

# **INSTALLING, OPERATING AND MAINTAINING**

## **MOLDED CASE MANUAL TRANSFER SWITCHES**

### **SINGLE OR DUAL OPERATOR**

## **WARNING!**

WHEN WORKING ON EQUIPMENT OF THIS TYPE, EXTREME DANGER OF ELECTROCUTION EXISTS THAT MAY RESULT IN INJURY OR DEATH. DO NOT ATTEMPT ANY REPAIRS OR ADJUSTMENTS TO THIS EQUIPMENT WITHOUT FIRST TAKING THE APPROPRIATE PRECAUTIONS TO PREVENT PERSONAL INJURY AND EQUIPMENT DAMAGE.

DURING INSTALLATION AND USE OF THIS PRODUCT, COMPLY WITH THE NATIONAL ELECTRICAL CODE (NEC), FEDERAL, STATE AND LOCAL CODES, AND ALL OTHER APPLICABLE SAFETY CODES.

MAIN UTILITY POWER MUST BE OFF DURING INSTALLATION, WHEN PERFORMING EQUIPMENT MAINTENANCE OUTSIDE THE EQUIPMENTS NORMAL MAINTENANCE SCOPE AND WHEN PERFORMING REQUIRED MAINTENANCE ON ANY POWER CABLE(S) CONNECTED TO THE EQUIPMENT.

## **WARRANTY**

Lake Shore Electric 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's satisfaction that the equipment requires valid warranty work and Lake Shore is promptly notified of same, Lake Shore will make necessary corrections, free of charge. F.O.B. works where manufactured.

Such necessary corrections constitute the full extent of Lake Shore'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 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 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 **APPENDIX A**, and **APPENDIX B** of this manual in order to maintain Lake Shore's one year exclusive warranty. Failure to perform this maintenance shall void the 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.**

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## **1. CONSTRUCTION**

The Transfer Switches covered in this manual use molded case switches and/or circuit breakers to accomplish the transfer of two separate power sources to a single load.

These molded case circuit breaker(s) and/or switch/switches, (molded case units), are interlocked via a mechanical control system.

The walking beam interlock installed between the two molded case units encompasses the mechanical interlock system. The interlock is located on the rear of the base plate and is a fulcrum and lever device, which positively prevents both of the molded case switches or circuit breakers from being in the **ON** position simultaneously.

All styles of transfer switches are provided with an insulated operating handle to enable personnel to manually operate the transfer switch in the event of an emergency. The handle is permanently mounted and readily accessible and allows the operator to manually operate the transfer switch under load.

All interface relays are of the enclosed industrial type to ensure long life and minimum maintenance. They are rated for continuous duty to eliminate overheating of coils.

## **2. DESCRIPTION OF OPERATION**

Lake Shore Electric Corporation offers a complete line of Manual Transfer Switches which provide dependable, positive, fast-acting manual transfer to an alternate power source. The permanently installed manual operating handle(s) provide reliable mechanical transfer of molded case switches and/or circuit breakers. A fulcrum and lever mechanical interlock, not accessible by the operator, prevents the switching devices from applying power from both sources simultaneously. All Lake Shore Electric Corporation manual transfer switches are safe to operate under load. As an added feature, Lake Shore's Manual Transfer Switches can offer withstand ratings up to 150KAIC, without need of upstream coordination.

Molded Case Manual Transfer Switches are available in Single or Dual Operator configurations. A single operating handle may be used to transfer from one source to the other, but will not allow for the switch to be placed in a neutral position.

The neutral, or "OFF", position is a required condition for all service entrance rated equipment that is met with the Dual Operator Manual Transfer Switch. Two separate operating handles may be used to transfer the load from one source to the other and allows the operator to place the switch in a neutral, de-energized position.

Lake Shore Electric Corporation's Molded Case Transfer Switches are U.L. Listed up to 1200 amps at 600Vac or 250Vdc (U.L. Standard 1008, File No. E32008) and are CSA approved.

Maintenance requirements are minimal, as the mechanical operating mechanism is permanently lubricated and sealed and does not require routine service.

(Refer to Individual Unit Wiring Diagrams Included with the Transfer Switch.)

### 3. INSTALLATION

#### 3.1. MOUNTING AND CONNECTING

The standard Lake Shore 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, thus preventing voltage drops and improper operation. The maximum recommended distance the automatic transfer switch should be installed from the engine generator set is 1400 feet.

