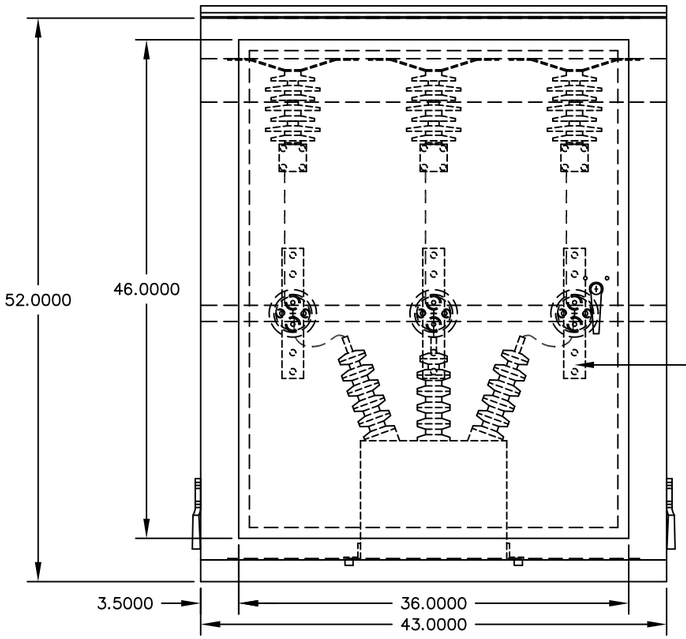
NO. 60F6900

OUTLINE NOTES

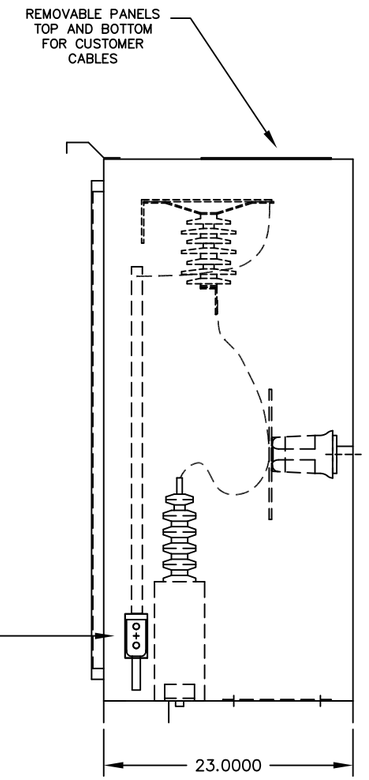
1) SPECIFICATIONS:
   A) SURGE PROTECTOR IS FOR USE WITH (1) GENERATOR SET AT 7200 VAC 3PHASE LINE TO LINE. WITH UNGROUNDED NEUTRAL.
   B) NOMENCLATURE DISCRIPTIONS, IF NOT ON THIS DRAWING (REFER TO LAKE SHORE STANDARD NOMENCLATURE.
   C) * = CUSTOMER SUPPLIED EQUIPMENT.

2) ENCLOSURE CONSTRUCTION:
   A) NEMA 3R, FREE-STANDING, 11 GA. SHEET METAL WITH 1.5"x4" 7 GA. CHANNEL BASE.
   B) (1) HINGED FRONT DOOR AND (2) REMOVABLE PANEL(S) IN TOP AND BOTTOM.
   C) MOUNTING DIMENSIONS ARE ±.125" ALL OTHER DIMENSIONS ARE APPROXIMATE.

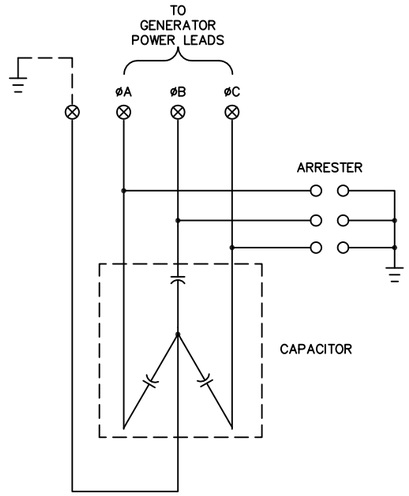
3) ENCLOSURE FINISH:
   A) PRIMED AND PAINTED ANSI-61 LIGHT GRAY.



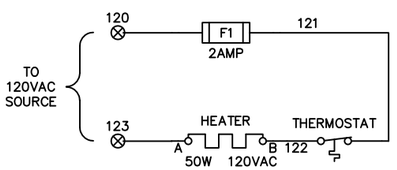
FRONT VIEW



SIDE VIEW



CONNECTION DIAGRAM



CUSTOMER

LAKE SHORE ELECTRIC CORPORATION
Bedford, Ohio U.S.A.

SCALE .1=1	REVISIONS	BY	DATE
DATE 040199			
DR'N DJA CK'D			
AP'VD			

TITLE: GENERATOR SURGE PROTECTOR OUTLINE

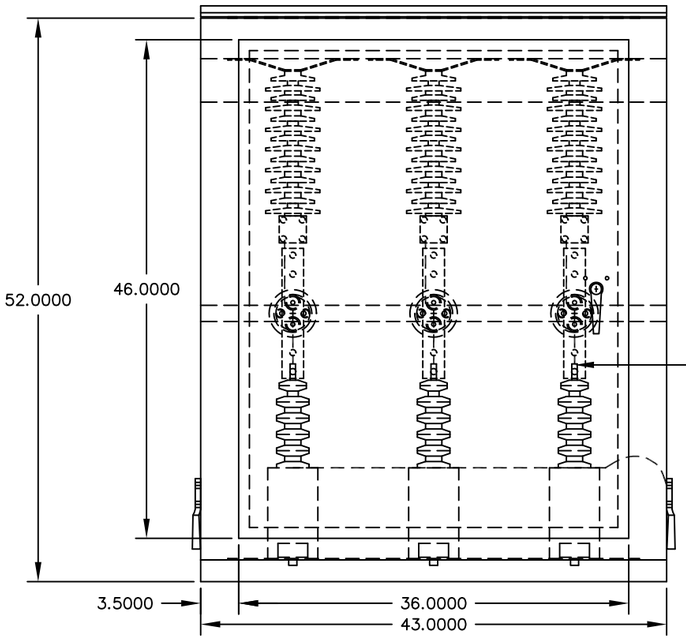
NO. 60F7200

OUTLINE NOTES

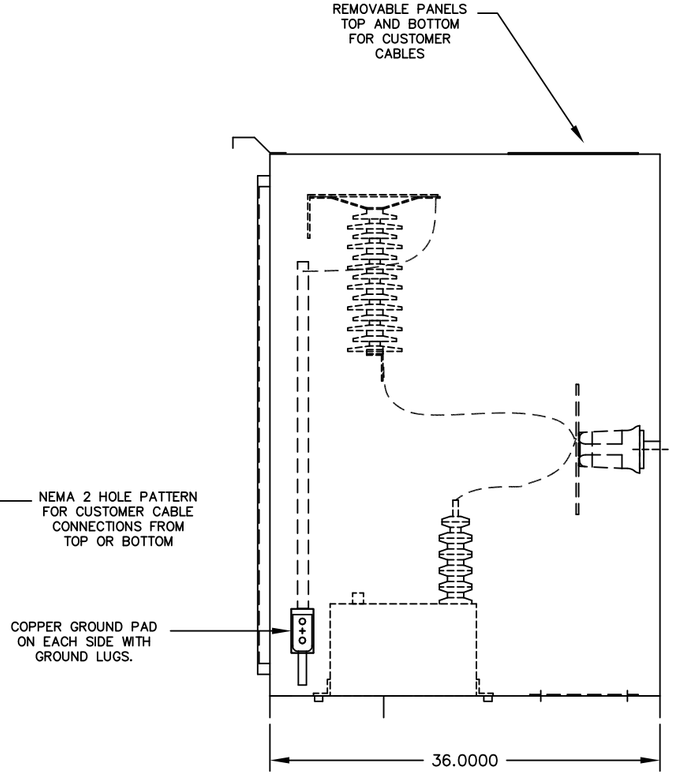
1) SPECIFICATIONS:
   A) SURGE PROTECTOR IS FOR USE WITH (1) GENERATOR SET AT 13800 VAC 3PHASE LINE TO LINE. WITH UNGROUNDED NEUTRAL.
   B) NOMENCLATURE DISCRIPTIONS, IF NOT ON THIS DRAWING (REFER TO LAKE SHORE STANDARD NOMENCLATURE.
   C) * = CUSTOMER SUPPLIED EQUIPMENT.

2) ENCLOSURE CONSTRUCTION:
   A) NEMA 3R, FREE-STANDING, 11 GA. SHEET METAL WITH 1.5"x4" 7 GA. CHANNEL BASE.
   B) (1) HINGED FRONT DOOR AND (2) REMOVABLE PANEL(S) IN TOP AND BOTTOM.
   C) MOUNTING DIMENSIONS ARE ±.125" ALL OTHER DIMENSIONS ARE APPROXIMATE.

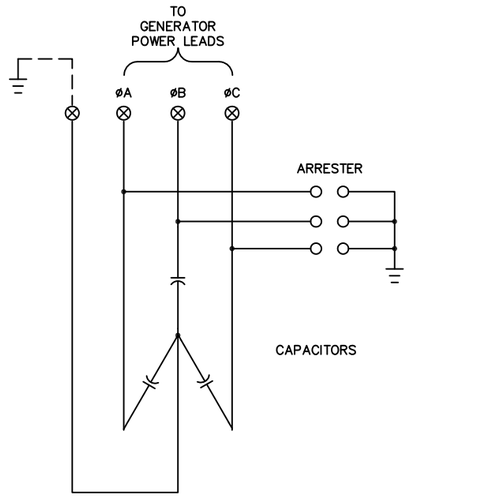
3) ENCLOSURE FINISH:
   A) PRIMED AND PAINTED ANSI-61 LIGHT GRAY.



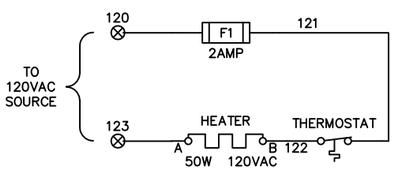
FRONT VIEW



SIDE VIEW



CONNECTION DIAGRAM



LAKE SHORE ELECTRIC CORPORATION Bedford, Ohio U.S.A.			
SCALE .1=1	REVISIONS	BY	DATE
DATE 040199			
DR'N DJA CK'D			
AP'VD			
TITLE GENERATOR SURGE PROTECTOR OUTLINE		NO. 60F13800	

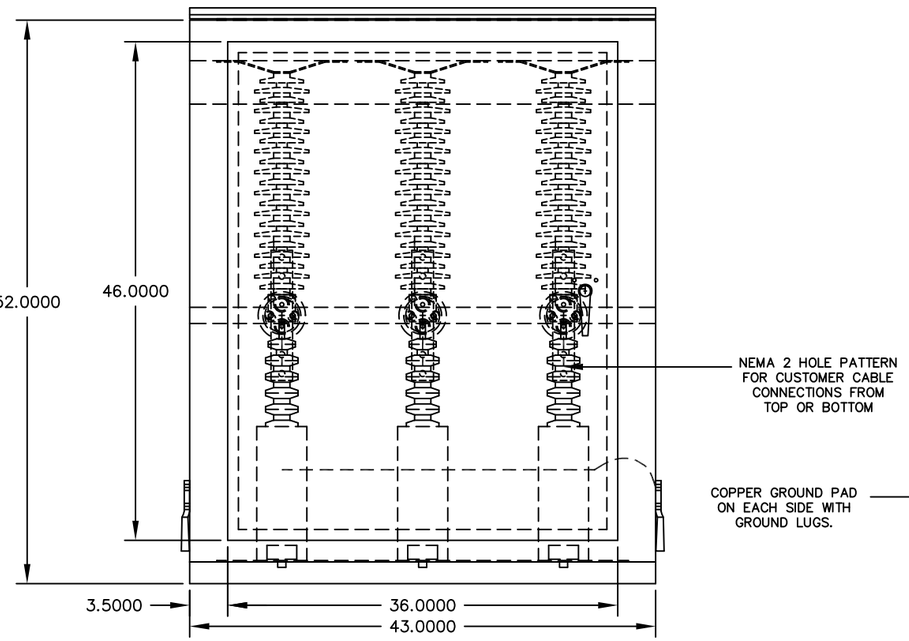
CUSTOMER

OUTLINE NOTES

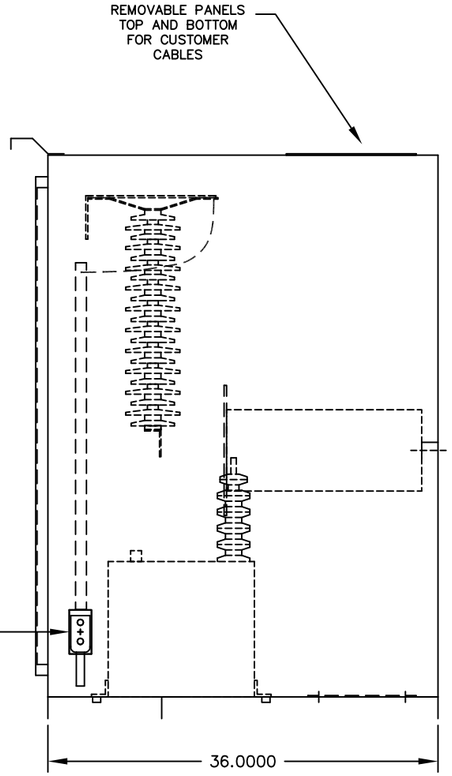
1) SPECIFICATIONS:
   A) SURGE PROTECTOR IS FOR USE WITH (1) GENERATOR SET AT 24000 VAC 3PHASE LINE TO LINE. WITH UNGROUNDED NEUTRAL.
   B) NOMENCLATURE DISCRIPTIONS, IF NOT ON THIS DRAWING (REFER TO LAKE SHORE STANDARD NOMENCLATURE.
   C) * = CUSTOMER SUPPLIED EQUIPMENT.

2) ENCLOSURE CONSTRUCTION:
   A) NEMA 3R, FREE-STANDING, 11 GA. SHEET METAL WITH 1.5"x4" 7 GA. CHANNEL BASE.
   B) (1) HINGED FRONT DOOR AND (2) REMOVABLE PANEL(S) IN TOP AND BOTTOM.
   C) MOUNTING DIMENSIONS ARE ±.125" ALL OTHER DIMENSIONS ARE APPROXIMATE.

