

LCDT Selectronic® Tattletale® Instrument Installation and Operation Manual

LCDT-92132N
Revised 07-06
Section 50
00-02-0205



Models: LCDT-NO and LCDT-NC

Power Supplies: LCDT-PS-CD (R)-P, LCDT-PS-CD-N, and LCDT-PS-120/24/12

Options: LCDT-ISB barrier (discontinued), and Class "C" lockout adapter (discontinued)

Please read the following information before installing. A visual inspection of this product for damage during shipping is recommended before mounting. This installation manual is intended for all LCDT Selectronic Tattletale Series models.

GENERAL INFORMATION

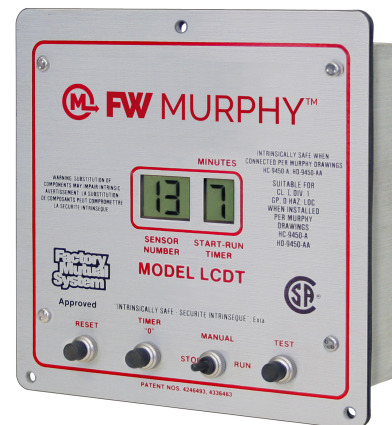
WARNING

BEFORE BEGINNING INSTALLATION OF THIS FW MURPHY PRODUCT

- ✓ Disconnect all electrical power to the machine.
- ✓ Make sure the machine cannot operate during installation.
- ✓ Follow all safety warnings of the machine manufacturer.
- ✓ Read and follow all installation instructions.



Suitable for Class I,
Division 1, Group D,
Hazardous Locations.



Description

The LCDT instrument is a solid state fault annunciator and shutdown control system rated for Class I, Division 1, Group D hazardous areas. It is designed to protect engine and motor-driven compressors and pumps.

The LCDT basic system consists of (1) the module, (2) the power supply, (3) the terminal block and cable assembly, (4) an optional barrier for non-intrinsically safe normally open sensors and (5) optional class "C" adapters for normally open or normally closed sensors.

The System can be powered by a CD ignition, 120 VAC, or by 12 or 24 VDC battery. Two basic models are available:

LCDT-NO for NORMALLY OPEN sensors.

LCDT-NC for NORMALLY CLOSED sensors.

CAUTION: We do not recommend the use switches having contacts immersed in oil. Because the LCDT operates on low voltage, the oil may act as an insulator between the contacts.

Module

The module indicates the sensor by number and hence the parameter, that causes an alarm or shutdown. It is enclosed in an aluminum box that accommodates 47 sensor inputs; 15 sensors can be locked out during start-up period. The sensors can be tested without shutting down the engine.

A liquid crystal display window gives a digital reading of the tripped sensor and the lockout timer countdown. A backup battery is provided to retain the display after engine shutdown.

Power Supply

Converts CD ignition voltage (± 90 -250 volts) or 12/24 VDC or 120 VAC to approximately 5.8 to 9.5 VDC for system operation. A voltage barrier within the power supply isolates the inputs from the outputs to prohibit transfer of voltage/current that could cause a spark in the input circuit.

Upon receipt of a shutdown signal, the power supply provides switching outputs to first operate a fuel gas valve for the engine and then to ground the engine ignition, as well as a relay for shutdown indication.

Terminal block and Cable Assembly

The plug-in type Terminal strip has 50 screw-type connections for normally open sensors or 50 pairs of connections for normally closed sensors. The terminal strip is connected to the LCDT module with the 36 in. (914 mm) long flat ribbon cable.

LCDT-50CA-36 for normally open sensors.

LCDT-100CA-36 for normally closed sensors.

Barrier for Non-intrinsically Safe (normally open) Sensors (discontinued)

The LCDT-ISB barrier option is designed to accept non-intrinsically safe normally open inputs and convert them to intrinsically safe outputs for the input terminal strip. Within a Class I, Division 1, Group D area, the input circuits to the barrier must be enclosed in conduit with applicable explosion-proof seals.

Class "C" Lockout Adapter (optional; discontinued)

Class "C" adapter to lock out the sensor input until a clear signal is received. Available for normally open and for normally closed systems.

Compatible Engine Type Ignitions for LCDT-PS-CD

Ignition Mfr. & Series	Polarity (Gnd.)	Output	Power supply
Altronic I, III, & V	Negative	Positive	-PS-CD-N
Altronic II	Positive	Negative	-PS-CD(R)P
American Bosch Magtronic	Negative	Positive	-PS-CD-N
Bendix S-1800, BLAR	Negative	Positive	-PS-CD-N
Bendix Sidewinder	Positive	Negative	-PS-CD(R)P
Fairbanks Morse SCSA	Positive	Negative	-PS-CD(R)P
Fairbanks Morse 9000	Negative	Positive	-PS-CD-N

*When used with approved ignitions. Contact FW Murphy for details.

**When installed per drawings HC-9450-A or HD-9450-AA.

SPECIFICATIONS

Power: Supplied by CD ignition of an engine, 120 VAC line, or by 12 or 24 VDC battery.

Power Consumption: CD ignition (2 mA @ 100V), 120 VAC (4 watts), 24 VDC (1 watt), or 12VDC (0.5 watts).

Power Inputs (Operating Voltage):

LCDT-PS-CD (R)-P: 90-250 VDC, CD ignition positive ground.
Relay for fuel valve and alarm outputs.

LCDT-PS-CD-N: 90-250 VDC, CD ignition negative ground.
(FET for output to fuel valve, ignition ground, and SPDT alarm relay.)

LCDT-PS-120/24/12: 120 VAC (6 VA), 24 VDC (1 watt), and 12 VDC (0.5 watts). Operated relay output.

Sensor Inputs: Accepts up to 47 sensors via a ribbon cable (NC-only 45).

NOTE: An approved isolation barrier such as a thermocouple type barrier for normally closed or normally open sensors, **must** be used between sensor switch and input terminals if sensor outputs come from any energy storing device such as a relay or transistor.

Relay Outputs Ratings:

LCDT-PS-CD (R)-P Contact rating: 4A, $\frac{1}{20}$ HP, 125/250 VAC
3A, 30 VDC.

LCDT-PS-120/24/12 Contact rating: 5A, 28 VDC.

