LAKE SHORE ELECTRIC CORPORATION

INSTALLING, OPERATING AND MAINTAINING

INSULATED CASE
FIXED AND DRAW OUT

AUTOMATIC TRANSFER SWITCHES

WITH MP 7600 CONTROLLER

LAKE SHORE ELECTRIC CORPORATION

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WARNING!

WHEN WORKING ON EQUIPMENT OF THIS TYPE, EXTREME DANGER OF ELECTROCUTION EXISTS, THIS MAY RESULT IN INJURY OR DEATH. DO NOT ATTEMPT ANY REPAIRS OR ADJUSTMENTS TO THIS EQUIPMENT WITHOUT FIRST TAKING EVERY PRECAUTION TO PREVENT ACCIDENTAL INJURIES.

IN INSTALLATION AND USE OF THIS PRODUCT, COMPLY WITH THE NATIONAL ELECTRICAL CODE, FEDERAL, STATE AND LOCAL CODES, AND ALL APPLICABLE SAFETY CODES. IN ADDITION, TURN OFF POWER AND TAKE OTHER NECESSARY PRECAUTIONS TO PREVENT PERSONAL INJURY AND EQUIPMENT DAMAGE.

NO ENTRANCE TO THE CABLE COMPARTMENT SHOULD EVER BE MADE UNLESS ALL SOURCES OF POWER TO THIS TRANSFER SWITCH HAVE BEEN DISCONNECTED AND LOCKED OUT.

WARRANTY

Lake Shore Electric Corporation Automatic Transfer Switches are guaranteed against defective materials and workmanship for a period of one year from date of shipment. If, within one year after shipment, it is proved to Lake Shore Electric Corporation's satisfaction that the equipment does not meet the above warranty, and if Lake Shore Electric Corporation is promptly notified of same, 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. This 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 is not responsible for damage to its equipment through 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 failure to meet conditions of the warranty 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, damages to associated equipment, cost of capital, cost of substitute products, facilities, service or replacement power, costs of downtime or claims of third parties for such damages.

> **Notice:** The owner of this automatic transfer switch must perform certain required maintenance functions as described in **Section #9 – Required Maintenance** of this manual in order to maintain Lake Shore Electric Corporation's one year exclusive warranty. Failure to perform this maintenance shall void this warranty.

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NOTE

Engineering changes may have been made after publication date. Any departure from this manual should be checked with Lake Shore Electric Corporation.

Lake Shore Electric Corporation reserves the right to change specifications without prior notice.

1. CONSTRUCTION

Insulated Case Transfer Switches manufactured by Lake Shore Electric Corporation use two stored energy insulated case switches and/or circuit breakers to accomplish the transfer between two separate power sources to a single load.

These insulated case switches and/or circuit breakers are electrically interlocked through the MP7600 Controller and auxiliary switches, and are also mechanically interlocked. The mechanical interlock is located on the right side of the two switches. This mechanism is a factory-installed device, which positively prevents both of the insulated case switches or circuit breakers from being in the **ON** position simultaneously. This redundant interlocking system provides a "Fail-Safe" design. **Note:** This mechanical interlock is not provided on units equipped with the Closed Transition Transfer Option.

Manually operable push buttons are accessible from the front of the switch to enable personnel to manually operate the transfer switch should this become necessary. These pushbuttons are permanently mounted and readily accessible in an emergency. This transfer switch can be manually operated under load.

All interface relays are of the enclosed industrial type to ensure long life and minimum maintenance. All relays are rated for continuous duty to eliminate overheating of coils. The MP7600 Controller, which is the heart of our control system, is a rugged, durable industrial quality device that assures minimum maintenance.

All timers including the plant exerciser are incorporated in the microprocessor control. All timer values are stored in non-volatile memory.

2. DESCRIPTION OF OPERATION

The following are general descriptions of operation applying to Insulated Case Transfer Switches. Certain accessory additions may modify the sequence of operations as required to suit specific applications.

The Insulated Case Automatic Transfer Switch utilizes the internal motor of each of the normal and emergency switches for its operation. Normally, the transfer switch operates on the preferred power source with the normal switch in the closed position and the emergency switch in the open position.

All phases of the preferred power source are continuously monitored by a voltage sensitive relay, 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 dropout set point, the voltage relay sends a signal to the MP 7600 Microprocessor controller. The MP 7600 in turn initiates a Time Delay Engine Start (TDES) timer. Upon completion of the TDES, a signal is given via a dry “form C” contact to the engine start circuit, and the Minimum Run Timer (MRT) is initiated. After the engine has started and develops frequency and voltage, the frequency voltage relay will send a signal to the MP 7600 indicating the generator set is ready to accept load. At that point it will initiate a Time Delay Emergency (TDE) timer. Upon completion of the TDE, the normal source switch will be opened thus placing the transfer switch in the neutral position. Upon opening of the normal side a Time Delay Neutral (TDN) is initiated which when timed out, allows for the

closing of the emergency switch thus connecting the alternate source to the load. With the Automatic Transfer Switch now operating on the emergency source, the voltage relay continues to monitor the normal source.

Upon restoration of normal power as sensed by the voltage relay, a Time Delay Return (TDR) is initiated. Upon completion of the TDR, the switch will retransfer the load from emergency by opening the emergency switch, initiating the TDN and when it times out close the normal switch. After retransfer to normal a Time Delay Engine Cool down (TDEC) timer is initiated. Upon completion of the TDEC and upon the completion of the MRT, the engine start signal will be removed.

Note: For a UTILITY TO UTILITY application, a preferred source selector switch is provided on all transfer switches built for Utility-to-Utility applications. The sequence of operation does not include the Time Delay Engine Start (TDES), Time Delay Engine Cool Down (TDEC) and Minimum Run Timer (MRT). Otherwise the operation is the same as described above.

For those Transfer Switches built as Draw Out switches, additional safety and reliability is provided. The transfer switch itself inherently functions to bypass either source by connecting the alternate source to the load. By offering the draw out feature, either or both of the insulated case switches can be withdrawn, thereby isolating them from live parts. This allows maintenance, service or replacement of the switch without loss of service to the load or danger to the maintenance personnel. Please refer to the Masterpact® NW manual, provided with each Insulated Case Automatic Transfer Switch, for detailed instruction on the operation of these insulated case products.

Note: When draw out transfer switches are placed in the test position, they are considered to be “not in automatic” notwithstanding the HMI display of the Mode of Operation. See page 12, 4.2, Operational Configuration.

The Insulated Case Automatic Transfer Switch is effectively used for Service Entrance Rated Transfer Switches because the independent motor design allows the necessary condition of having both switches in the off position so that the load is isolated and disconnected from the two sources.

The Insulated Case Automatic Transfer Switch is also effectively used for Closed Transition Transfer Switches because the independent motor design allows the necessary condition of having both switches in the on position so that the load is momentarily connected to both sources when they are synchronized providing a “make before break” transfer.

3. INSTALLATION

3.1 MOUNTING AND CONNECTING

The standard Lake Shore Electric Corporation transfer switch is designed for operation in a clean, dry, dust-free location where a minimum of vibration is present.

When used in conjunction with an engine generator set, it is recommended that the transfer switch be located as close as possible to the generator set, as this will reduce the length of the DC control wiring (required for automatic operation) thus preventing voltage drops and

improper operation. The maximum recommended distance the automatic transfer switch should be installed from the engine generator set batteries is 1400 feet, using #10 gauge wire.