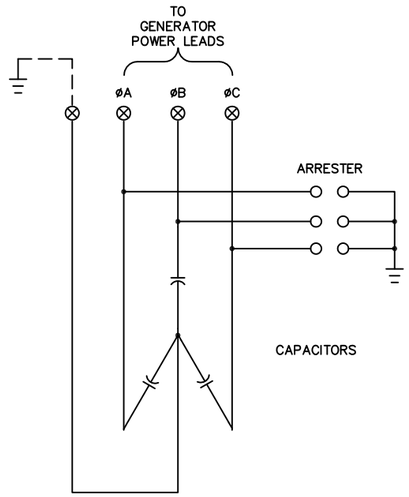
3) ENCLOSURE FINISH:
   A) PRIMED AND PAINTED ANSI-61 LIGHT GRAY.



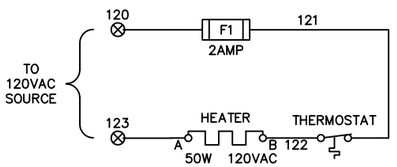
FRONT VIEW



SIDE VIEW



CONNECTION DIAGRAM



CUSTOMER

LAKE SHORE ELECTRIC CORPORATION
Bedford, Ohio U.S.A.

SCALE .1=1	REVISIONS	BY	DATE
DATE 040199			
DR'N DJA CK'D			
AP'VD			

TITLE: GENERATOR SURGE PROTECTOR OUTLINE

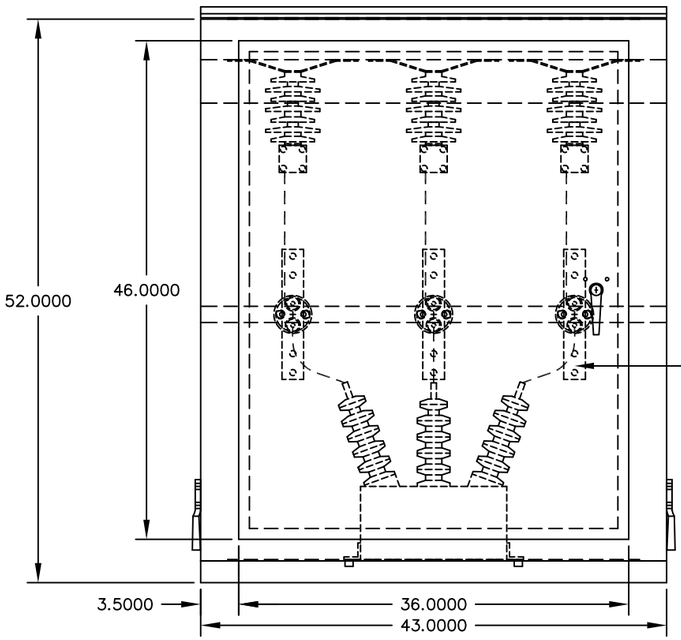
NO. 60F24000

OUTLINE NOTES

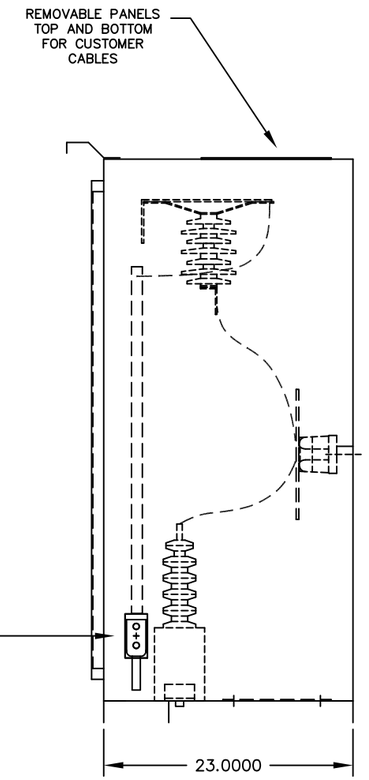
1) SPECIFICATIONS:
   A) SURGE PROTECTOR IS FOR USE WITH (1) GENERATOR SET AT 4160 VAC 3PHASE LINE TO LINE. WITH GROUNDED NEUTRAL.
   B) NOMENCLATURE DISCRIPTIONS, IF NOT ON THIS DRAWING (REFER TO LAKE SHORE STANDARD NOMENCLATURE.
   C) * = CUSTOMER SUPPLIED EQUIPMENT.

2) ENCLOSURE CONSTRUCTION:
   A) NEMA 3R, FREE-STANDING, 11 GA. SHEET METAL WITH 1.5"x4" 7 GA. CHANNEL BASE.
   B) (1) HINGED FRONT DOOR AND (2) REMOVABLE PANEL(S) IN TOP AND BOTTOM.
   C) MOUNTING DIMENSIONS ARE ±.125" ALL OTHER DIMENSIONS ARE APPROXIMATE.

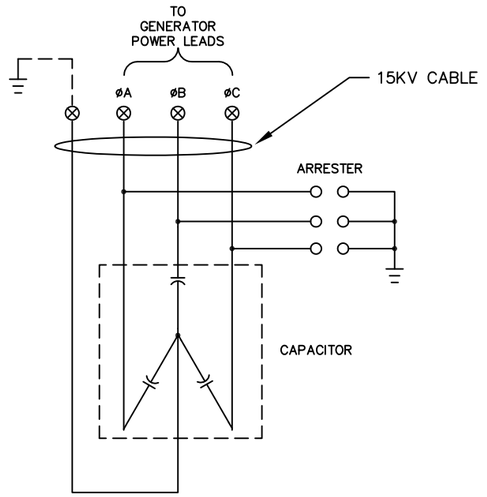
3) ENCLOSURE FINISH:
   A) PRIMED AND PAINTED ANSI-61 LIGHT GRAY.



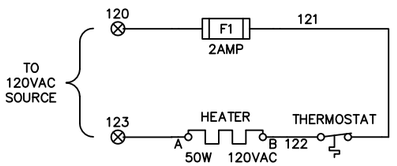
FRONT VIEW



SIDE VIEW



CONNECTION DIAGRAM



CUSTOMER

LAKE SHORE ELECTRIC CORPORATION
Bedford, Ohio U.S.A.

SCALE .1=1	REVISIONS	BY	DATE
DATE 040199			
DR'N DJA CK'D			
AP'VD	1) ADDED CABLE RATING	DJA	040901

TITLE: GENERATOR SURGE PROTECTOR OUTLINE

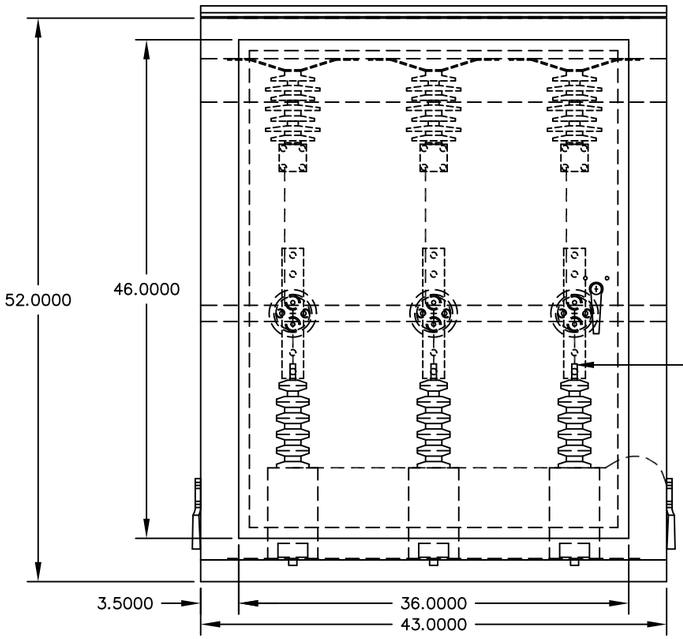
NO. 60F4160

OUTLINE NOTES

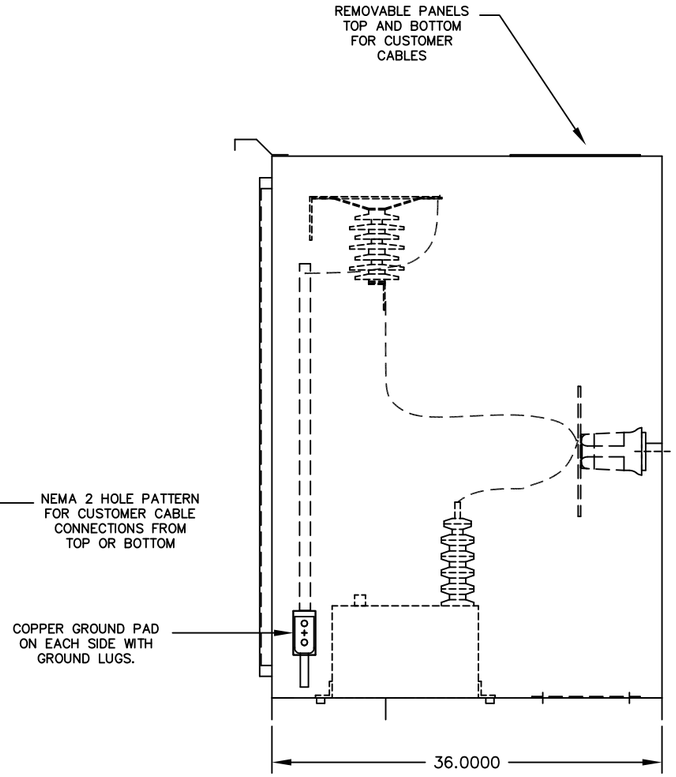
1) SPECIFICATIONS:
   A) SURGE PROTECTOR IS FOR USE WITH (1) GENERATOR SET AT 13800 VAC 3PHASE LINE TO LINE. WITH GROUNDED NEUTRAL.
   B) NOMENCLATURE DISCRIPTIONS, IF NOT ON THIS DRAWING (REFER TO LAKE SHORE STANDARD NOMENCLATURE.
   C) * = CUSTOMER SUPPLIED EQUIPMENT.

2) ENCLOSURE CONSTRUCTION:
   A) NEMA 3R, FREE-STANDING, 11 GA. SHEET METAL WITH 1.5"x4" 7 GA. CHANNEL BASE.
   B) (1) HINGED FRONT DOOR AND (2) REMOVABLE PANEL(S) IN TOP AND BOTTOM.
   C) MOUNTING DIMENSIONS ARE ±.125" ALL OTHER DIMENSIONS ARE APPROXIMATE.

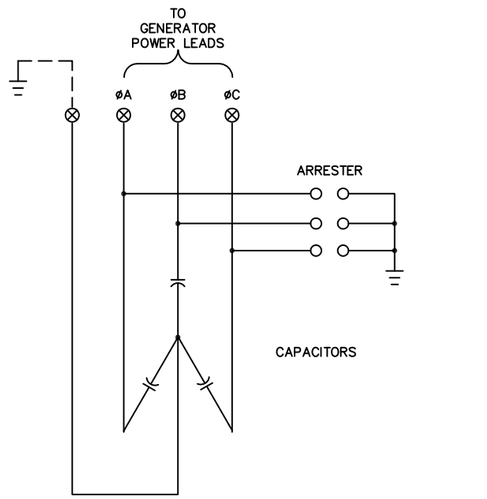
3) ENCLOSURE FINISH:
   A) PRIMED AND PAINTED ANSI-61 LIGHT GRAY.



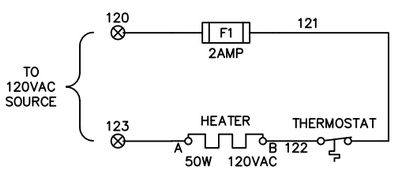
FRONT VIEW



SIDE VIEW



CONNECTION DIAGRAM



CUSTOMER

LAKE SHORE ELECTRIC CORPORATION
Bedford, Ohio U.S.A.

SCALE .1=1	REVISIONS	BY	DATE
DATE 040199			
DR'N DJA CK'D			
AP'VD			

TITLE: GENERATOR SURGE PROTECTOR OUTLINE

NO. 60G13800

LAKESHORE
ELECTRIC CORPORATION

ENGINEER'S GUIDEBOOK

AREA PROTECTION PANEL

LAKESHORE
ELECTRIC CORPORATION

Area Protection Panel

Introduction

Area Protection Panels (APP) are designed to monitor multiple points in an electrical system for proper normal source voltages.

Every APP comes with an output contact which changes state in the event of one, or more, areas being out of their correct voltage ranges. Each area is monitored with its' own Phase Failure Relay (PFR) to ensure it is within the proper voltage operating range.

When a failure of any single area occurs, the APP's output contact will change state to give the appropriate equipment a signal to activate.

As normal power returns, the APP's output contact changes back to its normal state to signal the appropriate equipment to deactivate.

Product Features

- UL 508 Listed
- Rated for up to 600 VAC
- Monitors from 1 to 24 points
- Available Standard Voltages 1ϕ 120 or 240 VAC and 3ϕ 208, 240 or 480 VAC
- Form "C" dry contacts output to emergency power system.
- Three phase units also monitor phase rotation.
- Solid State Relays
- Visible indication of failed circuit is provided directly on the sending relay.
- NEMA 1 Wall Mountable Enclosure, ANSI-61 light gray.
- Key locking handle provided.
- Engraved identification nameplates for each monitored point located on door.

Available Options

- Common Failure indicating light, (one light only), mounted on enclosure door.
  - This indicator light will visibly show that there is a problem to any personnel in the area.
  - To determine which area(s) have been affected, a trained operator will have to open the equipment to read which of the PFR lights are on to determine where loss of proper voltage has occurred.
- Area Failure indicating lights, (one per monitoring point), mounted on enclosure door.
  - These indicator lights will visibly show, to any personnel in the area of the APP, which areas have lost proper voltage.
  - Recommended when trained personnel is not available to open the equipment and read which areas have lost power.
- Multiple voltages can be monitored in a single panel. (NOTE: This would be a custom voltage order "S" and voltage quantities need to be specified.)