FET Outputs: LCDT-PS-CD-N rating (for fuel valve and ignition ground): 0.5 Amp. @ 250 V.

Operating Temperature: Module (head): -40 to 185°F (-40 to 85°).
Power Supply: 0 to 158°F (-18 to 70°C).

Storage Temperature: -40 to 302°F (-40 to 150°C).

Case: Module: LCDT-NO or NC: Anodized aluminum.

Power Supply (all models): Explosion-proof aluminum enclosure.

Multiplexer Scan Rate: Scans all 47 sensors in 0.7 seconds.

Start-Run/Test Timer: Standard 5 minutes. Specify other, (1 to 7 min. maximum, on increments of 1 minute only).

Laboratory Approvals: CSA[†] and Factory Mutual System^{††} approved for Class I, Division 1, Group D, Hazardous Locations.

[†]When used with approved ignitions. Contact FW Murphy for details. ^{††}When installed per drawings HC-9450-A or HC-9450-AA.

Power Inlet: Customer furnished 1/2 in. conduit (must be sealed).

Output Voltage: Approximately 5.8 to 9.5 VDC. Safety barrier on power supply maintains control circuits intrinsically safe.

Voltage Barrier: Clamps output at 9.5 VDC and ensures intrinsic safety of all input circuits connected to the LCDT.

Power and Control Outlet: Conduit outlet employs sealing fitting for hazardous locations. Power and control color-coded, 4-conductor cable, is factory installed through outlet conduit seal. Conductors are connected to terminal block on intrinsically safe side of barrier.

Backup Battery:

LCDT-PS-CD (R)-P: 6 VDC, Duracell PX28L Lithium (FW Murphy P/N 00002216).

LCDT-PS-CD-N: 6 VDC, DL223A Lithium or Sanyo CR P2 (FW Murphy P/N 00005125).

LCDT-PS 120/24/12: 1.2 VDC CH15 Nickel-cadmium (5 pcs.) SWE NI-1158 (FW Murphy P/N 00005124)

Shutdown Outputs:

By Relay outputs: LCDT-PS-CD (R)-P
LCDT-PS-120/24/12

By FET outputs: LCDT-PS-CD-N

Output Selections: (Customer selected, see page 5.)

- Ground Ignition immediately.
- Trip fuel shutoff valve, then ground ignition after 3-5 seconds delay.

Alarm Relay Output: SPDT form "C" contacts, provide for operation of a shutdown alarm (for rating refer to relay outputs).

LCDT-50CA-36 Terminal Strip/Cable Assembly

Ribbon Cable: 50 conductor, 36 in. (914 mm) long cable, with push-on type connector.

Terminal Block:

Normally Open Sensors: 50 screw type terminals (#6 screws), with mounting bracket.

Normally Closed Sensors: 50 pairs screw type terminals (#6 screws) and factory installed jumper with mounting bracket.

LCDT-ISB Intrinsically Safe Barrier (for Normally Open sensors; discontinued)

Hazardous Area Design: Explosion-proof design according to NEC requirements for Class I, Division 1, Group D areas, CSA and Factory Mutual System approved (see *Laboratory Approvals*)

Enclosure: Aluminum explosion-proof case, tapped at customer's end for 1/2 in. conduit. (see mounting section for dimensions.)

Sensor Inlet: Customer furnished 1/2 in. conduit, (must have approved seal within 18 in. [458 mm] of enclosure).

Output to Terminal Block: Manufacturer furnished electrical cable is connected to barrier outlet. Normally OFF electronic switch turns ON when either sensor trips.

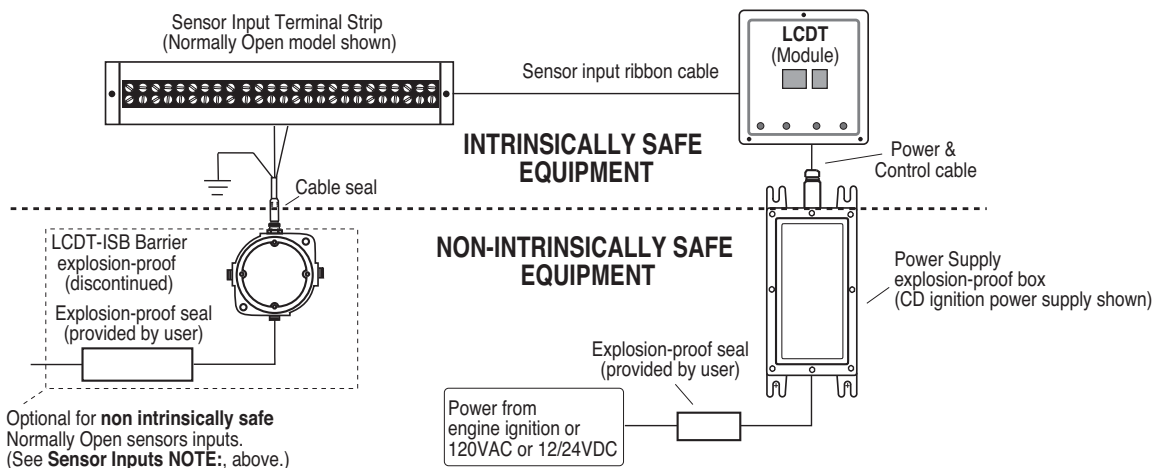
Class "C" lockout Adapter (N.O. or N.C. sensor; discontinued)

Intended for use between the LCDT and dry mechanical switches, this option is **NOT** listed for CSA or Factory Mutual standards.

SYSTEM INSTALLATION



CAUTION: For hazardous application requirements, the LCDT complete system must be installed in accordance with the National Electrical Code (NEC) Class I, Division 1, Group D (article 504) specifications, and per Murphy drawings HD-9450-AA (50080019) or HC-9450-A (50080021).