Insulated Case Transfer Switches are manufactured in free standing enclosures. Open transfer switches are generally mounted in a customer-supplied enclosure; consequently, there are certain steps, which should be followed:

1. Allow adequate space for placement of the control panel and HMI.
2. Mount to a rigid framework to prevent vibration.
3. Review all electrical clearances with the enclosure door or panels closed.
4. Insure there is no strain on the bus bars due to improper alignment.

Before bringing the power cables into the enclosure, be certain that the lugs will be of the correct size. If not, different sizes may be ordered from Lake Shore Electric Corporation.

The Normal source power cables are to be connected to the Normal Bus extensions marked NL1, NL2, and NL3. Please refer to the specific wiring diagram supplied with the switch. The Emergency source power cables are to be connected in a like manner to the Emergency bus extensions marked EL1, EL2 and EL3. (**Note:** Be careful to pass the cable through any current transformers or other devices, which may be part of a generator control.) The load cables are to be connected to the load bus extensions marked L1, L2 and L3. On three-phase, four-wire transfer switches, or single-phase, three-wire transfer switches, a neutral bus is provided. **Note:** Verify that the phase sequence of normal and emergency sources are identical. Failure to do this could result in damage to the transfer switch and/or other equipment and will void the warranty extended by Lake Shore Electric Corporation. When installing the power cables, be careful not to disturb or damage the control wires that go to the various terminals. Ground lugs are provided on all transfer switches. These lugs **must** be connected to earth ground.

CAUTION: Be sure to check that all power cable lugs are torqued to the applicable requirement for the switch see Section 9, Required Maintenance.

Connect DC voltage source and start contacts. Please refer to page 16, MP7600 installation.

There are numerous accessories available on Lake Shore Electric Corporation transfer switches which require external connections. Refer to the wiring diagram included with your transfer switch for specific instructions on connecting these accessories.

3.2 PLACING THE TRANSFER SWITCH IN OPERATION

Before energizing the switch electrically, be certain all external connections have been properly made according to the wiring diagram provided with the switch. Inspect all wires, cables, and bus bar for abraded insulation, foreign matter, and electrical clearance.

Manually set the transfer switch to the Normal source (Normal breaker **Closed** and Emergency Breaker **Open**) and energize the normal source. The red LED on the Voltage Sensing Relay should be lighted, indicating that the normal source is available and within the pick-up setting of the relay. If this does not light (i.e. pick up), place a voltmeter on the normal source to be sure that the voltage is adequate and within the range of the relay. The switch will not operate on a voltage other than that stamped on the nameplate of the transfer switch.

Do not attempt to energize the Emergency source until the switch is operating satisfactorily on normal. With the Normal source operating, the Emergency source may now be **manually** energized for testing. The Emergency source, including all safety interlocks, should be checked over before an attempt is made at a complete automatic system test. When the Emergency source has been tested satisfactorily and de-energized, a test of the automatic system can be tried.

All MP7600 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 voltage and frequency, the transfer switch should transfer to the emergency source.

Now return the operating mode to "Auto" at the HMI panel. The transfer switch should, after the appropriate time delays, return to normal if normal power is available. To test the Load Test Cycle, press the momentary Load Test Cycle pushbutton inside the door for two seconds. The transfer switch should start the engine, transfer to emergency, and return to normal after the appropriate time delays.

The above tests are sufficient to place the transfer switch in operation. The following pages contain specific information on the various components and troubleshooting.

4. MP 7600 CONTROLLER

4.1 INTRODUCTION

The Lake Shore Electric Corporation MP7600 is a sophisticated state of the art, microprocessor based controller. It consists of four major parts: a Power Supply board, a Relay Interface Board, a Main Control Board and a Human Machine Interface Panel. It is designed to operate in the "industrial" temperature range of –40 to +85 deg C.

Power Supply (Figure 1)

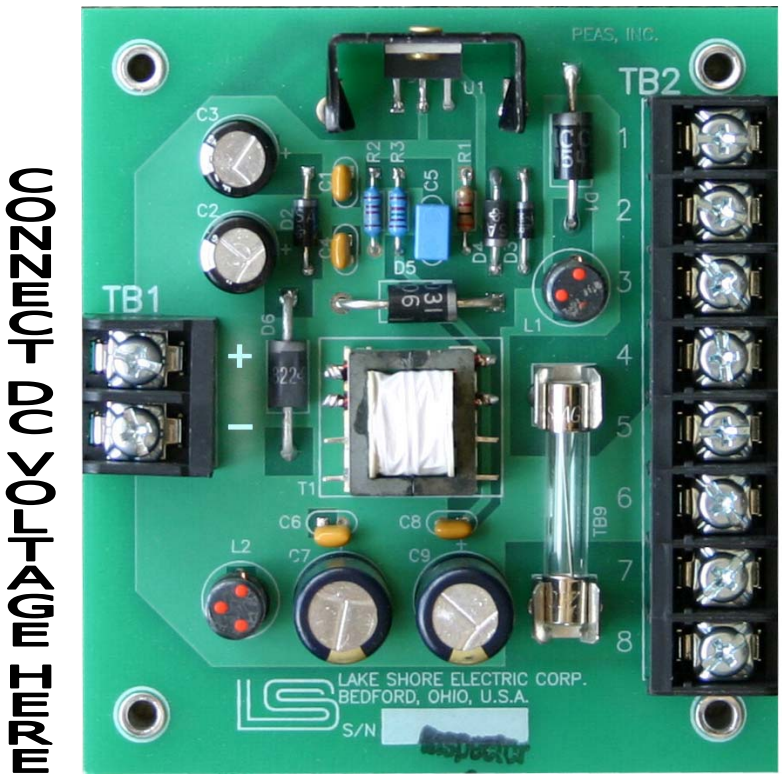
The Power Supply (PS) unit accepts a 12-volt dc or 24-volt dc input. It is designed to function on the engine starting batteries. Voltage regulation for the power supply is within 2% from no load to full load. External voltage sources can vary from 7 volts dc to 36 volts dc without harm to the MP7600 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

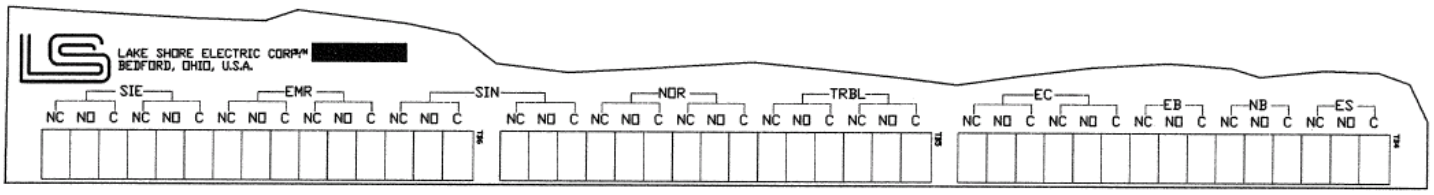


(Figure 1)

Relay Interface Board (Figure 2)

The Relay Interface Board (RIB) is the electro mechanical interfacing device between the MP7600 microprocessor controls and 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.

Customer Connections (on bottom side of board shown)



(Figure 2)

SIE	Switch in Emergency Position	TRBL	Trouble
EMR	Emergency Source Available	ECT	Transfer Pre-signal
SIN	Switch in Normal Position	ES	Engine Start
NOR	Normal Source Available		

Main Control Board (Figure 3)

The Main Control Board (MCB) contains the microprocessor and performs all of the logic necessary to control the transfer switch. It contains a perpetual date and time clock, which is programmed to automatically adjust for leap years. It contains the timers listed in the section marked “Setting Timers”. All timers, date and time settings are stored in battery backed-up non-volatile memory, which can be maintained de-energized for 90 out of 100 years.