APP Order Guide

AP	--	--	-	-	--	-	0	0	0

BASE
12 = 1 - 12
24 = 13 - 24

POINTS
01 = 1 Point
02 = 2 Points
03 = 3 Points
" "
23 = 23 Points
24 = 24 Points

PHASES
1 = Single Phase
3 = Three Phase

OPERATING VOLTAGE
A = 120 Vac 1ϕ
D = 240 Vac 1ϕ
B = 208 Vac 3ϕ
C = 480 Vac 3ϕ
G = 240 Vac 3ϕ
S = Custom Voltage (Specify)

DC VOLTAGE
12 = 12 Vdc
24 = 24 Vdc

DOOR INDICATOR LIGHTS
0 = None
A = Common Failure Light
B = Area Failure Lights

FOR FUTURE USE

Part Number Example: AP24133B24B000 (13 Monitored Points, 3ϕ, 208Vac, 24Vdc, Area Failure Lights Required)

NEMA 1 Enclosure Dimensions

MODEL PREFIX	HEIGHT	WIDTH	DEPTH
AP12	30"	24"	6 ¾"
AP24	36"	28"	6 ¾"

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

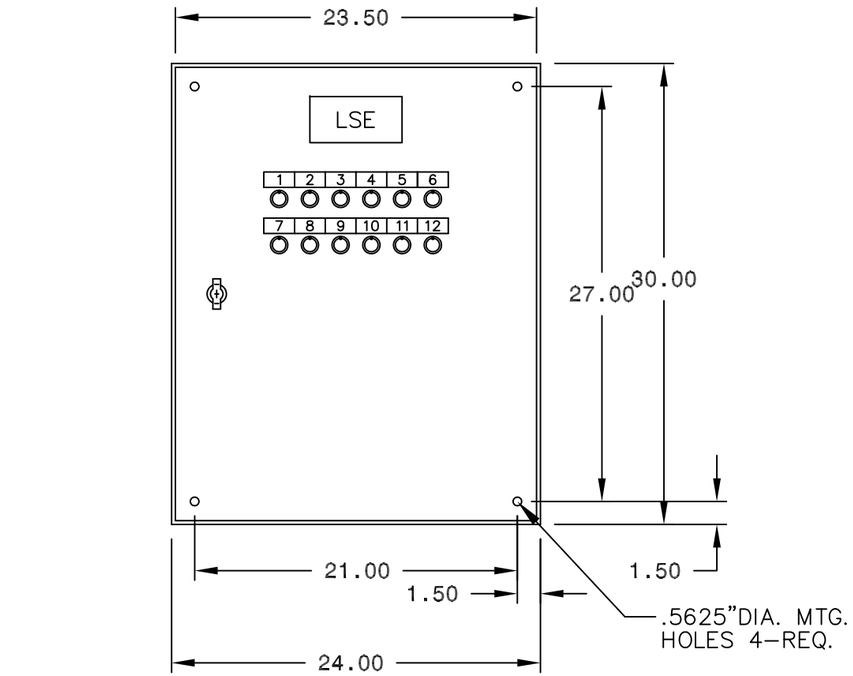
UL LISTED

Made in the USA

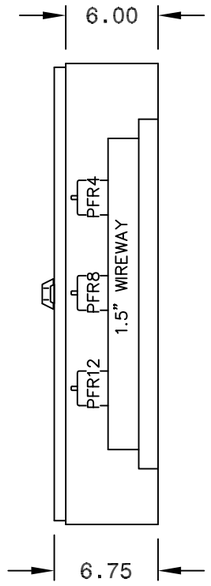
Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

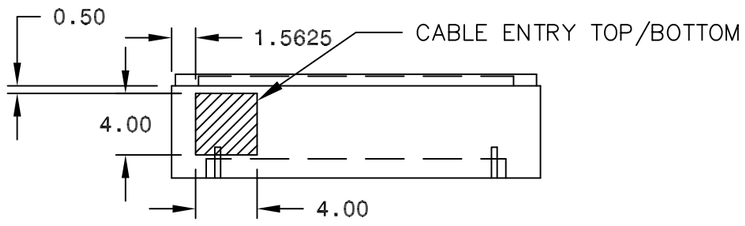
Rev: November 2016



FRONT VIEW



SIDE VIEW



BOTTOM VIEW
(Recommended Cable Access Areas)

OUTLINE NOTES

1) GENERAL ENCLOSURE CONSTRUCTION:
   A) WALL–MOUNTED
   B) 14 GA. SHEET METAL
   C) 1 HINGED FRONT DOOR
   D) MOUNTING DIMENSIONS ARE ± .0625", ALL OTHER DIMENSIONS ARE APPROXIMATE
   E) LOUVERS (OPTIONAL–NEMA 1 ONLY)

2) NEMA 1 ENCLOSURE:
   A) KEYLOCKABLE HANDLE (PADLOCKABLE HANDLE OPTIONAL)

3) ENCLOSURE FINISH:
   A) PRIMED & PAINTED ANSI–61 LIGHT GRAY (OTHER COLORS OPTIONAL)

AREA PROTECTION DOOR MOUNTED EQUIPMENT

1) AREA 1 (RED)
2) AREA 2 (RED)
3) AREA 3 (RED)
4) AREA 4 (RED)
5) AREA 5 (RED)
6) AREA 6 (RED)
7) AREA 7 (RED)
8) AREA 8 (RED)
9) AREA 9 (RED)
10) AREA 10 (RED)
11) AREA 11 (RED)
12) AREA 12 (RED)

REV	DESCRIPTION	BY	APV	DATE
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

LAKE SHORE ELECTRIC Corp
BEDFORD, OHIO U.S.A.

AREA PROTECTION PANEL
OUTLINE

SCALE: .1:1	DRN: - -	CHK: - -	APV: - -

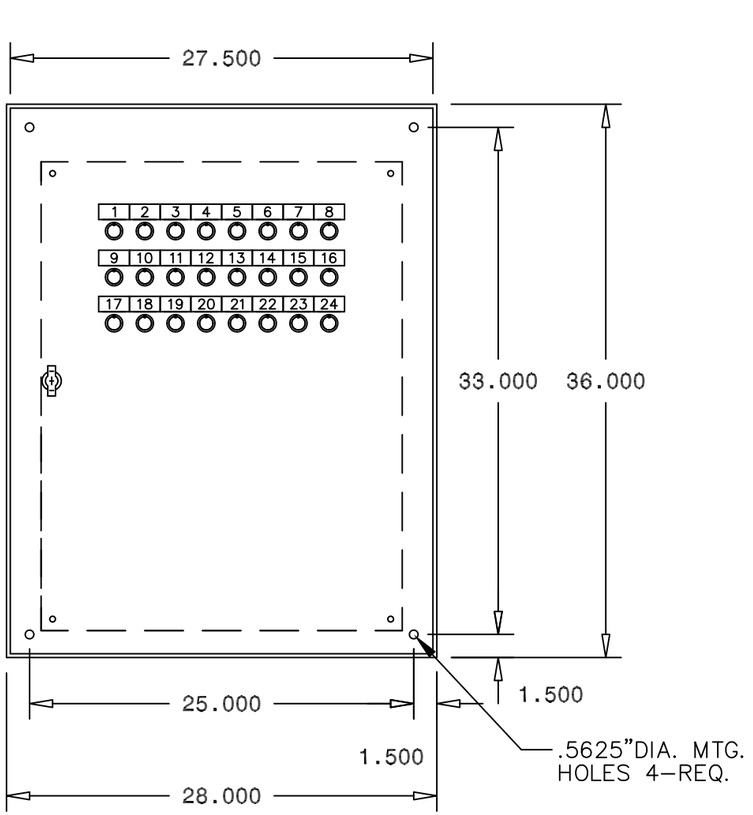
PROJ: -
-

CUSTOMER: - - -

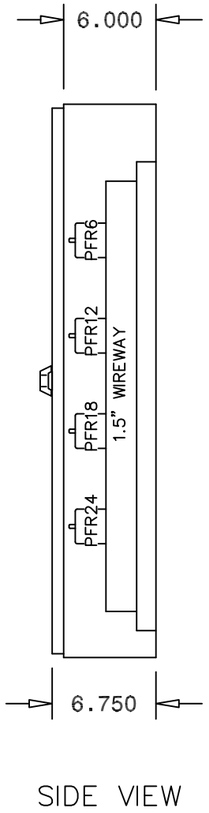
DWG NUMBER: XX2-XXXX-02 -

QUOTE/JOB#: -

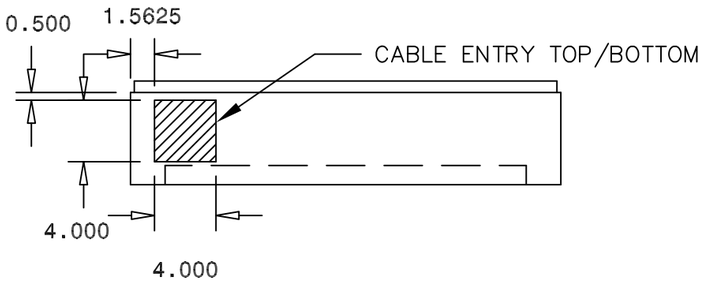
PG 1 OF 1



FRONT VIEW



SIDE VIEW



BOTTOM VIEW
(Recommended Cable Access Areas)

OUTLINE NOTES

1) GENERAL ENCLOSURE CONSTRUCTION:
   A) WALL–MOUNTED
   B) 14 GA. SHEET METAL
   C) 1 HINGED FRONT DOOR
   D) MOUNTING DIMENSIONS ARE ± .0625", ALL OTHER DIMENSIONS ARE APPROXIMATE
   E) LOUVERS (OPTIONAL–NEMA 1 ONLY)

2) NEMA 1 ENCLOSURE:
   A) KEYLOCKABLE HANDLE (PADLOCKABLE HANDLE OPTIONAL)

3) ENCLOSURE FINISH:
   A) PRIMED & PAINTED ANSI–61 LIGHT GRAY (OTHER COLORS OPTIONAL)

AREA PROTECTION DOOR MOUNTED EQUIPMENT

1)	AREA 1 (RED)	13)	AREA 13 (RED)
2)	AREA 2 (RED)	14)	AREA 14 (RED)
3)	AREA 3 (RED)	15)	AREA 15 (RED)
4)	AREA 4 (RED)	16)	AREA 16 (RED)
5)	AREA 5 (RED)	17)	AREA 17 (RED)
6)	AREA 6 (RED)	18)	AREA 18 (RED)
7)	AREA 7 (RED)	19)	AREA 19 (RED)
8)	AREA 8 (RED)	20)	AREA 20 (RED)
9)	AREA 9 (RED)	21)	AREA 21 (RED)
10)	AREA 10 (RED)	22)	AREA 22 (RED)
11)	AREA 11 (RED)	23)	AREA 23 (RED)
12)	AREA 12 (RED)	24)	AREA 24 (RED)

REV	DESCRIPTION	BY	APV	DATE
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

LAKE SHORE ELECTRIC Corp
BEDFORD, OHIO U.S.A.

AREA PROTECTION PANEL
OUTLINE

SCALE: .1:1 | DRN: - - | CHK: - - | APV: - -

PROJ: -
-

CUSTOMER: - - -

DWG NUMBER: XX2-XXXX-02 -

QUOTE/JOB#: -

PG 1 OF 1

LAKESHORE
ELECTRIC CORPORATION

ENGINEER'S GUIDEBOOK

PANELBOARD & SWITCHBOARD

LAKESHORE
ELECTRIC CORPORATION

Custom Switchboard

Introduction

Lake Shore Electric Corporation has been manufacturing Switchboards & Panel Boards since our inception in 1922. Our custom solutions can be designed to meet your specific electrical or dimensional requirements, as we make our own copper bus and customize our own sheet metal. From a simple breaker in a box to integrated power and distribution, we have a custom solution to meet your demanding standards. Our engineering team will design a product that keeps you on-budget and on-target for a smooth and convenient installation.

Recommendations

Please consult the factory for further information on the custom equipment required for your project. We offer free consultations and quotes for all custom equipment.

Product Overview

- Custom Built Switchboard per Customer Specifications
- Rated through 10,000 Amps
- Low, Medium & DC Voltages
- Indoor or Outdoor Applications
- Rear, Side or Front Accessibility
- 50-200kaic Rating
- 100% Fully Rated Copper Bus
- UL 891
- Main and Branch Circuit Breakers
- Ground Fault Protection on Mains and Distribution Devices
- Custom Communications Capabilities
- Powder Coat Finishes

We Can Incorporate Auxiliary Sections to Include:

- Quick Connection Cabinets
- Power Monitoring
- Utility or Customer Metering
- Surge Protection Devices
- Transformers
- Harmonic Mitigation and Power Factor Correction Devices
- Custom Busways & Wiring for Ancillary Equipment Connectivity

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

UL LISTED

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

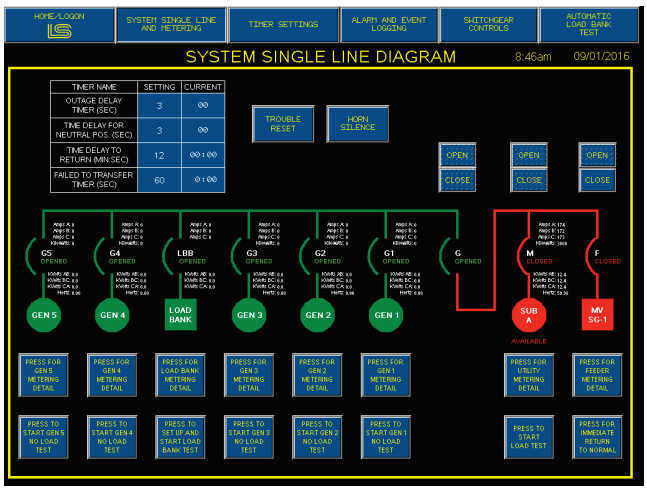
Rev: November 2016

LAKESHORE
ELECTRIC CORPORATION

Advanced Control System

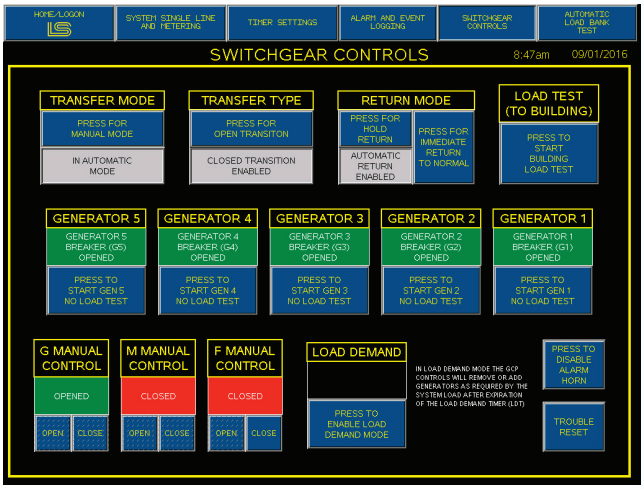
Endless Options of Controls and Data at Your Fingertips