Enclosed transfer switches are designed in one of two enclosures: 1) “Wall Mount” or 2) “Free Standing”. With NEMA enclosure ratings of 1, 3R, 12, 4 and 4X.

Open transfer switches are generally mounted in a customer-supplied enclosure(s); consequently, there are certain steps, which should be followed:

1. Allow adequate space for movement of the manual-operating handle.
2. Mount to a rigid framework to minimize vibration.
3. Review all electrical clearances with the enclosure door or panels closed.
4. On rear connected switches, insure there is no strain on the studs 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.

1. Lug size and arrangements may vary depending on molded case switch manufacturer.
2. Optional lug arrangements are available, but must be specified at the time the transfer switch is ordered. Consult Lake Shore Electric for details.

The Normal source power cables are connected to the Normal molded case switch at the terminals marked NL1, NL2, and NL3. Please refer to the specific wiring diagram supplied with the switch.

The Emergency source power cables are connected in a like manner to the Emergency molded case switch terminals 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 connected to the common bus at the terminals marked L1, L2 and L3. On a three-phase, four-wire transfer switch, or a single-phase, three-wire transfer switch, a neutral lug is provided.

**Note:** Verify that the phase sequence rotation of the normal and emergency sources, are identical. Failure to do this will result in damage to the transfer switch/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. A ground lug is provided on all transfer switches. This lug **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 APPENDIX A).

There are numerous accessories available on Lake Shore 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.

Before applying power to the load connections from either source of the transfer switch, install a three phase voltage meter to the load connections set to phase to phase readings. (NOTE: if a three phase voltage meter is not available, use two single phase voltage meters and install one across phases A and B and the second across phases B and C.)

Now, manually set the transfer switch to the Normal source (Normal breaker CLOSED & Emergency breaker OPEN) and energize the normal source. Using the appropriate equipment and safety precautions, verify that there is power on the load side of the Normal Source Breaker by checking the voltage readout on the temporary meter(s) installed on the load connections. Depending on the accessories order with the switch, which operate on Normal power, may be verified. (i.e.: Pilot Lights, Electrical Assist, etc)

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 systems test. Once the check is complete, set the transfer switch to the Emergency source (Emergency breaker CLOSED & Normal breaker OPEN). Using the appropriate equipment and safety precautions, verify that there is power on the load side of the Emergency Source Breaker by checking the voltage readout on the temporary meter(s) installed on the load connections. Depending on the accessories order with the switch, which operate on Emergency power, may be verified. (i.e.: Pilot Lights, Electrical Assist, etc)

Now return the manual transfer switch back to the Normal source and allow the Emergency source to cool down properly. The above tests are sufficient to place the transfer switch in operation. The following pages contain specific information on the various components.

Any questions relating to the use of this Manual Transfer Switch, or for Technical assistance, should be referred to the Service Department of Lake Shore Electric Corporation, 205 Willis Street, Bedford, Ohio 44146, Phone (440) 232-0200, Fax (440) 232-5644.



## 4. OPERATING MECHANISM

### 4.1. GENERAL INFORMATION

The operating mechanism, pictured in Figure 1 (page 9), is used in single handle operated and dual handle operated manual transfer switches. Operation of the manual transfer switch is simple and easy. Simply move the manual handle(s) (1) to the desired position.

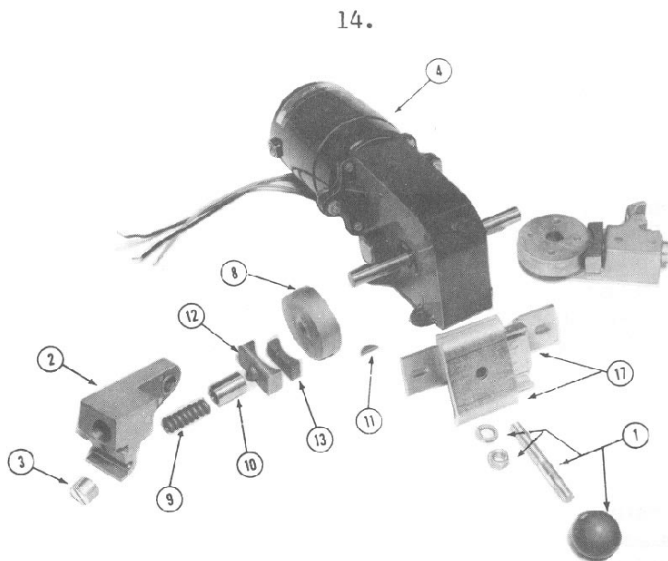
### 4.2. REQUIRED MAINTENANCE

Please refer to the APPENDIX A and APPENDIX B for required maintenance on the operating mechanism necessary to maintain your exclusive one-year Lake Shore Electric Corporation warranty.