There are no user serviceable components in the MCB; however, there are connections that need to be made to it. All of these connections will be made at the factory. There are no field connections to be made!

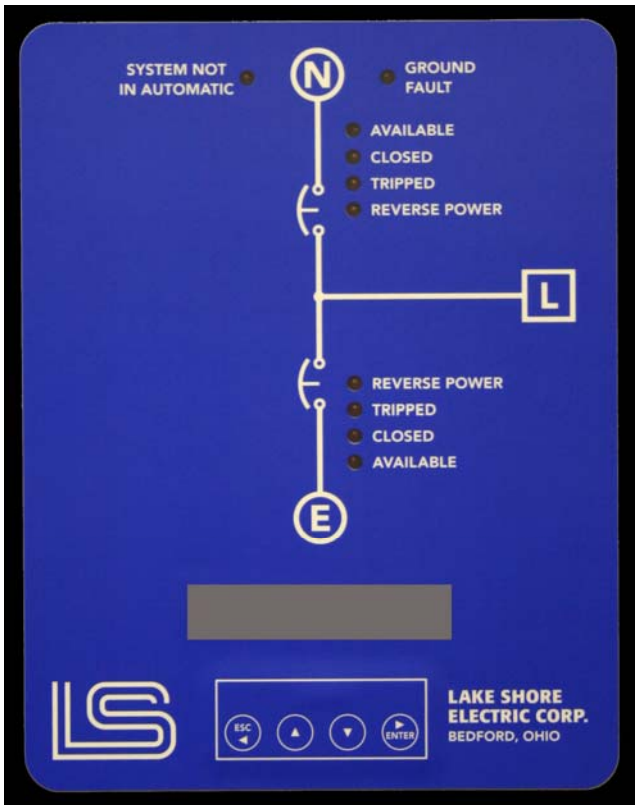
TB1

1	Ground	Power supply grounded Negative	9	PS	Peak Shaving
2	+9V	Power supply Positive	10	RPN	Reverse Power Normal
3	NOR	Normal Power Available	11	RPE	Reverse Power Emergency
4	EMR	Emergency Power Available	12	SYNC	Synchronizing
5	LTS	Load Test Switch	13	XIN2	Remote Disconnect
6	ORPB	Override Push Button	14	XIN3	Inphase Monitor
7	MSE	Menu System Enable	15	Input Return	
8	GFR	Ground Fault Relay			

(Figure 3)

Human Machine Interface Panel (Figure 4)

The Human Machine Interface Panel consists of a graphic overlay which displays a one-line representation of a transfer switch, various LED's to annunciate status of the switch, a two line, 40 character LCD to display transfer switch mode of operation, date, time, timers status, fault condition, exerciser status other pertinent data. Additionally, the HMI Panel contains a keypad, Which allows the transfer switch to be programmed.



(Figure 4)

4.2 OPERATIONAL CONFIGURATION

The MP7600 controls the operation of the automatic transfer switch and contains as standard features five modes of operation, up to nine timers, a plant exerciser, and various sets of dry contacts for customer use.

Modes of Operation (Utility to Generator)

There are five modes of operation. Four of which are selectable by using the HMI Panel

1. Automatic
2. Hand Crank
3. Load Test

4. Off/Reset

The fifth mode is Fault. In the fault mode, the transfer switch has failed to perform some function and the fault is displayed on the HMI Panel LCD. The eight types of fault that will be displayed are:

1. Ground Fault*
2. Reverse Power*
3. Bell Alarm (normal or emergency)*
4. Open Normal Failed
5. Open Emergency Failed
6. Both Opens Failed
7. Close Normal Failed
8. Close Emergency Failed

* Optional Equipment

Modes of Operation (Utility to Utility)

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/Reset

The fourth mode is Fault and will be displayed as shown above.

Timers (Utility to Generator)

Up to eight timers are available:

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. This timer is provided on Dual Motor & Insulated Case Transfer switches only.

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 starting the engine generator set and will keep the engine running until it has timed out.

SFT* Synchronize Fail Timer. This timer is adjustable from 0.0 to 60.0 minuets and is factory set at 15 minutes. 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.

ACBT* Auxiliary Contacts 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.

* Optional Equipment

Timers (Utility to Utility)

Up to four timers are available:

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.

ACBT* Auxiliary Contacts 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.

* Optional Equipment

Plant Exerciser

The Plant Exerciser operates on a weekly basis as follows:

1. It can be disabled
2. It can be enabled with or without load
3. Any time of day is selectable as start time
4. Any duration of exercise period is selectable (hh:mm) from 00:01 through 24:00
5. Any day or all days of the week (SMTWTFS) are selectable for exercising.
6. Any week or all weeks of the month are selectable.

Dry Contacts

Dry contacts are provided for:

1. One set of “form C” contacts to initiate engine start **
2. Two sets of “form C” contacts for remote “Switch in Emergency” indication
3. Two sets of “form C” contacts for remote “Switch in Normal” indication
4. Two sets of “form C” contacts for remote “Emergency Available” indication *
5. Two sets of “form C” contacts for remote “Normal Available” indication *
6. Two sets of “form C” contacts for remote “Trouble Indication” indication
7. Two sets of “form C” contacts for remote “Transfer Pre-signal” initiation *

* Optional Equipment
** Not included on Utility to Utility switches

Switches

Transfer switches are provided with four standard switches mounted internally:

1. Maintenance disconnect switch – which disconnects ac and dc power from the control circuit to allow for service and maintenance of the controls.

2. Load Test Switch – This provides for a complete load test cycle with load. When pressed for two seconds the transfer switch will perform a complete transfer to emergency and return to normal after operation of all applicable timers. **NOTE:** When the switches are withdrawn to the test position, the “not in automatic” light will flash and the load test switch will be inoperative.

3. Keypad enable switch – which will enable or disable the HMI keypad. When disabled, the HMI will display “Keypad Disabled” when any key is pressed.

4. Override TDR Switch – This will override the time delay imposed by the TDR timer.

4.3 INSTALLATION

Installation of the MP7600 Controller is straightforward and easy. Please follow the steps below and consult the drawings provided with the transfer switch.

Wiring

1. Verify that the external voltage source to the transfer switch is compatible with the relays supplied on the Relay Interface Board (i.e. either 12 vdc or 24 vdc).

2. Connect your external power source (12 or 24 volts dc) to the customer terminal blocks terminals TB1 + (Positive) and TB1 - (Negative) on the Power Supply Board (see page 9).

3. Connect the two wires for the engine start circuit to the Relay Interface Board ES contacts. (see page 10) Use the C and NO terminals of the ES Relay for energize to run.

Setting Date & Time

At the LCD display on the front of the switch (see Figure 4, page 12) press the “Enter” pad. The LCD will display “Main Menu/Select Mode”. Press “⇓” and the LCD will display “Main Menu/Set Current Time & Date”. Press “Enter”, the LCD will display Auto, DST changes? Yes. To accept this press “enter”. To change press “⇑” or “⇓” and the display will change from yes to no. Press “Enter” to accept this response. The LCD will now display the current time and date. A single character will be underlined. To increase or decrease its value, press either “⇓” or “⇑” until the value you desire is displayed. When the correct value is displayed press “Enter” and that value will be accepted. The curser will advance to the next character and the same value selection procedure should be followed until the correct time and date have been entered into the non-volatile memory.

At any time throughout programming the “ESC” pad may be pressed to return to the previous screen without accepting any new values.

