

Microprocessor Controls MP7600 System

Introduction

The Lake Shore Electric Corporation MP7600 Control System is a sophisticated, state of the art, microprocessor based controller for automatic transfer switches. This system consists of five components:

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

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

The MP7600 is fully programmable with four input keys and a two-line, 40 character, backlit, LCD display.

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

Diagnostic messages are displayed on the LCD.

System status is displayed by the diagnostic LED array.

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

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

The MP7600 provides optimum flexibility of transfer switch controls. All adjustments are easily accessible at the HMI Panel.

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

The controller provides for five modes of operation:

- Off / Reset - Turns MP7650 Controller Off (Manual Mode)
- Automatic - Will Monitor Sources to Supply Constant Power to the Load
- Hand Crank - Places the Transfer Switch into Manual Mode and then Starts the Generator Until Mode is Changed
- Load Test - Will Perform Load Transfer Test Until Mode is Changed
- Fault - A Trouble Condition Occurred and Will Be Stored in Memory and Displayed on the HMI Until it Has Been Cleared

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

Product Features

- **UL 1008 Listed**
- **LCD Backlit Display, 2 Lines, 20 Characters Each, User Input Keypad - 4 Buttons (Membrane Style)**
- **MP7600 Control Inputs**
 - Key Pad Disable
 - Load Test (Cycled or Maintained*)
 - Override Pushbutton
 - Remote Load Test*
 - Synchronizer*
 - Load Demand Inhibit*
 - Ground Fault Protection Relay*
 - Reverse Power Condition* (Normal & Emergency)
 - Remote Disconnect*
 - Peak Shave*
- **System Status LED's**
 - System Not in Automatic
 - System Ground Fault*
 - Source Available (Normal & Emergency)
 - Switch Position (Normal & Emergency)
 - Reverse Power* (Normal & Emergency)
 - Switch Withdrawn* (Normal & Emergency)
 - Switch Tripped* (Normal & Emergency)
 - Switch in Test* (Normal & Emergency)
- **Maximum: 48 Diagnostic LED's for System Troubleshooting**
- **Dry, Form "C", Contacts for Customer Interface**
 - SIN Switch in Normal 2 Sets
 - SIE Switch in Emergency 2 Sets
 - NOR Normal Source Available* 2 Sets
 - EMR Emergency Source Available* 2 Sets
 - TBRL Trouble 2 Sets
 - ES Engine Start 1 Set
 - EC Pre-transfer Signal* 2 Sets
- **Dry, Form "C", Contacts for System Control**
 - TN Normal Tripped* 1 Set
 - TE Emergency Tripped* 1 Set
 - CE Close Emergency 1 Set
 - CN Close Normal 1 Set
 - OE Open Emergency* 1 Set
 - ON Open Normal* 1 Set
- **Up to 9 field programmable timers**
 - TDES Time Delay Engine Start
 - TDE Time Delay Emergency
 - TDN Time Delay Neutral*
 - TDR Time Delay Return
 - TDEC Time Delay Engine Cool Down
 - MRT Minimum Run Timer
 - TDBT Time Delay Before Transfer*
 - SFT Synchronize Fail Timer*
 - SPPT Single Phase Protection Timer*
- **Engine Exerciser Clock for weekly testing with or without load**
- **Available for open or closed transition**

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



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Operation Instructions

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

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

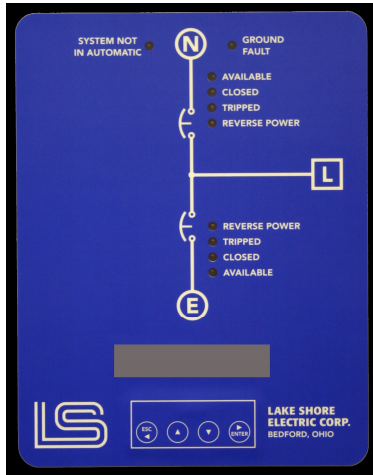


Figure 1

Operational Display Examples

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 2 shows a standard display of the controller in the automatic position with a programmed load test exerciser period. Also displayed is the time and date.



Figure 2

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



Figure 3

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

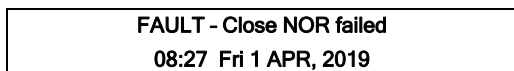


Figure 4

FAULT RESET Instructions

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

RESET to Factory Defaults Instruction

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

Setting Mode of Operation

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

Setting Date & Time

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

Setting Timers

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

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

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

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

NOTE: The value for the timer will only be saved after hitting "Enter" after modifying the 3rd digit for the timer setting.

NOTE 2: Extra step for SFT timer setup.

- a. If setting up the SFT timer, another question will appear; "If SFT Times Out - - - -", Open Transition? Yes/No
- b. Select Yes or No, then hit "Enter" to save the setting.

13. The LCD will sequence through all the timers in the same manner.
14. Repeat steps 8 thru 13 to modify other timers.

Plant Exerciser

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

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

Setting Plant Exerciser

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

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

NOTE: The value for the time of day to start the plant exerciser will only be saved after hitting "Enter" after modifying the 4th digit.