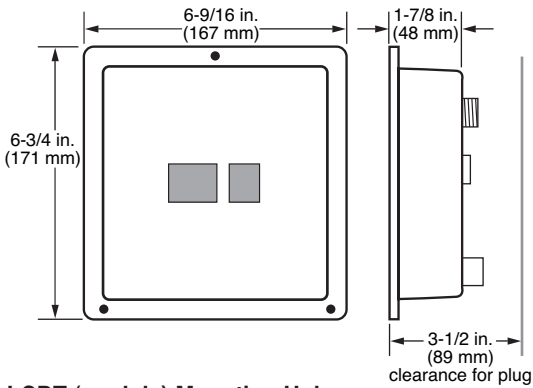


MOUNTING DIMENSIONS

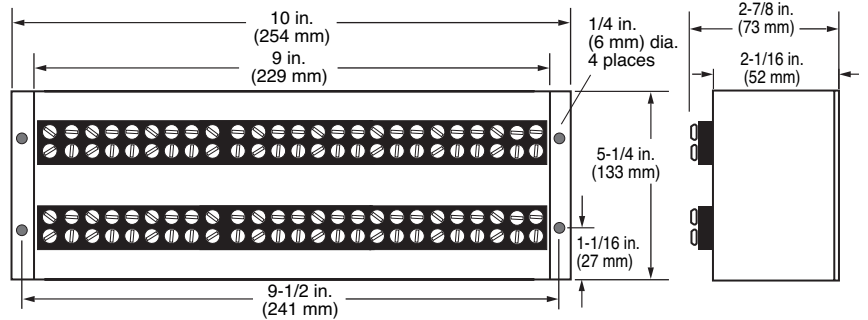


CAUTION: The LCDT system should be mounted within a weatherproof enclosure. A mounting hole of 5-7/8 in. (149 mm) high x 6-1/8 in. (156 mm) wide and three (3) 3/16 in. (5 mm) dia. screw holes are needed, see mounting drawing. Insert the LCDT from the front side of the panel and install the three mounting screws. Plan the terminal block and the power supply mounting for easy wiring and access.

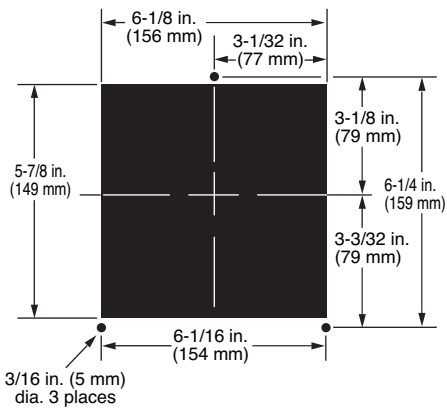
LCDT Module



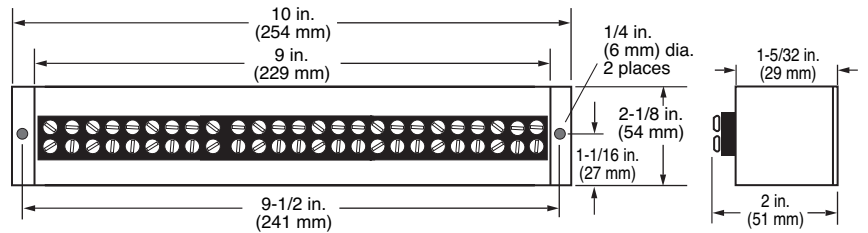
LCDT-TB-NC (50 pairs screw type terminals)



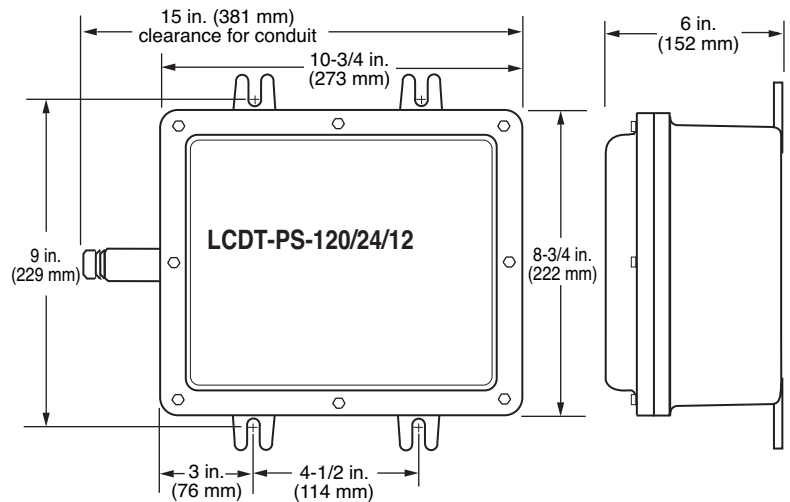
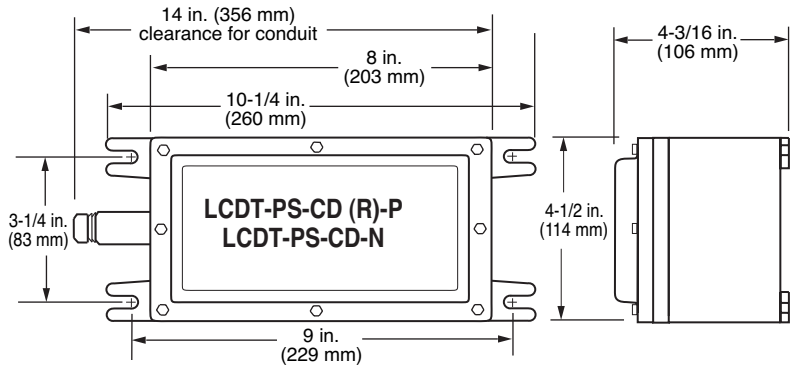
LCDT (module) Mounting Hole



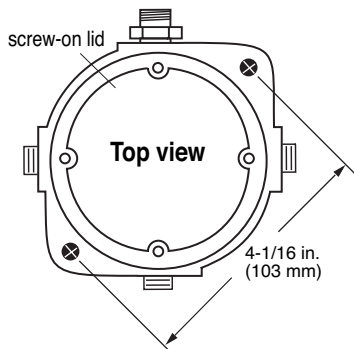
LCDT-TB-NO (50 screw type terminals)



LCDT-Power Supplies (explosion-proof box)

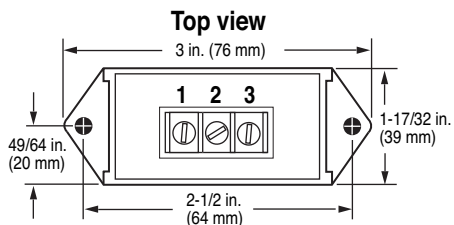


LCDT-ISB Barrier (For Normally Open inputs; discontinued)



NOTE: Allow 3-7/8 in. L x 3-7/8 in. W x 2-7/8 in. H (98 x 98 x 73 mm) for barrier clearance.