- Interactive Single Lines - Switchgear Controls - Generator Controls - Breaker Controls - Alarm and Event History - Automatic Exerciser - Metering Information - Timer Adjustments - Automatic Load Shedding - Security - Protection - Engine Monitoring - Load Bank- Custom Screen Designs for All Applications



Interactive Single Line

(Showing Standby Generator Application)



Switchgear Controls

Alarms and Event History

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

Made in the USA

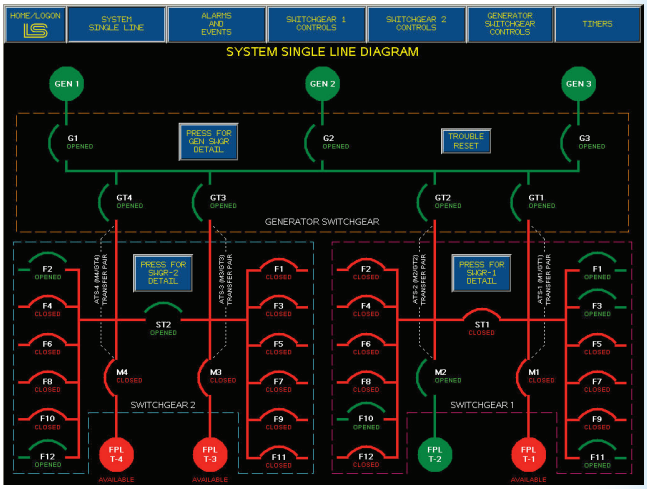
Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

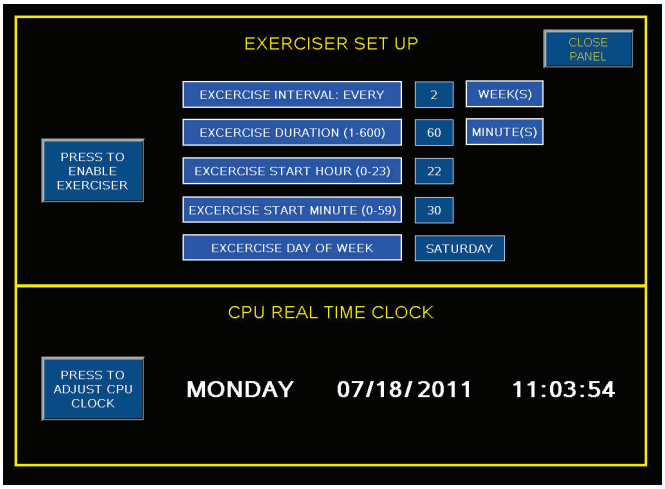
LAKESHORE
ELECTRIC CORPORATION

Single Line

(Showing Main-Tie-Main Application)



Timer Adjustment



Automatic Exerciser

LAKESHORE
ELECTRIC CORPORATION

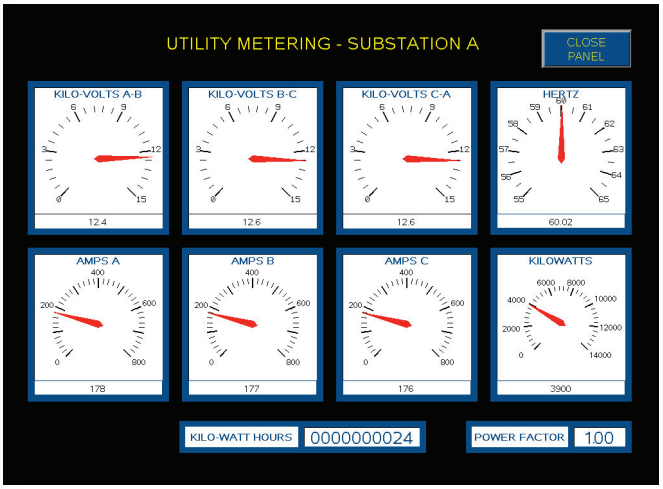
MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

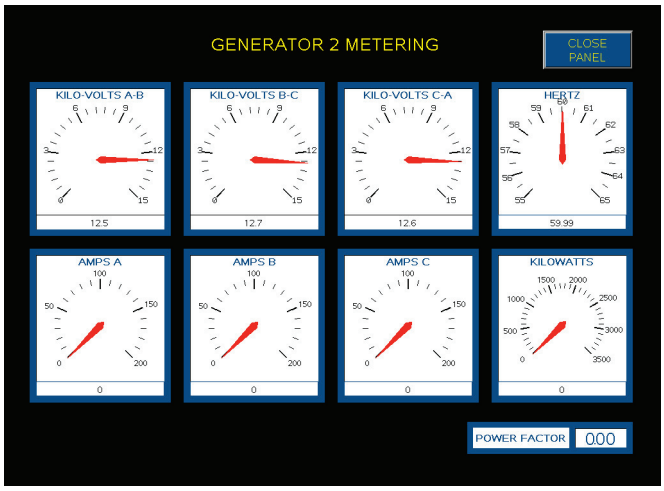
Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

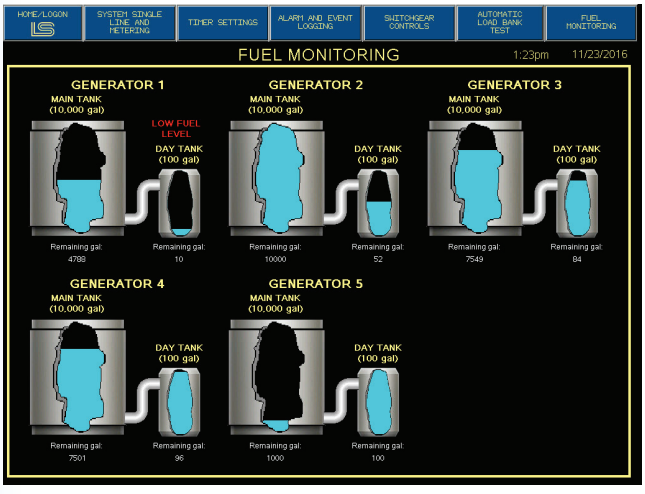
LAKESHORE
ELECTRIC CORPORATION



Utility Metering

Generator Metering





Engine Parameters

(Showing Fuel Monitoring)

LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

Made in the USA

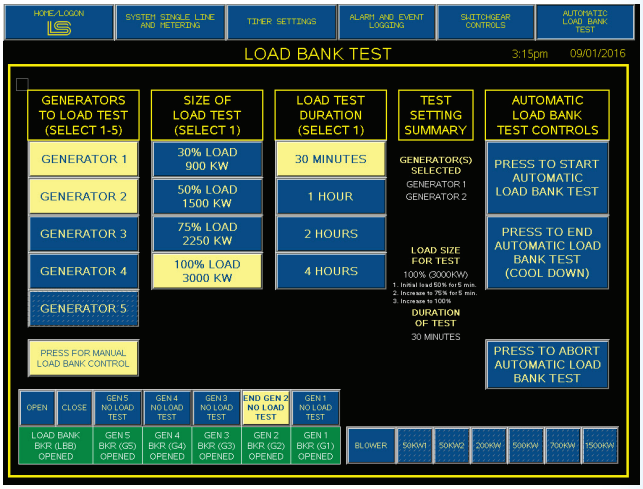
Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146

LAKESHORE
ELECTRIC CORPORATION

Load Bank Controls

(Manual or Automatic Testing)



Security Logon

(Configurable for Multiple Levels)

IO Summary Screen

(Real Time PLC I/O Monitoring)

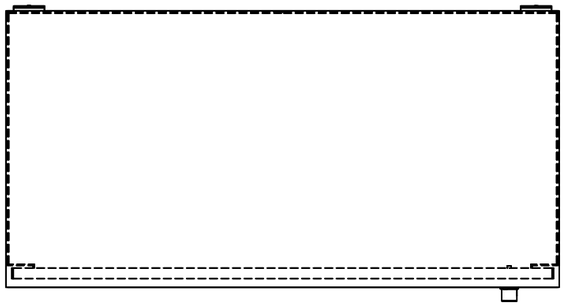
LAKESHORE
ELECTRIC CORPORATION

MINORITY BUSINESS MBE CERTIFIED ENTERPRISE

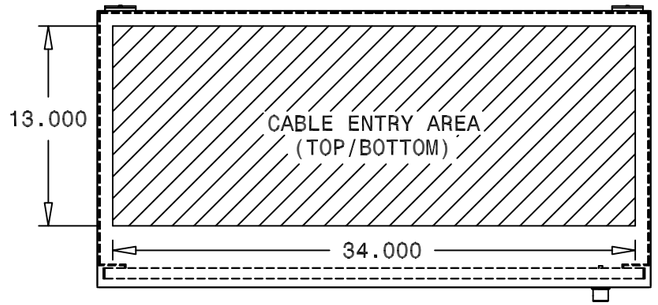
Made in the USA

Contact Information
p:800.225.0141
f:440.232.5644
sales@lake-shore-electric.com
www.lake-shore-electric.com

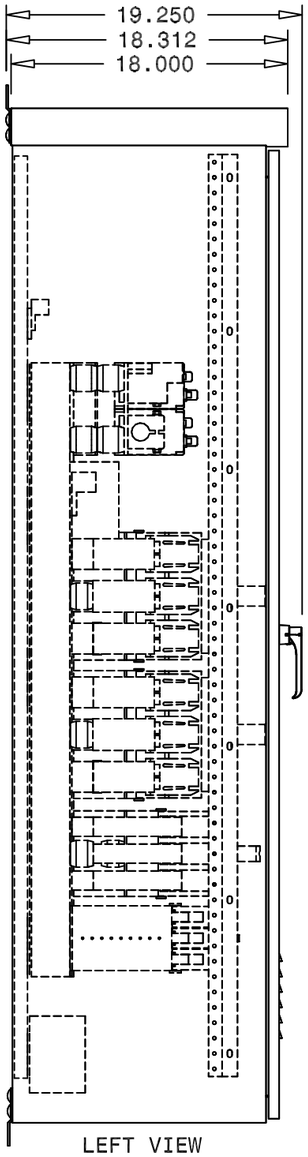
Global Headquarters
Lake Shore Electric
205 Willis Street
Bedford, OH 44146



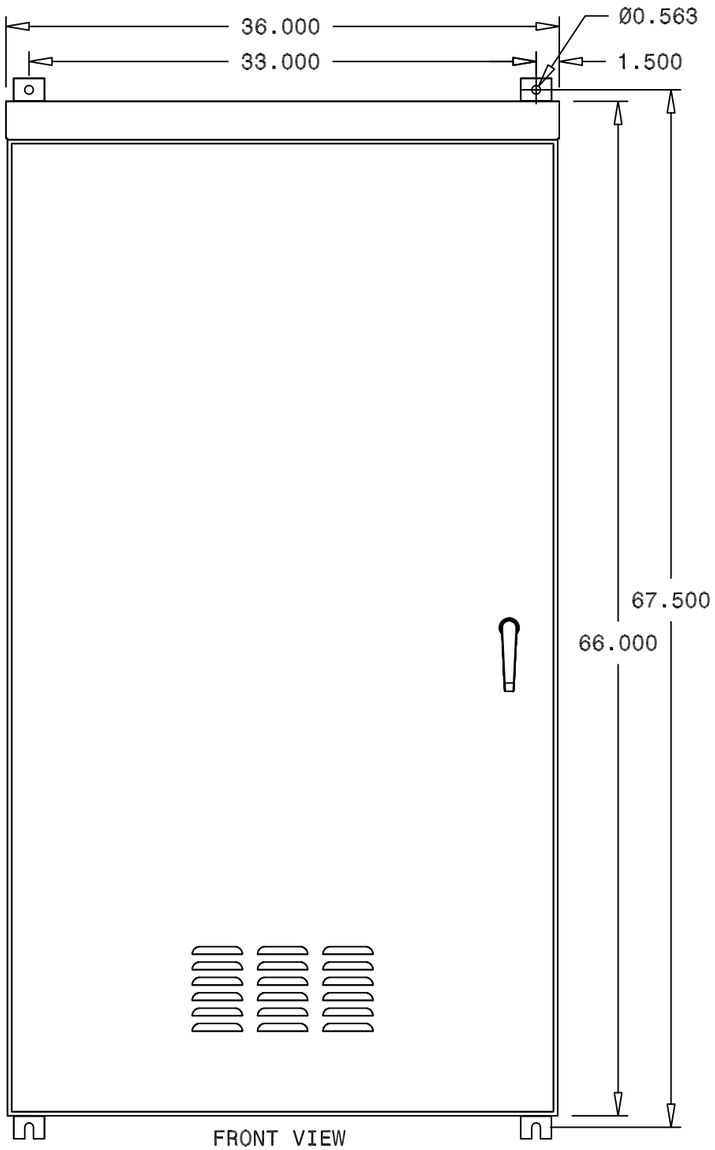
TOP VIEW



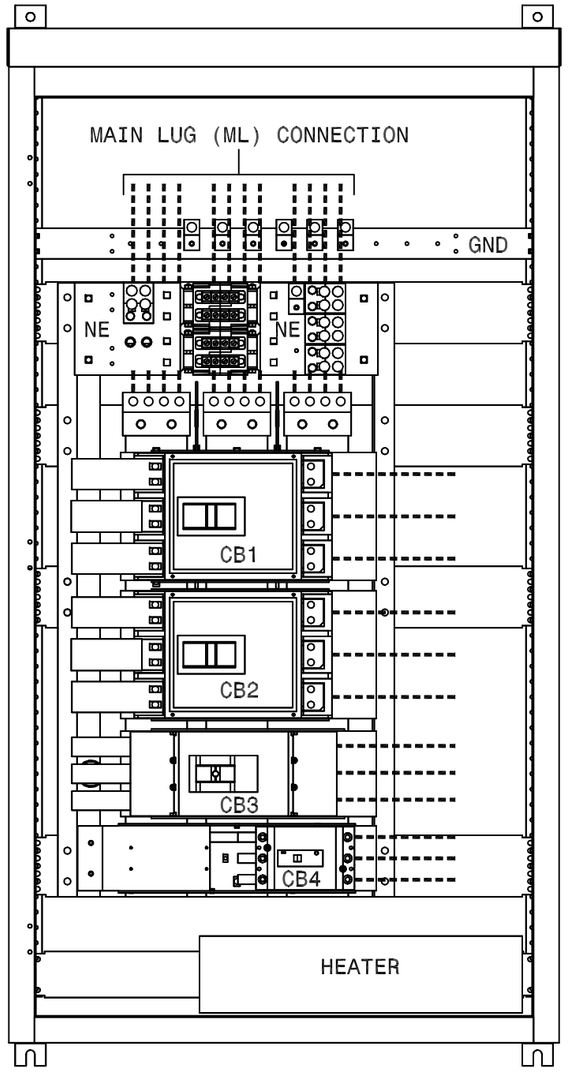
PLAN VIEW



LEFT VIEW



FRONT VIEW



(SHOWN WITHOUT DOOR AND DEAD FRONT)