Setting Timers

At the LCD display on the front of the switch (see Figure 4, page 12) press the “Enter” pad. The LCD will display “Main Menu/Select Mode”. Press “⇓” twice and the LCD will display “Main Menu/Setup Timers”.

Press “Enter” this will select that you wish to set any or all of the timers. The LCD will now display “SET UP TIMERS/Select Timer: TDES”. If you do not wish to change the TDES timer, press “⇓” and the display will advance to the next timer.

If you wish to change the TDES timer, press “Enter”. The LCD will now display “SET UP TIMERS/Set Time TDES: XXX sec”. Notice the first digit of the available time range will be

underlined. If you wish to increase or decrease its value, press either "⇓" or "⇑" until the value you desire is displayed. When the correct value is displayed press "Enter" and that value will be accepted.
The LCD will sequence through all the timers in the same manner. Press either "⇓" or "⇑" to select the timer you which to change and then press "Enter". Always complete any timer change by pressing the "Enter" pad. Failure to do so will not enter the value you wish to store in memory.

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

Setting Plant Exerciser

At the LCD display on the front of the switch (see Figure 4, page 12) press the "Enter" pad. The LCD will display "Main Menu/Select Mode". Press "⇓" three times and the LCD will display "Main Menu/Set Up Plant Exerciser". Press "Enter" and the LCD will display "SET UP EXERCISER/Load? Yes : Start: XX:XX.

Notice the first Letter of "Yes/ or No" will be underlined. If you wish to change from Yes to No or visa versa, press either "⇓" or "⇑" until the value you desire is displayed. Then press "Enter", this will advance the underlined text to the first digit of the start time (XX:XX). If you wish to increase or decrease its value, press either "⇓" or "⇑" until the value you desire is displayed. When the correct value is displayed press "Enter" and that value will be accepted.

The LCD will now display "SET UP EXERCISER/Duration (hh:mm): XX:XX. Notice that the first digit of the hour and minute duration timer is underlined. If you wish to increase or decrease its value, press either "⇓" or "⇑" until the value you desire is displayed. When the correct value is displayed press "Enter" and that value will be accepted. Continue until the LCD then displays "SET UP EXERCISER/Days (Caps = ON) : s m t w t f s". Notice that the first character will be underlined. If you press either "⇓" or "⇑", the underlined letter will change case. Upper case means that the day selected will perform an exercise.

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".

Continue until the LCD displays:

SET UP EXERCISER **Weeks 1 – 5 (•=OFF) 12345**

Notice the first character will be underlined. If you press either ⇓ or ⇑, the underlined item will change from a number to a dot and vice versa. Numbers indicate that week of the month is selected to exercise.

Note: If no weeks are selected (i.e. all dots appear), the exerciser will be disabled. This will be displayed in the operational display as "DO NOT EXERCISE".

Setting Mode of Operation

At the LCD display on the front of the switch (see Figure 4, page 12) press the "Enter" pad. The LCD will display "Main Menu/Select Mode". Press "Enter" and the LCD will display "MODE

SELECT/Automatic". If you do not wish to select "Automatic", press "⇓" and the display will advance to the next mode of operation.

If you wish to select "Automatic" as the mode of operation press "Enter". The display will return to the operating position.

Operational Display

When not in programming mode the LCD on the HMI panel will display (Operational Display) the mode selected, the status of the exerciser, time and date. Figure 5 shows a standard display of the controller in the automatic position with a programmed load test exercise period. Also displayed is the time and date.

AUTO – EXERCISE W/LOAD **08:22 Fri OCT 6, 2006**

(Figure 5)

The LCD displays the status of each timer. Figure 6 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 6)

Whenever there is a fault, the operation of the switch is terminated and the LCD displays the appropriate error message. Figure 7 shows a standard display of the controller displaying a Close Normal Failed fault.

FAULT – Close NOR failed **08:24 Fri OCT 6, 2006**

(Figure 7)

5. OPTIONAL ACCESSORIES

Lake Shore Electric Corporation offers many additional accessories for the Insulated Case switches. Please check the documents and drawings for your particular switch to see what additional options are included.

5.1 Service Entrance

This option provides for the Automatic Transfer Switch to be labeled as suitable for use as service equipment (SUSE). The actual determination of designating it as service equipment rests with the engineer in charge of the project or the authority having jurisdiction. When the Service Entrance accessory is selected, the Transfer Switch is suitable for use as Service Entrance Equipment and is provided with the following additional equipment:

Pad lockable Enclosure
Over Current Trip and Bell Alarm for the Service Disconnect
LED indication of source “Tripped”.
A means to disable the HMI keypad
Neutral bus with main and ground lugs.
Main bonding jumper per NEC 2002 250.8.
Appropriate nameplates and instructions to be applied in the field.

Instructions and labeling that accompanies the service entrance transfer switch will be in the following format.

1. When required by the National Electric Code or the engineer in charge of the project, connect one side of the grounding strap that is presently mounted on the neutral bar to ground. The other side of the grounding strap will remain connected to the neutral bar.

2. Apply the “SERVICE DISCONNECT” label on or near the operating handle of the Normal circuit breakers as required per the National Electrical Code or the engineer in charge of the project.

3. Apply the “SERVICE ENTRANCE” label on the outside of the enclosure door above the door handle. With instructions on how to operate the Service Disconnect as shown in Figure 8, page 20.

4. If the building is supplied by more than one service, a permanent plaque or directory should be installed at this service disconnect denoting the location of all other services, feeders and branch circuits supplying this building in accordance with 2002 NEC 230-2.E.

SERVICE ENTRANCE

1) Use the HMI keypad to change the operating mode to “Off/Reset”
2) Unlock and open the enclosure door
3) Place the “KEYPAD ENABLE” switch in the “DISABLE” position
4) Press any pad on the HMI to verify “Keypad Disabled” is displayed
5) Place the “MAINTENANCE DISCONNECT” switch in “OPEN” position
6) Place the Service Disconnect breaker in the “OFF/ 0” position
7) Open the control circuits fused disconnect
8) Close and lock enclosure door
9) Reverse the above procedure to place the equipment back in service

(Figure 8)

5.2 Ground Fault Protection or Indication

This option provides ground fault detection on the normal source of the transfer switch. Once the ground fault is detected, the switch can be factory configured to provide either **protection** or **indication**.

Ground fault protection means that the “GROUND FAULT” LED will light, the normal source will be opened, the switch will be automatically placed in the Fault Mode and the HMI LCD will display as shown in Figure 9.

FAULT – Ground Fault
08:24 Fri OCT 6, 2006

(Figure 9)

Ground fault indication means that the “GROUND FAULT” LED will light, however the operation of the transfer switch will not be interrupted and the mode of operation will not be changed.

5.3 Pre-Transfer Signal

This option provides an additional timer, ACBT Auxiliary Contacts 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, but can be used in other applications where motor disconnection before transfer is desirable. 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.

While this timer is timing out, its status will be displayed on the HMI LCD display as shown in Figure 10.

AUTO – EXERCISE W/LOAD **Awaiting TDBT: 4 sec**

(Figure 10)

Two form “C” contacts are provided on the Relay Interface Board and labeled EC.

5.4 Surge Suppression TVSS

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 lightening 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/Phase. No field installation is necessary.

5.5 Remote Disconnect

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 the terminal block of the Main Control Board shown on the drawings.

5.6 Circuit Breaker Trips

This option provides circuit breaker trips on either or both sides of the transfer switch. Trips will come complete will bell alarms and when tripped, the appropriate light will be illuminated on the HMI.