12. The LCD displays "SET UP EXERCISER/Duration (hh:mm): XX:XX".
13. The first digit of the hour and minute duration timer is underlined.
14. Depress either "↓" or "↑" until the desired value is displayed.
16. Depress "Enter" to store value or "ESC" to cancel.
- NOTE: The value for the time duration will only be saved after hitting "Enter" after modifying the 4th digit.
15. Depress "Enter" until the LCD then displays "SET UP EXERCISER/Days (Caps = ON) : s m t w t f s".
16. Notice that the first character will be underlined.
17. Depress "↓" or "↑" to change the selected days case.
 - a. Capital - Exercise Performed
 - b. Lower Case - No Exercise
18. Depress "Enter" to store value.
19. Depress "Enter" until the LCD then displays "SET UP WEEKS OF MONTH (NUMBER = ON; • = OFF) : 1 • 3 • 5".

(NOTE: If the "5th" week is selected and there is no 5th week in the month, the plant exerciser will not run.)

20. Notice that the first character will be underlined.
21. Depress "↓" or "↑" to change the selected number to a dot.
 - a. Number - Exercise Performed
 - b. Dot - No Exercise
22. Depress "Enter" to store value or "ESC" to cancel.

Standard Time Delays and Their Functions

- TDES** Time Delay Engine Start. This timer is adjustable from 0 to 300 seconds and is **FACTORY SET AT 3 SECONDS**. It is initiated upon sensing the loss of normal power and once timed out will initiate an engine start signal.
- TDE** Time Delay Emergency. This timer is adjustable from 0 to 300 seconds and is **FACTORY SET AT 3 SECONDS**. It is initiated upon the sensing of the emergency source and once timed out will initiate the transfer to the emergency source.
- TDN** Time Delay Neutral. This timer is adjustable from 0 to 300 seconds and is **FACTORY SET AT 3 SECONDS**. It is initiated upon the opening of one source and will inhibit the closing of the oncoming source until it has timed out.
- TDR** Time Delay Return. This timer is adjustable from 0.0 to 60.0 minutes and is **FACTORY SET AT 12 MINUTES**. It is initiated upon the restoration of normal power and will inhibit the switch from retransferring to the normal source until it has timed out. If at any time during the timing cycle normal power is not maintained, this timer will be terminated and will be reinitiated when normal power returns.
- TDEC** Time Delay Engine Cool down. This timer is adjustable from 0.0 to 60.0 minutes and is **FACTORY SET AT 10 MINUTES**. This timer is initiated upon the retransfer of the switch to the normal source and will keep the engine running until it has timed out.
- MRT** Minimum Run Timer. This timer is adjustable from 0.0 to 60.0 minutes and **FACTORY SET AT 10 MINUTES**. It is initiated upon the initiation of starting the engine generator set and will keep the engine running until it has timed out.

Optional Time Delays and Their Functions

- SFT** Synchronize Fail Timer. This timer is adjustable from 0.0 to 60.0 minutes and is **FACTORY SET AT 10 SECONDS**. It is only used for closed transition transfer switches. It is initiated at the time that actual transfer is permitted by the controller. If it times out prior to a transfer being complete, it will display "Trouble: SFT timed out", but will not terminate operation of the transfer switch. This is to alert the operator that the system took longer to synchronize than expected. The operator can clear this message by pressing "Enter" and then select "Clear Trouble". The operator can also program the MP7600 to continue to try for a closed transition transfer or to do an open transition transfer when this timer times out. This also drops out the trouble relay to annunciate that this transfer switch requires attention.
- TDBT** Time Delay Before Transfer. This timer is adjustable from 0 to 300 seconds and is **FACTORY SET AT 10 SECONDS**. It is initiated when the switch is ready to transfer and upon its completion the transfer will take place. This is typically used in elevator circuits.
- SPPT** Single Phase Protection Timer. This timer is adjustable from 0 to 300 seconds and is **FACTORY SET AT 10 SECONDS**. The SPPT timer begins timing when the under voltage relay drops out. If the transfer to emergency begins before this timer times out, this timer is turned off. If this timer times out before the transfer to emergency begins, an output is sent to trip the normal breaker to trip it open. This is to prevent damage to the load in case the system is on a utility single phase condition. On insulated case breakers this operates without any operator intervention because opening and tripping the breaker are the same mechanism and the breaker does not need to be reset.



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Relay Interface Board

The Relay Interface Board (RIB) is the electromechanical interfacing device between the MP7600 microprocessor controls, the power panel and the user interfaces. When the transfer switch is ordered, 12-volt dc or 24-volt dc operation must be selected. Although the power supply will accept any voltage within its range, the relays that populate the Relay Interface Board must be either 12-volt dc or 24-volt dc. Please ensure that the relay voltage agrees with your dc power source voltage.