LCDT Class "C" Lockout Adapter (discontinued)



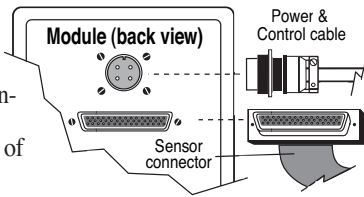
SYSTEM TYPICAL WIRING



WARNING: Perform the wiring operation with the power source "OFF" and the area made non-hazardous. Make sure the voltage and current requirements are within the LCDT ratings. Hard conduit with approved seals is required by the NEC for non-intrinsically safe connections.

1. Module connections

Interconnect the module and the power supply with the power and control cable. The sensor connector from the terminal strip, simply plugs into the back of the LCDT module.



2. Power supply typical connections



CAUTION: Do not run the power supply leads and the sensor leads wiring in the same conduit.

a. Conduit installation: Remove power before opening power supply cover. Install a 1/2 in. (13 mm) dia. conduit, from customer end of power supply to ignition or power source. Install an approved explosion-proof seal in the conduit within 18 in. (457 mm) of power supply enclosure.

Important: Use the green screw above conduit inlet (in power supply), to attach equipment ground per National Electrical Code (NEC).

- To obtain a built-in delay of 3-5 seconds for grounding the ignition after fuel valve has been tripped, remove jumper between eyelets **E1** and **E2**, on all power supplies models.
- If ignition grounding is not required, cut jumper between eyelets **E3** and **E4**. Refer to fuel valve wiring—power supply wiring, (CD ignition models only).

b. Customer Wiring: Refer to Power Supply Wiring, pages 5/6.

Important: Run wiring from ignition and fuel valve to power supply through conduit installed in "step 2-a".

3. Intrinsically safe barrier wiring (normally open sensor only)

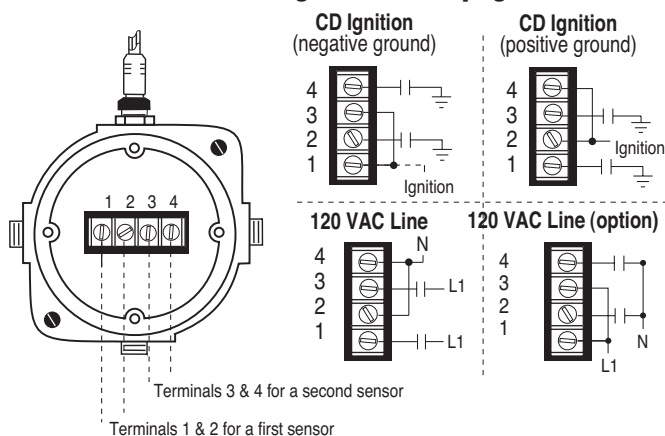


WARNING: Secure the area of hazardous conditions before opening barrier cover or operating sensor contacts.

- Run Sensor switches wiring through conduit and isolate from the LCDT terminal block with an explosion-proof barrier.
- For wiring refer to the following typical wiring diagrams.

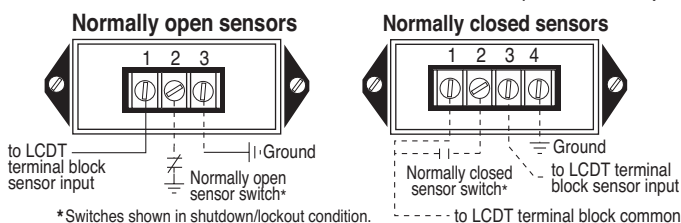
Normally Open System Barrier LCDT-ISB barrier (optional; discontinued)

- See the alternative wiring on the next page -



NOTE: Terminals #1 & #3 must be (+) positive with respect to #2 and #4.

CLASS "C" LOCKOUT ADAPTER TYPICAL WIRING (discontinued)



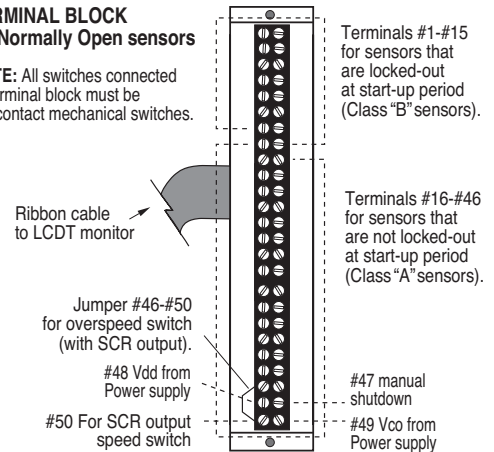
4. Normally open sensor input wiring

a. Jumper Installation/Removal:

- When digital electronic speed switch with SCR output is used for overspeed protection, install jumper between terminals #46 and #50 of the sensor input terminal block.
- Wire each intrinsically safe sensor to be locked out during start up to one of the terminals #1 through #15.
- Wire sensors not locked out at start up to terminals #16 through #46. Jumper between terminal #50 and #46 for overspeed from SCR output. Terminal #47 is manual stop.

TERMINAL BLOCK for Normally Open sensors

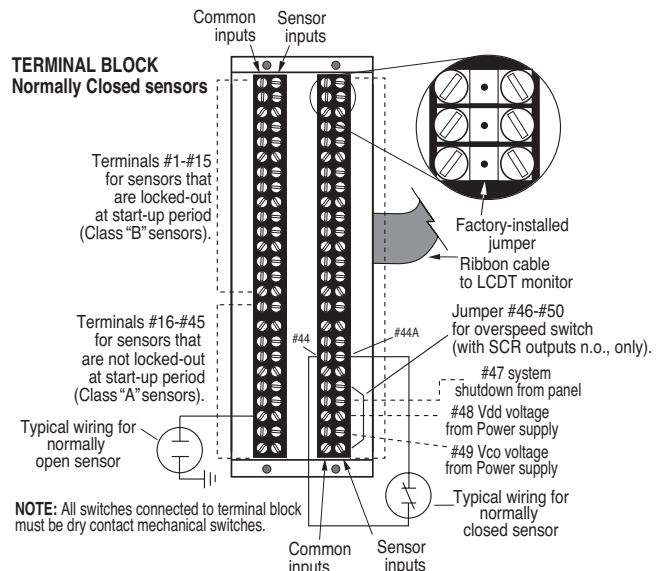
NOTE: All switches connected to terminal block must be dry contact mechanical switches.