OUTLINE NOTES

1) GENERAL ENCLOSURE CONSTRUCTION:
   A) WALL MOUNT, NEMA 3R RATED
   B) 14 GA. STEEL (ANSI-61 LIGHT GRAY)
   C) DEAD FRONT DESIGN
   D) MOUNTING DIMENSIONS ARE ± .063",
      ALL OTHER DIMENSIONS ARE APPROXIMATE

2) LUG CONNECTION DATA:
   A) CB1 - (4) 4/0-500 MCM PER PHASE AND NE
   B) CB2 - (4) 4/0-500 MCM PER PHASE AND NE
   C) CB3 - (2) 4/0-500 MCM PER PHASE AND NE
   D) CB4 - (1) #6-3/0 MCM PER PHASE AND NE.
   E) ML - (4) 4/0-500 MCM PER PHASE AND NE.

REV	DESCRIPTION	BY	APV	DATE
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

LAKE SHORE ELECTRIC Corp
BEDFORD, OHIO U.S.A.

1200 AMP SWITCHBOARD
OUTLINE

SCALE: 1:10 | DRN: --- --/--/-- | CHK: --- --/--/-- | APV: --- --/--/--

PROJ: -
-

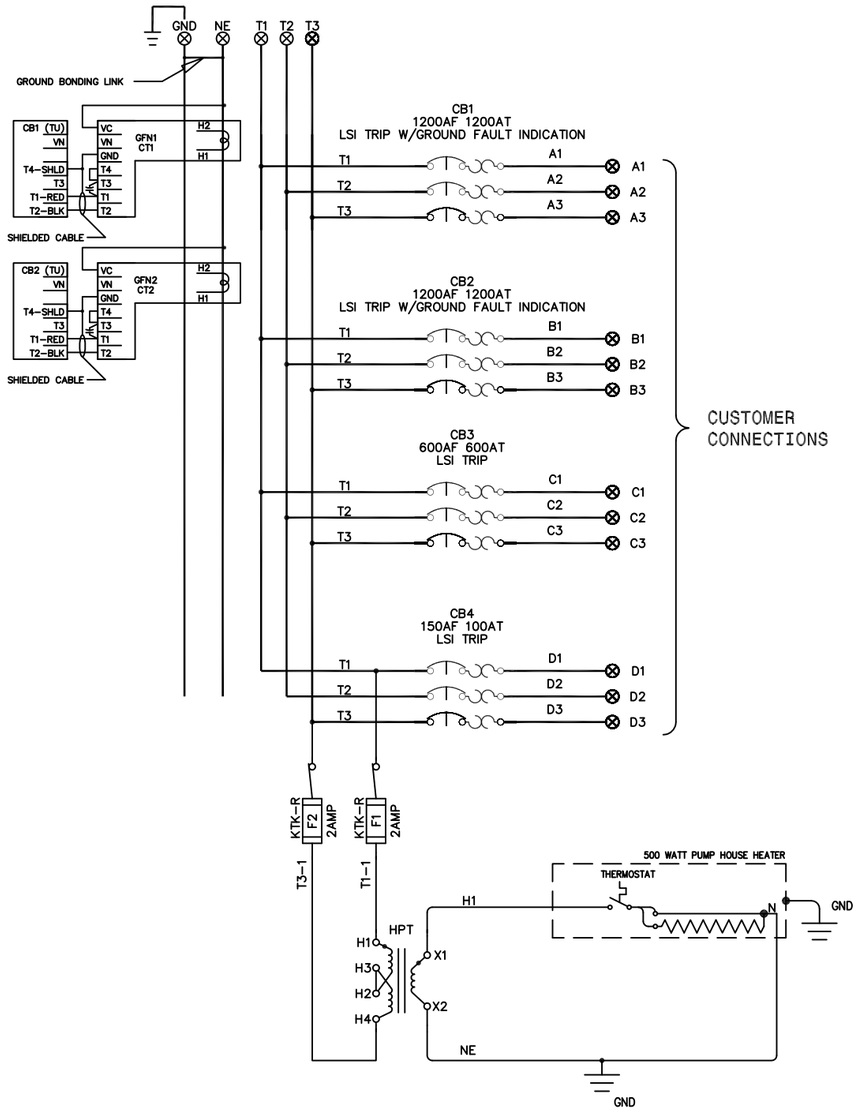
CUSTOMER:
-
-
-

DWG NUMBER
XX2-XXXX-02 -

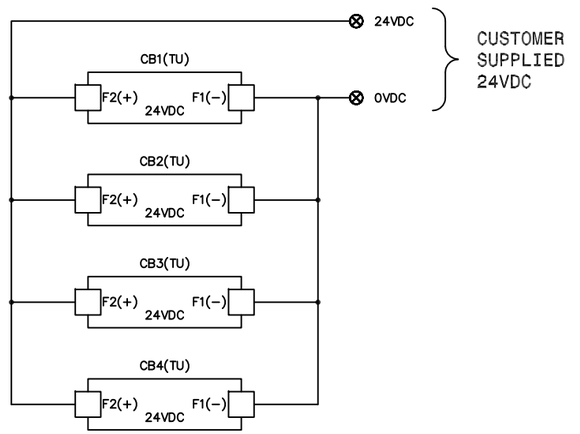
QUOTE/JOB#: -

PG 1 OF 1

CUSTOMER CONNECTIONS
277/480VAC 3PH 4W 60HZ
1200A, 100% RATED COPPER BUS



AC SCHEMATIC



DC SCHEMATIC

NOTES

1) RELAY & TIMER CONTACTS LOCATION: (LINE # = LOCATED IN DC SCHEMATIC) (WIRE #'S = LOCATED IN AC SCHEMATIC)
2) NOMENCLATURE DESCRIPTIONS, IF NOT ON THIS DRAWING (REFER TO LAKE SHORE STANDARD NOMENCLATURE – ES103)
3) COMPONENT LOCATION MARKER, USED WHEN LOCATED IN A DIFFERENT SECTION: (0 = LOCATED OUTSIDE OF SECTION)
4) CUSTOMER CONNECTION TERMINAL BLOCK (TB1)
5) CUSTOMER CONNECTION TERMINAL BLOCK (LOCATED ON PC BOARD OR BLACK BOX)
6) LAKE SHORE CONNECTION TERMINAL BLOCK (TB2 OR TB3)
7) LAKE SHORE CONNECTION TERMINAL BLOCK (LOCATED ON PC BOARD OR BLACK BOX)
8) LAKE SHORE SEC. TO SEC. TERMINAL BLOCK (TB4)
9) LAKE SHORE SEC. TO SEC. TERMINAL BLOCK (LOCATED ON PC BOARD OR BLACK BOX)
10) CUSTOMER ENGINE TERMINAL BLOCK (ETB)
11) CUSTOMER WIRING
12) CUSTOMER CABLING
13) CUSTOMER SUPPLIED EQUIPMENT

NOTE: ALL WIRE TO BE #14 GAGE STD RED WIRE.

REV	DESCRIPTION	BY	APV	DATE
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

LAKE SHORE ELECTRIC Corp
BEDFORD, OHIO U.S.A.

1200 AMP SWITCHBOARD
AC/DC SCHEMATIC

SCALE: NONE | DRN: --- --/--/-- | CHK: --- --/--/-- | APV: --- --/--/--

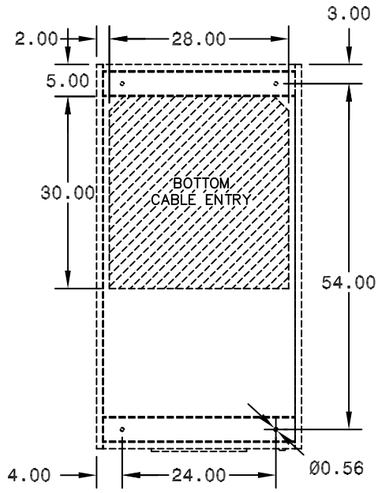
PROJ: -
-

CUSTOMER: -
-
-

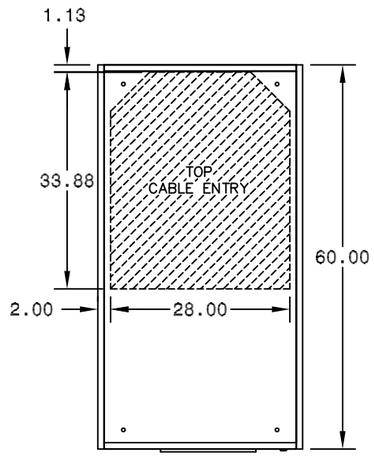
DWG NUMBER XX2-XXXX-03 -

QUOTE/JOB#: -

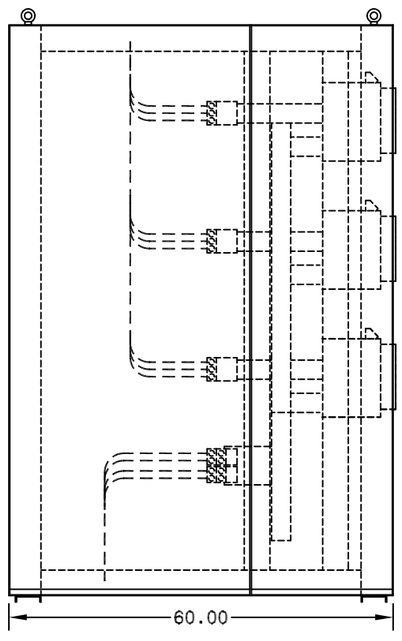
PG 1 OF 1



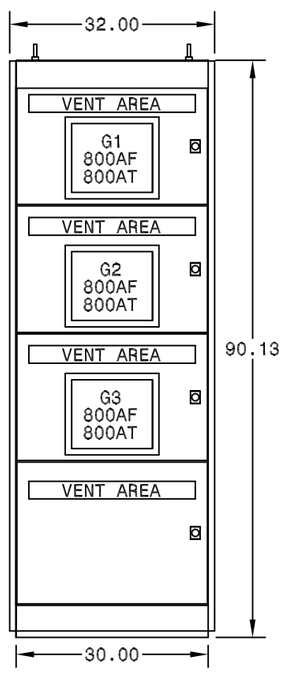
FLOOR PLAN
FRONT



TOP VIEW



LEFT SIDE VIEW



FRONT VIEW

OUTLINE NOTES

1) GENERAL ENCLOSURE CONSTRUCTION:
   A) FREE-STANDING NEMA 1 ENCLOSURE
   B) 14 GA. DOORS & COVERS
   C) 11 GA. FRAME
   D) 1.0"x4.0" 7 GA. CHANNEL BASE
   E) FRONT & REAR DOORS, PADLOCKABLE
   F) REMOVABLE, BOLT-ON COVERS (TOP & SIDES)
   G) OPEN BOTTOM FOR CABLE ENTRY
   H) FRONT & REAR ACCESS REQUIRED
   I) PAINTED ANSI-61 LIGHT GRAY

2) LUGS:
   A) 800A CB(S) - (3) #2-600MCM PER PHASE & NE
   B) 3000A MAIN - (8) 300-800MCM PER PHASE & NE

REV	DESCRIPTION	BY	APV	DATE
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

LAKE SHORE ELECTRIC Corp
BEDFORD, OHIO U.S.A.