5.7 Source Available Auxiliary Contacts

This option provides two form “C” contact output on the Relay Interface Board for customer use. They are identified as “EMR” (Emergency Available) and “NOR” (Normal Available).

5.8 Maintain 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.

5.9 Load Demand Inhibit

This option provides an input to the transfer switch, which forces transfer from emergency to normal (or neutral if normal is not available) and prohibits the transfer to emergency when normal is not available. This option is used in conjunction with load demand control in associated Lake Shore Electric Paralleling Switchgear. Customer interconnection can be made at the terminal block of the Main Control Board shown on the drawings.

5.10 Peak Shave

This option provides a terminal block input, which will initiate a transfer of the load to emergency. Should emergency fail, the switch will return to normal. This is typically used in conjunction with peak shaving Lake Shore Electric Paralleling Switchgear. Customer interconnection can be made at the terminal block of the Main Control Board shown on the drawings.

5.11 Manual Return to Normal

This option eliminates the "TDR" Time Delay to Return timer. In its place a switch and a parallel terminal block are provided. When equipped with this option, the transfer switch will never return to the normal source unless the return is initiated by the pressing of the switch or closing of the remote contacts. The input is only momentary (Between .5 and 1.0 seconds).

5.12 Closed Transition Transfer

This option provides for a closed transition (make before break) transfer from normal to emergency when both sources are available and a closed transition transfer from emergency to normal to complete the transfer cycle.

Included with this option is a timer "SFT" synchronize fail timer. This timer when timing will be displayed on the HMI LCD as show in Figure 11.

AUTO – EXERCISE W/LOAD **Awaiting synchronization**

(Figure 11)

Should the timer time out before the transfer is made, the HMI display as shown in Figure 12 will show the following and the trouble contacts will change state. 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 synchronizer has not detected a match of those two sources, the transfer will not be completed.

AUTO – EXERCISE W/LOAD **TROUBLE: SFT timed out**

(Figure 12)

As a safeguard, the Closed Transition Transfer Option not only has a Sync Check Relay, but also a reverse power relay for each source. In the event that both sources might be left in the closed position because of some malfunction, the reverse power relays will sense an unauthorized flow of power and trip and/or cross trip both sources. This will place the transfer switch in a fault condition and energize the trouble relay. The HMI panels will then display as shown in Figure 13 along with the appropriate reverse power pilot light.

FAULT – Reverse Power **08:24 Fri OCT 6, 2006**

(Figure 13)

5.13 Single Phase Protection

Upon a loss of phase or under voltage of the normal source, the transfer switch will, after a field adjustable time delay, be disconnected from the normal source to prevent damage to connected equipment regardless of the availability of the alternate source.

6. VOLTAGE RELAYS

6.1 VOLTAGE SENSING – CLOSE DIFFERENTIAL

This relay continuously monitors the voltage of a three phase or a single-phase power source. When the voltage in each phase attains a value equal to or greater than the "pick-up" setting, the output contacts change state and the L.E.D. energizes. 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.

Pick-up and dropout values are adjustable from 70 to 100% of nominal voltage via two potentiometers that are externally accessible.

Factory Setting

Unless a customer or specifications require specific settings, the Voltage Sensing Relay will be factory set to dropout at 80% and pick-up at 90% of nominal voltage.

Three Phase Style

The Lake Shore voltage-sensing relay is field adjustable.

CALIBRATION:

Select proper voltage range.
Set pickup potentiometer full clockwise.
Set dropout potentiometer full counter-clockwise
Using a small screwdriver, turn the calibrate potentiometer fully clockwise.
Apply nominal input voltage to unit.
Slowly turn the calibration potentiometer counter-clockwise until the units picks up as indicated by the "energized" light.
Set pickup and dropout potentiometers to desired settings.
Unit is ready for operation.

Note: Field adjustment can only be considered approximate if potentiometers are set using the scale on the front of the unit. For an accurate setting of the pickup and dropout points, a variable voltage power supply must be used.

Single Phase Style

The single-phase voltage sensing relays are adjustable to 70 to 100% of the voltage range selected. Indication of pickup or dropout can only be verified by attaching a continuity meter to the common and normally open terminals. When the meter shows

continuity, the PFR is picked up.

CALIBRATION:

Remove protective black plugs (if present).

Using a small slotted screwdriver, turn the dropout potentiometer fully counter-clockwise.

Using a small slotted screwdriver, turn the pickup potentiometer fully clockwise.

Apply required level of pickup voltage to the unit.

Turn the pickup potentiometer slowly counter-clockwise until the meter shows continuity.

Reduce the voltage to the required voltage dropout level.

Turn the dropout potentiometer slowly clockwise until the meter shows no continuity.

6.2 FREQUENCY VOLTAGE RELAY

General

This device is used to prevent transfer to the Emergency power source until the emergency power generator has reached correct operating voltage and frequency.

Factory Setting

The unit pickup set point is factory set at 48 Hz (50 Hz line) or 58 Hz (60 Hz line) and 108 vac. This device is not field-adjustable.

7. INSULATED CASE SWITCHES

The operating or switching mechanisms used in the Insulated Case Transfer switches are MASTERPACT® NW automatic and non-automatic circuit breakers. The MASTERPACT® devices may be non-automatic, automatic, fixed or draw-out as required by the transfer switch configuration. See the MASTERPACT® O & M manual provided with the Insulated Case Transfer Switch for necessary technical information on these products. If additional information is necessary, please contact the factory; call 800-225-0141.

Masterpact® NW Low-voltage Power/Insulated Case Circuit Breaker

8. TROUBLESHOOTING GUIDE

This guide is intended to assist an individual with a basic understanding of electrical circuitry to troubleshoot an automatic transfer switch as manufactured by Lake Shore Electric Corporation. Any questions relating to the use of this Operating Manual should be referred to the Service Department of Lake Shore Electric Corporation, 205 Willis Street, Bedford, Ohio 44146, Phone (440) 232-0200 or (800) 225-0141, Fax (440) 232-5644.

Note: Please note that for Utility-to-Utility transfer switches, the following section 8.1 is not applicable. Additionally, all references to TDES, TDEC, MRT and the engine start relay are not applicable.

CAUTION: WHEN WORKING ON EQUIPMENT OF THIS TYPE, EXTREME DANGER FROM ELECTRICAL HAZARD EXITS. DO NOT ATTEMPT ANY REPAIRS OR ADJUSTMENTS TO THIS EQUIPMENT WITHOUT TAKING EVERY PRECAUTION TO PREVENT AN ACCIDENT.

WARNING!

IN INSTALLATION AND USE OF THIS PRODUCT, COMPLY WITH THE NATIONAL ELECTRICAL CODE, FEDERAL, STATE AND LOCAL CODES, AND ALL APPLICABLE SAFETY CODES. IN ADDITION, **TURN OFF** POWER AND TAKE OTHER NECESSARY PRECAUTIONS TO PREVENT PERSONAL INJURY AND EQUIPMENT DAMAGE.

WHEN WORKING ON EQUIPMENT OF THIS TYPE, EXTREME DANGER OF ELECTROCUTION EXISTS, THIS MAY RESULT IN INJURY OR DEATH. **DO NOT** ATTEMPT ANY REPAIRS OR ADJUSTMENTS TO THIS EQUIPMENT WITHOUT FIRST TAKING EVERY PRECAUTION TO PREVENT ACCIDENTAL INJURIES.