### 4.3. OPERATOR MECHANISM ASSEMBLY (USE WITH ELECTRICAL ASSIST ONLY)

To assemble the operating mechanism, first place the drive drum keys (11) on each side of the shaft, which extends from the gearbox. Next, slide the two drive drums (8) on the shafts. Insert one drive shoe pivot (10) into one drive arm (2) from the bottom, followed by the drive shoe (12) and the drive shoe lining (13). Be sure that the lining fits snugly into the drive shoe and that the concave cup end of the drive shoe pivot (10) engages the nipple on the drive shoe. Hold the entire assembly together and slip it onto one shaft, pushing it all the way to the drive drum. Now the spring (9) and adjustment screw (3) may be assembled into the drive arm (2) from the top. Repeat this procedure for the other drive arm assembly, if present.

Place the lever arm support (17) in such a way that it straddles the gearbox and engages the drive arm assemblies on both sides of the gearbox. Tighten the mounting screws and assemble the lever arm across the two molded case switches by fastening the lever arm to the lever arm support with the manual handle assembly (1). Observe the molded case switch-actuating lever, as it manually opens and closes the molded case switch, checking that it completely transfers the molded case switches. The disassembly procedure of the mechanism is the reverse of the above.



### LEGEND

1. Manual Handle
2. Drive Arms
3. Adjustment Screw
4. Motor (N/A)
8. Drive Drums
9. Spring
10. Drive Shoe Pivot
11. Drive Drum Keys
12. Drive Shoe
13. Drive Shore Lining
17. Lever Arm  
Mounting Bracket

Figure 1

## 5. MOLDED CASE SWITCHES

### 5.1. GENERAL INFORMATION

The molded case switches used in transfer switches are the standard devices supplied by molded case switch manufactures. Figure 2 (page 10).

Thermal magnetic or magnetic trip units may be installed for thermal overload and short circuit protection. When these trips are provided, a bell alarm contact is included inside the breaker to provide remote annunciation that the transfer switch breaker, Normal and/or Emergency, has tripped due to an overload. This signal(s) may be run to an indicator circuit of the customers choosing.

If either breaker trips due to overload, it can be reset by manually operating the transfer switch to a position so that the breaker resets. After resetting, return the transfer switch to the proper position.

### 5.2. INSPECTION AND MAINTENANCE

Terminal lugs and trip units must be tight to prevent overheating. Due to the inherent wiping action built into the moving contacts of all molded case switches, operating the switch several times under load will remove any high resistance film that may have formed. Under normal conditions, additional cleaning of contacts is not required. However, should operating and/or atmospheric conditions make it desirable to clean the contacts further, the following procedure is recommended. (Refer to Figure 2).

Disengage the trip if it is present and remove completely from the breaker.

**NOTE: FAILURE TO REMOVE THE TRIP BEFORE REMOVING THE COVER WILL SNAP OFF THE ACTUATING HANDLE AND THE UNTIL WILL HAVE TO BE REPLACED AT THE CUSTOMERS COST.**

Next, remove the screws holding the cover on. Gently pull on the cover to remove it. Wipe contact surfaces with a clean, lint free cloth. If surfaces are excessively oxidized or corroded, scrape lightly with a fine file before wiping.



Figure 2

## **6. OPTIONAL ACCESSORIES**

Lake Shore Electric offers many additional accessories for the Single Operator and Dual Operator manual transfer switches. Please check the documents and drawings for your particular switch to see what additional options are included.

### **6.1. SERVICE ENTRANCE – SE**

This option provides for the Manual Transfer Switch to be labeled as suitable for use as service equipment. 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:

1. Padlockable Enclosure
2. Over Current Trip
3. Bell Alarm for the For Remote Trouble Circuit Installed by Customer
4. Neutral Bus with Main and Ground Lugs
5. Main Bonding Jumper per NEC 2002 250.8
6. 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.
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. Place Operating Mode of HMI to “Off/Reset”.
2. Unlock and open the enclosure door.
3. Place the “Menu System Enable” switch in the “Disabled” position.
4. Depress any pad on the HMI to verify that → Keypad Disabled ← is displayed.
5. Place the service disconnect switch in the OFF or OPEN position.
6. Open the fused disconnect for F1, F2, and F3.
7. Close and lock the enclosure door.
8. Reverse the above procedure to place the equipment back in service.