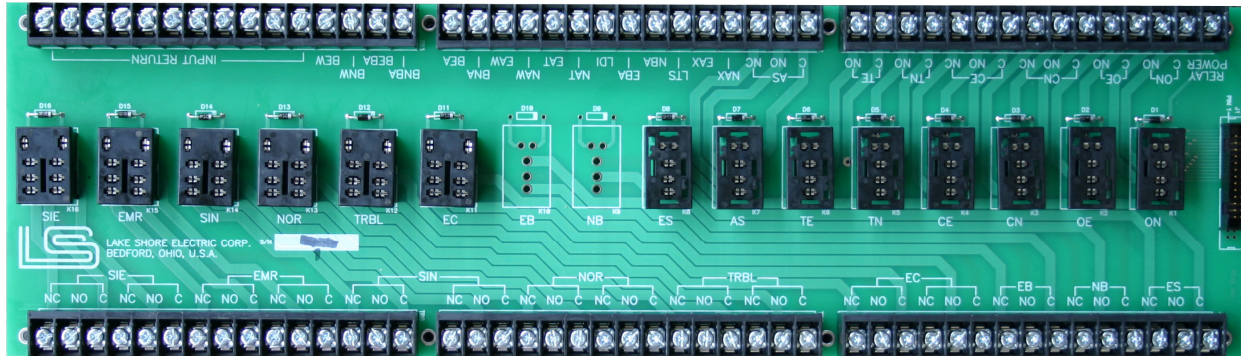


Figure 5 - Relay Interface Board

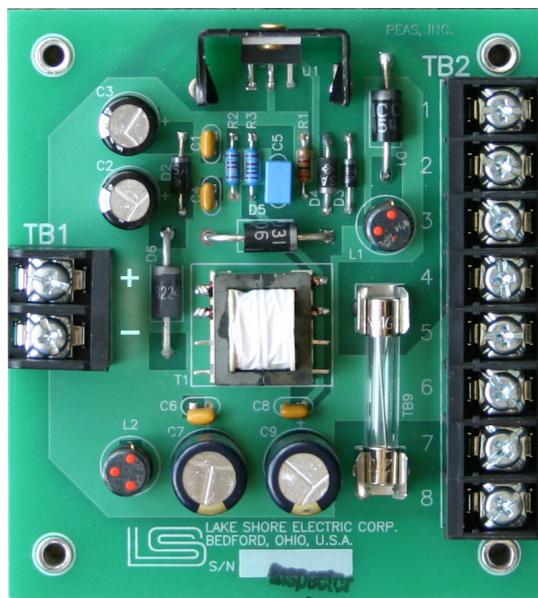


Figure 6 - Power Supply Board

Power Supply Board

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

MP7600 - Main Control Board



Figure 7

TB1 Connections (See Figure 7)

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

Microprocessor System Specifications

MP7600 Microprocessor System	
Operating Voltage	12Vdc or 24Vdc
Power Consumption: Passive Monitoring	24 ~ 48 VA ≅ 2A @ Selected Voltage
Power Consumption: Operating MC Units	Max Inrush: 260 VA
Power Consumption: Operating IC Units	Max Inrush: 500 VA
Customer Connection Contact Type	Form "C" Dry Contacts [C, NO, NC]
Customer Connection Contact Rating	10 Amps Max Contacts
Ambient Temperature: Operating	-20°C to +60°C [-4°F to 140°F]
Ambient Temperature: Storage	-40°C to +80°C [-40°F to 176°F]
Humidity	5 to 85% RH, no condensation
Weight	Approximate (56 oz., 3.5 lbs.)
Industrial Control Equipment	UL 1008 Listed
Construction	Solid State Circuitry
Dimensions (W x H x D)*	8 ¼" x 11 ¼" x 2"
Mounting (W x H)*	6 ¼" x 9 ½"

* Reference Figure 7.

Microprocessor System Order Guide

MP7600 Microprocessor System Part Numbers	
MP7600 Main Control Board	70LSEMP1857106
MP7600 Display (LCD) Board	70LSEMP1857601
MP7600 LED Board	70LSEMP1857201
HMI Overlay for Front of Door Fixed IC or MC Units	58NPTOL7678000
Drawout IC Units	58NPTOL7678001
Keypad	43XYMKP4408300
Relay Interface Board, RIB	70LSEMP1857400
ICE Cube Relays, 12Vdc	
1 Pole	32IDEDC1940001
2 Pole	32IDEDC1940002
Hold Down Spring	43IDESP1940180
ICE Cube Relays, 24Vdc	
1 Pole	32IDEDC1940004
2 Pole	32IDEDC1940005
Hold Down Spring	43IDESP1940180
Power Supply Board, PSB	70LSEMP1857301
Communication Ribbon Cable IC Units, 100"	70LSEMP1858526
MC Units, 72"	70LSEMP1857526
Standard Control Switches Keypad Enable, KPE	02CASTS1673562, Maintained
Override Pushbutton, ORPB	02CASPB1673561, Momentary
Load Test Switch, LTS	02CASPB1673561, Momentary