The following conditions **MUST** be met before attempting to troubleshoot an Insulated Case Transfer Switch:

1. A wiring diagram for the specific switch must be available.
2. Normal and Emergency voltage and frequency must be available and within the correct operating limits.
3. Control circuit voltage (if transformers are used) must be 110 to 125 volts.
4. Connections to the under-voltage relay must be correct and the relay must be adjusted to pick up on the voltage at which the switch is operating. See voltage relay instructions on a Page 23.
5. All timers must be turned down or considerations given to them while the tests are being conducted.
6. If trip units are included in the switch, they must be reset if previously tripped due to an overload.
7. All electrical connections must be tight and in accordance with the wiring diagram.
8. All components must be free of obvious defects with the exception of normal usage.
9. The switch must be connected to a good earth ground.

When you are satisfied that all the above conditions are met, and all accessories are either

working correctly or eliminated, the problem will be confined to:

1. The MP 7600 Controller
2. The Interface Control Relays
3. The interconnections and cable connections
4. The Insulated Case Switches

The troubleshooting procedures outlined here are designed to test the control circuit and the operating mechanism of the transfer switch. It is, therefore, necessary that all factors external to the transfer switch are correct, and that all accessory devices which are not imperative to switch operation either operate satisfactorily or are bypassed and jumpered out of the circuit.

Many of the accessory devices described below may not exist in the transfer switch being examined. The proper wiring diagrams should be on hand before beginning work on the switch. We recommend that the entire manual be read before attempting to make any adjustment. Above all, **CAUTION** is recommended.

Many of the troubleshooting tests require a simulated failure of the normal source. This can be done with the Load Test Switch.

8.1 NORMAL POWER FAILS – ENGINE DOES NOT START

1) Verify:

   a) Maintenance Disconnect Switch (if applicable) is in the “NORMAL” position.

   b) LCD Display indicates that the ATS is in the “AUTOMATIC” position.

   c) 12VDC or 24VDC is available on the control circuit input terminals to the ATS.

2) Check the fuse in the DC circuit. Verify that DC voltage is available from either side of the fuse to battery negative. If not, replace the fuse.

3) Look at the diagnostic LED’s on the main controller board. Verify that the LED labeled “NOR” is <u>NOT</u> on.

   a) If the LED is on, either the main controller board or voltage-sensing relay has failed. To determine which unit failed, disconnect the wire on terminal NOR of the main controller board. If the LED remains on, the main controller board has failed. If the LED turns off, the voltage-sensing relay has failed.

   b) If the LED is <u>NOT</u> on, continue to the next step.

4) Look at the diagnostic LED's on the main controller board. Verify that the LED labeled "ES" is on. If the LED is not on, the main control board has failed. If the LED is on, continue to the next step.

5) Verify that the "ES" relay on the Relay Interface Board is being signaled to energize by measuring the proper DC voltage (either 12VDC or 24VDC) across diode D8 on the Relay interface board.

   a) If there is no voltage on diode D8, the main controller board, ribbon cable, and/or the relay interface board have failed. To determine which component has failed, this signal needs to be traced. This signal leaves the main controller board on connector J4 pin 16. If voltage is not present on this pin, the main controller board has failed. The signal travels through the ribbon cable and arrives on the relay interface board on J1 pin 16. If voltage is not present on this pin of the ribbon cable, the ribbon cable has failed. If voltage is present on this pin but, not across D8, the relay interface board has failed.

   b) If there is voltage available on D8 continue to the next step.

6) Verify that the "ES" relay is functioning. Remove the wires from C and NO for the ES relay on the Relay Interface Board. Place an Ohmmeter or continuity checker across these terminals and verify continuity. If there is no continuity here, either the relay has failed or the Relay Interface Board has failed. The easiest method to check this is to replace the relay. If there is still no continuity, the Relay Interface Board has failed. If there is continuity here, reconnect the wires from C and NO for the ES relay on the Relay Interface Board and continue to the next step.

7) Remove the customer's engine starting wires from terminals C and NO of the ES Relay and measure continuity across these terminals. If continuity exists across these terminals, the problem is in the wiring to the engine generator set or the starting system of the engine generator set.

8.2 ENGINE STARTS – AUTOMATIC TRANSFER SWITCH WILL NOT TRANSFER TO EMERGENCY

1) Check for proper voltage on the generator output. This should be measured at the input terminals to the Automatic Transfer Switch EL1, EL2, and EL3. If the output voltage of the generator is incorrect, contact the engine generator set supplier. If the generator has the proper output voltage continue to the next step.

2) Check to see that the Frequency Voltage Relay (FVR) or Emergency Relay (ER) are energized. The FVR has a red LED to indicate that it is energized; the Emergency relay has a yellow neon light to do the same. If not energized review connections from generator input to the FVR or ER relay. If energized continue to next step.

3) Look at the diagnostic LED's on the main controller board. Verify that the LED labeled "EMR" is on.

a) If the LED is not on, either the FVR or ER has a failed output contact or the main control board has failed. To determine what has failed, place a jumper on the main control board from terminal "input return" to "EMR". If the "EMR" LED turns on, the FVR or ER output contact has failed. If the "EMR" LED remains off, the main control board has failed.

b) If the LED is on, continue to the next step.

4) Check to see that the switches have been given a signal to open and close. This step varies between Open Transition and Closed Transition.

An Insulated Case Transfer Switch has two stages to transfer to emergency. First Normal must open and secondly, Emergency must close. For Closed Transition, Emergency must close first, and then Normal must open.

a) NORMAL FAILS TO OPEN – OPEN TRANSITION

1.) For an Insulated Case Automatic Transfer Switch "ON" (open normal) will begin the transfer to emergency. If the Normal Insulated Case Switch remains closed verify that the "ON" LED on the main control board is on. If the "ON" LED is not on, the main control board has failed. If the "ON" LED is on continue to the next step.

2.) Verify that the "ON" relay on the Relay Interface Board is working by measuring control voltage at the "C" and "NO" terminals of the "ON" relay on the Relay Interface Board to common – (common is neutral or ground). There are three possibilities:

a.) <u>Control voltage is not available on "C" or "NO".</u> This indicates that power is not getting to the Relay Interface Board. Check the wiring between the generator input terminals and this Relay Interface board.

b.) <u>Control voltage is only available on the "C" or "NO" terminal but not both.</u> This indicates that the "ON" relay is not closed. Check for DC voltage across D1.

(1) If there is no voltage on D1, the main controller board, ribbon cable, and/or the relay interface board has failed. To determine which component has failed, this signal needs to be traced. This signal leaves the main controller board on connector J4 pin 20. If voltage is not present on this pin, the main controller board has failed. The signal travels through the ribbon cable and arrives on the relay interface board on J1 pin 20. If voltage is not present on this pin of the ribbon cable,

the ribbon cable has failed. If voltage is present on this pin but not across D1, the relay interface board has failed. If there is nominal DC voltage across D4, continue to the next step.

(2) Verify that the "ON" relay is functioning. Remove the wires from C and NO for the ON relay on the Relay Interface Board. Place and Ohmmeter or continuity checker across these terminals and verify continuity. If there is no continuity here, either the relay has failed or the Relay Interface Board has failed. The easiest method to check this is to replace the relay. If there is still no continuity, the Relay Interface Board has failed. If there is continuity here, the relay is bad. Now reconnect the wires from C and NO for the ON relay on the Relay Interface Board. This should resolve the problem.

c.) Control Voltage is available on both "C" and "NO" terminals. This indicates that power is getting through the Relay Interface Board. Check the voltage on the normal switch open coil C1 & C2 and the wiring between the Relay Interface Board and the open coil of the Insulated Case Switch.

b) EMERGENCY FAILS TO CLOSE – (OPEN TRANSITION)

1.) For an Insulated Case Automatic Transfer Switch "CE" (close emergency) will complete the transfer to emergency. If the Emergency Insulated Case Switch remains open verify that the "CE" LED on the main control board is on. If the "CE" LED is not on, the main control board has failed. If the "CE" LED is on continue to the next step.