INDOOR SWITCHBOARD
277/480VAC 3P 4W 3000A OUTLINE

SCALE: 1=24 | DRN: --- --/--/-- | CHK: --- --/--/-- | APV: --- --/--/--

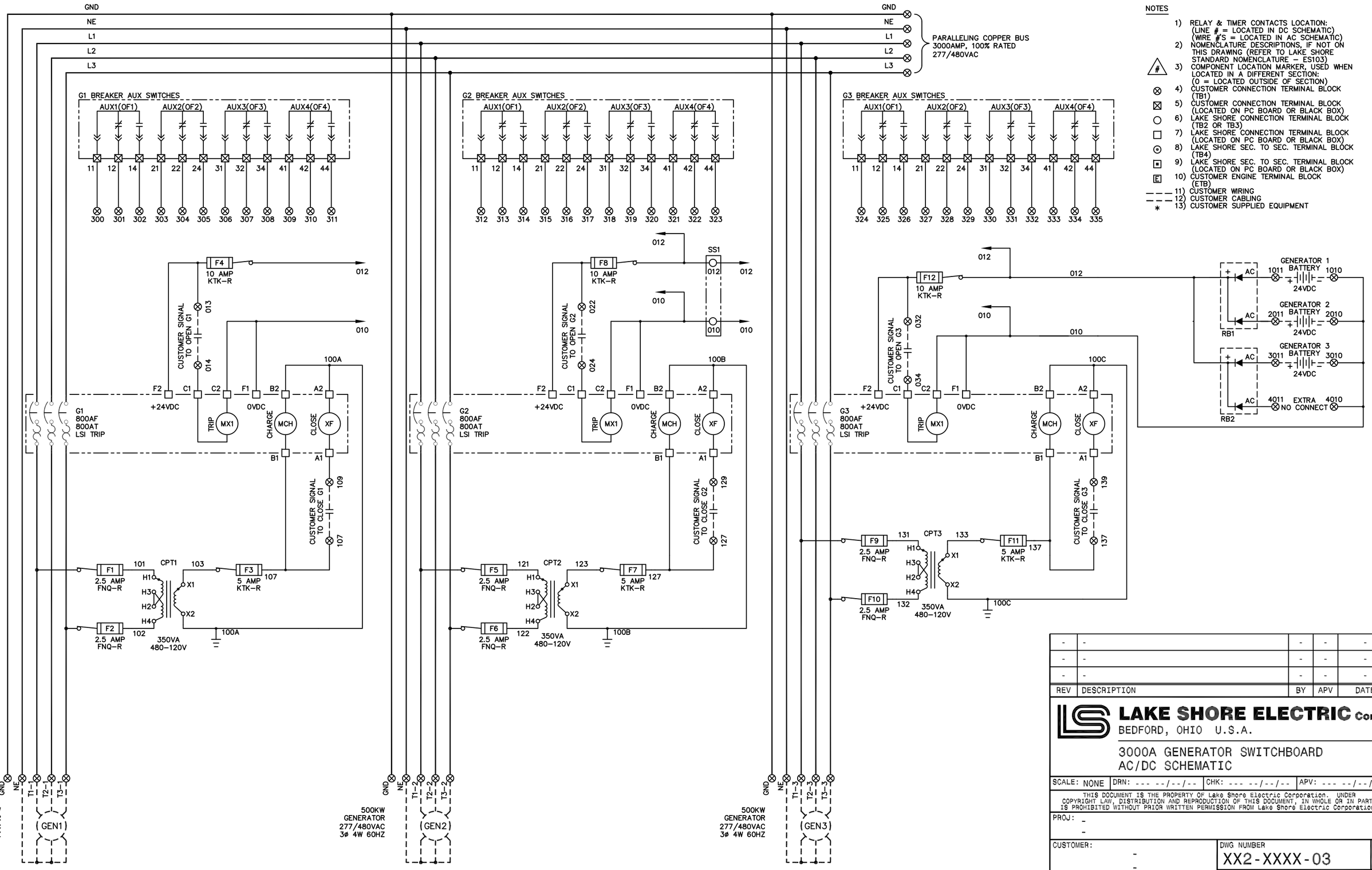
PROJ: -
-

CUSTOMER:
-
-
-

DWG NUMBER
XX2-XXXX-02
-

QUOTE/JOB#:
-

PG 1 OF 1



NOTES

1) RELAY & TIMER CONTACTS LOCATION: (LINE # = LOCATED IN DC SCHEMATIC) (WIRE #'S = LOCATED IN AC SCHEMATIC)
2) NOMENCLATURE DESCRIPTIONS, IF NOT ON THIS DRAWING (REFER TO LAKE SHORE STANDARD NOMENCLATURE – ES103)
3) COMPONENT LOCATION MARKER, USED WHEN LOCATED IN A DIFFERENT SECTION: (0 = LOCATED OUTSIDE OF SECTION)
4) CUSTOMER CONNECTION TERMINAL BLOCK (TB1)
5) CUSTOMER CONNECTION TERMINAL BLOCK (LOCATED ON PC BOARD OR BLACK BOX)
6) LAKE SHORE CONNECTION TERMINAL BLOCK (TB2 OR TB3)
7) LAKE SHORE CONNECTION TERMINAL BLOCK (LOCATED ON PC BOARD OR BLACK BOX)
8) LAKE SHORE SEC. TO SEC. TERMINAL BLOCK (TB4)
9) LAKE SHORE SEC. TO SEC. TERMINAL BLOCK (LOCATED ON PC BOARD OR BLACK BOX)
10) CUSTOMER ENGINE TERMINAL BLOCK (ETB)
11) CUSTOMER WIRING
12) CUSTOMER CABLING
13) CUSTOMER SUPPLIED EQUIPMENT

REV	DESCRIPTION	BY	APV	DATE
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

LAKE SHORE ELECTRIC Corp
BEDFORD, OHIO U.S.A.

3000A GENERATOR SWITCHBOARD
AC/DC SCHEMATIC

SCALE: NONE | DRN: --- --/--/-- | CHK: --- --/--/-- | APV: --- --/--/--

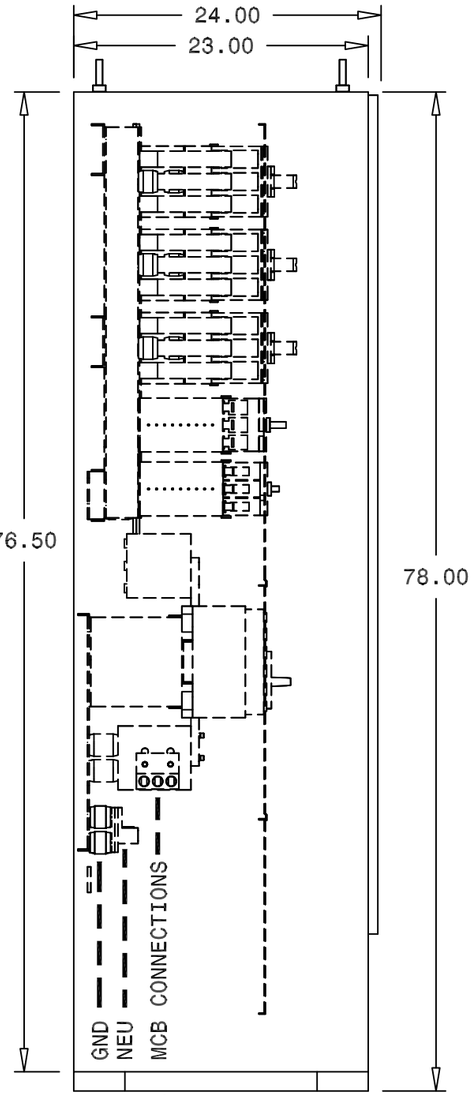
PROJ: -
-

CUSTOMER: -
-
-

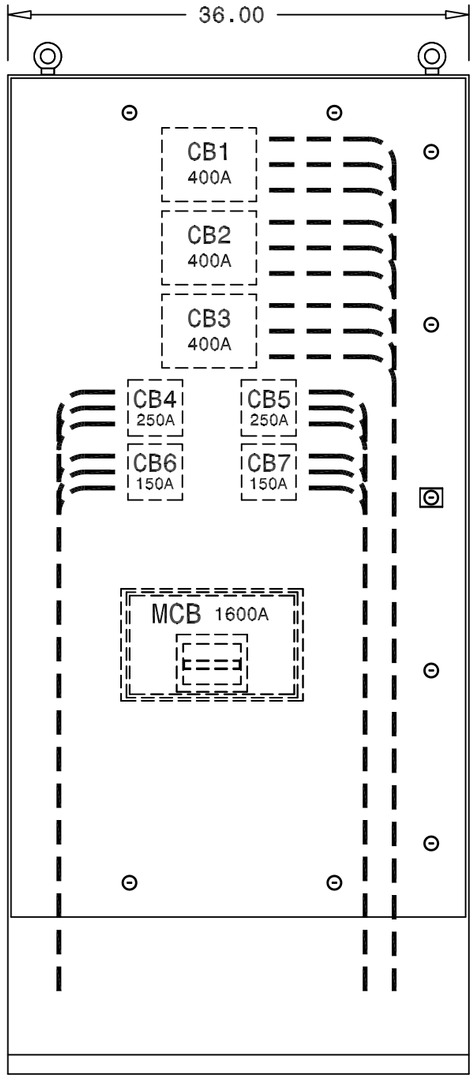
DWG NUMBER: XX2-XXXX-03 -

QUOTE/JOB#: -

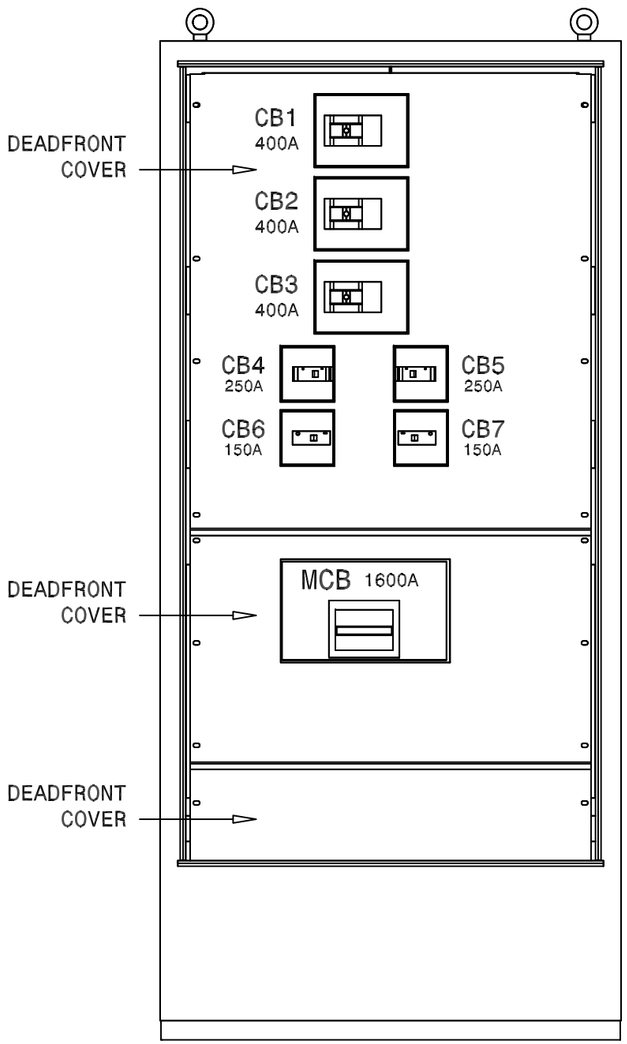
PG 1 OF 1



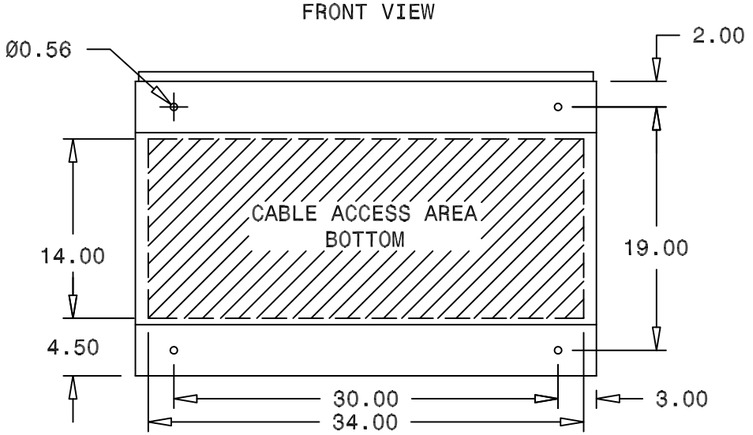
SIDE VIEW



FRONT VIEW



FRONT VIEW
(SHOWN WITHOUT DOOR)



BOTTOM VIEW

OUTLINE NOTES

1) GENERAL ENCLOSURE CONSTRUCTION:
   - A) FREE STANDING ENCLOSURE
   - B) HINGED FRONT DOOR
   - C) ESTIMATED SYSTEM WEIGHT: NA
   - D) ALL DIMENSIONS EXPRESSED IN INCHES
   - E) FABRICATED FROM 14 GA. STAINLESS STEEL
   - F) FINISH NATURAL (BRUSHED)
   - G) PADLOCKABLE HANDLE
   - H) GASKETED DOOR
   - I) NEMA 4X ENCLOSURE

2) CIRCUIT BREAKER (CB) CONNECTION DATA:
   1. 1600AF - (4) 4/0-500 MCM PER Ø AND NEU
   2. 400AF - (2) 4/0-500 MCM PER Ø AND NEU
   3. 250AF - (1) 4/0-350 MCM PER Ø AND NEU
   4. 150AF - (1) #14-3/0 PER Ø AND NEU

REV	DESCRIPTION	BY	APV	DATE
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

LAKE SHORE ELECTRIC Corp
BEDFORD, OHIO U.S.A.