5. Normally closed sensor input wiring

a. Jumper Installation/Removal:

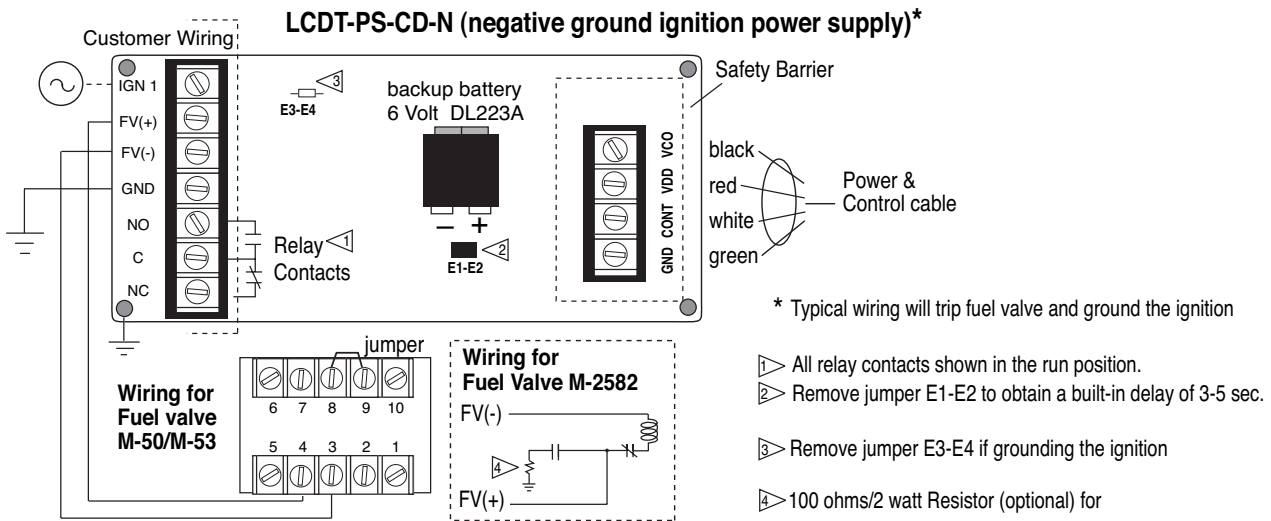
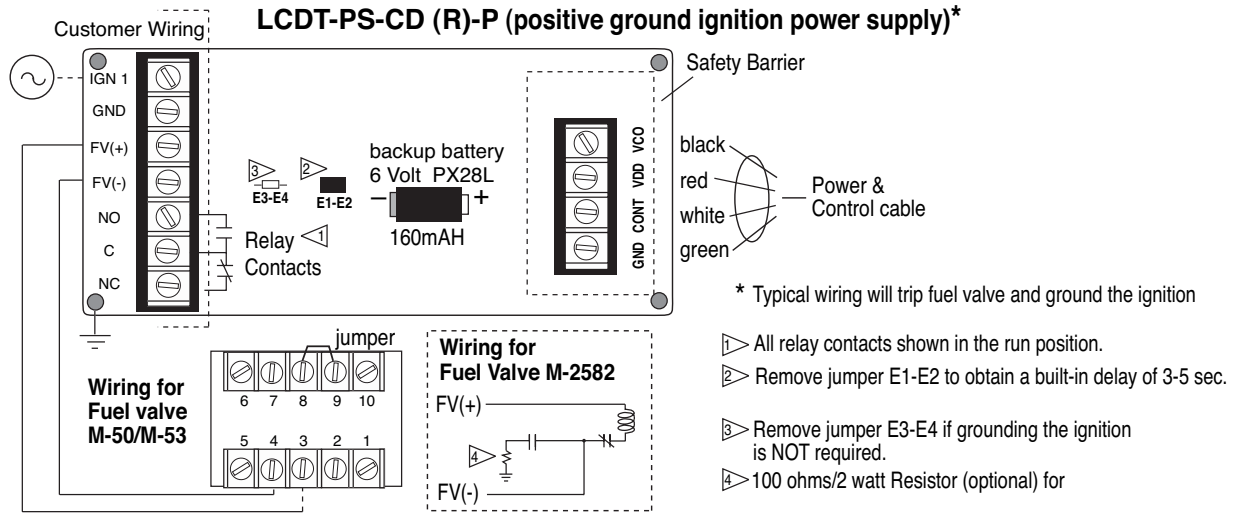
- When digital electronic speed switch with SCR output is used for overspeed protection, install jumper between terminals #46 and #50 of the sensor input terminal block. Overspeed input #46 is normally open only.
- Remove the factory-installed jumper and connect a wire from terminals #1 through #45 to one side of each sensor switch.
- For sensors to be locked out during startup wire other side of sensor switch to one of sensor terminals #1A through #15A. For sensors not locked out during startup wire other side to one of terminals #16A through #45A.
- To wire Normally Open sensors to Normally Closed terminal block leave the factory-installed jumper in place. Connect sensor between jumpered input terminals and ground.