2.) Verify that the CE relay on the Relay Interface Board is working by measuring 120VAC nominally at the "C" and "NO" terminals of the CE relay on the Relay Interface Board to common – (common is wire 100, or neutral). There are three possibilities:

a.) 120 VAC voltage is not available on "C" or "NO". This indicates that power is not getting to the Relay Interface Board. Check the wiring between the generator input terminals and this Relay Interface board.

b.) 120 VAC is only available on the "C" or "NO" terminal but not both. This indicates that the "CE" relay is not closed. Check for DC voltage across D4.

(1) If there is no voltage on D4, the main controller board, ribbon cable, and/or the relay interface board have failed. To determine which component has failed, this

signal needs to be traced. This signal leaves the main controller board on connector J4 pin 17. If voltage is not present on this pin, the main controller board has failed. The signal travels through the ribbon cable and arrives on the relay interface board on J1 pin 17. If voltage is not present on this pin of the ribbon cable, the ribbon cable has failed. If voltage is present on this pin but not across D4, the relay interface board has failed. If there is nominal DC voltage across D4, continue to the next step.

(2) Verify that the "CE" relay is functioning. Remove the wires from C and NO for the CE relay on the Relay Interface Board. Place and Ohmmeter or continuity checker across these terminals and verify continuity. If there is no continuity here, either the relay has failed or the Relay Interface Board has failed. The easiest method to check this is to replace the relay, if there is still no continuity; the Relay Interface Board has failed. If there is continuity here, the relay is bad. Now reconnect the wires from C and NO for the CE relay on the Relay Interface Board. This should resolve the problem.

c.) <u>120 VAC is available on both "C" and "NO" terminals</u>. This indicates that power is getting through the Relay Interface Board. Check the voltage on the emergency switch close coil A1 & A4 and the wiring between the Relay Interface Board and the Emergence Switch close coil.

c) EMERGENCY FAILS TO CLOSE – (CLOSED TRANSITION)

1.) For an Insulated Case Automatic Transfer Switch with Closed transition option and both sources available, the "AS" (activate synchronization) LED on the main control board must be on. If the "AS" LED is not on, the main control board has failed. If the "AS" LED is on, continue to the next step.

2.) Once the normal and emergency source are in sync, the synchronizing device closes it's contact lighting up the "SYNC" LED on the main control board. If this LED is not lit, the two sources are not in sync, the synchronizer is not functioning and/or the main control board has failed. To verify it is not the control board, remove the "CE" (close emergency) relay from the relay interface board to prevent the Emergency Insulated Case Switch from closing out of phase and then place a jumper across terminals "input return" and "sync" on the main control board. The "SYNC" LED should light indicating that the main control board is functioning. If the "SYNC" LED is on continue to the next step.

3.) If the Emergency Insulated Case Switch remains open verify that the "CE" LED on the main control board is on. If the "CE" LED is not on, the main control board has failed. If the "CE" LED is on continue to the next step.

4.) Verify that the CE relay on the Relay Interface Board is working by measuring 120VAC nominally at the "C" and "NO" terminals of the CE relay on the Relay Interface Board to common – (common is neutral or ground). There are three possibilities:

a.) 120 VAC voltage is not available on "C" or "NO". This indicates that power is not getting to the Relay Interface Board. Check the wiring between the generator input terminals and this Relay Interface board.

b.) 120 VAC is only available on the "C" or "NO" terminal but not both. This indicates that the "CE" relay is not closed. Check for DC voltage across D4.

(1) If there is no voltage on D4, the main controller board, ribbon cable, and/or the relay interface board have failed. To determine which component has failed, this signal needs to be traced. This signal leaves the main controller board on connector J4 pin 17. If voltage is not present on this pin, the main controller board has failed. The signal travels through the ribbon cable and arrives on the relay interface board on J1 pin 17. If voltage is not present on this pin of the ribbon cable, the ribbon cable has failed. If voltage is present on this pin but not across D4, the relay interface board has failed. If there is nominal DC voltage across D4, continue to the next step.

(2) Verify that the "CE" relay is functioning. Remove the wires from C and NO for the CE relay on the Relay Interface Board. Place and Ohmmeter or continuity checker across these terminals and verify continuity. If there is no continuity here, either the relay has failed or the Relay Interface Board has failed. The easiest method to check this is to replace the relay. If there is still no continuity, the Relay Interface Board has failed. If there is continuity here, the relay is bad. Now reconnect the wires from C and NO for the CE relay on the Relay Interface Board. This should resolve the problem.

c.) 120 VAC is available on both "C" and "NO" terminals. This indicates that power is getting through the Relay Interface Board. Check the voltage on the emergency switch close coil

A1 & A4 and the wiring between the Relay Interface Board and the Emergency Switch close coil.

d) NORMAL FAILS TO OPEN – (CLOSED TRANSITION)

Same as 4A – Normal Fails to open – (open transition)

8.3 AUTOMATIC TRANSFER SWITCH WILL NOT TRANSFER TO NORMAL

1) Check for proper voltage on the utility input. This should be measured at the input terminals to the Automatic Transfer Switch NL1, NL2, and NL3. If the voltage of the utility is incorrect, contact the local utility company. If the utility has the proper output voltage continue to the next step.

2) Check to see that the Phase Failure Relay (PFRN) is energized. The PFRN has a red LED to indicate that it is energized. If not energized review connections from generator input to the PFRN relay. If energized continue to next step.

3) Look at the diagnostic LED's on the main controller board. Verify that the LED labeled "NOR" (Normal On Relay) is on.

   a) If the LED is not on, either the PFRN has a failed output contact or the main control board has failed. To determine what has failed, place a jumper on the main control board from terminal "input return" to "NOR". If the "NOR" LED turns on, the PFRN output contact has failed. If the "NOR" LED remains off, the main control board has failed.

   b) If the LED is on, continue to the next step.

4) Check to see that the switches have been given a signal to open and close. This step varies between an open transition and closed transition switch.

   An Insulated Case Transfer Switch has two stages to transfer to normal. First emergency must open and secondly, normal must close. For Closed Transition, normal must close first, and then Emergency must open.

   a) EMERGENCY FAILS TO OPEN – OPEN TRANSITION

      1.) For an Insulated Case Automatic Transfer Switch "OE" (open emergency) will begin the transfer to normal. If the Emergency Insulated Case Switch remains closed verify that the "OE" LED on the main control board is on. If the "OE" LED is not on, the main control board has failed. If the "OE" LED is on continue to the next step.

      2.) Verify that the "OE" relay on the Relay Interface Board is working by measuring control power at the "C" and "NO" terminals of the "OE" relay on the Relay Interface Board to common – (common is neutral or ground). There are three possibilities:

a.) Control voltage is not available on “C” or “NO”. This indicates that power is not getting to the Relay Interface Board. Check the wiring between the utility input terminals and this Relay Interface board.

b.) Control voltage is only available on the “C” or “NO” terminal but not both. This indicates that the “OE” relay is not closed. Check for DC voltage across D2.