1600A SWITCHBOARD
OUTLINE

SCALE: 1-12	DRN: --- --/--/--	CHK: --- --/--/--	APV: --- --/--/--

PROJ: -
-

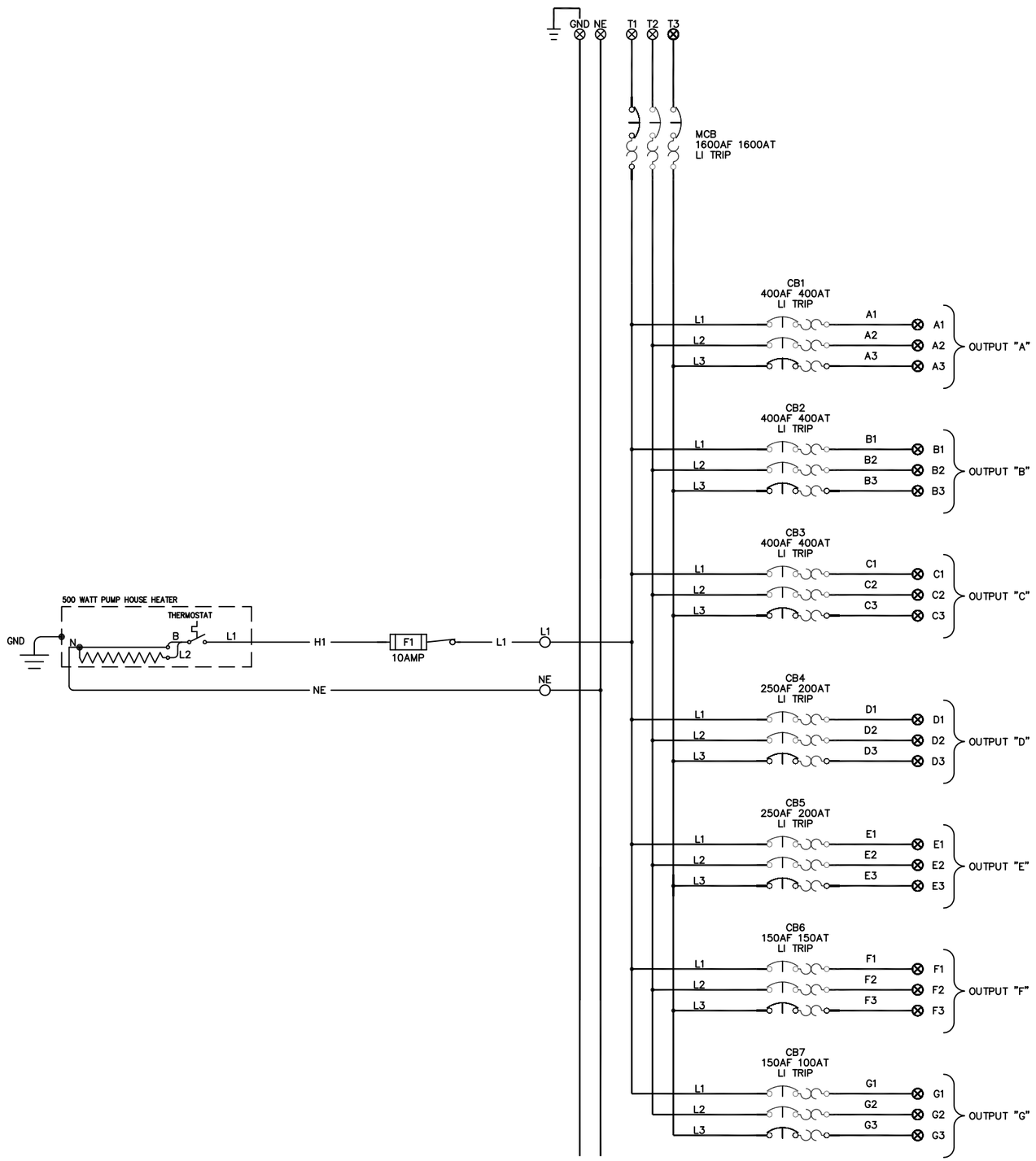
CUSTOMER:
-
-
-

DWG NUMBER
XX2-XXXX-02
-

QUOTE/JOB#:
-

PG 1 OF 1

CUSTOMER INPUT CONNECTIONS
120/208VAC 3PH 4W 60HZ
1600A, 100% RATED COPPER BUS



NOTES

1) RELAY & TIMER CONTACTS LOCATION:
   (LINE # = LOCATED IN DC SCHEMATIC)
   (WIRE #'S = LOCATED IN AC SCHEMATIC)
2) NOMENCLATURE DESCRIPTIONS, IF NOT ON THIS DRAWING (REFER TO LAKE SHORE STANDARD NOMENCLATURE – ES103)
3) COMPONENT LOCATION MARKER, USED WHEN LOCATED IN A DIFFERENT SECTION:
   (0 = LOCATED OUTSIDE OF SECTION)
4) CUSTOMER CONNECTION TERMINAL BLOCK (TB1)
5) CUSTOMER CONNECTION TERMINAL BLOCK (LOCATED ON PC BOARD OR BLACK BOX)
6) LAKE SHORE CONNECTION TERMINAL BLOCK (TB2 OR TB3)
7) LAKE SHORE CONNECTION TERMINAL BLOCK (LOCATED ON PC BOARD OR BLACK BOX)
8) LAKE SHORE SEC. TO SEC. TERMINAL BLOCK (TB4)
9) LAKE SHORE SEC. TO SEC. TERMINAL BLOCK (LOCATED ON PC BOARD OR BLACK BOX)
10) CUSTOMER ENGINE TERMINAL BLOCK (ETB)
11) CUSTOMER WIRING
12) CUSTOMER CABLING
13) CUSTOMER SUPPLIED EQUIPMENT

REV	DESCRIPTION	BY	APV	DATE
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

LAKE SHORE ELECTRIC Corp
BEDFORD, OHIO U.S.A.

1600A SWITCHBOARD
AC SCHEMATIC

SCALE: NONE | DRN: --- --/--/-- | CHK: --- --/--/-- | APV: --- --/--/--

PROJ: -
-

CUSTOMER: -
-
-

DWG NUMBER XX2-XXXX-03 -

QUOTE/JOB#: -

PG 1 OF 1

LAKESHORE ELECTRIC CORPORATION

TERMS & CONDITIONS OF SALE

1. Quotations

a. Quotations automatically expire 30 (thirty) calendar days after quotation date and are subject to termination or modification by written notice within that period.

b. Clerical, estimating and other errors by Seller are subject to correction.

2. Sales and Other Taxes

a. Seller's quoted or published prices do not include any present or future sales tax, use tax, excise tax or duty of any nature whatsoever unless specifically stated otherwise.

b. On sales to Ohio Buyers, Seller is obligated to charge, collect and remit Sales Tax to the State of Ohio, unless a valid exemption certificate is submitted to Seller by Buyer. Such Sales Tax shall be added to the invoice and must be paid by the Buyer to the Seller.

c. On sales to Buyers outside the State of Ohio, it is the Buyer's obligation and responsibility to remit any such taxes or duties when due, directly to applicable governmental tax agencies. Seller will not show or include such taxes or duties on any quotations or invoices; if any such taxes or duties are remitted to Seller, even though not billed, such payment will not be forwarded to the agencies involved but will be returned to or credited to the Buyer.

3. Prices and Minimum Charges

a. Prices and discounts are subject to change without notice.

b. Price information published in catalogs or price lists is not a definite offer to sell. Such prices should be confirmed before relying on them.

c. All orders are shipped F.O.B. Lake Shore Electric (Bedford, Ohio) with freight cost billed collect to the Buyer.

d. In the event of price increases, the price of equipment on order but unshipped will not be increased for a period of ninety (90) days, provided all equipment on order is released for shipment within the ninety (90) day period. After 90 days, the price will be adjusted upon shipment to reflect the price increase but in no case will the increase exceed 15% per annum.

e. Minimum order and billing charge is fifty dollars (US) ($ 50.00) on domestic shipments and one hundred dollars (US) ($100.00) on shipments to points outside the United States.

4. Credit, Terms of Payment and Service Charges

a. Upon Seller's request, Buyer must promptly supply all credit information requested so that satisfactory credit can be established by the Seller.

b. Terms of payment are thirty (30) days from date of invoice, for those customers to whom credit has been established.

c. Pro-rata payments shall become due as partial shipments are made and invoiced. No percent age of any invoice may be withheld as a retainer, or other set-off, without written consent of the Seller.

d. If Buyer's financial condition at any time is not satisfactory to Seller, if payments due to Seller are in arrears over sixty (60) days, Seller reserves the right to suspend work on current orders, and/or to withhold shipment of completed equipment, and to require complete payment of all amounts in arrears, plus full or partial payment in advance for work in process. In the event of such suspension of work, or withholding of shipment, Seller shall be held harmless from any damages that result due to delays on the job.

e. A service charge of 2% per month will be added to any unpaid balance, past due.

5. Order Acceptance

a. Orders accepted by Seller are subject to these Conditions of Sale.

b. The Buyer shall process no order until Seller receives a bona fide signed Purchase Order.

c. All orders accepted by our sales representatives are subject to approval at the home office in Bedford, Ohio.

LAKESHORE ELECTRIC CORPORATION

TERMS & CONDITIONS OF SALE

6. Cancellations or Returns

a. Orders placed cannot be cancelled or changed without express consent of Seller in writing, and shall be subject to payment by Buyer to Seller for any losses, engineering and/or fabrication costs, or any other expenses incurred by Seller by reason of such cancellation or change.

b. Material cannot be returned by Buyer to Seller without express written consent and authorization of Seller in writing. Standard shelf-good items, if authorized for return, shall be subject to a restocking and handling charge of twenty percent (20%). Custom-built items, duly authorized to be returned, shall be accepted for return or credit only to the extent of value to Seller in each individual case. No credit shall be issued to other than the original Buyer. Minimum restocking charges for custom-built items shall be fifty percent (50%).

7. Shipping Dates and Penalty Clause

a. Shipping dates quoted or promised are based on Seller's (1) best estimates; (2) prompt receipt of all necessary information from Buyer.

b. All promises as to date of shipments are made in good faith and the Seller will endeavor to keep such promises by taking every reasonable precaution in the placing of its orders and obligating the component manufacturers in every way possible to insure their carrying out their agreement. But, since all manufacturers in accepting orders specifically deny any liability for consequential damages, this proposal is made with the distinct understanding that we are not held liable for damages of any character whatsoever consequential upon delays in shipments unless in particularly cases where the measure of damage is covered by special agreement and in such cases delays due to strikes, fires, delays in transportation and other causes beyond Lake Shore Electric's reasonable control must be understood as entitling us to corresponding extensions of time.

c. Seller will not accept any liability arising from penalty or liquidated damages clauses of any kind, written or implied, unless specifically approved in writing by an officer of the Seller at the time the order was accepted.

8. Storage Charges and Delayed Shipments

a. If equipment is manufactured and completed in accordance with Buyer's delivery date instructions and delivery is delayed or deferred by Buyer, for the convenience of Buyer, the equipment will be invoiced on the date of completion and terms of payment shall apply from the invoice date.

b. Seller reserves the right to either store such equipment in its factory or in a commercial ware house, at the risk and expense of the Buyer, and Buyer shall be liable for any other expenses incidental to such delay or storage.

9. Warranty and Limits of Liability

a. The Seller warrants its products to be free from defects in material or workmanship over a period of one (1) year from date of shipment or one (1) year from date of startup. In no case shall warranty length exceed eighteen (18) months from date of shipment. Also, no warranty shall be extended or recognized on any equipment for which full payment has not been received.

b. If, within one (1) year after shipment, it shall be proved to Seller's satisfaction that the equipment does not meet the above warranty, and if Buyer promptly advises Seller in writing, Seller will make necessary corrections free of charge F.O.B. works where manufactured. Such necessary corrections constitute the full extent of Seller's warranty. There are no warranties which extend beyond those described herein.

c. Seller does not warrant any equipment of other manufacturers designated or furnished by Buyer.

TERMS & CONDITIONS OF SALE

d. Seller is not responsible for damage to its equipment through acts of God, improper installation or use, unauthorized repair or modifications, or attempts to operate it above its rated capacities or in abnormal environments.

e. In no event, whether as a result of breach of contract, failure to meet conditions of any warranty or shipping schedule, or otherwise, shall Seller be liable for any special, incidental or consequential damages, including but not limited to, loss profit or revenues, loss of good will, damage to associated equipment, cost of capital, cost of substitute products, facilities, service or replacement power, cost of downtime or claims of Buyer's customers for such damages.

f. If Seller furnished Buyer with any assistance or advice concerning any equipment supplied, the furnishing of such assistance or advice shall not subject Seller to any liability, whether in contract, warranty, tort (including negligence) or otherwise.

g. As we take great care in packing our apparatus and employ only experienced personnel for this purpose, we cannot be held responsible for breakage after having received "in good order" receipts from the transportation company, all claims for breakage and damage should be made to carriers but we will be glad to render customer assistance in securing satisfactory adjustment of such claims.

h. In order to maintain this warranty, Buyer must perform all "required maintenance" as described in the Operating and Maintenance Manual that accompanied the equipment furnished by Lake Shore Electric Corporation.

i. The foregoing warranty is exclusive and is in lieu of all other warranties, whether written, oral, implied or statutory. No warranty of merchantability or of fitness for purpose shall apply.

10. General

a. All designs and specifications shown in Seller's catalog are subject to change without notice.

b. All equipment shall be installed by Buyer at the expense of the Buyer.

c. Failure of Seller to insist on strict performance of any of the terms and conditions herein, shall not be deemed a waiver of any rights or remedies which Seller may have, hereto under or by law.

d. Custom fabricated control equipment is built per information provided to the Seller by the Buyer. It is the Buyer's responsibility to review and approve all drawings and designs before fabrication begins. If the Buyer elects to waive drawing approval, the Buyer assumes responsibility for the correct operation of the equipment.

e. Where special designs, engineering or drawings are required to fabricate a special control system, these drawings shall remain the property of the Seller unless the Buyer has made previous arrangements to purchase these designs.

LAKESHORE
ELECTRIC CORPORATION

STANDARD WARRANTY

Standard Warranty and Limits of Liability

Lake Shore Electric Corporation warrants its products to be free from defects in material or workmanship over a period of one (1) year from date of shipment or one (1) year from date of startup. In no case shall warranty length exceed eighteen (18) months from date of shipment. Also, no warranty shall be extended or recognized on any equipment for which full payment has not been received.

If, within one (1) year after shipment, it shall be proved to Lake Shore Electric Corporation's satisfaction that the equipment does not meet the above warranty, and if Buyer promptly advises Lake Shore Electric Corporation in writing, Lake Shore Electric Corporation will make necessary corrections free of charge, F.O.B. works where manufactured. Such necessary corrections constitute the full extent of Lake Shore Electric Corporation's warranty. There are no warranties which extend beyond those described herein.

Lake Shore Electric Corporation does not warrant any equipment of other manufacturers designated or furnished by Buyer.

Lake Shore Electric Corporation is not responsible for damage to its equipment through acts of God, improper installation or use, unauthorized repair or modifications, or attempts to operate it above its rated capacities or in abnormal environments.

In no event, whether as a result of breach of contract, failure to meet conditions of any warranty or shipping schedule, or otherwise, shall Lake Shore Electric Corporation be liable for any special, incidental or consequential damages, including but not limited to, loss of profit or revenues, loss of good will, damage to associated equipment, cost of capital, cost of substitute products, facilities, service or replacement power, cost of downtime or claims of Buyer's customers for such damages.

If Lake Shore Electric Corporation furnished Buyer with any assistance or advice concerning any equipment supplied, the furnishing of such assistance or advice shall not subject Lake Shore Electric Corporation to any liability, whether in contract, warranty, tort (including negligence) or otherwise.

As we take great care in packing our apparatus and employ only experienced personnel for this purpose, we cannot be held responsible for breakage after having received "in good order" receipts from the transportation company, all claims for breakage and damage should be made to carriers but we will be glad to render customer assistance in securing satisfactory adjustment of such claims.

In order to maintain this warranty, Buyer must perform all "required maintenance" as described in the Operating and Maintenance Manual that accompanied the equipment furnished by Lake Shore Electric Corporation.