### SERVICE ENTRANCE LABEL

#### 6.2. GROUND FAULT PROTECTION OR INDICATION – GFP / GFPE

This option provides ground fault detection in one of three places; 1) normal power, 2) emergency power, or 3) the load bus of the transfer switch.

**(GFP) Ground fault protection** means that when an overload condition is detected by the trip unit installed on the Normal Breaker, it will trip open the normal breaker and the Bell Alarm will send out a signal.

**(GFPE) Ground fault protection on emergency** means that when an overload condition is detected by the trip unit installed on the Emergency Breaker, it will trip open the emergency breaker and the Bell Alarm will send out a signal.

#### 6.3. SURGE SUPPRESSION TVSS – SPD

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. No field installation is necessary.

#### 6.4. 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.

#### 6.5. CIRCUIT BREAKER TRIPS – CBTN / CBTE

This option provides circuit breaker trips on either or both sides of the transfer switch. Trips will come complete with bell alarms.

## **6.6. AUXILIARY CONTACTS SOURCE AVAILABLE – ACSA**

This option provides a form “C” contact wired out to terminal blocks. They are identified as “EMR” (Emergency Available) and “NOR” (Normal Available).

## **6.7. AUXILIARY CONTACTS SWITCH POSITION – ACSP**

This option provides a single auxiliary contact with the Normal and Emergency side breakers that are wired out to terminal blocks. They are identified as “SIE” (Switch in Emergency) and “SIN” (Switch in Normal).

## **6.8. PILOT LIGHTS – PL**

This option provides pilot lights on the door of the transfer switch which indicate the current position of the normal and emergency breakers and when a source is available. This option is typically used in conjunction with a manual transfer switch which has the electrical assist option and/or requires source available/switch position annunciation.

## **6.9. ELECTRICAL ASSIST – EA**

This option is included when operation of the breakers is required without opening the front door of a manual transfer switch. This will provide 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.

## **6.10. CONTROL ENABLE SWITCH – CES**

This option provides a keyed switch on the door of the transfer switch that allows the operator to lock out the push button controls provided with the Electrical Assist option.

## **6.11. CAM-LOCK® CONNECTIONS**

This option provides Cam-Lock® connectors and custom bus connections available at customer request. Please consult the factory for details.

### **6.12. MULTIFUNCTION METER – MFM**

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

If communications are required for the meter, an RS-485 module is provided. If other communications protocols are needed, a conversion module may be used convert the RS-485 to the appropriate protocol. Please consult the factory for the appropriate converter.

### **6.13. PHASE SEQUENCE MONITOR – PSM**

This option provides a visual indicator on the door of the transfer switch that shows the phase sequence of the bus that it is monitoring. Consult the factory for the various locations this equipment may be located.

### **6.14. STRIP HEATER – SH**

This option provides heaters with an adjustable thermostat inside the enclosure of the transfer switch. The purpose is to help control condensation on the control equipment. When installing the transfer switch, it is important to make sure that all cables coming into the enclosure have the proper sealant installed around them.

**7. APPENDIXES**

**7.1. APPENDIX A**

**\*FIELD CABLE SIZE & LUG TORQUE REQUIREMENTS  
USE COPPER WIRE ONLY  
LINE-LOAD-NEUTRAL UNLESS OTHERWISE SPECIFIED**

**REQUIRED MAINTENANCE**

The following cable lug torques are required to be checked every six months in order to maintain the Lake Shore Electric Corporation exclusive "one year" warranty.

**I. TORQUE – SOCKET HEAD SCREWS**

Socket Size (inches)	
Across Flats	Torque (LB-IN.)
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.

**7.2. APPENDIX B**

**INTERNAL MOLDED CASE TORQUE REQUIREMENTS**

**REQUIRED MAINTENANCE**

The following lug torques are required to be checked every six months in order to maintain the Lake Shore Electric Corporation exclusive "one year" warranty.

**I. EATON (CUTLER-HAMMER) LUG TO MOLDED CASE SWITCH/BREAKER**

K – Frame	6 – 8 LBS. – FT.
L – Frame	6 – 8 LBS. – FT.
N – Frame	31.25 – 37.5 LBS. – FT.

**II. EATON (CUTLER-HAMMER) TRIP TO MOLDED CASE BREAKER**

K – Frame	6 – 8 LBS. – FT.
L – Frame	10 – 12 LBS. – FT.
N – Frame	N/A Electronic Trip Unit