(1) If there is no voltage on D2, the main controller board, ribbon cable, and/or the relay interface board have failed. To determine which component has failed, this signal needs to be traced. This signal leaves the main controller board on connector J4 pin 18. If voltage is not present on this pin, the main controller board has failed. The signal travels through the ribbon cable and arrives on the relay interface board on J1 pin 18. If voltage is not present on this pin of the ribbon cable, the ribbon cable has failed. If voltage is present on this pin but not across D2, the relay interface board has failed. If there is nominal DC voltage across D2, continue to the next step.

(2) Verify that the “OE” relay is functioning. Remove the wires from C and NO for the ON relay on the Relay Interface Board. Place and Ohmmeter or continuity checker across these terminals and verify continuity. If there is no continuity here, either the relay has failed or the Relay Interface Board has failed. The easiest method to check this is to replace the relay. If there is still no continuity, the Relay Interface Board has failed. If there is continuity here, the relay is bad. Now reconnect the wires from C and NO for the OE relay on the Relay Interface Board. This should resolve the problem.

c.) Control voltage is available on both “C” and “NO” terminals. This indicates that power is getting through the Relay Interface Board. Check the voltage on the emergency switch open coil C1 & C2 and the wiring between the Relay Interface Board and the emergency switch open coil.

b) NORMAL FAILS TO CLOSE – (OPEN TRANSITION)

1.) For an Insulated Case Automatic Transfer Switch “CN” (close normal) will complete the transfer to normal. If the Normal Insulated Case Switch remains open verify that the “CN” LED on the main control board is on. If the “CN” LED is not on, the main control board has failed. If the “CN” LED is on continue to the next step.

2.) Verify that the CN relay on the Relay Interface Board is working by measuring 120VAC nominally at the "C" and "NO" terminals of the CN relay on the Relay Interface Board to common – (common is neutral or ground). There are three possibilities:

a.) 120 VAC voltage is not available on "C" or "NO". This indicates that power is not getting to the Relay Interface Board. Check the wiring between the utility input terminals and this Relay Interface board.

b.) 120 VAC is only available on the "C" or "NO" terminal but not both. This indicates that the "CN" relay is not closed. Check for DC voltage across D3.

(1) If there is no voltage on D3, the main controller board, ribbon cable, and/or the relay interface board have failed. To determine which component has failed, this signal needs to be traced. This signal leaves the main controller board on connector J4 pin 19. If voltage is not present on this pin, the main controller board has failed. The signal travels through the ribbon cable and arrives on the Relay Interface Board on J1 pin 19. If voltage is not present on this pin of the ribbon cable, the ribbon cable has failed. If voltage is present on this pin but not across D3, the relay interface board has failed. If there is nominal DC voltage across D3, continue to the next step.

(2) Verify that the "CN" relay is functioning. Remove the wires from C and NO for the CE relay on the Relay Interface Board. Place and Ohmmeter or continuity checker across these terminals and verify continuity. If there is no continuity here, either the relay has failed or the Relay Interface Board has failed. The easiest method to check this is to replace the relay. If there is still no continuity, the Relay Interface Board has failed. If there is continuity here, the relay is bad. Now reconnect the wires from C and NO for the CN relay on the Relay Interface Board. This should resolve the problem.

c.) 120 VAC is available on both "C" and "NO" terminals. This indicates that power is getting through the Relay Interface Board. Check the voltage on the normal switch close coil A1 & A4 and the wiring between the Relay Interface Board and the normal switch close coil.

c) NORMAL FAILS TO CLOSE – (CLOSED TRANSITION)

1.) For an Insulated Case Automatic Transfer Switch with Closed transition option and both sources available, the “AS” (activate synchronization) LED on the main control board must be on. If the “AS” LED is not on, the main control board has failed. If the “AS” LED is on, continue to the next step.

2.) Once the normal and emergency source are in sync, the synchronizing device closes it’s contact lighting up the “SYNC” LED on the main control board. If this LED is not lit, the two sources are not in sync, the synchronizer is not functioning and/or the main control board has failed. To verify it is not the control board, remove the “CN” (close normal) relay from the relay interface board to prevent the Normal Insulated Case Switch from closing out of phase and then place a jumper across terminals “input return” and “sync” on the main control board. The “SYNC” LED should light indicating that the main control board is functioning. If the “SYNC” LED is on continue to the next step.

3.) If the Normal Insulated Case Switch remains open verify that the “CN” LED on the main control board is on. If the “CN” LED is not on, the main control board has failed. If the “CN” LED is on continue to the next step.

4.) Verify that the CN relay on the Relay Interface Board is working by measuring 120VAC nominally at the “C” and “NO” terminals of the CN relay on the Relay Interface Board to common – (common is neutral or ground). There are three possibilities:

a.) <u>120 VAC voltage is not available on “C” or “NO”.</u> This indicates that power is not getting to the Relay Interface Board. Check the wiring between the utility input terminals and this Relay Interface board.

b.) <u>120 VAC is only available on the “C” or “NO” terminal but not both.</u> This indicates that the “CN” relay is not closed. Check for DC voltage across D3.

(1) If there is no voltage on D3, the main controller board, ribbon cable, and/or the relay interface board have failed. To determine which component has failed, this signal needs to be traced. This signal leaves the main controller board on connector J4 pin 19. If voltage is not present on this pin, the main controller board has failed. The signal travels through the ribbon cable and arrives on the relay interface board on J1 pin 19. If voltage is not present on this pin of the ribbon cable, the ribbon cable has failed. If voltage is present on this pin but not across D3, the relay interface board has failed. If there is nominal DC voltage across D3, continue to the next step.

(2) Verify that the “CN” relay is functioning. Remove the wires from C and NO for the CN relay on the Relay Interface Board. Place and Ohmmeter or continuity checker across these terminals and verify continuity. If there is no continuity here, either the relay has failed or the Relay Interface Board has failed. The easiest method to check this is to replace the relay, if there is still no continuity; the Relay Interface Board has failed. If there is continuity here, the relay is bad. Now reconnect the wires from C and NO for the CN relay on the Relay Interface Board. This should resolve the problem.

c.) <u>120 VAC is available on both “C” and “NO” terminals</u>. This indicates that power is getting through the Relay Interface Board. Check the voltage on the normal switch close coil A1 & A4 and the wiring between the Relay Interface Board and the normal switch close coil.

d) EMERGENCY FAILS TO OPEN – (CLOSED TRANSITION)

Same as 4A – Emergency fails to open – (open transition)

9. REQUIRED MAINTENANCE

LUG TORQUE REQUIREMENTS - USE COPPER WIRE ONLY
LINE-LOAD-NEUTRAL

The following cable lug torque values are required to be checked at installation and every six months in order to maintain the Lake Shore Electric Corporation exclusive one year warranty.

TIGHTENING TORQUE VALUES
FOR
SCREW CONNECTIONS

AWG. Or Circular Mill Size	Tighten Torque in Inch Pounds	
	Screw Driver	External Drive Wrench
14	35	75
12	35	75
10	35	75
8	40	75
6	45	110
4	45	110
2	50	150
1	50	150
1/0	50	180
2/0	50	180
3/0		250
4/0		250
250		325
350		325
500		375
600		375
700		375
750		375
800		500
1000		500

TIGHTENING TORQUE VALUES
FOR
SOCKETHEAD SCREW CONNECTORS

Internal Socket Size Across Flats Inches	Tightening Torque in Inch Pounds
1/8	45
5/32	100
3/16	120
7/32	150
1/4	200
5/16	275
3/8	375
1/2	500
9/16	600

Warning: Whenever bus and cable connections are being maintained, all power sources to the transfer switch must be disconnected and locked out.