The foregoing warranty is exclusive and is in lieu of all other warranties, whether written, oral, implied or statutory. No warranty of merchantability or of fitness for purpose shall apply.

Lake Shore Electric Corporation does offer extended warranty coverage on all products. Please contact the factory sales department for information and limits of extended warranty terms and coverage.

LAKESHORE ELECTRIC CORPORATION

SWITCHBOARD & ENGINE NOMENCLATURE

SYM	DESCRIPTION
ABR	AUXILIARY BREAKER RELAY
AC	ACTUATING CONTACT
AH	ALARM HORN
AHL	ALARM HORN LIGHT
AHR	ALARM HORN RELAY
AM	AMMETER
AMS	AMMETER SWITCH
APL	ALTERNATE POWER ON LIGHT
APR	ALTERNATE POWER ON RELAY
APS	ALTERNATE POWER SWITCH
AS	AUTOMATIC SYNCHRONIZER
ATR	AUXILIARY TROUBLE RELAY
ATS	AUTOMATIC TRANSFER SWITCH
AUX	CIRCUIT BREAKER AUX. SWITCH
AVS	AMMETER/VOLTMETER SWITCH
B	BLUE
BA	BELL ALARM
BATT	BATTERY
BC	BATTERY CHARGER
BCAM	BATTERY CHARGER AMMETER
BCFC	BATTERY CHARGER FAILURE CONTACT
BCFL	BATTERY CHARGER FAILURE LIGHT
BCFR	BATTERY CHARGER FAILURE RELAY
BCL	BREAKER CLOSED LIGHT
BCR	BREAKER CLOSED RELAY
BCS	BREAKER CONTROL SWITCH
BCVM	BATTERY CHARGER VOLTMETER
BK	BLACK
BOL	BREAKER OPEN LIGHT
BOR	BREAKER OPEN RELAY
BR	BROWN
BTL	BREAKER TRIP RED LIGHT
BTR	BREAKER TRIP RELAY
C	CAPACITOR
CB	CIRCUIT BREAKER
CBR	CLOSE BREAKER RELAY
CCO	CRANK CUT-OUT RELAY
CCT	CROSS CURRENT TRANSFORMER
CDL	COOL DOWN LIGHT
CLT	CRANK LENGTH TIMER
CM	CRANKING MOTOR
CMC	CRANKING MOTOR CONTACTOR
CNTL	CONTROL
CPB	CRANK PUSHBUTTON
CPR	CONTROL POWER RELAY
CS	CONTROL SWITCH (MAN-OFF/RESET-STANDBY-AUTO)
CT	CURRENT TRANSFORMER
CTD	CAPACITOR TRIP DEVICE

SYM	DESCRIPTION
CTR	CRANK TERMINATION RELAY
CUL	CURRENT LIGHT
CUR	CURRENT RELAY
D	DIODE
DBR	DEAD BUS RELAY
DBT	DEAD BUS TIMER
DFL	DIFFERENTIAL FAULT LIGHT
DPR	DASHPOT RELAY
DR	DIFFERENTIAL RELAY
DS	DISCONNECT SWITCH
EMT	ENGINE MAINTAIN TIMER
EPAL	EMERGENCY POWER AVAILABLE LIGHT
EPL	EMERGENCY POWER ON LIGHT
EPR	EMERGENCY POWER ON RELAY
ERL	ENGINE RUN LIGHT
ERR	ENGINE RUN RELAY
ESL	EMERGENCY STOP LIGHT
ESP	EMERGENCY STOP PUSHBUTTON
ESPP	ENGINE STOP PUSHBUTTON
ESPR	ENGINE STOP RELAY
ESR	EMERGENCY STOP RELAY
ESS	EMERGENCY SHUTDOWN SOLENOID
ESTP	ENGINE START PUSHBUTTON
ESTR	ENGINE START RELAY
ETM	ELAPSED TIME METER
F	FUSE
FCB	FIELD CIRCUIT BREAKER
FES	FLOAT EQUALIZER SWITCH
FLR	FLASHING RELAY
FM	FREQUENCY METER
FOPS	FUEL OIL PRESSURE SWITCH
FPG	FUEL PRESSURE GAUGE
FPL	FAIL TO PARALLEL LIGHT
FPS	FUEL PRESSURE SWITCH
FPSR	FUEL PRESSURE SENDER
FPT	FAIL TO PARALLEL TIMER
FR	FREQUENCY RELAY
FSV	FUEL SOLENOID VLAVE
FV	FUEL VALVE
FVR	FREQUENCY VOLTAGE RELAY
G	GREEN
GCB	GENERATOR CIRCUIT BREAKER
GCS	GOVERNOR CONTROL SWITCH
GF	GROUND FAULT
FA	GROUND FAULT AMMETER
GFL	GROUND FAULT LIGHT
GFP	GROUND FAULT RESET (PUSHBUTTON)
GFR	GROUND FAULT RELAY
GFS	GROUND FAULT SENSOR

LAKESHORE ELECTRIC CORPORATION

SWITCHBOARD & ENGINE NOMENCLATURE

SYM	DESCRIPTION
GOFL	GENERATOR OFF LIGHT
GOL	GENERATOR ON LIGHT
GOLL	GENERATOR ON LINE LIGHT
GPL	GLOW PLUG
GPLL	GLOW PLUG LIGHT
GPLR	GLOW PLUG RELAY
GPLS	GLOW PLUG SWITCH
GPLT	GLOW PLUG TIMER
GPR	GENERATOR PREFERRED RELAY
GPS	GENERATOR PREFERRED SWITCH
GRL	GENERATOR RUNNING LIGHT
GRS	GERERATOR RUNNING SWITCH
GSS	GENERATOR SYNCHRONIZING SWITCH
GTL	GENERATOR TROUBLE LIGHT
GY	GREY
H	HEATER
HBVL	HIGH BATTERY VOLTAGE LIGHT
HBVR	HIGH BATTERY VOLTAGE RELAY
HBVS	HIGH BATTERY VOLTAGE SWITCH
HBVT	HIGH BATTERY VOLTAGE TIMER
HFLL	HIGH FUEL LEVEL LIGHT
HFLR	HIGH FUEL LEVEL RELAY
HFS	HIGH FUEL SWITCH
HS	HEATER SWITCH
HSL	HORN SILENCE LIGHT
HSP	HORN SILENCE PUSHBUTTON
HSR	HORN SILENCE RELAY
HSS	HORN SILENCE SWITCH
HWTL	HIGH WATER TEMPERATURE LIGHT
HWTR	HIGH WATER TEMPERATURE RELAY
HWTS	HIGH WATER TEMPERATURE SWITCH
ILS	ISOCHRONOUS LOAD SHARING MODULE
K	CONTROL RELAY
L	INDUCTOR
LAR	LOAD ADD RELAY
LBD	LAMP BOARD
LBS	LOAD BANK SWITCH (OFF-AUTOMATIC)
LBVL	LOW BATTERY VOLTAGE LIGHT
LBVR	LOW BATTERY VOLTAGE RELAY
LBVS	LOW BATTERY VOLTAGE SWITCH
LBVT	LOW BATTERY VOLTAGE TIMER
LDC	LOAD DEMAND CONTROLLER
LDTL	LOW DAY TANK LIGHT
LDTR	LOW DAY TANK RELAY
LDTS	LOW DAY TANK SWITCH
LED	LIGHT EMITTING DIODE
LER	LOSS OF EXCITATION RELAY
LFLL	LOW FUEL LEVEL LIGHT
LFLR	LOW FUEL LEVEL RELAY

SYM	DESCRIPTION
LOPL	LOW OIL PRESSURE LIGHT
LOPR	LOW OIL PRESSURE RELAY
LSL	LOAD SHED LIGHT
LSR	LOAD SHED RELAY
LSTL	LOW STORAGE TANK LIGHT
LSTR	LOW STORAGE TANK RELAY
LTP	LAMP TEST PUSHBUTTON
LWLL	LOW WATER LEVEL LIGHT
LWLR	LOW WATER LEVEL RELAY
LWLS	LOW WATER LEVEL SWITCH
LWPL	LOW WATER PRESSURE LIGHT
LWPR	LOW WATER PRESSURE RELAY
LWPS	LOW WATER PRESSURE SWITCH
LWTL	LOW WATER TEMPERATURE LIGHT
LWTR	LOW WATER TEMPERATURE RELAY
LWTS	LOW WATER TEMPERATURE SWITCH
MDS	MAINTENANCE DISCONNECT SWITCH
MO	MOTOR OPERATOR
MVC	MANUAL VOLTAGE CONTROL
MVL	MANUAL VOLTAGE LIGHT
MVR	MANUAL VOLTAGE RELAY
N	NEUTRAL
NAL	NOT IN AUTO LIGHT
NAR	NOT IN AUTO RELAY
NCT	NEUTRAL CURRENT TRANSFORMER
NGR	NEUTRAL GROUNDING RESISTOR
NPAL	NORMAL POWER AVAILABLE LIGHT
NPL	NORMAL POWER ON LIGHT
NPR	NORMAL POWER ON RELAY
NPS	NORMAL POWER SWITCH
OFR	OVERFREQUENCY RELAY
OPBL	OIL PRESSURE BYPASS LIGHT
OPBR	OIL PRESSURE BYPASS RELAY
OPBT	OIL PRESSURE BYPASS TIMER
OPG	OIL PRESSURE GAUGE
ORPB	OVERRIDE PUSHBUTTON (ATS)
ORR	OFF/RESET RELAY
OPSR	OIL PRESSURE SENDER
OTSR	OIL TEMPERATURE SENDER
OSL	OVERSPEED LIGHT
OSR	OVERSPEED RELAY
OTG	OIL TEMPERATURE GAUGE
OVL	OVERVOLTAGE LIGHT
OVR	OVERVOLTAGE RELAY
P	POTENTIOMETER
PAL	PRE-ALARM LIGHT
PAR	PRE-ALARM RELAY
PBR	PARALLEL BUS RELAY
PBT	PARALLEL BUS TIMER

LAKESHORE ELECTRIC CORPORATION

SWITCHBOARD & ENGINE NOMENCLATURE

SYM	DESCRIPTION
PE	PLANT EXERCISER
PFM	POWER FACTOR METER
PFR	PHASE FAILURE RELAY (U/VOL)
PFRO	PHASE FAILURE RELAY (O/VOL)
PFS	POWER FAILURE SWITCH
PHWTL	PRE-HIGH WATER TEMP. LIGHT
PHWTR	PRE-HIGH WATER TEMP. RELAY
PHWTS	PRE-HIGH WATER TEMP. SWITCH
PL	PANEL LIGHTS
PLOPL	PRE-LOW OIL PRESSURE LIGHT
PLOPR	PRE-LOW OIL PRESSURE RELAY
PLOPS	PRE-LOW OIL PRESSURE SWITCH
PLS	PANEL LIGHT SWITCH
PLWLL	PRE-LOW WATER LEVEL LIGHT
PLWLR	PRE-LOW WATER LEVEL RELAY
PLWTL	PRE-LOW WATER TEMP. LIGHT
PLWTR	PRE-LOW WATER TEMP. RELAY
PM	PARALLELING MODULE
PR	PILOT RELAY
PT	POTENTIAL TRANSFORMER
Q	TRANSIS. SILICON CONT. RECTIFIER
R	RESISTOR
RB	RECTIFIER BRIDGE
RBD	RELAY BOARD
REC	RECEPTACLE
RIR	RECRANK INHIBIT RELAY
RP	RESET PUSHBUTTON
RPL	REVERSE POWER LIGHT
RPR	REVERSE POWER RELAY
RPT	REVERSE POWER TIMER
RR	RESET RELAY
RS	RACK SOLENOID
RST	RACK SOLENOID TIMER
RVR	REGULATOR VOLTAGE RELAY
S	SWITCH
SAP	SPEED ADJUST POTENTIOMETER
SAR	SLAVE ACTUATING
SAS1	UNDERSPEED SWITCH
SAS2	OVERSPEED SWITCH
SBO	BOOST RESERVOIR ASSEMBLY
SC	SPEED CONTROL
SCR	SYNCHRONIZING CHECK RELAY
SCS	SYNCHROSCOPE
SCUR	SLAVE CURRENT RELAY
SGFR	SLAVE GROU D FAULT RELAY
SL	SYNC LIGHT
SLA	SYNC LIGHT ASSEMBLY
SLS	SYNC LIGHT SWITCH
SLSR	SLAVE LOAD SHED RELAY

SYM	DESCRIPTION
SM	STARTMASTER
SOVR	SLAVE OVERVOLTAGE RELAY
SPBR	SLAVE PARALLEL BUS RELAY
SPFR	SLAVE POWER FAILURE RELAY
SPR	SLAVE PILOT RELAY
SR	START RELAY
SRPR	SLAVE REVERSE POWER RELAY
SS	SELECTOR SWITCH
SSR	SYSTEM START RELAY
ST	SHUNT TRIP
STR	SYSTEM TROUBLE RELAY
SUFR	SLAVE UNDERFREQUENCY RELAY
SUVR	SLAVE UNDERVOLTAGE RELAY
T	TRANSFORMER
TB	TERMINAL BLOCK
TH	THERMOSTAT
TR	TROUBLE RELAY
TSDV	THROTTLE SOLENOID DUMP VALVE
U	INTEGRATED CIRCUIT
UCUL	UNDERCURRENT LIGHT
UFL	UNDERFREQUENCY LIGHT
UFR	UNDERFREQUENCY RELAY
UFT	UNDERFREQUENCY TIMER
UV	UNDERVOLTAGE RELEASE
UVL	UNDERVOLTAGE LIGHT
UVR	UNDERVOLTAGE RELAY
UVT	UNDERVOLTAGE TIMER
V	VIOLET
VAR	VOLTAGE ADJUST RHEOSTAT
VCB	VACUUM CIRCUIT BREAKER
VM	VOLTMETER
VMS	VOLTMETER SWITCH
VMT	VOLTMETER TRANSDUCER
VR	VOLTAGE REGULATOR
VRM	VARMETER
VRMT	VARMETER TRANSDUCER
W	WHITE
WHM	WATTHOUR METER
WM	WATTMETER
WMT	WATTMETER TRANSDUCER
WTG	WATER TEMPERATURE GAUGE
WUT	WARM UP TIMER
Y	YELLOW
Z	ZENER DIODE