POWER SUPPLY TYPICAL WIRING INSTALLATION

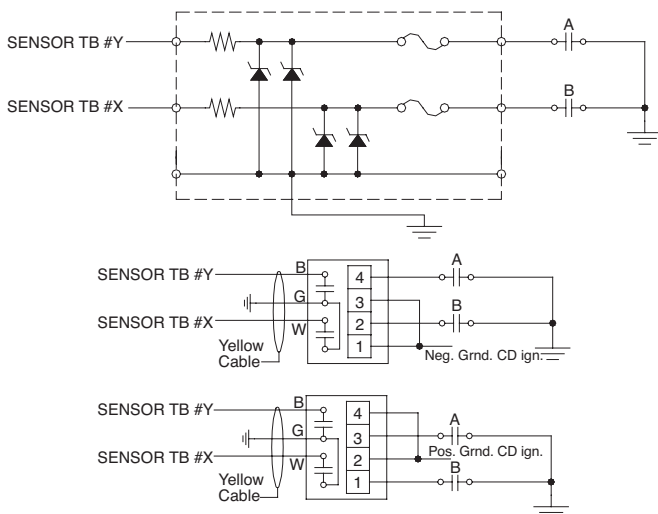


WARNING: Perform the wiring operation with the power source "OFF" and the area made non-hazardous. Conduit is recommended to protect wires from damage. Do NOT route sensor leads and power supply wiring in the same conduit.

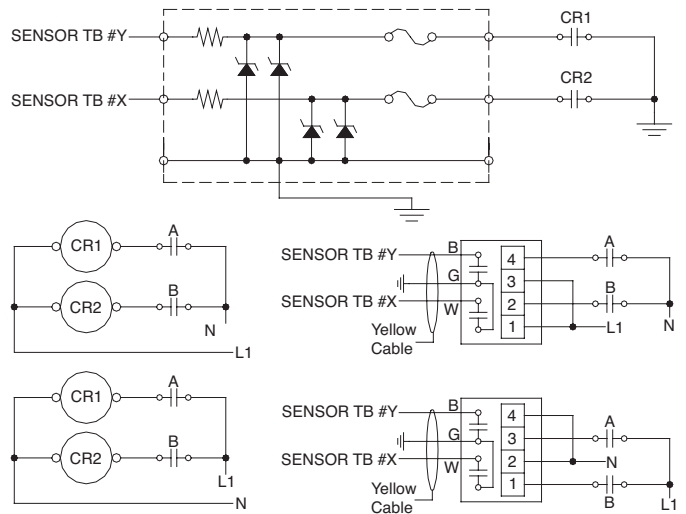


Alternative Wiring for substituting LCDT-ISB with 7760 type barrier

How to Substitute 7760 Type Barrier Instead of LCDT-ISB



How to Substitute 7760 Type Barrier with Two Relays Instead of LCDT-ISB

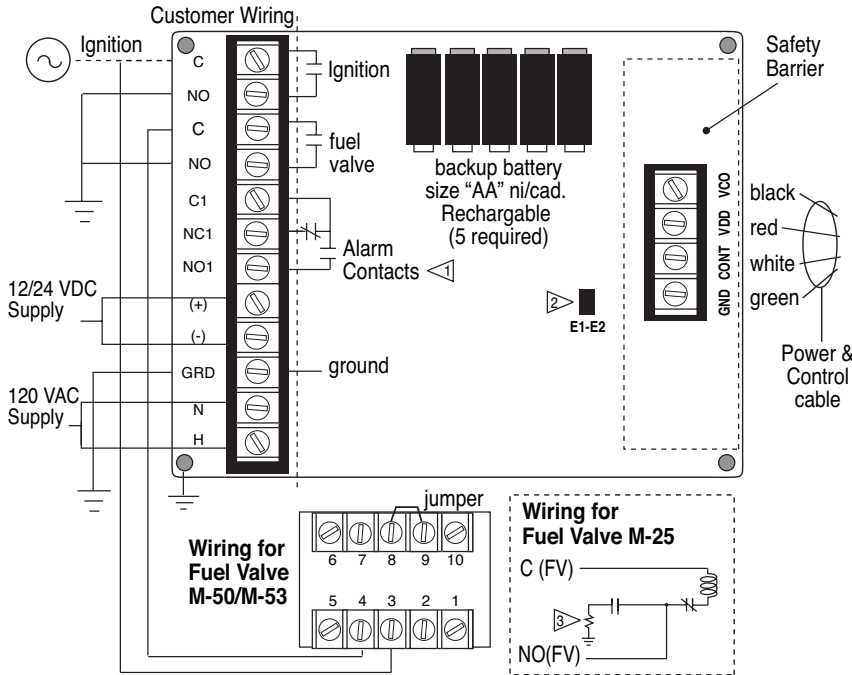


POWER SUPPLY TYPICAL WIRING INSTALLATION



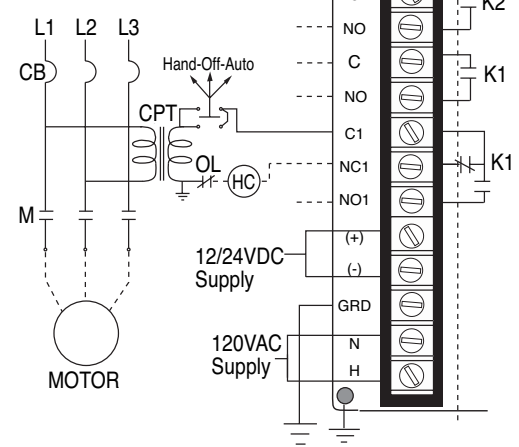
WARNING: Perform the wiring operation with the power source "OFF" and the area made non-hazardous. Conduit is recommended to protect wires from damage. Do NOT route sensor leads and power supply wiring in the same conduit.

LCDT-PS-120/24/12 (120 VAC, 12 or 24 VDC power supply)



- ▶ All relay contacts shown in the run position
- ▶ Remove jumper E1-E2 to obtain a delay of 3-5 sec.
- ▶ 100 ohms/2 watt Resistor (optional) for

Optional Wiring for Electric Motor Applications



SEQUENCE OF OPERATIONS

TYPICAL OPERATING PROCEDURE

To perform this operation, the system must be properly installed and faulted sensors cleared. To demonstrate typical operation, assume that power comes from an engine with CD type ignition.

1. Battery Check

- a. Hold down TEST pushbutton and check Start Run Timer display. A decimal (.) point visible in display indicates low battery.

NOTE: For backup battery replacement, refer to Power Supply typical wiring diagrams.

2. Initially Faulted Sensor Check (before startup) -NO models only.

When ignition is not present on ignition powered models, the sensors are not scanned until the reset button is pushed. Once ignition is present, the sensors are continually scanned.

- a. Set Manual switch to RUN.
- b. Momentarily press RESET pushbutton and observe Sensor Number window for faulted sensor indication.
- c. Initiate Time lockout by clearing any faulted sensors then press the RESET button. Repeat until all faulted sensors are cleared.

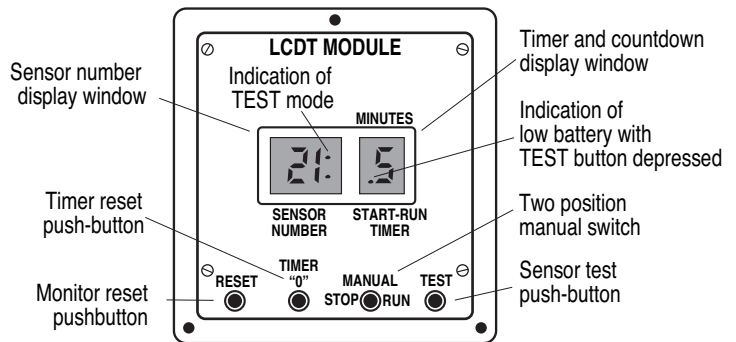
3. System Startup.

- a. Set Manual Switch to RUN.
- b. Press Reset to clear any faulted sensors and set up power supply for engine operation.
- c. Apply starting power to engine. At time out of the Start-Run Timer, all locked out sensors are made active.

NOTE: If engine fails to start, refer to trouble shooting section, page-8.

4. Sensor Test (only while engine is running). To verify that sensors are hooked up and working.

- a. Press RESET first, then press TEST pushbutton to override shut down function while sensors are being tested.
- b. Verify that the colon (:) is in the sensor number window to indicate TEST mode, and that full count appears in the Start Run Timer window.



NOTE: Test ends when the timer times out or Timer "0" button is depressed. (Full time is reset each time RESET is depressed).

c. Test system sensors as follows:

1. Trip first sensor to be tested and verify that sensor number appears in Sensor Number window.
2. Clear sensor just tripped then press the RESET pushbutton. Verify that sensor number is cleared from Sensor Number window and that full count appears in Timer window.

NOTE: If you fail to clear LCDT after tripping sensor, engine will shut down when timer times out.

3. Repeat Steps "1" and "2" for each sensor.

- d. To end test, press Timer "0" pushbutton or test will end automatically when timer times out.

5. System Shutdown. Set Manual Switch to STOP.

- a. Verify that engine stops and that Sensor Number 47 appears in the sensor number display.

NOTE: Sensor No. 47 indicates that system has been shut down by operation of the Manual Stop Switch.

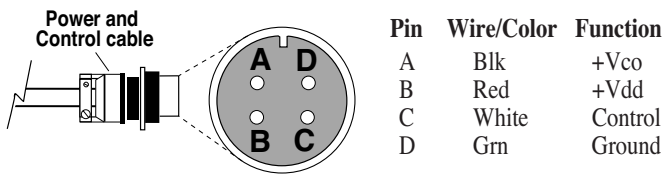
CONTROLS AND INDICATORS DESCRIPTION

The **LCDT MODULE** is a 47-channel multiplexed data selector with inputs for up to 46 sensor channels. Channel #47 is used as a Manual Stop and channel #46 is dedicated to Overspeed (normally open on both n.o and n.c. models). A tripped sensor appears as a Logic-0 to the multiplexer at the associated input. The multiplexer sequentially addresses the 46 input channels and the STOP. Any tripped sensor (or a Panel STOP) will be detected and its assigned number will appear in the sensor number window.

Terminal Block & Sensor Input Cable interconnect the 46 sensor inputs and the LCDT module. The terminal block contains 50 conductors. In system installation, the sensor numbers correspond to the terminal numbers.

Power and Control Inputs/Outputs are connected from the power supply to the LCDT module through the power and control cable. See power and control cable designations in schematic below.

Power and Control cable connector designation



Liquid Crystal Display (LCD) shows the appropriate sensor number in the left-hand two digits, lockout timer countdown (in minutes) is displayed in the right-hand window. Two dots in the left-hand display window indicate that the LCDT is in the TEST mode. A single dot in the right-hand display (while TEST button is held down) indicates low battery in power supply.

Terminal Number Function

Terminals #1 - #15 are dedicated to dry contact sensors monitoring parameters such as pressures and flows that are faulted while engine is not running. (Class “B” functions, lockout by start/run timer.)

Terminals #16 - #45 are dedicated to sensors that monitor operating parameters not locked out by start/run timer. (Class “A” functions).

Terminal #46 is dedicated to monitoring overspeed (n.o., only).

Terminal #47 is used for manual shutdown. (Upon a STOP, the number 47 is indicated in the LCD window.)

Terminal #48 is check point for Vdd Voltage from power supply.

Terminal #49 is check point for Vco voltage from power supply. Vco is present on Ignition power systems only when the engine is running.

Terminal #50 is a special output for use with electronic digital speed switches having SCR outputs.

Manual Stop/Run Switch sets the Run or Stop mode from the panel. For normal operation, the switch must be in the RUN position. When placed in the STOP position, this switch shuts down the system by simulating a fault condition on sensor input #47. The number 47 will appear in the Sensor Number (left-hand) display.

Reset Push-Button resets all tripped sensor inputs and resets the display. This push-button resets the Start-Run Timer to full count. If momentarily pressed before system start up, Reset causes any initially-faulted sensors (above sensor number 15) to be detected and displayed (inputs are not scanned when engine is not running). The button also resets shutdown or alarm outputs.

Timer Zero Push-Button zeroes the Start-Run Timer as indicated

by “0” in the Start Run Timer window. If in the RUN position, pressing the button ends startup and initiates RUN mode; if in TEST, pressing the button ends the test.

Test Push-Button After system start up the Test push-button can be used to set the unit to the TEST mode. In TEST the unit displays sensor fault inputs just as in normal operation (except that the system is not shut down by sensor operation). In this mode, the timer times the test period and the system automatically comes out of the TEST mode when the time counts down to zero. Pressing this push-button during the start up or test period resets the Start-Run Timer to its maximum time and displays the time in the timer window.

Tripped Sensors When a tripped sensor is detected, the signal is transferred by the multiplexer to the LCDT. The display registers and indicates the sensor number. The unit sends a control signal to the power supply (shut-down relay) to shut down the engine. The faulted sensor number is retained in the display. The remaining sensor inputs are disabled until the LCDT is manually reset.

Start-Run Timer A Start-Run Timer circuit allows five (5) minutes for the system to come up to speed without being shut down by speed-related conditions (such as low oil pressure). Time is indicated in the Start-Run Timer window. As the time period is used up, the timer counts down to zero (0). At startup, the first 15 sensor inputs are locked out until time zero. The system should be up to speed and the locked-out parameters up to normal. If any of the 15 sensors are still tripped at the end of the time period, the unit will shutdown the engine and display the faulted sensor. The balance of the channels (16-46) are functional during the start up period and will shutdown the engine if tripped. Pressing the Timer “O” push-button forces the time count to zero, ending the startup lock-out period.

Start-Run Timer as Test Timer In the TEST mode, the Start-Run timer locks out all shutdown functions. This mode enables all sensors to be tripped and displayed individually, but inhibits shutdown due to tripped sensors until time zero. The TEST push-button sets the unit into the TEST mode for the Start-Run timer period. It is indicated by a colon (:) in the Sensor Number window. In the TEST mode, the shutdown function is locked out and each sensor can be tested and displayed without shutting down the system. Reset the unit (press RESET button), and the timer count restarts at full count. The TEST mode ends when the timer counts to zero or if the Timer “0” button is depressed.

BARRIER FOR NON-INTRINSICALLY SAFE INPUTS

The Model LCDT-ISB (discontinued) is designed to accept two non-intrinsically safe, **normally open** inputs and convert them to intrinsically safe outputs. An internal barrier isolates the outputs from the inputs. The internal terminal block provides connection for the user circuits while a factory-installed cable from the output terminal block provides intrinsically safe connection to the LCDT input terminal block.

The minimum input voltage for the LCDT-ISB (intrinsically safe barrier) is 90 volts. For normally closed systems or dry relay contacts use an intrinsically safe (approved) barrier. For any other voltages use a relay and a thermocouple barrier, mounted in a separate explosion-proof box or out of the hazardous area. The LCDT-ISB can be replaced by dry contact switches and or pilot relays and a thermocouple type barrier.

Note: Before attempting operation, make sure the system and all related equipment items are properly installed and tested for the normally open system.

TROUBLESHOOTING INSTRUCTIONS



WARNING! Do NOT open power supply until operations have been shut down and area has been rendered non-hazardous. Always make sure on ignition powered devices that the panel ground and the device ground are the same, and well connected. Make sure that the ground from the unit being monitored is connected directly to the ignition. Do NOT run sensor wires in conduit with any other wire. Do NOT apply voltage to any annunciator input terminals. Do NOT bundle sensor wires with any other wiring. When using barriers to the sensor terminal strip, always make troubleshooting checks without the barriers. A blown barrier may short the annunciator. If everything checks okay without the barriers, connect barriers one at a time to find the cause of the problem. Most barriers are polarity sensitive.

These instructions will assist in the correction of most problems which you may encounter with the unit. Before checking the list, first refer back to the connections (wiring) and operation procedures. If problems persist after making the checks, consult any FW Murphy facility.

SYMPTOM	CAUSE	TEST	REMEDY
No display	1. No power to LCDT module 2. Shorted/open trace, (module).	a. Check that Power & Control cable is connected to the module. b. Check voltage between holes "B" and "D" of the Power and Control cable connector (good above 5.8 VDC)†. c. Check battery voltage while mounted in the power supply. * LCDT-PS-CD-N/(R)-P: 5.8 V minimum. * LCDT-PS-120/24/12: this model has (5) Ni-Cad batteries, each should read at least 1.2 volts, (<i>Ni-Cad batteries are recharged after 24 hours with power supply connected</i>). d. Check the Power supply output by measuring the voltage between terminals VDD and GND of the 4-point terminal block under the Safety cover (reading should be 5.8 V min.). e. Check the Power & Control cable by measuring the resistance between hole "B" of the Power and Control cable connector, and the VDD terminal (4-point terminal block in power supply). f. Check the Power & Control cable by measuring the resistance between hole "D" of the Power and Control cable connector, and the GROUND terminal (4-point terminal block in power supply). Reading should be less than "1" ohm. g. If system passes test 1a. thru 1f. . . .	a. Connect cable. b. If voltage is correct, replace the module. c. Replace battery(ies). d. If output is less than 5.8 V, replace Power supply. e. If reading is greater than "1" ohm replace the Power & Control cable. f. If reading is greater than "1" ohm replace the Power & Control cable. g. Replace the module
Engine fails to start	3. Sensor not cleared (on LCDT display). 4. Sensor cleared (on LCDT display) but engine fails to start. 5. Power supply failure.	a. Press RESET. If condition still exists, Check sensor wiring to terminal block according to wiring instructions. (Look for shorted wires, open circuits, closed circuits, broken wires.) b. Turn the Stop-Run switch to Stop, then press Reset and verify for number 47 to be displayed. Turn Stop-Run to Run and RESET. <i>Ignition ground should clear allowing engine to start.</i> c. Check Power and Control cable, place a jumper (metal paper clip can be used) between sockets "B" and "C". The relay in the power supply should pickup, and unground the ignition. d. Repeat the low battery voltage test. (Test-1c, above).	a. Repair or replace wiring as needed. b. If engine fails to start, check Power supply per 1a-1f. c. If engine starts, replace the module. d. Replace battery(ies).
Random Shutdowns	6. High voltage/ignition leads in same conduit or installed close to sensor leads. 7. Open sensor/ lead insulation broken or grounded lead wires.	a. Temporarily reroute sensor leads and any other wiring in separate conduit. b. Check sensor wiring to terminal block according to wiring instructions. (Look for shorted wires, open circuits, closed circuits, broken wires.)	a. Route sensor leads and any other wiring in separated conduit. b. Check sensor switch. Repair or replace sensor wiring if needed.

† LCDT-PS-CD-N power supply will work with lower battery voltage; however, the battery should be replaced.

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